

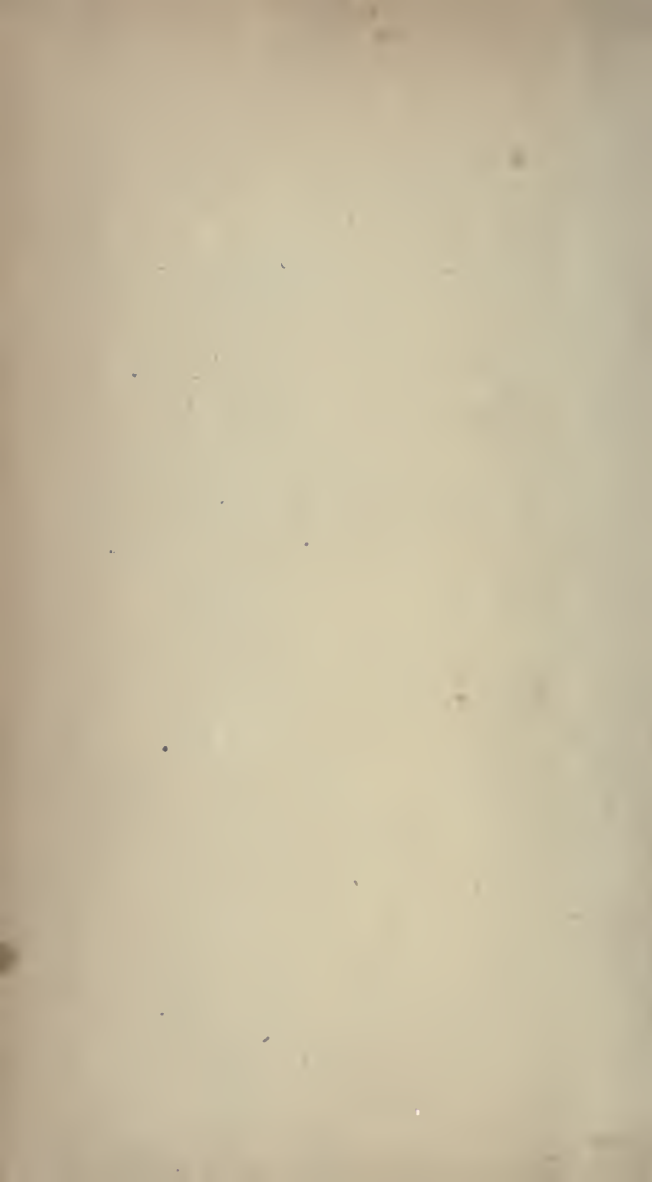



50

A. O. DuBois

1866

9.





Digitized by the Internet Archive  
in 2007 with funding from  
Microsoft Corporation

Account of the ...

...

...

...

...

...

...

...

...

...

# KEY

TO

## THE NATIONAL ARITHMETIC;

CONTAINING

Full Solutions to nearly all the Problems.

DESIGNED FOR THE

USE OF TEACHERS AND PRIVATE STUDENTS.

*Ex libris Albert Dubouché*

BY JOHN HERBERT SANGSTER, M.A., 186

MATHEMATICAL MASTER AND LECTURER IN CHEMISTRY AND NATURAL  
PHILOSOPHY IN THE NORMAL SCHOOL FOR UPPER CANADA.

---

Montreal :

PRINTED AND PUBLISHED BY JOHN LOVELL,  
AND SOLD BY R. & A. MILLER;

Toronto :

R. & A. MILLER, 62 KING STREET EAST.

1861.





## PREFACE.

---

It was the original intention of the author to give, in the Key, merely a series of brief hints upon the solutions of the more difficult problems. He was led to modify this plan and to issue the work in its present form, chiefly from the consideration that as there are in the country many young persons who, from various causes, are unable to avail themselves of the advice and assistance of a teacher, it would be a great boon to these to have access to a book to which they might refer with the certainty of having every doubt removed as to the correctness of their work and methods of solution. He offers the work to his fellow-teachers with the hope that they will accord it the same favourable reception that they have so kindly given to the National Arithmetic.

TORONTO, *May*, 1861.



# CONTENTS.



	PAGE.
Reduction Descending.....	5
Reduction Ascending .....	6
Reduction of Canadian Currency to Dollars and Cents...	8
Multiplication.....	9
Division.....	14
Miscellaneous Exercises, Arith. page 118.....	20
Resolution of Numbers into their prime factors.....	27
Divisors of numbers .....	27
Number of divisors.....	28
Common measure of two or more numbers.....	29
Greatest Common Measure .....	30
Least Common Multiple.....	32
Reduction of Scales of Notation.....	34
Fundamental Rules in different scales.....	39
Duodecimal Multiplication.....	40
Miscellaneous Exercises, Arith. page 149.....	41
Reduction of Fractions.....	49
Addition of Fractions.....	58
Subtraction of Fractions .....	63
Multiplication of Fractions.....	65
Division of Fractions.....	69
Miscellaneous Exercises in Vulgar Fractions.....	74
Reduction of Decimals.....	77
Addition of Decimals.....	83
Subtraction of Decimals .....	85
Multiplication and Division of Decimals.....	86
Miscellaneous Exercises in Decimals .....	87
Miscellaneous Exercises, Arith. page 198.....	91
Simple Proportion.....	102
Compound Proportion .....	109

Conjoined Proportion.....	112
Miscellaneous Exercises, Arith. page 222.....	114
Practice.....	121
Bills of Parcels.....	127
Miscellaneous Exercises, Arith. page 231.....	129
Percentage.....	135
Commission.....	136
Brokerage.....	137
Insurance.....	139
Custom House Business.....	140
Assessment of Taxes.....	141
Simple Interest.....	142
Compound Interest.....	154
Discount.....	158
Bank Discount.....	161
Equation of Payments.....	162
Partnership.....	163
Profit and Loss.....	169
Barter.....	173
Alligation.....	175
Reduction of Currencies.....	180
Exchange.....	182
Arbitration of Exchange.....	183
Involution.....	184
Square Root.....	185
Cube Root.....	190
Extraction of other Roots.....	199
Logarithms.....	200
Logarithmic Arithmetic.....	208
Arithmetical Progression.....	215
Geometrical Progression.....	220
Single Position.....	226
Double Position.....	229
Compound Interest.....	233
Annuities at Simple Interest.....	235
Annuities at Compound Interest.....	236
Examination Papers.....	239
Arithmetical Recreations.....	284

# KEY TO NATIONAL ARITHMETIC.

Page 50.

(1)	(2)	(3)	(4)	(5)
d.	£	£ s.	£ s.	£ s.
23328	348	38 10	58 13	58 13
4	20	20	20	20
93312 f.	6960 s.	770 s.	1173 s.	1173 s.
		12	12	12
		9240 d.	14076 d.	14076 d.
				4
				56304 f.

(6)	(7)	(8)	(9)
£ s. d.	£ s. d.	cwt. qrs. lbs.	cwt. qrs. lbs.
59 13 6½	63 0 9	16 2 16	14 3 16
20	20	4	4
1193 s.	1260 s.	66 qrs.	59 qrs.
12	12	25	25
14322 d.	15129d.	346	311
4		132	118
57291 f.		1666 lbs.	1491 lbs.

(10)	(11)	(12)	(13)	(14)
lbs. oz. dwt. grs.	lbs. oz. dwt. grs.	yrs.	mile.	yrs. d. h. m.
3 5 12 16	7 11 15 14 20	20	1	46 21 8 56
12	12	365	8	365
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
41 oz.	95	7300 dys.	8 fur.	251
20	20	24	40	276
<hr/>	<hr/>	<hr/>	<hr/>	138
832 dwt.	1915 dwt.	29200	320 per.	<hr/>
24	24	14600	5½	16811 days.
<hr/>	<hr/>	<hr/>	<hr/>	24
3344	7674	175200 hrs	1600	<hr/>
1664	3830		160	67252
<hr/>	<hr/>		1760 yds.	33622
19984 grs.	45974 grs.		3	403472 hrs.
			5280 ft.	60
				24208376 min.

(15)	(16)	(17)	(18)	(19)	(20)
sq. per.	a. r. per.	sq. miles.	cub. ft.	pks.	pks.
74	46 3 12	767	767	767	797
30½	4	640	1728	2	2
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
2220	187 r.	30680	6136	1534 gals	1594 gals
18½	40	4602	1534	4	4
<hr/>	<hr/>	<hr/>	5369	<hr/>	<hr/>
2238½ sq. yds.	7492 per.	490880 sq. a.	767	6136 qts.	6376 qts.
	30½		<hr/>	<hr/>	2
	224760		1325376 cub. in.	<hr/>	<hr/>
	1873			<hr/>	12752 pts.
	226633 sq. yds.				

Page 51.

(1)	(2)	(3)
f.	grs.	yds.
4)32756	24)23547	5½)397024
<hr/>	<hr/>	2 2
12)8189 d.	20)981 dwt. 3 grs.	<hr/>
<hr/>	<hr/>	11)794048
20)682s. 5d.	12)49 oz. 1 dwt. 3 grs.	<hr/>
<hr/>	<hr/>	40)72186r. 2hf-yds.=1yd.
£34 2s. 5d.	4 lbs. 1 oz. 1 dt. 3 g.	8)1804 fur. 26 r. 1 yd.
		225 m. 4 f. 26 r. 1 y.

(4)	(5)	(6)	
sec.	lbs.	lbs.	
60)28635	25)1666	25)1491	
<u>        </u>	<u>        </u>	<u>        </u>	
60)477 m. 15 sec.	4)66 qrs. 16 lbs.	4)59 qrs. 16 lbs.	
<u>        </u>	<u>        </u>	<u>        </u>	
7 hrs. 57 m. 15 sec. 16 cwt. 2 q. 16 lbs. 14 cwt. 3 q. 16 lbs.			
(7)	(8)	(9)	(10)
grs.	oz.	cub. in.	Fl. e.
24)115200	16)107520	1728)1674674	767
<u>        </u>	<u>        </u>	<u>        </u>	3
20)4800 dwt.	6720 lbs.	969 ft. 242 in.	<u>        </u>
<u>        </u>			4)2301 qrs.
12)240 oz.			<u>        </u>
<u>        </u>			575 yds. 1 qr.
20 lbs.			
(11)	(12)	(13)	
ft.	cub. in.	cub. ft.	
3)183810	1728)138297	128)67893	
<u>        </u>	<u>        </u>	<u>        </u>	
5½)61270 yds.	27)80 ft. 57 in.	530 cord 53c.ft.	
2) 2	<u>        </u>		
<u>        </u>	2 c. yds. 26 c. ft. 57 c. in.		
11)122540			
<u>        </u>			
40)11140 per.			
<u>        </u>			
8)278 fur. 20 per.			
<u>        </u>			
3)34 m. 6 fur. 20 per.			
<u>        </u>			
11 lea. 1 m. 6 fur. 20 per.			
(14)	(15)	(16)	
sec.	qts.	c. ft.	
60)3561829	4)1597	8)1000	
<u>        </u>	<u>        </u>	<u>        </u>	
60)59363 m. 49 sec.	2)399 gals. 1 qt.	125 cords	
<u>        </u>	<u>        </u>		
24)989 h. 23 m. 49 s.	4)199 pks. 1 gal. 1 qt.		
<u>        </u>	<u>        </u>		
7)41 d. 5 h. 23 m. 49 s.	49 bush. 3 pecks 1 gal. 1 qt.		
<u>        </u>			
5 wks. 6 days 5 hrs. 23 min. 49 sec.			

$$\begin{array}{r} (17) \\ \text{seconds.} \\ 60)10000 \\ \hline \end{array}$$

$$\begin{array}{r} 60)166' 40'' \\ \hline 2^\circ 46' 40'' \end{array}$$

$$\begin{array}{r} (18) \\ \text{sq. links.} \\ 10000)70000 \\ \hline \end{array}$$

$$7 \text{ sq. ch.}$$

$$\begin{array}{r} (19) \\ \text{grs.} \\ 20)11521 \\ \hline \end{array}$$

$$3)576 \text{ scr. 1 gr.}$$

$$8)192 \text{ dr. 1 gr.}$$

$$12)24 \text{ oz. 1 gr.}$$

$$2 \text{ lbs. 1 gr.}$$

(20)

sq ft.

$$9)26025$$

$$30\frac{1}{4})2891 \text{ yds. 6 ft.}$$

$$4 ) \quad 4$$

$$121)11564 \text{ quarter yards.}$$

$$95 \text{ per. } 69 \text{ quar. yds. 6 ft. =}$$

$$40)95 \text{ per. } 17 \text{ yds. 8 ft. 36 in.}$$

$$2 \text{ r. } 15 \text{ sq. p. } 17 \text{ sq. y. } 8 \text{ sq. ft. } 36 \text{ sq. in.}$$

Page 53.

(1)

$$\pounds 3 \times 400 = 1200 \text{ cents.}$$

$$7\text{s.} \times 20 = 140 \text{ "}$$

$$1\frac{1}{4}\text{d.} = 5 \text{ far.} \times 5 \div 12 = 2\frac{1}{2} \text{ "}$$

$$\pounds 3 \text{ } 7\text{s. } 1\frac{1}{4}\text{d.} = 1342\frac{1}{2} \text{ cts.}$$

(2)

$$\pounds 29 \times 400 = \$116.00$$

$$18\text{s.} \times 20 = 3.60$$

$$3\frac{1}{2}\text{d.} = 14 \text{ far.} \times 5 \div 12 = .05\frac{5}{6}$$

$$\pounds 29 \text{ } 18\text{s. } 3\frac{1}{2}\text{d.} = \$119.65\frac{5}{6}$$

(3)

$$11\frac{1}{4}\text{d.} = 45 \text{ far.} \times 5 \div 12 = 18\frac{3}{4} \text{ cts.}$$

(4)

$$\pounds 69 \times 400 = \$276.00$$

$$15\text{s.} \times 20 = 3.00$$

$$6\text{d.} = 24 \text{ far.} \times 5 \div 12 = .10$$

$$\pounds 69 \text{ } 15\text{s. } 6\text{d.} = \$279.10$$

(5)

$$18\text{s.} \times 20 = \$3.60$$

$$8\frac{1}{2}\text{d.} = 34 \text{ far.} \times 5 \div 12 = .14\frac{1}{6}$$

$$18\text{s. } 8\frac{1}{2}\text{d.} = \$3.74\frac{1}{6}$$



(6)

$$£17 \times 400 = \$68.00$$

$$16s. \times 20 = 3.20$$

$$5\frac{1}{2}d. = 23 \text{ far.} \times 5 \div 12 = .09\frac{7}{12}$$

$$£17 \text{ } 16s. \text{ } 5\frac{1}{2}d. = \$71.29\frac{7}{12}$$

(7)

$$£87 \times 400 = \$348.00$$

(8)

$$15s. \times 20 = \$3.00$$

$$15s. \text{ } 11\frac{1}{2}d. = \$3.19\frac{7}{12}$$

(9)

$$£16 \times 400 = \$64.00$$

$$6s. \times 20 = 1.20$$

$$2d. = 8 \text{ far.} \times 5 \div 12 = .03\frac{1}{3}$$

$$£16 \text{ } 6s. \text{ } 2d. = \$65.23\frac{1}{3}$$

(10)

$$£2 \times 400 = \$8.00$$

$$9s. \times 20 = 1.80$$

$$11d. = 44 \text{ far.} \times 5 \div 12 = .18\frac{1}{3}$$

$$£2 \text{ } 9s. \text{ } 11d. = \$9.98\frac{1}{3}$$

Page 90.

(25)

$$36 = 12 \times 3$$

$$\begin{array}{r} \$169.78 \\ 12 \\ \hline 2037.36 \\ 3 \\ \hline \$6112.08 \end{array}$$

(26)

$$121 = 11 \times 11$$

$$\begin{array}{r} 796342.3 \\ 11 \\ \hline 8759765.3 \\ 11 \\ \hline 96357418.3 \end{array}$$

(27)

$$144 = 12 \times 12$$

$$\begin{array}{r} \$33460 \\ 12 \\ \hline 401520 \\ 12 \\ \hline \$4818240 \end{array}$$

(28)

$$648 = 12 \times 9 \times 6$$

$$\begin{array}{r} 735 \\ 12 \\ \hline 8820 \\ 9 \\ \hline 79380 \\ 6 \\ \hline 476280 \end{array}$$

(29)

$$18 = 6 \times 3$$

$$\begin{array}{r} \text{£ s. d.} \\ 3 \quad 7 \quad 6 \\ \quad \quad 6 \\ \hline 20 \quad 5 \quad 0 \\ \quad \quad 3 \\ \hline 60 \quad 15 \quad 0 \end{array}$$

(30)

$$22 = 11 \times 2$$

$$\begin{array}{r} \text{£ s. d.} \\ 5 \quad 14 \quad 6\frac{1}{2} \\ \quad \quad 11 \\ \hline 62 \quad 19 \quad 11\frac{1}{2} \\ \quad \quad 2 \\ \hline 125 \quad 19 \quad 11 \end{array}$$

(31)

$$810 = 10 \times 9 \times 9$$

$$\begin{array}{r} \text{£ s. d.} \\ 3 \quad 4 \quad 7 \\ \quad \quad 10 \\ \hline 32 \quad 5 \quad 10 \\ \quad \quad 9 \\ \hline 290 \quad 12 \quad 6 \\ \quad \quad 9 \\ \hline 2615 \quad 12 \quad 6 \end{array}$$

(32)

$$54 = 9 \times 6$$

$$\begin{array}{r} \text{cwt. qrs. lbs. oz.} \\ 11 \quad 3 \quad 14 \quad 7 \\ \quad \quad \quad \quad 9 \\ \hline 107 \quad 0 \quad 4 \quad 15 \\ \quad \quad \quad \quad 6 \\ \hline 642 \quad 1 \quad 4 \quad 10 \end{array}$$

(33)

$49 = 7 \times 7$

bush.	pk.	gal.	qt.	pt.
26	3	1	1	1
				7

188	1	1	2	1
				7

1319	0	1	1	1
------	---	---	---	---

(34)

$63 = 9 \times 7$

yds.	qrs.	na.	in.
2	2	2	2
			9

24	0	2	0
			7

168	3	2	0
-----	---	---	---

(35)

$288 = 12 \times 12 \times 2$

dys.	hrs.	min.	sec.
5	17	33	11
			12

68	18	38	12
			12

825	7	38	24
			2

1650	15	16	48
------	----	----	----

(40)

$83 = 3 + 10 \times 8$

£	s.	d.	£	s.	d.
12	2	4	36	7	0
		10			

121	3	4	969	6	8
-----	---	---	-----	---	---

1005	13	8
------	----	---

(41)

$999 = 10 \times 10 \times 10 - 1$

£	s.	d.
963	0	0½
		10

9630	0	7½
		10

96300	6	3
		10

963003	2	6
963	0	0½

962040	2	5½
--------	---	----

(42)

$3178 = 8 + 10 \times 7 + 10 \times 10 \times 1 + 10 \times 10 \times 10 \times 3$

£	s.	d.	£	s.	d.
3	6	5½	26	11	6
		10			

33	4	4½	232	10	7½
		10			

332	3	9	332	3	9
		10			

3321	17	6	9965	12	6
------	----	---	------	----	---

10556	18	4½
-------	----	----

(43)

$678 = 8 + 10 \times 7 + 10 \times 10 \times 6$

bush.	pk.	gal.	bush.	pk.	gal.
16	3	1	135	0	0
		10			

168	3	0	1181	1	0
		10			

1687	2	0	10125	0	0
------	---	---	-------	---	---

11441	1	0
-------	---	---

(44)

$$247 = 7 + 10 \times 4 + 10 \times 10 \times 2$$

m. fur. rds. yds.		m. fur. rds. yds.
23 6 33	$4 \times 7 =$	166 7 36 $0\frac{1}{2}$
	10	

238 4 17	$1\frac{1}{2} \times 4 =$	954 1 29 $0\frac{1}{2}$
	10	

2385 4 12 4	$\times 2 =$	4771 0 25 $2\frac{1}{2}$
		5892 2 10 $3\frac{1}{2}$

(45)

$$721 = 1 + 10 \times 2 + 10 \times 10 \times 7$$

S. deg. min. sec.		S. deg. min. sec.
3 16 30	$45 \times 1 =$	3 16 30 45
	10	

35 15 7	$30 \times 2 =$	71 0 15 0
	10	

355 1 15 0	$\times 7 =$	2485 8 45 0
		2559 25 30 45

(52)

7071  
556

42426  
35355  
35355  

---

3931476

(53)

15607  
3094

62428  
140463  
468210  

---

48288058

(54)

39948123  
6007

279636861  
23968873800  

---

239968374861

(55)

2778588  
9867

19450116  
16671528  
22228704  
25007292  

---

27416327796

(61)

3.2517  
.023

97551  
65034  

---

.0747891

(62)

64.001  
340

2560040  
192003  

---

21760.340

(63)

482000  
.37

3374000  
1446000  

---

178340.00

(64)

3782.4  
.00917

264768  
37824  
340416  

---

34.684608

(65)

87.96  
220

175920  
17592  

---

19351.20

(66)	(67)	(68)	(69)
216 = 6 × 6 × 6	\$61135·37	255226	176 = 11 × 8 × 2
	229	143	
\$83469	<u>          </u>	<u>          </u>	203736
6	55021833	765678	11
<u>          </u>	12227074	1020904	<u>          </u>
500814	12227074	255226	2241096
6	<u>          </u>	<u>          </u>	8
<u>          </u>	\$13999999·73	36497318	<u>          </u>
3004884			17928768
6			2
<u>          </u>			<u>          </u>
\$18029304			35857536

(70)	(71)	(72)	(73)
116700	3721	297 = 11 × 9 × 3	35 = 7 × 5
235	73	32000	9344000
<u>          </u>	<u>          </u>	11	7
583500	11163	<u>          </u>	<u>          </u>
350100	26047	352000	65408000
233400	<u>          </u>	9	5
<u>          </u>	271633	<u>          </u>	<u>          </u>
27424500		3168000	327040000
		3	
		<u>          </u>	
		9504000	

(74)

(75)

749 = 9 + 10 × 4 + 10 × 10 × 7

999998 = 1000000 - 2

lbs. oz. drs. scr. gr.

lbs. oz. drs. scrs. grs.

123 4 7 2 17 × 9 = 1110 8 7 1 13

1698732

10

1000000

1234 1 7 1 10 × 4 = 4936 7 6 0 0

1698732000000

10

3397464

12341 7 3 0 0 × 7 = 86391 3 5 0 0

1698728602536

            
92438 8 2 1 13

(76)

$640 = 10 \times 8 \times 8$   
 bush. pk. gal. qt. pt.  
 123 1 1 1 1  
10  
 1234 0 1 3 0  
8  
 9873 3 0 0 0  
8  
 78990 0 0 0 0

(77)

89  
 .73  
267  
 623  
\$64.97

(78)

$1143 = 3 + 10 \times 4 + 10 \times 10 \times 1 + 10 \times 10 \times 10 \times 1$   
 yds. qrs. na. in.      yds. qrs. na. in.  
 7 3 2 1  $\times 3 =$  23 2 3 0  $\frac{1}{2}$   
10  
 79 0 0 1  $\times 4 =$  316 0 1 1  $\frac{1}{2}$   
10  
 790 1 0 1  $\times 1 =$  790 1 0 1  
10  
 7902 3 0 1  $\times 1 =$  7902 3 0 1  
9032 3 2 0

(79)

1634.5789  
 635000  
81728945000  
 49037367  
 98074734  
1037957601.5

(80)

\$968.49  
 3.4  
387396  
 290547  
\$3292.866

\$3292.866  
 3.7  
23050062

9878598  
\$12183.6042

\$12183.6042  
 3292.866  
 968.49  
\$16444.9602

Page 110.

(18)

$$\begin{array}{r}
 6423)798965(124\overset{2}{6}\overset{5}{4}\overset{1}{2}\overset{3}{3} \\
 \underline{6423} \\
 15666 \\
 12846 \\
 \underline{28205} \\
 25692 \\
 \underline{2513}
 \end{array}$$

(19)

$$\begin{array}{r}
 \text{£ s. d.} \\
 12)176 \text{ 14 } 6 \\
 \underline{14 \text{ 14 } 6\frac{1}{2}}
 \end{array}$$

(20)

$$\begin{array}{r}
 741)56789(76\overset{4}{7}\overset{1}{1} \\
 \underline{5187} \\
 4919 \\
 4446 \\
 \underline{473}
 \end{array}$$

(21)

$$\begin{array}{r}
 7894)6785158(859\overset{4}{8}\overset{1}{9}\overset{1}{1} \\
 \underline{63152} \\
 46995 \\
 39470 \\
 \underline{75258} \\
 71046 \\
 \underline{4212}
 \end{array}$$

(22)

$$\begin{array}{r}
 \text{£ s. d. } \text{£ s. d.} \\
 317)4728 \text{ 16 } 2(14 \text{ 18 } 4\overset{5}{3}\overset{4}{1}\overset{7}{7} \\
 \underline{317} \\
 1558 \\
 1268 \\
 \underline{290} \\
 20 \\
 \underline{5816} \\
 317 \\
 \underline{2646} \\
 2536 \\
 \underline{110} \\
 12 \\
 \underline{1322} \\
 1268 \\
 \underline{54}
 \end{array}$$

(23)

$$\begin{array}{r}
 429)97896\cdot64(\$228\cdot19\overset{1}{1}\overset{1}{2}\overset{1}{3}) \\
 \underline{858} \\
 1209 \text{ 47600} \\
 \underline{858} \\
 3516 \\
 3432 \\
 \underline{84\cdot6} \\
 42\cdot9 \\
 \underline{41\cdot74} \\
 38\cdot61 \\
 \underline{3\cdot13}
 \end{array}$$

(24)

$$\begin{array}{r}
 6)970763 \\
 \underline{161793\cdot8333+}
 \end{array}$$

(26)

$$\begin{array}{r}
 1209 \text{ 47600}977076(20\overset{2}{4}\overset{5}{8}\overset{1}{8}) \\
 \underline{95200} \\
 25076
 \end{array}$$

(25)

$$\begin{array}{r}
 9)71234 \\
 \underline{7914\frac{5}{9}}
 \end{array}$$

84·6

42·9

41·74

38·61

3·13

(27)

lbs.	oz.	drs.	scr.	grs.	lbs.	oz.	drs.	scr.	grs.
498)7289	6	4	2	13	(14	7	5	0	12 $\frac{37}{187}$
<u>498</u>									
2309									
<u>1992</u>									

(29)

9712)7867674(810 $\frac{954}{9712}$   
 77696  
9807  
 9712  
954

(28)

	£	s.	d.	s.	d.
317	487)	157	16	7	(6 5 $\frac{1}{2}$ .... $\frac{59}{187}$
<u>12</u>		<u>20</u>			

(30)

	m. fur.	rds.	m. fur.	rds.
3810	37)422	3	38	(11 3 14
<u>3486</u>	<u>407</u>			
324	<u>234</u>			15
<u>8</u>	<u>12</u>			<u>8</u>
2596	<u>2815</u>			123
<u>2490</u>	<u>2435</u>			<u>111</u>
106	<u>380</u>			12
<u>3</u>	<u>4</u>			<u>40</u>
320	<u>1520</u>			518
<u>20</u>	<u>1461</u>			<u>37</u>
6413	<u>59</u>			148
<u>5976</u>				<u>148</u>
<u>437</u>				

Page 112.

(32)

25=5×5  
 5)3766  
5)753... 1  
150... 3  
 3×5+1=16  
 150 $\frac{1}{5}$

(33)

42=7×6  
 7)26406  
6)3772... 2  
628... 4  
 4×7+2=30  
 628 $\frac{2}{7}$

(34)

96=12×8  
 12)25431  
8)2119... 3  
264... 7  
 7×12+3=87  
 264 $\frac{3}{8}$

(35)

24=12×2  
 £ s. d.  
 12)24 17 6  
2)2 1 5 $\frac{1}{2}$   
1 0 8 $\frac{1}{2}$

(36)

$$49 = 7 \times 7$$

£	s.	d.
7)740	13	4
<hr/>		
7)105	16	2½...1
<hr/>		
15	2	3¼...¼

(37)

$$56 = 8 \times 7$$

£	s.	d.
8)547	12	4
<hr/>		
7)68	9	0½
<hr/>		
9	15	6¼...¼

(38)

$$35 = 7 \times 5$$

7)6789436	
<hr/>	
5)969919...3	
<hr/>	
193983...4	
4 × 7 + 3 = 31	
193983¾	

(39)

$$147 = 7 \times 7 \times 3$$

7)753293	
<hr/>	
7)107613... 2	
<hr/>	
3)15373... 2	
<hr/>	
5124... 1	

$$1 \times 7 \times 7 + 2 \times 7 + 2 = 65$$

$$5124\frac{65}{47}$$

(40)

$$81 = 9 \times 9$$

lbs.	oz.	dwt.	grs.
9)1798	6	11	9
<hr/>			
9)199	10	1	6...3
<hr/>			
22	2	9	0...6
6 × 9 + 3 = 57			
22 lbs. 2 oz. 9 dwt. 0½7 grs.			

(43)

£	s.	d.	)	£	s.	d.
491	12	0½	)	8968	13	7½
20				20		
<hr/>				<hr/>		
9832				179373		
12				12		
<hr/>				<hr/>		
117984				2152483		
4				4		
<hr/>				<hr/>		
471937	)		8609934	(18¼)	15068	
<hr/>			471937	<hr/>		
<hr/>			3890564	<hr/>		
<hr/>			3775496	<hr/>		
<hr/>			115068	<hr/>		

(44)

m.	fur.	rds.	)	m.	fur.	rds.
17	5	27	)	1027	1	6
8				8		
<hr/>				<hr/>		
141				8217		
40				40		
<hr/>				<hr/>		
5667	)		328686	( 58		
<hr/>			28335	<hr/>		
<hr/>			45336	<hr/>		
<hr/>			45336	<hr/>		



(45)				(46)							
£	s.	d.		£	s.	d.	dwt. grs.	lbs.	oz.	dwt. grs.	
57	0	7½	)	171	1	10½	5 9 )	9	9	3 12	
20				20			24	12			
<hr/>				<hr/>				<hr/>			
1140				3421			129	117			
12				12				20			
<hr/>				<hr/>				<hr/>			
13687				41062				2343			
4				4				24			
<hr/>				<hr/>				<hr/>			
54750	)			164250	(3		129	56244	(436		
				164250				516			
								464			
								387			
								774			
								774			

(47)				(56)							
a.	r.	per.		a.	r.	per.					
91	0	6	)	2366	3	36	47·655 ÷ 4·5 =				
4				4			45)476·55(10·59				
<hr/>				<hr/>				<hr/>			
364				9467			26·5				
40				40			22·5				
<hr/>				<hr/>				<hr/>			
14566	)			378716	(26		4·05 ;				
				29132			4·05 ;				
				87396							
				87396							

(57)				(58)			
756·98	÷	76·73612	=	47·5782975	÷	26·175	=
7673612)		75698000	(9·864 +	26175)		47578·2975	(1·8177
		69062508				26175	
<hr/>				<hr/>			
		6635492·0				21403·2	
		6138889·6				20940·0	
<hr/>				<hr/>			
		496602·40				463·29	
		460416·72				261·75	
<hr/>				<hr/>			
		36185·680				201·547	
		30694·448				183·225	
<hr/>				<hr/>			
		5491·232				18·3225	
						18·3225	

(59)  
 $1 \div 7.6345 =$   
 $76345)10000.0(0.1309+$   
 $7634.5$   


---

 $2365.50$   
 $2290.35$   


---

 $75.1500$   
 $68.7105$

(60)  
 $75.347 \div 0.3829 =$   
 $3829)753470(196.7798 +$   
 $3829$   


---

 $37057$   
 $34461$   


---

 $25960$   
 $22974$   


---

 $2986.0$   
 $2680.3$   


---

 $305.70$   
 $268.03$   


---

 $37.670$   
 $34.461$   


---

 $3.2090$   
 $3.0632$   


---

 $.1458$

(61)  
 $.0002 \div .000000008 =$   
 $8)200000$   


---

 $25000$

Page 116.

(61)  
 $95)\$3300000(\$34736.8421$   
 $285$   


---

 $450$   
 $380$   


---

 $700$   
 $665$   


---

 $350$   
 $285$   


---

 $650$   
 $570$   


---

 $80.0$   
 $76.0$   


---

 $4.00$   
 $3.80$   


---

 $.200$   
 $.190$   


---

 $.100$   
 $.095$   


---

 $.005$

(63) dys.  
 $28800)95270400(3308$   
 $86400$   


---

 $88704$   
 $86400$   


---

 $230400$   
 $230400$   


---

 days.  
 $365\frac{1}{4})3308$   
 $4 \quad 4$   


---

 yrs. days.  
 $1461)13232(9 \quad 20\frac{1}{4}$   
 $13149$   


---

 $4)83$   


---

 $20\frac{1}{4}$

(62)  
 $126)\$3860000(\$30634.9206$   
 $378$   


---

 $800$   
 $756$   


---

 $440$   
 $378$   


---

 $620$   
 $504$   


---

 $116.0$   
 $113.4$   


---

 $2.60$   
 $2.52$   


---

 $.800$   
 $.756$   


---

 $.044$

(64)  
 $35781628)\$1145012096(\$32$   
 $107344884$   


---

 $71563256$   


---

 $71563256$

	(65)		(66)		(67)
27475271)	\$3764112127(\$137	9)	\$972	108)	\$972(\$9
	<u>27475271</u>		<u>          </u>		<u>972</u>
	101658502		\$108		
	<u>82425813</u>				(70)
	192326897	(69)	792)340480(429 $\frac{1}{3}$ oz.	1728)	1000(·578 oz.
	<u>192326897</u>		<u>3168</u>		<u>864·0</u>
			2368		136·00
(68)			<u>1584</u>		<u>120·96</u>
294)	\$8526(\$29			(72)	
	588	(71)	19)4750(250lbs.		15·040
	<u>          </u>	m. fur.	7840	38	<u>13·824</u>
	2646	33 2	<u>7128</u>	<u>          </u>	
	2646	8		95	1·216
		<u>          </u>	712	95	
	266				
	<u>40</u>			(74)	
	10640	bush. pk. gal. qt. pt.	297)729 1 1 1 1 (2 1 1 2 1 $\frac{1}{2}$		
	<u>5<math>\frac{1}{2}</math></u>		<u>594</u>		
	53200		<u>135</u>		
	<u>5320</u>		<u>4</u>		
1155)	58520(50 $\frac{7}{15}$ )		<u>541</u>		
	<u>5775</u>		<u>297</u>		
	770		<u>244</u>		
	50 $\frac{7}{15}$ = 50 $\frac{1}{3}$ .		<u>2</u>		
			<u>489</u>		
(73)			<u>297</u>		
	978·634 ÷ 96·34762 =		<u>          </u>		
9634762)	97863400(10·157				
	<u>9634762</u>		<u>192</u>		
			<u>4</u>		
	1515780·0		<u>          </u>		
	<u>963476·2</u>		<u>769</u>		
			<u>594</u>		
	552303·80		<u>          </u>		
	<u>481738·10</u>		<u>175</u>		
			<u>2</u>		
	70565·700		<u>          </u>		
	<u>67443·334</u>		<u>351</u>		
			<u>297</u>		
	<u>3122·366</u>		<u>          </u>		
			54		
					$\frac{54}{97} = \frac{2}{11}$ .

(75)

lbs.	oz.	dr.	cwt.	qr.	lbs.	oz.	dr.
9	7	8	)	179	3	4	16 0

16

4

(76)

m. fur. rds. m.

151

719

93 4 7 25000

16

25

8

8

914

3599

748

200000

151

1438

40

40

2424

17979

29927

29927)

8000000(267 7<sup>18295</sup>/<sub>23927</sub>

16

59854

107890

201460

17979

179562

287680

218980

16

209489

1726080

9491

287680

24

2424)4602880 (1898<sup>366</sup>/<sub>303</sub>

37964

2424

18982

21788

227784

19392

209489

23968

18295

21816

21520

19392

2128

 $\frac{2128}{2424} = \frac{266}{303}$ 

Page 118.

(3)

DCCIX, M̄VCCCLXXVI, M̄XCMXCIX, L̄XXXVMIV,  
 MMM̄CMXLV̄MMDXCVI.

(4)

$$\begin{array}{r}
 72 = 8 \times 9 \\
 \text{lbs. oz.} \\
 749 \ 10 \\
 \quad 8 \\
 \hline
 5997 \ 0 \\
 \quad 9 \\
 \hline
 53973 \ 0
 \end{array}$$

(5)

$$\begin{array}{r}
 17 = 7 + 10 \times 1 \\
 \text{s. d.} \quad \quad \text{£ s. d.} \\
 4 \ 7\frac{1}{2} \times 7 = 1 \ 12 \ 6\frac{1}{2} \\
 \quad 10 \\
 \hline
 \text{£}2 \ 6 \ 5\frac{1}{2} \times 1 = 2 \ 6 \ 5\frac{1}{2} \\
 \hline
 \quad \quad \quad 3 \ 18 \ 11\frac{1}{2}
 \end{array}$$

(6)

$$\begin{array}{r}
 3Q)285000000Q \\
 \hline
 \quad \quad \quad \text{dys. hrs.} \\
 24)95000000(3958333 \ 8 \\
 \quad 72 \\
 \quad \hline
 \quad 230 \quad 365\frac{1}{2})3958333(10837 \\
 \quad 216 \quad \quad 4 \quad \quad 4 \\
 \quad \hline
 \quad 140 \quad 1461)15833332 \\
 \quad 120 \quad \quad 1461 \\
 \quad \hline
 \quad 200 \quad \quad 12233 \\
 \quad 192 \quad \quad 11688 \\
 \quad \hline
 \quad 80 \quad \quad 5453 \\
 \quad 72 \quad \quad 4383 \\
 \quad \hline
 \quad 80 \quad \quad 10702 \\
 \quad 72 \quad \quad 10227 \\
 \quad \hline
 \quad 80 \quad \quad 4)475 \text{ quarter days.} \\
 \quad 72 \quad \quad \text{days. hrs.} \\
 \quad \quad \quad 118\frac{1}{2} = 118 \ 18 \\
 \quad \quad \quad 8 \text{ rem.} \quad \quad \text{Add} \quad 8 \\
 \quad \quad \quad \hline
 \quad \quad \quad 119 \ 2 \\
 10837 \text{ yrs. } 119 \text{ days, } 2 \text{ hrs.}
 \end{array}$$

(7)

$$\begin{array}{r}
 \text{£}729 \times 400 = \$2916 \cdot 00 \\
 170 \times 20 = \quad 3 \cdot 40 \\
 6\frac{1}{2} \text{ d.} = 25 \text{ far.} \times 5 \div 12 = \quad 10\frac{5}{12} \\
 \hline
 \$2919 \cdot 50\frac{5}{12} \\
 \text{B}
 \end{array}$$

(8)

$$\begin{array}{r}
 \$10000 \\
 9876 \cdot 23 \\
 \hline
 \$123 \cdot 77
 \end{array}$$

(10)

in.  
 12)7964327  
 \_\_\_\_\_  
 12)663693-11 }  
 \_\_\_\_\_ } 119 in.  
 55307- 9 }  
 9)55307 ft. 119 in.

30 1/4 ) 6145 yds. 2 ft. 119 in.  
 4              4

121)24580      203 p. 4 1/4 y. = 203 p. 4 yds. 2 ft. 36 in.  
 11)24580      Add                                              2 ft. 119 in.

11)2234-6 }  
 \_\_\_\_\_ } 17 qr. yds.  
 203-1 }

(11)

\$729·43  
 16·70  
 976·81  
 9987·17  
 429·00  
 129·19  
 \_\_\_\_\_  
 \$12268·30

40)203 p. 4 yds. 5 ft. 11 in.  
 4)5 fur. 3 p. 4 yds. 5 ft. 11 in.  
 \_\_\_\_\_  
 1 m. 1 f. 3 p. 4 yds. 5 ft. 11 in.

(12)

$$429 = 9 + 10 \times 2 + 10 \times 10 \times 4$$

wks.	dys.	hrs.	min.		wks.	dys.	hrs.	min.
6	4	3	17	$\times 9 =$	59	2	5	33
				10				
_____					_____			
65	6	8	50	$\times 2 =$	131	5	17	40
				10				
_____					_____			
659	0	16	20	$\times 4 =$	2636	2	17	20
					_____			
					2827	3	16	33

wks.  
 52)2827(54 yrs. 19 wks. 3 dys. 16 hrs. 33 min.  
 260  
 \_\_\_\_\_  
 227  
 208  
 \_\_\_\_\_  
 19 wks.

(15)

(16)

tons.  
324  
20  
cwt. qr. lbs. —  
13 2 14 6480  
4 4  
— —  
54 25920  
25 25

\$136  
 $\$136 \times 4 = 544 - 95 = 449$   
1902  
2487  
 $\$9237 - \$2487 = \$6750$

284 129600  
108 51840  
1364 ) 648000

(17)

yds. qrs. na. yds. qrs. na.  
3 1 2 ) 39 2 3  
4 4  
13 158  
4 4  
54 ) 635 (11  $\frac{1}{4}$   
54

$(475 \frac{100}{1364} = 475 \frac{25}{341} \text{ hds.})$

(14)

78.96 10240  
00042 9548  
15792 6920  
31584 6820  
0331632 100

(18)

(19)

(21)

a. a. a. r. per.  
25 732 96 3 17  
197 674 4  
156 —  
97 58 387  
199 40  
674 15497 ) \$7764.0 (\$0.501

(20)

\$ 20 \$312  
75 275  
97  
83 \$ 37

lbs. oz. dwt. grs.  
12)36 8 14 16  
3 0 14 13  $\frac{1}{2}$

(22)

a. r. per.  
6 3 12  
7 2 0  
9 0 13  
5 2 36  
29 0 21

7748.5  
15.500  
15.497  
3

275

(23)

(24)

(25)

5	lbs. oz. dwt. grs.	$£972 \times 400 = \$3888 \cdot 00$
7	5 9 8 0	$11s. \times 20 = 2 \cdot 20$
9	3 2 16 16	$11\frac{1}{4}d. = 45 \text{ far.} \times 5 \div 12 = \cdot 18\frac{3}{4}$
—	4 6 17 0	
21)294(14	1 8 19 22	<u><math>\\$3890 \cdot 38\frac{3}{4}</math></u>
21	<u>          </u>	
—	15 4 1 14	
84		
84		

(26)

(27)

(28)

lbs. oz. drs. scr. grs.	56	cwt. qr. lbs.
179 3 3 1 14	25	6 2 11
12	—	5 3 16
—	280	8 0 7
2151 oz.	112	3 1 17
8	—	<u>                    </u> lbs.
—	1400	24 0 1 = 2401
17211 drs.	2	<u>                    </u> -15
3	—	12005
—	2800 sq. ft. in roof.	2401
51634 scr.	6	<u>                    </u>
20	—	$\$360 \cdot 15$
—	16800	
1032694 grs.		

(29)

(30)

29	\$	\$
57	139468	370129
—	98579	238047
203	<u>          </u>	<u>          </u>
145	\$238047	\$132082
<u>          </u>		
1653		
·15		
<u>          </u>		
8265		
1653		
<u>          </u>		
\$247·95		



(31)

£ s. d.	£ s. d.
9 19 11½	1694 16 0¼
20	20
— ¼ = 6¾	— 1½ = 3¾
199	33896
12	12
2399	406752
84	84
9659	1627030
19192	3254016
201579	34167190(169·49
	201579
	1400929
	1209474
	1914550
	1814211
	100339·0
	80631·6
	19707·40
	18142·11
	1565·29

(34)

cwt. qr. lbs.	lbs.
2 0 17	
3 2 15	
2 1 20	
5 3 17	
14 0 19 = 1419	·37½
	9933
	4257
	709½
	\$532·12½

(32)

£19 × 400 = \$76·00
19s. × 20 = 3·80
11½d = 47far. × 5 ÷ 12 = ·19½
\$79·99½

(33)

cwt. qr. lbs.	cwt. qr. lbs.	lbs.
3 2 11	12 0 0	
4 1 15	8 0 1	
8 0 1	3 3 24 = 399	·15
	1995	
	399	
	\$59·85	

(36)

43·2 ÷ 76·8437 =
768437)432000·0(0·562
384218·5
47781·50
46106·22
1675·280
1536·874
138·406

(37)

$$\begin{array}{r}
 123 \cdot 4 \div \cdot 000000066 = \\
 123400000000 \div 66 \\
 6)123400000000 \\
 \hline
 11)20566666666 \cdot 666 \\
 \hline
 1869696969 \cdot 69
 \end{array}$$

(38)

$$\begin{array}{r}
 \$63 \cdot 29 \quad \$2789 \cdot 27 \\
 17 \quad 1075 \cdot 93 \\
 \hline
 44303 \quad \$1713 \cdot 34 \\
 6329 \\
 \hline
 \$1075 \cdot 93
 \end{array}$$

(39)

$$\begin{array}{r}
 £29 \times 400 = \$116 \cdot 00 \quad \$278 \cdot 43 \\
 6s. \times 20 = 1 \cdot 20 \quad 417 \cdot 16 \\
 11\frac{1}{4}d. = 47far. \times 5 \div 12 = \cdot 19\frac{7}{12} \quad 11 \cdot 27 \\
 \hline
 117 \cdot 39\frac{7}{12} \quad 2110 \cdot 40 \\
 \hline
 723 \cdot 15 \\
 117 \cdot 39\frac{7}{12} \\
 \hline
 173) 3657 \cdot 80\frac{7}{12} \\
 12 \quad 12 \\
 \hline
 2076) 43893 \cdot 67(21 \cdot 1433
 \end{array}$$

(40)

$$\begin{array}{r}
 2076) 491544(236\frac{102}{19} \\
 4152 \\
 \hline
 7634 \\
 6228 \\
 \hline
 14064 \\
 12456 \\
 \hline
 1608 \\
 \hline
 \frac{1608}{2076} = \frac{102}{19} \\
 4152 \\
 \hline
 2373 \\
 2076 \\
 \hline
 297 \cdot 6 \\
 207 \cdot 6 \\
 \hline
 90 \cdot 00 \\
 83 \cdot 04 \\
 \hline
 6 \cdot 960 \\
 6 \cdot 228 \\
 \hline
 \cdot 7320 \\
 \cdot 6228 \\
 \hline
 \cdot 1092
 \end{array}$$

## Page 127.

(3)	(4)	(5)	(6)
2)11368	2)2934	3)1011	2)1000
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
2)5684	3)1467	337	2)500
<u>        </u>	<u>        </u>		<u>        </u>
2)2842	3)489	3×337	2)250
<u>        </u>	<u>        </u>		<u>        </u>
7)1421	163		5)125
<u>        </u>			<u>        </u>
7)203	2×3 <sup>2</sup> ×163		5)25
<u>        </u>			<u>        </u>
29			5
2 <sup>3</sup> ×7 <sup>2</sup> ×29			2 <sup>3</sup> ×5 <sup>3</sup>

(7)	(8)	(9)	(10)
2)1024	2)32320	7)707	2)1118
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
2)512	2)16160	101	13)589
<u>        </u>	<u>        </u>		<u>        </u>
2)256	2)8080	7×101	43
<u>        </u>	<u>        </u>		
2)128	2)4040		2×13×43
<u>        </u>	<u>        </u>		
2)64	2)2020		
<u>        </u>	<u>        </u>		
2)32	2)1010		
<u>        </u>	<u>        </u>		
2)16	5)505		
<u>        </u>	<u>        </u>		
2)8	101		
<u>        </u>			
2)4	2 <sup>6</sup> ×5×101		
<u>        </u>			
2			
2 <sup>10</sup>			

## Page 128.

(3)

$$100=2^2 \times 5^2$$

1..2..4

1..5..25

1..2..4..5..10..20..25..50..100

(4)

$$810 = 3^4 \times 2 \times 5$$

1..3..9..27..81  
1..2

---

1..3..9..27..81..2..6..18..54..162  
1..5

---

1..3..9..27..81..2..6..18..54..162..5..15..45..135..405..  
10..30..90..270..810 =

1..2..3..5..6..9..10..15..18..27..30..45..54..81..90..135..  
162..270..405..810.

(5)

$$920 = 2^3 \times 5 \times 23.$$

1..2..4..8  
1..5

---

1..2..4..8..5..10..20..40  
1..23

---

1..2..4..8..5..10..20..40..23..46..92..184..115..230..460..920 =

1..2..4..5..8..10..20..23..40..46..92..115..184..230..460..920.

(6)

$$25000 = 5^5 \times 2^3$$

1..5..25..125..625..3125  
1..2..4..8

---

1..5..25..125..625..3125..2..10..50..250..1250..6250..4..20..100..  
500..2500..12500..8..40..200..1000..5000..25000 =

1..2..4..5..8..10..20..25..40..50..100..125..200..250..500..625..  
1000..1250..2500..3125..5000..6250..12500..25000.

---

Page 128.

(2)

$$88200 = 2^3 \times 3^2 \times 5^2 \times 7^2$$

$$3 + 1 = 4$$

$$2 + 1 = 3$$

$$2 + 1 = 3$$

$$2 + 1 = 3$$

$$4 \times 3 \times 2 \times 3 = 108$$

(3)

$$3500 = 2^2 \times 5^3 \times 7$$

$$2 + 1 = 3$$

$$3 + 1 = 4$$

$$1 + 1 = 2$$

$$3 \times 4 \times 2 = 24$$

(4)

$$6336=2^6 \times 3^2 \times 11$$

$$6+1=7$$

$$2+1=3$$

$$1+1=2$$

$$7 \times 3 \times 2=42$$

(5)

$$824=2^3 \times 103$$

$$3+1=4$$

$$1+1=2$$

$$4 \times 2=8$$

(6)

$$49000=2^3 \times 5^3 \times 7^2$$

$$3+1=4$$

$$3+1=4$$

$$2+1=3$$

$$4 \times 4 \times 3=48$$

(7)

$$81000=2^3 \times 3^4 \times 5^3$$

$$3+1=4$$

$$4+1=5$$

$$3+1=4$$

$$4 \times 5 \times 4=80$$

(8)

$$75600=2^4 \times 3^3 \times 5^2 \times 7$$

$$4+1=5$$

$$3+1=4$$

$$2+1=3$$

$$1+1=2$$

$$5 \times 4 \times 3 \times 2=120$$

(9)

$$256000=2^{10} \times 5^2$$

$$10+1=11$$

$$2+1=3$$

$$11 \times 3=33$$

---

 Page 129.

(2)

$$21=7 \times 3$$

$$18=2 \times 3 \times 3$$

$$27=3 \times 3 \times 3$$

$$36=4 \times 3 \times 3$$

3 is common to all.

(3)

$$21=3 \times 7$$

$$77=11 \times 7$$

$$42=2 \times 3 \times 7$$

$$35=5 \times 7$$

7 is common to all.

(4)

$$26=2 \times 13$$

$$52=2 \times 2 \times 13$$

$$91=7 \times 13$$

$$143=11 \times 13$$

13 is common to all.

(5)

$$82=41 \times 2$$

$$118=59 \times 2$$

$$146=73 \times 2$$

2 is common to all.

## Page 130.

(2)	(3)	(4)
296)407(1	308)506(1	74)84(1
<u>296</u>	<u>308</u>	<u>74</u>
111)296(2	198)308(1	10)74(7
<u>222</u>	<u>198</u>	<u>70</u>
74)111(1	110)198(1	4)10(2
<u>74</u>	<u>110</u>	<u>8</u>
37)74(2	88)110(1	2)4
<u>74</u>	<u>88</u>	<u>2</u>
G. C. M. = 37.	22)88(4	G. C. M. = 2.
	<u>88</u>	
	G. C. M. = 22.	

(5)	(6)
1825)2555(1	556)672(1
<u>1825</u>	<u>556</u>
730)1825(2	116)556(4
<u>1460</u>	<u>464</u>
365)730(2	92)116(1
<u>730</u>	<u>92</u>
G. C. M. = 365.	24)92(3
	<u>72</u>
	20)24(1
	<u>20</u>
	4)20
	<u>5</u>
	G. C. M. = 4.

Page 131.

$$\begin{array}{r}
 (9) \\
 110)140(1 \\
 \underline{110} \\
 30)110(3 \\
 \underline{90} \\
 20)30(1 \\
 \underline{20} \\
 10)630 \quad 10)20 \\
 \underline{60} \quad \underline{10} \\
 68 \quad 2
 \end{array}$$

$$\begin{array}{r}
 (10) \\
 1326)3094(2 \\
 \underline{2652} \\
 442)1326(3 \\
 \underline{1326}
 \end{array}$$

Also 4420 is divisible by 442 ;  
therefore it is their G. C. M.

Therefore 10 is their G. C. M.

$$\begin{array}{r}
 (11) \\
 468)922(1 \\
 \underline{468} \\
 454)468(1 \\
 \underline{454} \\
 14)454(32 \\
 \underline{42} \\
 34 \\
 \underline{28} \\
 6)14(2 \\
 \underline{12} \\
 2)6 \\
 \underline{4} \\
 3
 \end{array}$$

$$\begin{array}{r}
 (12) \\
 204)1190(5 \\
 \underline{1020} \\
 170)204(1 \\
 \underline{170} \\
 34)170(5 \\
 \underline{170} \\
 17)2006(118 \\
 \underline{17} \\
 30 \\
 \underline{17} \\
 136 \\
 \underline{136} \\
 G. C. M.=17.
 \end{array}$$

375 is not divisible by 2,  
and therefore their G. C. M. is 1.

Page 132.

$$\begin{array}{l}
 (15) \\
 56=2^3 \times 7 \\
 84=2^2 \times 3 \times 7 \\
 140=2^2 \times 5 \times 7 \\
 168=2^3 \times 3 \times 7
 \end{array}$$

The greatest factors which are common are  $2^2$  and 7 ;  
therefore the G. C. M.= $2^2 \times 7=28$ .

(16)

$$241920=2^8 \times 3^3 \times 5 \times 7$$

$$380160=2^8 \times 3^3 \times 5 \times 11$$

$$69120=2^9 \times 3^3 \times 5$$

$$103680=2^8 \times 3^4 \times 5$$

The greatest factors which are common are  $2^8$ ,  $3^3$  and  $5$  ;  
therefore the G. C. M.  $=2^8 \times 3^3 \times 5=34560$ .

(17)

$$10800=2^4 \times 3^3 \times 5^2$$

$$28040=2^3 \times 5 \times 701$$

$$2160=2^4 \times 3^3 \times 5$$

The greatest factors which are common are  $2^3$  and  $5$  ;  
therefore the G. C. M.  $=2^3 \times 5=40$ .

---

 Page 133.

(2)

$$6=2 \times 3$$

$$7=7$$

$$42=2 \times 3 \times 7$$

$$9=3^2$$

$$10=2 \times 5$$

$$630=2 \times 3^2 \times 5 \times 7$$

$$2 \times 3^2 \times 5 \times 7=630.$$

(3)

$$1=1$$

$$2=2$$

$$3=3$$

$$4=2^2$$

$$5=5$$

$$6=2 \times 3$$

$$7=7$$

$$8=2^3$$

$$9=3^2$$

$$3^2 \times 2^3 \times 5 \times 7=2520.$$

(4)

$$6=2 \times 3$$

$$9=3^2$$

$$12=2^2 \times 3$$

$$15=3 \times 5$$

$$18=2 \times 3^2$$

$$21=3 \times 7$$

$$30=2 \times 3 \times 5$$

$$2^2 \times 3^2 \times 5 \times 7=1260.$$

(5)

$$670=2 \times 5 \times 67$$

$$100=2^2 \times 5^2$$

$$335=5 \times 67$$

$$25=5^2$$

$$2^2 \times 5^2 \times 67=6700.$$

(6)

$$8=2^3$$

$$10=2 \times 5$$

$$18=2 \times 3^2$$

$$27=3^3$$

$$36=2^2 \times 3^2$$

$$44=2^2 \times 11$$

$$396=2^2 \times 3^2 \times 11$$

$$2^3 \times 3^3 \times 5 \times 11=11880.$$



(9)

2)12..10..24

2) 6.. 5..12

3) 3.. 5.. 6

1.. 5.. 2

(10)

2)14..21..3..2..63

3) 7..21..3..1..63

7) 7.. 7..1..1..21

1.. 1..1..1.. 3

(11)

2)18..12..39..216..234

2) 9.. 6..39..108..117

3) 9.. 3..39.. 54..117

3) 3.. 1..13.. 18.. 39

$2 \times 2 \times 3 \times 5 \times 2 = 120$   $2 \times 3 \times 7 \times 3 = 126$  13) 1.. 1..13.. 6.. 13

1.. 1.. 1.. 6.. 1  
 $2 \times 2 \times 3 \times 3 \times 13 \times 6 = 2808$

(12)

2)8..18..15..20..70

2) 4.. 9..15..10..35

3) 2.. 9..15.. 5..35

5) 2.. 3.. 5.. 5..35

2.. 3.. 1.. 1.. 7  
 $2 \times 2 \times 3 \times 5 \times 2 \times 3 \times 7 = 2520.$

(13)

2)24..16..18..20

2) 12.. 8.. 9..10

2) 6.. 4.. 9.. 5

3) 3.. 2.. 9.. 5

1.. 2.. 3.. 5  
 $2 \times 2 \times 2 \times 3 \times 2 \times 3 \times 5 = 720.$

(14)

2)60..50..144..35..18

2) 30..25.. 72..35.. 9

3) 15..25.. 36..35.. 9

3) 5..25.. 12..35.. 3

5) 5..25.. 4..35.. 1

1.. 5.. 4.. 7.. 1  
 $2 \times 2 \times 3 \times 3 \times 5 \times 5 \times 4 \times 7 = 25200.$

(15)

2)27..54..81..14..63

3) 27..27..81.. 7..63

3) 9.. 9..27.. 7..21

3) 3.. 3.. 9.. 7.. 7

7) 1.. 1.. 3.. 7.. 7

1.. 1.. 3.. 1.. 1  
 $2 \times 3 \times 3 \times 3 \times 7 \times 3 = 1134.$

(19)

300|300..200..150..60..75..125  
 10|           2                           5

$300 \times 10 = 3000.$

(20)

165|20..60..15..165..210..63..27  
 21| 4.. 4                           14..21.. 9  
 12| 4.. 4                           2           3

$165 \times 21 \times 12 = 41580.$

(21)

$$\begin{array}{r|l}
 144 & 12 \dots 132 \dots 144 \dots 60 \dots 96 \dots 1728 \\
 12 & \quad 11 \quad \quad \quad 5 \quad 2 \quad 12 \\
 55 & \quad 11 \quad \quad \quad 5 \\
 \hline
 & 144 \times 12 \times 55 = 95040.
 \end{array}$$

Page 138.

(3)	(4)	(5)	(6)
12)592835	5)3700	11)10000	6)1000000
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
12)49402..e	5)740..0	11)909..1	6)166666..4
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
12)4116..t	5)148..0	11)82..7	6)27777..4
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
12)343..0	5)29..3	7..5	6)4629..3
<u>        </u>	<u>        </u>		<u>        </u>
12)28..7	5)5..4	7571.	6)771..3
<u>        </u>	<u>        </u>		<u>        </u>
2..4	1..0		6)128..3
			<u>        </u>
2470te.	104300.		6)21..2
			<u>        </u>
			3..3
			33233344.
(7)	(8)	(9)	(10)
8)10000	12)12345654321	9)10000	2)300
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
8)1250..0	12)1028804526..9	9)1111..1	2)150..0
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
8)156..2	12)85733710..6	9)123..4	2)75..0
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
8)19..4	12)7144475..t	9)13..6	2)37..1
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
2..3	12)595372..e	1..4	2)18..1
	<u>        </u>		<u>        </u>
23420.	12)49614..4	14641.	2)9..0
	<u>        </u>		<u>        </u>
	12)4134..6		2)4..1
	<u>        </u>		<u>        </u>
	12)344..6		2)2..0
	<u>        </u>		<u>        </u>
	12)28..8		1..0
	<u>        </u>		
	2..4		
	248664et69.		100101100

(14)

IX

8)37704  
        
 8)4311..5  
        
 8)480..1  
        
 8)54..4  
        
     6..1  
 61415.

(15)

V

7)444  
        
 7)32..5  
        
     2..3  
    235.

V

7)4321  
        
 7)313..5  
        
 7)21..6  
        
     1..4  
    1465.

(16)

IV

9)1212201  
        
 9)23121..0  
        
 9)1101..0  
        
 9)21..0  
        
     1..0  
 10000.

(19)

IV

20212331  
 4  
    
 8  
 4  
    
 34  
 4  
    
 137  
 4  
    
 550  
 4  
    
 2203  
 4  
    
 8815  
 4  
    
 35261

(20)

III

101202220  
 3  
    
 3  
 3  
    
 10  
 3  
    
 32  
 3  
    
 96  
 3  
    
 290  
 3  
    
 872  
 3  
    
 2618  
     3  
        
 7854

(21)

IX

1522365  
 9  
    
 14  
 9  
    
 128  
 9  
    
 1154  
 9  
    
 10389  
 9  
    
 93507  
 9  
    
 841568

(22)

VI

33233344  
 6  
    
 21  
 6  
    
 128  
 6  
    
 771  
 6  
    
 4629  
 6  
    
 27777  
 6  
    
 166666  
 6  
    
 1000000

(24)

IX  
3)132713  
 3)40834..0  
3)13271..1  
 3)4083..1  
3)1327..0  
 3)408..1  
3)132..2  
 3)40..2  
3)13..0  
 3)4..0  
 1..1

IX  
12)132713  
 12)10207..9  
12)682..t  
 12)51..8  
 3..t

IX  
8)132713  
 8)14757..1  
8)1652..0  
 8)184..6  
8)21..5  
 2..3

IX	III		XII	VIII
132713 =	11002210110 =		3t8t9 =	235601
<u>9</u>	<u>3</u>		<u>12</u>	<u>8</u>
12	4	332	46	19
<u>9</u>	<u>3</u>	<u>3</u>	<u>12</u>	<u>8</u>
110	12	997	560	157
<u>9</u>	<u>3</u>	<u>3</u>	<u>12</u>	<u>8</u>
997	36	2991	6730	1262
<u>9</u>	<u>3</u>	<u>3</u>	<u>12</u>	<u>8</u>
8974	110	8974	80769 den.	10096
<u>9</u>	<u>3</u>	<u>3</u>		<u>8</u>
80769 denary.	332	26923		80769 denary.
		<u>3</u>		
		80769 denary.		

(25)

XII	XII	XII	XII
9) <u>t2t290</u>	6) <u>t2t290</u>	4) <u>t2t290</u>	2) <u>t2t290</u>
9) <u>117978..0</u>	6) <u>185856..0</u>	4) <u>268683..0</u>	2) <u>515146..0</u>
9) <u>1624t..2</u>	6) <u>34e4e..0</u>	4) <u>78180..3</u>	2) <u>268683..0</u>
9) <u>2032..4</u>	6) <u>69t9..5</u>	4) <u>1e050..0</u>	2) <u>134341..1</u>
9) <u>284..2</u>	6) <u>1179..3</u>	4) <u>5913..0</u>	2) <u>78180..1</u>
9) <u>37..1</u>	6) <u>233..3</u>	4) <u>1533..3</u>	2) <u>3t0t0..0</u>
4..7	6) <u>46..3</u>	4) <u>439..3</u>	2) <u>1e050..0</u>
	6) <u>9..0</u>	4) <u>10e..1</u>	2) <u>e626..0</u>
	1..3	4) <u>32..3</u>	2) <u>5913..0</u>
		4) <u>9..2</u>	2) <u>2t67..1</u>
		2..1	2) <u>1533..1</u>
			2) <u>877..1</u>
			2) <u>439..1</u>
			2) <u>21t..1</u>
			2) <u>10e..0</u>
			2) <u>65..1</u>
			2) <u>32..1</u>
			2) <u>17..0</u>
			2) <u>9..1</u>
			2) <u>4..1</u>
			2) <u>2..0</u>
			1..0

(Continued on next page.)

(25 continued.)

XII	IX	VI	IV	II	
$t2t290 = 4712420 = 130333500 = 21231330030 = 1001101101111100001100$					
<u>12</u>	<u>9</u>	<u>6</u>	<u>4</u>	<u>2</u>	
122	43	9	9	2	1243
<u>12</u>	<u>9</u>	<u>6</u>	<u>4</u>	<u>2</u>	<u>2</u>
1474	388	54	38	4	2487
<u>12</u>	<u>9</u>	<u>6</u>	<u>4</u>	<u>2</u>	<u>2</u>
17690	3494	327	155	9	4975
<u>12</u>	<u>9</u>	<u>6</u>	<u>4</u>	<u>2</u>	<u>2</u>
212289	31450	1965	621	19	9951
<u>12</u>	<u>9</u>	<u>6</u>	<u>4</u>	<u>2</u>	<u>2</u>
2547468	283052	11793	2487	38	19902
	<u>9</u>	<u>6</u>	<u>4</u>	<u>2</u>	<u>2</u>
	2547468	70763	9951	77	39804
		<u>6</u>	<u>4</u>	<u>2</u>	<u>2</u>
		424578	39804	155	79608
		<u>6</u>	<u>4</u>	<u>2</u>	<u>2</u>
		2547468	159216	310	159216
			<u>4</u>	<u>2</u>	<u>2</u>
			636867	621	318433
			<u>4</u>	<u>2</u>	<u>2</u>
		2547468 den.	1243		636867
					<u>2</u>
					1273734
					<u>2</u>
					2547468 den.

Page 142.

(31)	(32)	(33)	(34)
VI	XII	III	VIII
252	62te)32e75721(62te	201210	57264
252	31556	102321	675
<hr/>	<hr/>	<hr/>	<hr/>
544	161e7	21212	354604
2224	1059t		513354
544	<hr/>		434070
<hr/>	58192		<hr/>
122024	52512		51117344
	<hr/>		
	58801		
	58801		
(35)	(36)	(37)	(38)
II	VII	VII	XII
101	2143)142613(50·5254	65432	71348
1001	14111	43210	5e614
1111	<hr/>	1444	<hr/>
1011	1503·0	65001	17864
1000	1411·1	54321	
1111	<hr/>	<hr/>	
10101	61·60	326041	
<hr/>	43·16		
1010100	<hr/>		
	15·410		
	14·111		
	<hr/>		
	1·2660		
	1·1635		
	<hr/>		
	·1022		
	(39)	(40)	
	XII	II	
	34t7	100101)1010100001(10010	<sup>111</sup> 100101
	6666	100101	
	<hr/>	<hr/>	
	18536	101000	
	18536	100101	
	18536	<hr/>	
	18536	111	
	<hr/>		
	1736e296		

Page 146.

(45)

4 ft.	7'	6''	10'''			
9	7	11	11			
<hr/>						
		4	2	11''''	3''''	2''''
	4	2	11	3	2	
2	8	4	11	10		
41	8	1	6			
<hr/>						
44	9	1	8	0	5	2

(46)

19 ft.	10'	3''			
11	2	7			
<hr/>					
		11	6	11''''	9''''
	3	3	8	6	
218	4	9			
<hr/>					
222	8	0	5	9	

(47)

9''	7'''	4''''			
7	3	11''''			
<hr/>					
		8''''	9''''	8''''	8''''
	2	4	10	0	
5	7	3	4		
<hr/>					
5	10	4	11	8	8

(48)

9½ in.	=9'	9''			
9'	9''				
5	7	4''			
<hr/>					
		3	3''''	0''''	
	5	8	3		
4	0	9			
<hr/>					
4	6	8	6		

(49)

7 ft.	4'	11''			
3	2	2			
<hr/>					
		1	2	9''	10''''
1	2	9	10		
22	2	9			
<hr/>					
23	6	9	7	10	

(51)

15 ft.					
1	2'				
<hr/>					
2	6				
15					
<hr/>					
17	6				
	8				
<hr/>					
11	8	0''=			

(52)

xii					
45·6					
t·3					
<hr/>					
1146					
3870					
<hr/>					
398·46					
2					

(53)

10 ft.					
5					
<hr/>					
50 sq.ft.					
7					
<hr/>					
c'rds.c.ft.					
128)350(2	94				
256					
<hr/>					
94 cub.ft.					

11½ cub.ft.=11 cub.ft. 1152 cub.in. ——— cub.ft.

774·90=1096·9'

xii

774=1096 com. scale.



(54)		(55)		(56)
4 ft.		XII		25 ft. = 300 in.
5½		4·78		20 " = 240 "
—		9·6		2 ft. 6 in. = 30 "
20		—		
1		23 t 0		8
—		3590		4
21 sq. ft.		—		—
70		38·0 t		32
—		2·e		2
128)1470(11¾ cords		—		—
128		34492		64 = 8 × 8
—		7418		8)2160000
190		— cub.ft.		—
128		t8·652 = 128 6' 5" 2"		8)270000
—		t8 duoden. = 128 den.		—
62		—		—
1½ = ¾.				33750

Page 149.

(1)

£93 × 400	= \$372·00	£276 × 400	= \$1104·00
14s. × 20	= 2·80	19s. × 20	= 3·80
7½d. = 30 f. × 5 ÷ 12	= ·12½	10½d. = 42 f. × 5 ÷ 12	= ·17½
£93 14s. 7½d.	= \$374·92½	£276 19s. 10½d.	= \$1107·97½
£275 × 400	= \$1100 00		\$729·18
4s. × 20	= ·80		710·50
11½d. = 47 f. × 5 ÷ 12	= ·19⅞		166·78
£275 4s. 11½d.	= \$1100·99⅞		374·92½
			1107·97½
			497·81
			1100·99⅞
			\$4688·16⅞

(2)

$$576 = 6 + 10 \times 7 + 10 \times 10 \times 5$$

m. fur. per. yds. ft. in.		m. fur. per. yds. ft. in.
47 6 17 4 2	7 × 6 =	286 6 27 1 2 0
	10	
478 0 18 4 1	10 × 7 =	3346 3 11 4 2 4
	10	
4780 4 28 2 0	4 × 5 =	23902 7 21 4 3 2
		27536 1 21 0 1 6

(3)

$$243000 = 2^3 \times 3^5 \times 5^3$$

$$3 + 1 = 4$$

$$5 + 1 = 6$$

$$3 + 1 = 4$$

$$4 \times 6 \times 4 = 96$$

(4)

V	VIII
8) <u>4234434</u>	5) <u>713427</u>
8) <u>241110..4</u>	5) <u>133721..2</u>
8) <u>13423..1</u>	5) <u>22303..2</u>
8) <u>1024..1</u>	5) <u>3532..1</u>
8) <u>32..3</u>	5) <u>570..2</u>
2..1	5) <u>113..1</u>
	5) <u>17..0</u>
	3..0
VIII	V
<u>713427</u>	<u>30012122</u>
<u>213114</u>	<u>4234434</u>
500313	20222133

(5)

$$79 \cdot 342 \div 00006378 =$$

6378) 7934200000	(1243994·98275
<u>6378</u>	
15562	
<u>12756</u>	
28060	
<u>25512</u>	
25480	
<u>19134</u>	
63460	
<u>57402</u>	
60580	
<u>57402</u>	
31780	
<u>25512</u>	
6268·0	
<u>5740·2</u>	
527·80	
<u>510·24</u>	
17·560	
<u>12·756</u>	
4·8040	
<u>4·4646</u>	
·33940	
<u>·31890</u>	
·02050	

(7)

40	5.	7.	9.	11.	15.	18.	20.	21.	22.	24.	28.	30.	33.	35.	36.	40.	42.	44.	45.	48.	50.	
21	7.	9.	11.	3.	9	21.	11.	3.	7.	3.	33.	7.	9	21.	11.	9.	6.	5.				
33	3	11	3			11.			11	3				11.	3.	2.	5.					
10																					3.	5.

$$40 \times 21 \times 33 \times 10 = 277200.$$

(9)

$$9999993000 = 10000000000 - 7000.$$

$$64276 \cdot 3427 \times 10000000000 = 642763427000000$$

$$64276 \cdot 3427 \times 7000 = \underline{\underline{449934398 \cdot 9}}$$

$$642762977065601 \cdot 1$$

(10)

IX

5) 78263

5) 15230..3

5) 2760..0

5) 511..4

5) 102..0

5) 17..3

3..1

IX

11) 78263

11) 6430..3

11) 526..6

11) 43..0

3..6

IX

7) 78263

7) 11160..3

7) 1407..5

7) 177..3

7) 23..4

3..0

V

7) 3130403

7) 214200..3

7) 13220..5

7) 1101..3

7) 41..4

3..0

XI

7) 36063

7) 5640..3

7) 884..5

7) 128..3

7) 11..4

3..0

(12)

$$\begin{aligned} £672 \times 400 &= \$2688 \cdot 00 \\ 7s. \times 20 &= 1 \cdot 40 \\ 7d. = 28 f. \times 5 \div 12 &= \cdot 11\frac{2}{3} \\ \hline £672 \ 7s. \ 7d. &= \$2689 \cdot 51\frac{2}{3} \end{aligned}$$

(13)

$$\begin{aligned} 891)243000(272 \\ 1782 \\ \hline 6480 \\ 6237 \\ \hline \end{aligned}$$

(13 continued.)

81)37800(466

324

540

486

54)81(1

54

27)54(2

54

Therefore G. C. M. = 27.

2430

1782

648)891(1

648

243)648(2

486

162)243(1

162

81)162(2

162

(17)

(18)

(19)

$$\begin{array}{r} £ \ s. \ d. \ 2)276000 \\ 178 \ 16 \ 4\frac{2}{3} \\ 97 \ 15 \ 11\frac{1}{2} \\ 693 \ 19 \ 11\frac{2}{3} \\ 216 \ 11 \ 9\frac{1}{2} \\ 678 \ 14 \ 7\frac{1}{2} \\ 197 \ 13 \ 11\frac{2}{3} \\ 117 \ 6 \ 5 \\ 91 \ 1 \ 1\frac{2}{3} \\ \hline 2272 \ 0 \ 3\frac{1}{3} \end{array} \quad \begin{array}{r} 2)138000 \\ 2)69000 \\ 2)34500 \\ 2)17250 \\ \hline 3)8625 \ 87 \ 1 \ 1 \ 3 \\ 5)2875 \\ 5)575 \\ 5)115 \\ \hline 23 \\ 2^5 \times 3 \times 5^3 \times 23 \end{array} \quad \begin{array}{r} 6 \ \text{ft.} \ 2' \ 7'' \ 9''' \ 10'''' \\ 13 \ 11 \ 11 \ 11 \ 7 \\ \hline 3 \ 7 \ 6'''' \ 6'''' \ 8'''' \ 10'''' \\ 5 \ 8 \ 5 \ 2 \ 0 \ 2 \\ 5 \ 8 \ 5 \ 2 \ 0 \ 2 \\ 80 \ 10 \ 5 \ 7 \ 10 \\ \hline 0 \ 10 \ 8 \ 10 \ 10 \end{array}$$

(20)	(21)	(22)
XII	IV	VIII
713t96)7te9·047(·011436	3333333	10000
<u>713t·96</u>	<u>4</u>	<u>8</u>
97t·2t7	15	8
<u>713·t96</u>	<u>4</u>	<u>8</u>
266·4110	63	64
<u>245·3720</u>	<u>4</u>	<u>8</u>
21·05300	255	512
<u>19·3e846</u>	<u>4</u>	<u>8</u>
3·862760	1023	4096
<u>3·67e490</u>	<u>4</u>	
·1t3290	4095	
	<u>4</u>	
	16383	

(23)

74002702 ÷ 144 = 513907 ft. 94 in.  
 512907 ft. ÷ 9 = 57100 yards 7 ft.  
 57100 yds. ÷ 30¼ = 1887 per. 18¼ yds.  
 1887 per. 18 yds. 2 ft. 36 in.  
 Add 7 ft. 94 in.

40)1887 per. 19 yds. 0 ft. 130 in.

4)47 r. 7 per. 19 yds. 0 ft. 130 in.

11 a. 3 r. 7 per. 19 yds. 0 ft. 130 in.

(24)

1728 | 240.. 780.. 1260.. 1728  
 65 | 5.. 65.. 15  
 3 | 3  
 1728 × 65 × 3 = 336960.



(28)	(29)	(30)
762·4978	723426	lbs. oz. drs. scr.
63·423	938·9126141	129 0 0 0
<hr/>	<hr/>	63 4 7 2
22874934	722487·0873859	<hr/>
15249956		65 7 0 1
30499912		
22874934		
45749868		
<hr/>		
48359·8979694		

(31)

$$1064 = 2^3 \times 7 \times 19.$$

1..2..4..8
1..7
<hr/>
1..2..4..8..7..14..28..56
1..19
<hr/>
1..2..4..8..7..14..28..56..19..38..76..152..133..266..532..1064 =
1..2..4..7..8..14..19..28..38..56..76..133..152..266..532..1064

(32)

30 ft. 6 in. = 366 in.	366
20 ft. 11 in. = 251 in.	251
2 ft. 7 in. = 31 in.	<hr/>
	366
	1830
	732
	<hr/>
	in.
	31)91866(2963 $\frac{1}{3}$
	62
	<hr/>
	298
	279
	<hr/>
	2963 $\frac{1}{3}$ ÷ 36 = 82 $\frac{5}{9}$ yds.
	196
	186
	<hr/>
	106
	93
	<hr/>
	13

Page 158.

(30)

$$\frac{2}{5}, \frac{5}{7}, \frac{8}{9}, \frac{3}{5}, \frac{5}{8} = \frac{2 \times 7 \times 9 \times 5 \times 18}{5 \times 7 \times 9 \times 5 \times 18}, \frac{5 \times 5 \times 9 \times 5 \times 18}{5 \times 7 \times 9 \times 5 \times 18}, \frac{8 \times 5 \times 7 \times 5 \times 18}{5 \times 7 \times 9 \times 5 \times 18},$$

$$\frac{3 \times 5 \times 7 \times 9 \times 18}{5 \times 7 \times 9 \times 5 \times 18}, \frac{5 \times 5 \times 7 \times 9 \times 5}{5 \times 7 \times 9 \times 5 \times 18} = \frac{11340}{28350}, \frac{21250}{28350}, \frac{25200}{28350}, \frac{17010}{28350}, \frac{7875}{28350}$$

(31)

$$\frac{8}{11}, \frac{12}{13}, \frac{5}{14} = \frac{8 \times 13 \times 14}{11 \times 13 \times 14}, \frac{12 \times 11 \times 14}{11 \times 13 \times 14}, \frac{5 \times 11 \times 13}{11 \times 13 \times 14} = \frac{1456}{2002}, \frac{1848}{2002}, \frac{715}{2002}$$

(32)

$$\frac{6}{7}, \frac{4}{11}, \frac{5}{13}, \frac{4}{7}, \frac{1}{2} = \frac{6 \times 11 \times 13 \times 7 \times 2}{7 \times 11 \times 13 \times 7 \times 2}, \frac{4 \times 7 \times 13 \times 7 \times 2}{7 \times 11 \times 13 \times 7 \times 2},$$

$$\frac{5 \times 7 \times 11 \times 7 \times 2}{7 \times 11 \times 13 \times 7 \times 2}, \frac{4 \times 7 \times 11 \times 13 \times 2}{7 \times 11 \times 13 \times 7 \times 2}, \frac{1 \times 7 \times 11 \times 13 \times 7}{7 \times 11 \times 13 \times 7 \times 2} =$$

$$\frac{12012}{14014}, \frac{5096}{14014}, \frac{5390}{14014}, \frac{8008}{14014}, \frac{7007}{14014}.$$

(33)

$$\frac{6}{11}, \frac{4}{7}, \frac{8}{13} = \frac{6 \times 7 \times 13}{11 \times 7 \times 13}, \frac{4 \times 11 \times 13}{11 \times 7 \times 13}, \frac{8 \times 11 \times 7}{11 \times 7 \times 13} = \frac{546}{1001}, \frac{572}{1001}, \frac{616}{1001}$$

(34)

$$\frac{5}{6}, \frac{4}{7}, \frac{4}{5}, \frac{2}{11} = \frac{5 \times 7 \times 5 \times 11}{6 \times 7 \times 5 \times 11}, \frac{4 \times 6 \times 5 \times 11}{6 \times 7 \times 5 \times 11}, \frac{4 \times 6 \times 7 \times 11}{6 \times 7 \times 5 \times 11},$$

$$\frac{2 \times 6 \times 7 \times 5}{6 \times 7 \times 5 \times 11} = \frac{1925}{2310}, \frac{1320}{2310}, \frac{1848}{2310}, \frac{420}{2310}.$$



(35)

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{5}, \frac{2}{7} = \frac{1 \times 3 \times 5 \times 7}{2 \times 3 \times 5 \times 7}, \frac{2 \times 2 \times 5 \times 7}{2 \times 3 \times 5 \times 7}, \frac{3 \times 2 \times 3 \times 7}{2 \times 3 \times 5 \times 7},$$

$$\frac{2 \times 2 \times 3 \times 5}{2 \times 3 \times 5 \times 7} = \frac{105}{210}, \frac{140}{210}, \frac{126}{210}, \frac{60}{210}.$$

Page 159.

(38)

$$\frac{1}{3}, \frac{3}{8}, \frac{4}{6}, \frac{2}{4}, \frac{7}{15}.$$

The least common multiple of 5, 8, 6, 4, 15 is 120.

The multiplier for both terms of the first fraction is  $\frac{120}{3} = 40$ ; for the second  $\frac{120}{8} = 15$ ; for the third  $\frac{120}{6} = 20$ ; for the fourth  $\frac{120}{4} = 30$ ; for the fifth  $\frac{120}{15} = 8$ .

Multiplying by these numbers, we obtain  $\frac{40}{120}, \frac{45}{120}, \frac{80}{120}, \frac{90}{120}$ , and  $\frac{56}{120}$ .

(39)

$$\frac{6}{11}, \frac{2}{3}, \frac{4}{7}, \frac{48}{77}, \frac{13}{33}.$$

The least common multiple of 11, 3, 7, 77 and 33 is 231.

The multiplier for both terms of the first fraction is  $\frac{231}{11} = 21$ ; for the second,  $\frac{231}{3} = 77$ ; for the third,  $\frac{231}{7} = 33$ ; for the fourth,  $\frac{231}{77} = 3$ ; and for the fifth,  $\frac{231}{33} = 7$ .

Multiplying by these numbers, we obtain  $\frac{126}{231}, \frac{154}{231}, \frac{132}{231}, \frac{54}{231}$ , and  $\frac{91}{231}$ .

(40)

$$\frac{1}{2}, \frac{3}{3}, \frac{3}{6}, \frac{5}{8}, \frac{7}{10}, \frac{13}{15}, \frac{7}{15}, \frac{37}{80}.$$

The least common multiple of 2, 3, 5, 6, 8, 10, 15, 16 and 80 is 240.

The multiplier for both terms of the first fraction is  $\frac{240}{2} = 120$ ; for the second,  $\frac{240}{3} = 80$ ; for the third,  $\frac{240}{6} = 40$ ; for the fourth,  $\frac{240}{8} = 30$ ; for the fifth,  $\frac{240}{10} = 24$ ; for the sixth,  $\frac{240}{15} = 16$ ; for the seventh,  $\frac{240}{15} = 16$ ; and for the ninth,  $\frac{240}{80} = 3$ .

Multiplying by these numbers, we obtain  $\frac{120}{240}, \frac{160}{240}, \frac{144}{240}, \frac{90}{240}$ ,  $\frac{310}{240}, \frac{216}{240}, \frac{208}{240}, \frac{105}{240}$ , and  $\frac{111}{240}$ .

(41)

$$\frac{3}{5}, \frac{7}{10}, \frac{6}{25}, \frac{11}{30}, \frac{13}{45}, \frac{23}{60}.$$

The least common multiple of 5, 10, 25, 30, 45, and 60 is 900.

The multiplier for both terms of the first fraction is  $\frac{900}{5} = 180$ ; for the second,  $\frac{900}{10} = 90$ ; for the third,  $\frac{900}{25} = 36$ ; for the fourth,  $\frac{900}{30} = 30$ ; for the fifth,  $\frac{900}{45} = 20$ ; and for the sixth,  $\frac{900}{60} = 15$ .

Multiplying by these numbers, we obtain  $\frac{540}{900}$ ,  $\frac{630}{900}$ ,  $\frac{216}{900}$ ,  $\frac{330}{900}$ ,  $\frac{260}{900}$ , and  $\frac{345}{900}$ .

(42)

$$\frac{19}{20}, \frac{7}{30}, \frac{11}{40}, \frac{1}{50}.$$

The least common multiple of 20, 30, 40, and 50 is 600.

The multiplier for both terms of the first fraction is  $\frac{600}{20} = 30$ ; for the second,  $\frac{600}{30} = 20$ ; for the third,  $\frac{600}{40} = 15$ ; and for the fourth,  $\frac{600}{50} = 12$ .

Multiplying by these numbers, we obtain  $\frac{570}{600}$ ,  $\frac{140}{600}$ ,  $\frac{165}{600}$  and  $\frac{12}{600}$ .

(43)

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}, \frac{11}{12}, \frac{15}{16}, \frac{23}{24}.$$

The least common multiple of 2, 3, 4, 6, 8, 12, 16, and 24 is 48.

The multiplier for both terms of the first fraction is  $\frac{48}{2} = 24$ ; for the second,  $\frac{48}{3} = 16$ ; for the third,  $\frac{48}{4} = 12$ ; for the fourth,  $\frac{48}{6} = 8$ ; for the fifth,  $\frac{48}{8} = 6$ ; for the sixth,  $\frac{48}{12} = 4$ ; for the seventh,  $\frac{48}{16} = 3$ ; and for the eighth,  $\frac{48}{24} = 2$ .

Multiplying by these numbers, we obtain  $\frac{24}{48}$ ,  $\frac{32}{48}$ ,  $\frac{36}{48}$ ,  $\frac{40}{48}$ ,  $\frac{42}{48}$ ,  $\frac{44}{48}$ ,  $\frac{46}{48}$ , and  $\frac{48}{48}$ .

(44)

$$\frac{5}{7}, \frac{11}{12}, \frac{12}{15}, \frac{8}{27}, \frac{2}{35}, \frac{17}{40}.$$

The least common multiple of 7, 12, 15, 27, 35 and 40 is 7560.

The multiplier for both terms of the first fraction is  $\frac{7560}{7} = 1080$ ; for the second,  $\frac{7560}{12} = 630$ ; for the third,  $\frac{7560}{15} = 504$ ; for the fourth,  $\frac{7560}{27} = 280$ ; for the fifth,  $\frac{7560}{35} = 216$ ; for the sixth,  $\frac{7560}{40} = 189$ .

Multiplying by these numbers, we obtain  $\frac{5400}{7560}$ ,  $\frac{6930}{7560}$ ,  $\frac{40008}{7560}$ ,  $\frac{2240}{7560}$ ,  $\frac{12018}{7560}$ , and  $\frac{3213}{7560}$ .

(45)

$$\frac{1}{15}, \frac{7}{8}, \frac{4}{3}, \frac{11}{12}, \frac{6}{11}, \frac{13}{20}, \frac{5}{7}, \frac{22}{35}.$$

The least common multiple of 15, 8, 3, 12, 11, 20, 7, and 35 is 9240.

The multiplier for both terms of the first fraction is  $\frac{2^2 \cdot 3^2 \cdot 7}{1 \cdot 3} = 616$ ; for the second,  $\frac{2^2 \cdot 3^2 \cdot 7}{8} = 1155$ ; for the third,  $\frac{2^2 \cdot 3^2 \cdot 7}{3} = 3080$ ; for the fourth,  $\frac{2^2 \cdot 3^2 \cdot 7}{12} = 770$ ; for the fifth,  $\frac{2^2 \cdot 3^2 \cdot 7}{11} = 840$ ; for the sixth,  $\frac{2^2 \cdot 3^2 \cdot 7}{20} = 462$ ; for the seventh,  $\frac{2^2 \cdot 3^2 \cdot 7}{7} = 1320$ ; for the eighth,  $\frac{2^2 \cdot 3^2 \cdot 7}{35} = 264$ .

Multiplying by these numbers, we obtain  $\frac{8624}{9240}, \frac{8085}{9240}, \frac{13320}{9240}, \frac{8470}{9240}, \frac{5040}{9240}, \frac{3178}{9240}, \frac{7320}{9240},$  and  $\frac{7656}{9240}$ .

---

 Page 160.

(47)

$$\frac{4}{7} \text{ of } \frac{3}{5} \text{ of } \frac{6}{11} \text{ of } \frac{35}{72} = \frac{4 \times 3 \times 6 \times 35}{7 \times 5 \times 11 \times 72} = \frac{2520}{27720} = \frac{1}{11}.$$

(48)

$$\frac{2}{3} \text{ of } \frac{4}{9} \text{ of } \frac{6}{7} \text{ of } \frac{81}{100} \text{ of } \frac{25}{34} = \frac{2 \times 4 \times 6 \times 81 \times 25}{3 \times 9 \times 7 \times 100 \times 34} = \frac{97200}{453600} = \frac{1}{4}.$$

(49)

$$\frac{21}{35} \text{ of } \frac{6}{11} \text{ of } \frac{77}{36} = \frac{21 \times 6 \times 77}{35 \times 11 \times 36} = \frac{1}{10}.$$

(50)

$$\frac{2}{5} \text{ of } \frac{4}{7} \text{ of } \frac{3}{11} \text{ of } \frac{13}{17} = \frac{2 \times 4 \times 3 \times 13}{5 \times 7 \times 11 \times 17} = \frac{312}{6545}.$$

Page 161.

(53)

$$\frac{5}{9} \text{ of } \frac{6}{7} \text{ of } \frac{2}{3} \text{ of } \frac{3}{16} = \frac{5 \times 6 \times 2 \times 3}{9 \times 7 \times 3 \times 16} = \frac{5 \times \overset{2}{\cancel{6}} \times \overset{2}{\cancel{2}} \times \overset{3}{\cancel{3}}}{\underset{3}{\cancel{9}} \times 7 \times \overset{8}{\cancel{8}} \times \underset{4}{\cancel{16}}} = \frac{5}{3 \times 7 \times 4} = \frac{5}{84}.$$

(54)

$$\frac{2}{3} \text{ of } \frac{5}{9} \text{ of } \frac{18}{132} \text{ of } \frac{6}{11} \text{ of } \frac{11}{13} \text{ of } \frac{13}{17} = \frac{2 \times 5 \times 18 \times 6 \times 11 \times 13}{3 \times 9 \times 132 \times 11 \times 13 \times 17} =$$

$$\frac{2 \times 5 \times \overset{2}{\cancel{18}} \times \overset{2}{\cancel{6}} \times \overset{2}{\cancel{11}} \times \overset{2}{\cancel{13}}}{\underset{33}{\cancel{3 \times 9}} \times \underset{1}{\cancel{132}} \times \underset{1}{\cancel{11}} \times \underset{1}{\cancel{13}} \times \underset{1}{\cancel{17}}} = \frac{2 \times 5}{33 \times 17} = \frac{10}{561}.$$

(55)

$$\frac{2}{7} \text{ of } \frac{4}{11} \text{ of } 5\frac{1}{2} = \frac{2 \times 4 \times 11}{7 \times 11 \times 2} = \frac{\overset{2}{\cancel{2}} \times 4 \times \overset{11}{\cancel{11}}}{7 \times \overset{11}{\cancel{11}} \times \overset{2}{\cancel{2}}} = \frac{4}{7}.$$

(56)

$$\frac{1}{9} \text{ of } \frac{8}{13} \text{ of } \frac{117}{200} \text{ of } \frac{50}{169} \text{ of } \frac{17}{17} \text{ of } \frac{13}{6} = \frac{1 \times 8 \times 117 \times 50 \times 13 \times 13}{9 \times 13 \times 200 \times 169 \times 17 \times 6}$$

$$\frac{1 \times \overset{2}{\cancel{8}} \times \overset{9}{\cancel{117}} \times \overset{5}{\cancel{50}} \times \overset{13}{\cancel{13}} \times \overset{13}{\cancel{13}}}{\underset{4}{\cancel{9}} \times \underset{13}{\cancel{13}} \times \underset{4}{\cancel{200}} \times \underset{13}{\cancel{169}} \times \underset{3}{\cancel{17}} \times \underset{6}{\cancel{6}}} = \frac{1}{17 \times 3} = \frac{1}{51}.$$

(57)

$$\frac{3}{11} \text{ of } \frac{4}{7} \text{ of } \frac{9}{19} \text{ of } \frac{33}{47} \text{ of } \frac{38}{72} \text{ of } \frac{47}{7} = \frac{3 \times 4 \times 9 \times 33 \times 38 \times 47}{11 \times 7 \times 19 \times 47 \times 72 \times 7} =$$

$$\frac{3 \times 4 \times \overset{3}{\cancel{9}} \times \overset{2}{\cancel{33}} \times \overset{2}{\cancel{38}} \times \overset{2}{\cancel{47}}}{\underset{11}{\cancel{11}} \times \underset{7}{\cancel{7}} \times \underset{19}{\cancel{19}} \times \underset{47}{\cancel{47}} \times \underset{72}{\cancel{72}} \times \underset{7}{\cancel{7}}} = \frac{3 \times 3}{7 \times 7} = \frac{9}{49}.$$

(58)

$$\frac{1}{7} \text{ of } \frac{3}{11} \text{ of } \frac{154}{1} = \frac{4 \times 3 \times 154}{7 \times 11 \times 1} = \frac{4 \times 3 \times \overset{2}{\cancel{14}} \overset{14}{\cancel{14}}}{7 \times 11 \times 1} = \frac{2 \times 4 \times 3}{1} = 24.$$

Page 162.

(61)

$$\frac{\frac{14}{25}}{\frac{17}{25}} = \frac{\frac{14}{25}}{\frac{17}{25}} = \frac{14 \times 25}{45 \times 42} = \frac{\overset{5}{\cancel{14}} \times \overset{5}{\cancel{25}}}{\underset{9}{\cancel{45}} \times \underset{3}{\cancel{42}}} = \frac{5}{9 \times 3} = \frac{5}{27}.$$

(62)

$$\frac{\frac{11}{718}}{\frac{11}{143}} = \frac{\frac{11}{718}}{\frac{11}{143}} = \frac{11 \times 18}{12 \times 143} = \frac{11 \times \overset{3}{\cancel{18}}}{\underset{2}{\cancel{12}} \times \underset{13}{\cancel{143}}} = \frac{3}{2 \times 13} = \frac{3}{26}.$$

(63)

$$\frac{15\frac{3}{5}}{7\frac{3}{5}} = \frac{\frac{78}{5}}{\frac{39}{5}} = \frac{78 \times 5}{5 \times 39} = \frac{\overset{2}{\cancel{78}} \times \overset{2}{\cancel{5}}}{\underset{5}{\cancel{5}} \times \underset{39}{\cancel{39}}} = 2.$$

(64)

$$\frac{11\frac{3}{3}}{12\frac{8}{3}}, \frac{3\frac{1}{9}}{9}, \frac{2}{3} = \frac{\frac{35}{3}}{\frac{63}{3}}, \frac{\frac{13}{9}}{9}, \frac{2}{3} = \frac{35 \times 5}{3 \times 63}, \frac{13 \times 1}{9 \times 4}, \frac{2 \times 5}{7 \times 3} = \frac{175}{204}, \frac{13}{36}, \frac{10}{21}.$$

(65)

$$\frac{7\frac{1}{2}}{15\frac{3}{4}}, \frac{5\frac{7}{8}}{1\frac{3}{6}}, \frac{2\frac{3}{3}}{3\frac{3}{7}} = \frac{\frac{7}{2}}{\frac{63}{4}}, \frac{\frac{47}{8}}{1\frac{3}{6}}, \frac{\frac{12}{5}}{2\frac{4}{7}} = \frac{7 \times 4}{12 \times \underset{3}{\cancel{63}}}, \frac{47 \times \overset{2}{\cancel{16}}}{8 \times 3}, \frac{12 \times 7}{5 \times \underset{2}{\cancel{24}}} = \frac{1}{3 \times 9}, \frac{47 \times 2}{3}, \frac{7}{5 \times 2} = \frac{1}{27}, 31\frac{1}{3}, 7\frac{1}{5}.$$

D

(66)

$$\frac{16\frac{2}{3}}{11\frac{2}{3}}, \frac{6\frac{1}{2}}{13}, \frac{17}{18\frac{1}{3}}, \frac{21\frac{3}{5}}{10\frac{2}{7}}, \frac{1}{4\frac{3}{5}} = \frac{50}{3}, \frac{31}{5}, \frac{17}{1}, \frac{108}{7}, \frac{1}{2} = \frac{10}{50 \times 3},$$

$$\frac{31 \times 1}{5 \times 13}, \frac{17 \times 3}{55 \times 1}, \frac{108 \times 7}{72 \times 5}, \frac{1 \times 5}{2 \times 23} = \frac{10}{7}, \frac{31}{65}, \frac{51}{55}, \frac{21}{10}, \frac{5}{46} = 1\frac{3}{7}, \frac{31}{65}, \frac{51}{55}, 2\frac{1}{10}, \frac{5}{46}.$$

Page 163.

(69)

$$\frac{4}{5} \text{ of } \frac{1}{1\frac{3}{4}} = \frac{1}{20} \text{ of a lb.}$$

(70)

$$\frac{2}{3} \text{ of } \frac{3}{7} \text{ of } \frac{1}{1\frac{1}{2}} \text{ of } \frac{1}{20} = \frac{1}{7 \times 6 \times 20} = \frac{1}{840}.$$

(71)

$$\frac{2}{9} \text{ of } \frac{5}{3\frac{1}{2}} \text{ of } \frac{1}{7} = \frac{5}{9 \times 2} = \frac{5}{18} \text{ wk.}$$

(72)

$$\frac{5}{11} \text{ of } \frac{81}{5} \text{ of } \frac{4}{4} \text{ of } \frac{1}{5} = \frac{81}{11 \times 4 \times 5} = \frac{81}{220} \text{ Eng. Ell.}$$

(73)

$$\frac{3}{7} \text{ of } \frac{4}{11} \text{ of } \frac{1}{5\frac{1}{2}} = \frac{3}{7} \text{ of } \frac{4}{11} \text{ of } \frac{2}{11} = \frac{24}{47} \text{ per.}$$

(74)

$$\frac{2}{3} \text{ of } \frac{4}{7} \text{ of } 21 \frac{1}{14} \text{ of } \frac{1}{8} = \frac{2 \times 4 \times 295 \times 1}{3 \times 7 \times 14 \times 8} = \frac{295}{294} = 1 \frac{1}{294} \text{ c.}$$

(75)

$$\frac{3}{19} \text{ of } \frac{4}{17} \text{ of } 9 \frac{1}{2} \text{ of } \frac{1}{40} \text{ of } \frac{1}{4} = \frac{3 \times 4 \times 19 \times 1 \times 1}{19 \times 17 \times 2 \times 40 \times 4} = \frac{3}{17 \times 2 \times 40} = \frac{3}{1360} \text{ a.}$$

Page 164.

(78)

$$\frac{14}{79} \text{ of } \frac{4}{1} \text{ of } \frac{2}{1} \text{ of } \frac{4}{1} = 4 \frac{4}{9} \text{ qt.}$$

(79)

$$\frac{2}{3} \text{ of } \frac{4}{1} \times \frac{2}{1} \times \frac{4}{1} \times \frac{5}{1} \times \frac{3}{2} = \frac{2 \times 4 \times 4 \times 5}{3} = 1 \frac{2}{3}.$$

(80)

$$\frac{7}{3} \times \frac{2}{1} \times \frac{2}{1} \times \frac{4}{1} \times \frac{2}{1} \times \frac{2}{1} \times \frac{3}{1} \times \frac{3}{2} = \frac{7 \times 2 \times 2 \times 4 \times 2}{3} = 2 \frac{2}{3}.$$

(81)

$$\frac{17}{22} \times \frac{6}{1} \times \frac{8}{1} \times \frac{3}{1} = \frac{17 \times 6 \times 8 \times 3}{11} = 2 \frac{11}{11} \text{ scr.}$$

(82)

$$\frac{1}{5000} \times \frac{2}{3} \times \frac{3}{4} \times \frac{6}{11} \times \frac{2}{7} \times \frac{2}{1} \times \frac{4}{1} = \frac{2 \times 6 \times 2 \times 2 \times 4}{625 \times 7} = \frac{192}{4375} \text{ dr.}$$

(84)

bush. pk. gal. qt. pt.

$$\begin{array}{r} 11)3 \quad 0 \quad 0 \quad 0 \quad 0 \\ \hline 1 \quad 0 \quad 0 \quad 1\frac{5}{11} \end{array}$$

lbs. oz. dr.

$$\begin{array}{r} 7)6 \quad 0 \quad 0 \\ \hline 13 \quad 11\frac{3}{7} \end{array}$$

(85)

yds. qr. na. in.

$$\begin{array}{r} 13) \quad 7 \quad (2 \quad 0 \quad 1\frac{5}{13} \\ \quad 4 \\ \hline 28 \text{ qrs.} \\ \quad 26 \\ \hline \quad 2 \\ \quad 4 \\ \quad - \\ \quad 8 \text{ na.} \\ \quad 2\frac{1}{4} \\ \hline 18 \\ 13 \\ \hline 5 \end{array}$$

(87)

fur. per. yds. ft. in.

$$\begin{array}{r} 9)8 \quad 0 \quad 0 \quad 0 \quad 0 \\ \hline 35 \quad 3 \quad 0 \quad 2 \end{array}$$

£ s. d.

$$\begin{array}{r} 7)4 \quad 0 \quad 0 \\ \hline 11 \quad 5\frac{1}{7} \end{array}$$

(86)

lbs. oz. dwt. grs.

$$\begin{array}{r} 9)8 \quad 0 \quad 0 \quad 0 \\ \hline 10 \quad 13 \quad 8 \end{array}$$

sq. m. a. r. pr. yds. ft. in.

$$\begin{array}{r} 113) \quad 11 \quad (62 \quad 1 \quad 8 \quad 4 \quad 2 \quad 79\frac{1}{13} \\ \quad 640 \end{array}$$

7040 a.

678

260

484 yds.

226

452

34

32

4

9

136 r.

288 ft.

113

226

23

62

40

144

920 per.

248

904

248

16

62

30\frac{1}{2}

8928 in.

480

791

4

1018

484 yds.

1017

1



Page 165.

(90)

$$\begin{aligned} 6 \text{ bus. } 1 \text{ pk. } 1 \text{ gal. } 1 \text{ qt. } 1 \text{ pt.} &= 411 \text{ pts.} \\ 50 \text{ bush.} &= 3200 \text{ pts.} \end{aligned}$$

And the required fraction is  $\frac{411}{3200}$ .

(91)

$$\begin{aligned} 35 \text{ per. } 9 \text{ ft. } 2 \text{ in.} &= 7040 \text{ in.} \\ 1 \text{ fur.} &= 7920 \text{ in.} \end{aligned}$$

The required fraction is  $\frac{7040}{7920} = \frac{88}{99} = \frac{8}{9}$ .

(92)

$$\begin{aligned} 7 \text{ hrs. } 12 \text{ min.} &= 432 \text{ min.} \\ 1 \text{ day} &= 1440 \text{ min.} \end{aligned}$$

Therefore the fraction is  $\frac{432}{1440} = \frac{3}{10}$ .

(93)

$$\begin{aligned} 3 \text{ sq. yds. } 2 \text{ ft. } 120 \text{ in.} &= 3000 \text{ in.} \\ 3 \text{ sq. per. } 13\frac{1}{2} \text{ yds. } 1 \text{ ft. } 72 \text{ in.} &= 135000 \text{ in.} \end{aligned}$$

And the fraction is  $\frac{3000}{135000} = \frac{1}{45}$ .

(94)

$$\begin{aligned} 7 \text{ oz. } 7 \text{ drs. } 2 \text{ scr. } 14 \text{ grs.} &= 3834 \text{ grs.} \\ 21 \text{ lbs.} &= 120960 \text{ grs.} \end{aligned}$$

The fraction is  $\frac{3834}{120960} = \frac{425}{14400} = \frac{71}{2400}$ .

(95)

$$\begin{aligned} 9 \text{ min. } 48 \text{ sec.} &= 588 \text{ sec.} \\ 1 \text{ day} &= 86400 \text{ sec.} \end{aligned}$$

The required fraction is  $\frac{588}{86400} = \frac{7}{1000}$ .

(96)

$$\begin{aligned} 16 \text{ bush. } 1 \text{ pk. } 1 \text{ pt.} &= 1041 \text{ pts.} \\ 69 \text{ bush.} &= 4416 \text{ pts.} \end{aligned}$$

Therefore the fraction is  $\frac{1041}{4416} = \frac{347}{1472}$ .

(97)

$$3 \text{ qrs. } 3\frac{1}{9} \text{ na.} = 15\frac{1}{9} = 1\frac{16}{9} \text{ na.}$$

$$1 \text{ Eng. ell} = 20 \text{ na.}$$

$$\text{And the fraction is } \frac{1\frac{16}{9}}{20} = \frac{1\frac{36}{9}}{180} = \frac{34}{45}.$$

(98)

$$13 \text{ dwt. } 7 \text{ grs.} = 319 \text{ grs.}$$

$$1 \text{ lb. Troy} = 5760 \text{ grs.}$$

$$\text{The required fraction is } \frac{319}{5760}.$$

(99)

$$4800 \text{ cub. ft.}$$

$$54 \text{ cords} = 6912 \text{ cub. ft.}$$

$$\text{Therefore the fraction is } \frac{4800}{6912} = \frac{400}{576} = \frac{50}{72} = \frac{25}{36}.$$

Page 167.

(6)

$$\frac{1}{3} + \frac{1}{3} + \frac{2}{3} = \frac{4}{3} = 2\frac{1}{3}.$$

(7)

$$\frac{1}{2} + \frac{6}{2} + \frac{7}{2} + \frac{9}{2} + \frac{11}{2} + \frac{5}{2} = \frac{30}{2} = 3\frac{3}{2} = 3\frac{1}{2}.$$

(8)

$$4\frac{3}{7} + 11\frac{4}{7} + 16\frac{5}{7} + 21\frac{6}{7} + 19\frac{7}{7} = 4 + 11 + 16 + 21 + 19 + (\frac{3}{7} + \frac{4}{7} + \frac{5}{7} + \frac{6}{7} + \frac{7}{7}) = 71 + \frac{26}{7} = 73\frac{4}{7}.$$

(9)

$$16\frac{2}{3} + 11\frac{7}{3} + 18\frac{4}{3} + 17\frac{9}{3} + 112\frac{2}{3} = 16 + 11 + 18 + 17 + 112 + (\frac{2}{3} + \frac{7}{3} + \frac{4}{3} + \frac{9}{3} + \frac{2}{3}) = 174 + \frac{23}{3} = 174 + 3\frac{2}{3} = 177\frac{2}{3}.$$

(10)

$$4\frac{1}{2} + 1\frac{1}{2} + 7\frac{1}{2} = 4 + 1 + (4 + \frac{1}{2} + 7\frac{1}{2}) = 5 + (13\frac{3}{2} + 1\frac{1}{2} + \frac{8}{2}) = 5 + 16\frac{1}{2} = 6\frac{1}{2}.$$

(11)

$$\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{4}{5} + \frac{5}{6} + \frac{6}{7} + \frac{7}{8} + \frac{8}{9}.$$

These fractions reduced to their least common denominator become  $\frac{1260}{2520} + \frac{1680}{2520} + \frac{1890}{2520} + \frac{2016}{2520} + \frac{2100}{2520} + \frac{2160}{2520} + \frac{2295}{2520} + \frac{2240}{2520} = \frac{15551}{2520} = 6\frac{131}{252}.$

(12)

$\frac{3}{4} + \frac{5}{6} + \frac{1}{3}$  when reduced to their least common denominator become  $\frac{45}{60} + \frac{50}{60} + \frac{20}{60} = \frac{115}{60} = 2\frac{5}{12}$ .

(13)

$$\frac{1}{2} + \frac{5}{6} + \frac{6}{7} + \frac{3}{8} + \frac{8}{11}.$$

These fractions when reduced to their least common denominator become  $\frac{7700}{9240} + \frac{7700}{9240} + \frac{7980}{9240} + \frac{3465}{9240} + \frac{6720}{9240} = \frac{33127}{9240} = 3\frac{5477}{9240}$ .

(14)

$$\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7}.$$

These fractions when reduced to their least common denominator become  $\frac{210}{420} + \frac{140}{420} + \frac{105}{420} + \frac{84}{420} + \frac{70}{420} + \frac{60}{420} = \frac{669}{420} = 1\frac{83}{140}$ .

(15)

$$16\frac{3}{4} + 47\frac{2}{3} + 21\frac{17}{33} + 17\frac{7}{8} + 19\frac{1}{2} = 16 + 47 + 21 + 19 + (\frac{3}{4} + \frac{2}{3} + \frac{17}{33} + \frac{7}{8} + \frac{1}{2}).$$

$$16 + 47 + 21 + 19 = 103.$$

$$\frac{3}{4} + \frac{2}{3} + \frac{17}{33} + \frac{7}{8} + \frac{1}{2} = \frac{486}{1782} + \frac{396}{1782} + \frac{918}{1782} + \frac{693}{1782} + \frac{891}{1782} = \frac{3384}{1782} = \frac{376}{198} = \frac{188}{99} = 1\frac{89}{99}.$$

$$103 + 1\frac{89}{99} = 104\frac{89}{99}.$$

(16)

$$17\frac{1}{2} + 43\frac{3}{7} + 168\frac{1}{3} + 207\frac{8}{21} + 506\frac{125}{126} = 17 + 43 + 168 + 207 + 506 + (\frac{1}{2} + \frac{3}{7} + \frac{1}{3} + \frac{8}{21} + \frac{125}{126}).$$

$$17 + 43 + 168 + 207 + 506 = 941.$$

$$\frac{1}{2} + \frac{3}{7} + \frac{1}{3} + \frac{8}{21} + \frac{125}{126} = \frac{63}{126} + \frac{54}{126} + \frac{42}{126} + \frac{48}{126} + \frac{125}{126} = \frac{332}{126} = \frac{173}{63} = 2\frac{47}{63}.$$

$$941 + 2\frac{47}{63} = 943\frac{47}{63}.$$

(17)

$$6\frac{3}{4} + 11\frac{1}{2} + 2\frac{9}{8} + 16\frac{7}{8} + \frac{1}{2} + \frac{5}{21} + 17\frac{1}{2} = 6 + 11 + 16 + 17 + (\frac{3}{4} + \frac{1}{2} + \frac{9}{8} + \frac{7}{8} + \frac{1}{2} + \frac{5}{21} + \frac{1}{2}).$$

$$6 + 11 + 16 + 17 = 50.$$

$$\frac{3}{4} + \frac{1}{2} + \frac{9}{8} + \frac{7}{8} + \frac{1}{2} + \frac{5}{21} + \frac{1}{2} = \frac{352}{336} + \frac{168}{336} + \frac{315}{336} + \frac{147}{336} + \frac{168}{336} + \frac{80}{336} + \frac{336}{336} = \frac{1201}{336} = 3\frac{205}{336}.$$

$$50 + 3\frac{205}{336} = 53\frac{205}{336}.$$

(18)

$$\frac{1}{5} + \frac{3}{5} + \frac{7}{5} + 68\frac{1}{5} = 68 + (\frac{1}{5} + \frac{3}{5} + \frac{7}{5} + \frac{1}{5}).$$

$$\frac{1}{5} + \frac{3}{5} + \frac{7}{5} + \frac{1}{5} = \frac{36}{180} + \frac{120}{180} + \frac{140}{180} + \frac{45}{180} = \frac{341}{180} = 1\frac{161}{180}.$$

$$68 + 1\frac{161}{180} = 69\frac{161}{180}.$$

(19)

$$173\frac{3}{2} + 8\frac{5}{7} + 91\frac{1}{3} = 173 + 8 + 91 + (\frac{3}{2} + \frac{5}{7} + \frac{1}{3}).$$

$$173 + 8 + 91 = 272.$$

$$\frac{3}{2} + \frac{5}{7} + \frac{1}{3} = \frac{91}{364} + \frac{260}{364} + \frac{308}{364} = \frac{659}{364} = 1\frac{295}{364}.$$

$$272 + 1\frac{295}{364} = 273\frac{295}{364}.$$

(20)

$$1\frac{1}{6} + 2\frac{2}{4} + 3\frac{3}{6} + 4\frac{4}{8} = 1 + 2 + 3 + 4 + (\frac{1}{6} + \frac{2}{4} + \frac{3}{6} + \frac{4}{8}).$$

$$1 + 2 + 3 + 4 = 10.$$

$$\frac{1}{6} + \frac{2}{4} + \frac{3}{6} + \frac{4}{8} = \frac{6750}{400} + \frac{6900}{400} + \frac{6912}{400} + \frac{6960}{400} = \frac{27522}{400} = 3\frac{329}{400}.$$

$$10 + 3\frac{329}{400} = 13\frac{329}{400}.$$

(21)

$$\frac{1}{8} + \frac{3}{8} + \frac{4}{8} + \frac{5}{8} + \frac{7}{8} + \frac{3}{4} + \frac{1}{2} + \frac{5}{6} = \frac{6}{8} + \frac{12}{8} + \frac{48}{8} + \frac{10}{8} + \frac{24}{8} + \frac{40}{8} = \frac{142}{8} = 3\frac{5}{8}.$$

(22)

$$7 + 11\frac{1}{2} + 18 + 26\frac{2}{3} + 79\frac{4}{7} = 7 + 11 + 18 + 26 + 79 + (\frac{1}{2} + \frac{2}{3} + \frac{4}{7}).$$

$$7 + 11 + 18 + 26 + 79 = 141.$$

$$\frac{1}{2} + \frac{2}{3} + \frac{4}{7} = \frac{77}{164} + \frac{66}{164} + \frac{56}{164} = \frac{199}{164} = 1\frac{45}{164}.$$

$$141 + 1\frac{45}{164} = 142\frac{45}{164}.$$

(23)

$$\frac{1}{5} \text{ of } \frac{3}{7} \text{ of } \frac{2}{3} = \frac{18}{6} = 3\frac{3}{5}. \quad \frac{3}{5} + 7\frac{2}{7} + 3\frac{3}{5} = 10 + (\frac{3}{5} + \frac{2}{7} + \frac{3}{5}).$$

$$\frac{3}{5} + \frac{2}{7} + \frac{3}{5} = \frac{110}{165} + \frac{30}{165} + \frac{99}{165} = \frac{239}{165} = 1\frac{74}{165}.$$

$$10 + 1\frac{74}{165} = 11\frac{74}{165}.$$

(24)

$$\frac{4\frac{1}{2}}{78} = \frac{\frac{13}{3}}{78} = \frac{13 \times 18}{3 \times 7} = \frac{78}{7} = 11\frac{1}{7}.$$

$$\frac{1}{2} \text{ of } \frac{36}{11} \text{ of } \frac{4}{15} \text{ of } \frac{1}{4} = \frac{1 \times 36 \times 4 \times 11}{2 \times 11 \times 15 \times 4} = \frac{18}{15} = 1\frac{3}{5}.$$

$$\frac{20\frac{3}{4}}{711} = \frac{\frac{83}{4}}{711} = \frac{83 \times 11}{4 \times 83} = \frac{11}{4} = 2\frac{3}{4}.$$

$$11\frac{1}{7} + 1\frac{3}{5} + 2\frac{3}{4} = 11 + 1 + 2 + (\frac{1}{7} + \frac{3}{5} + \frac{3}{4}) = 14 + (\frac{1}{7} + \frac{3}{5} + \frac{3}{4}).$$

$$\frac{1}{7} + \frac{3}{5} + \frac{3}{4} = \frac{60}{140} + \frac{84}{140} + \frac{105}{140} = \frac{249}{140} = 1\frac{109}{140}.$$

$$14 + 1\frac{109}{140} = 15\frac{109}{140}.$$

(25)

$$3\frac{2}{3} + 11\frac{1}{6} + 14\frac{3}{8} = 3 + 11 + 14 + (\frac{2}{3} + \frac{1}{6} + \frac{3}{8}) = 28 + (\frac{2}{3} + \frac{1}{6} + \frac{3}{8}).$$

$$\frac{2}{3} + \frac{1}{6} + \frac{3}{8} = \frac{32}{48} + \frac{8}{48} + \frac{18}{48} = \frac{58}{48} = \frac{29}{24}. \quad 28 + 1\frac{29}{24} = 29\frac{29}{24}.$$

(26)

$$\frac{1}{2} \text{ of } \frac{2}{3} = \frac{2}{3}, \quad \frac{2}{3} \text{ of } \frac{6}{7} = \frac{4}{7}, \quad \frac{2}{3} \text{ of } \frac{7}{9} = \frac{7}{15}, \quad \frac{2}{3} \text{ of } \frac{27}{10} = \frac{18}{10}, \quad \frac{2}{3} \text{ of } \frac{1}{2} \text{ of } \frac{1}{2} \text{ of } \frac{1}{2} \text{ of } \frac{1}{2} = \frac{1}{80}.$$

$$\frac{2}{3} + \frac{4}{7} + \frac{7}{15} + \frac{18}{10} + \frac{1}{80} = \frac{630}{1680} + \frac{960}{1680} + \frac{784}{1680} + \frac{504}{1680} + \frac{21}{1680} = \frac{2099}{1680} = 1\frac{419}{1680}.$$

(27)

$$41\frac{1}{2} + 105\frac{2}{3} + 300\frac{3}{4} + 241\frac{5}{6} + 472\frac{1}{2} = 41 + 105 + 300 + 241 + 472 + (\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{5}{6} + \frac{1}{2}).$$

$$41 + 105 + 300 + 241 + 472 = 1159.$$

$$\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{5}{6} + \frac{1}{2} = \frac{90}{180} + \frac{120}{180} + \frac{135}{180} + \frac{150}{180} + \frac{90}{180} = \frac{585}{180} = 3\frac{3}{4}.$$

$$1159 + 3\frac{3}{4} = 1162\frac{3}{4}.$$

(28)

$$92\frac{5}{4} + 37\frac{8}{9} + 7\frac{1}{6} = 92 + 37 + 7 + (\frac{5}{4} + \frac{8}{9} + \frac{1}{6}) = 136 + (\frac{5}{4} + \frac{8}{9} + \frac{1}{6}).$$

$$\frac{5}{4} + \frac{8}{9} + \frac{1}{6} = \frac{225}{360} + \frac{320}{360} + \frac{60}{360} = \frac{605}{360} = 1\frac{245}{360}.$$

$$136 + 1\frac{245}{360} = 137\frac{245}{360}.$$

(29)

$$\frac{10\frac{3}{8}}{2\frac{2}{5}} = \frac{5\frac{3}{4}}{1\frac{2}{5}} = \frac{53 \times 5}{5 \times 12} = \frac{53}{12} = 4\frac{5}{12}. \quad \frac{2}{3} \text{ of } \frac{7}{8} = \frac{7}{12}.$$

$$21\frac{1}{2} + 35\frac{1}{8} + 4\frac{5}{12} + \frac{7}{12} = 21 + 35 + 5 + (\frac{1}{2} + \frac{1}{8}) = 61\frac{5}{8}.$$

(30)

$$\frac{1}{4} \text{ of } \frac{1}{3} = \frac{121}{12} = 10\frac{1}{12}. \quad \frac{1}{5} \text{ of } \frac{3}{8} \text{ of } \frac{1}{8} = \frac{2541}{160} = 15\frac{141}{160}.$$

$$\frac{111}{16} = 6\frac{15}{16}. \quad \frac{1}{3} \text{ of } \frac{2}{7} \text{ of } \frac{17}{8} \text{ of } \frac{1}{7} = \frac{119}{63} = 1\frac{56}{63}.$$

$$10\frac{1}{12} + 6\frac{15}{16} + 15\frac{141}{160} + 1\frac{56}{63} = 10 + 6 + 15 + 1 + (\frac{1}{12} + \frac{15}{16} + \frac{141}{160} + \frac{56}{63}).$$

$$\frac{1}{12} + \frac{15}{16} + \frac{141}{160} + \frac{56}{63} = \frac{840}{10080} + \frac{9450}{10080} + \frac{8880}{10080} + \frac{8960}{10080} = \frac{28133}{10080} = \frac{4019}{1440} = 2\frac{1139}{1440}.$$

$$32 + 2\frac{1139}{1440} = 34\frac{1139}{1440}.$$

Page 169.

(34)

	oz.	dr.	scr.	grs.
$\frac{1}{11}$ of a lb. =	4	2	2	$14\frac{6}{11}$
$\frac{3}{7}$ of an oz. =	3	1	5	$\frac{5}{7}$
$\frac{1}{11}$ of a dr. =		1	1	$\frac{9}{11}$
$\frac{5}{6}$ of a scr. =			18	$\frac{3}{2}$
	4 6 2 18 $\frac{72}{251}$			

(36)

$\frac{1}{7}$ of a yd. =	5	$\frac{1}{7}$
$\frac{1}{7}$ of a ft. =	1	$\frac{5}{7}$
$\frac{1}{7}$ of an in. =	$\frac{1}{7}$	$\frac{5}{7}$
	7	

(38)

	day	hrs.	min.
$\frac{1}{4}$ of a week =	1	18	0
$\frac{1}{3}$ of a day =		8	0
$\frac{1}{5}$ of an hour =		12	
	2 2 12		

(35)

	qr.	na.	in.
$\frac{2}{8}$ of a yard =	2	1	$1\frac{7}{8}$
$\frac{1}{4}$ of an Eng. ell =	2	1	$1\frac{3}{4}$
$\frac{5}{7}$ of a qr. =	3	0	$2\frac{7}{8}$
	3 3 1 $\frac{30}{40}$		

(37)

	fur.	per.	yds.	ft.	in.
$\frac{1}{11}$ of a mile =	5	3	3	1	6
$\frac{1}{13}$ of a fur. =	12	1	2	0	$\frac{2}{13}$
$\frac{3}{22}$ of a yd. =			1	2	$\frac{8}{11}$
	5 16 0 0 3 $\frac{23}{43}$				

(39)

	s.	d.
$\frac{1}{4}$ of a £ =	2	10 $\frac{3}{4}$
$\frac{2}{3}$ of a s. =	2	3
$\frac{1}{2}$ d. =		$\frac{5}{12}$
	3 13 $\frac{1}{4}$	

(40)

	£	s.	d.
$\frac{5}{8}$ of 21s.	=	13	$1\frac{1}{2}$
$\frac{5}{8}$ of 5s.	=	3	$1\frac{1}{2}$
$\frac{5}{8}$ of £3 12s. 6d.	=	2	5 $3\frac{1}{2}$
$\frac{7}{10}$ of a £	=	10	$9\frac{3}{4}$
$\frac{4}{5}$ of a d.	=		$\frac{4}{5}$
		3	12 $4\frac{1}{4}$

Page 171.

(7)

$$\frac{3}{4} - \frac{7}{20} = \frac{15}{20} - \frac{7}{20} = \frac{8}{20} = \frac{2}{5}.$$

(8)

$$\frac{7}{17} \text{ of } \frac{3}{14} \text{ of } \frac{26}{11} = \frac{3 \times 48}{17 \times 11} = \frac{144}{187}. \quad \frac{205}{1496} + \frac{144}{187} = \frac{205}{1496} + \frac{1152}{1496} =$$

$$\frac{1357}{1496} = 1\frac{561}{1496} = 1\frac{3}{8}.$$

$$\frac{8\frac{1}{2}}{6\frac{1}{11}} = \frac{3\frac{1}{2}}{1\frac{1}{11}} = \frac{35 \times 11}{4 \times 70} = \frac{11}{4 \times 2} = \frac{11}{8} = 1\frac{3}{8}.$$

$$1\frac{3}{8} - 1\frac{3}{8} = 0.$$

(9)

$$982\frac{7}{8} - 29\frac{2}{20} = 982\frac{340}{400} - 29\frac{553}{740} = 981 + 1\frac{340}{740} - 29\frac{553}{740} = 981\frac{740}{740} - 29\frac{553}{740} = 952\frac{187}{740}.$$

(10)

$$69\frac{1}{11} - 18\frac{86}{46} = 69\frac{146}{46} - 18\frac{386}{46} = 68 + 1\frac{146}{46} - 18\frac{386}{46} = 68\frac{586}{46} - 18\frac{386}{46} = 50\frac{200}{46} = 50\frac{50}{11.5}.$$

(11)

$$100\frac{1}{2} - 9\frac{5}{8} = 100\frac{4}{8} - 9\frac{5}{8} = 99 + 1\frac{4}{8} - 9\frac{5}{8} = 99\frac{4}{8} - 9\frac{5}{8} = 90\frac{7}{8}.$$

(12)

$$\frac{1}{2} \text{ of } \frac{37}{4} = \frac{37}{8} = 4\frac{5}{8}. \quad 6\frac{1}{2} - 4\frac{5}{8} = 6\frac{4}{8} - 4\frac{5}{8} = 5 + 1\frac{4}{8} - 4\frac{5}{8} = 5\frac{8}{8} - 4\frac{5}{8} = 1\frac{3}{8}.$$

(13)

$$611\frac{43}{191} - 610\frac{88}{99} = 611\frac{8557}{38009} - 610\frac{37818}{38009} = 610 + 1\frac{8557}{38009} - 610\frac{37818}{38009} = 610\frac{38009}{38009} - 610\frac{37818}{38009} = 610\frac{191}{38009} = \frac{191}{38009}.$$

(14)

$$\frac{5}{9} \text{ of } \frac{2}{1} = \frac{10}{9}. \quad \frac{1}{8} + \frac{1}{9} = \frac{9}{72} + \frac{8}{72} = \frac{17}{72}. \quad \frac{6}{7} \text{ of } \frac{1}{48} = \frac{1}{7}.$$

$$\frac{10}{9} - \frac{17}{72} = \frac{80}{72} - \frac{17}{72} = \frac{63}{72}.$$

(15)

$$\begin{array}{r} \text{oz. dr.} \\ \frac{2}{3} \text{ of a lb.} = 10 \ 10\frac{2}{3} \\ \frac{8}{9} \text{ of a dr.} = \qquad \qquad \frac{8}{9} \\ \hline 10 \ 9\frac{7}{9} \end{array}$$

(16)

$$\begin{array}{r} 24\frac{1}{24} - 21\frac{1}{21} = 24\frac{7}{68} - 21\frac{8}{68} = \\ 23 + 1\frac{7}{68} - 21\frac{8}{68} = 23\frac{75}{68} - \\ 21\frac{8}{68} = 21\frac{67}{68}. \end{array}$$

(17)

$$\begin{array}{r} \text{fur. per. yds. ft. in.} \\ \frac{2}{3} \text{ of a mile} = 1 \ 31 \ 0 \ 1 \ 10 \\ \frac{7}{11} \text{ of a fur.} = \qquad \qquad 25 \ 2 \ 1 \ 6 \\ \hline 1 \ 5 \ 3 \ 1 \ 10 \end{array}$$

(18)

$$\frac{2}{9} \text{ of } 1\frac{35}{2} = 1\frac{5}{2} = 7\frac{1}{2}. \quad \frac{1}{16} \text{ of } \frac{57}{2} = \frac{57}{32} = 1\frac{25}{32}.$$

$$7\frac{1}{2} - 1\frac{25}{32} = 7\frac{16}{32} - 1\frac{25}{32} = 6 + 1\frac{16}{32} - 1\frac{25}{32} = 6\frac{16}{32} - 1\frac{25}{32} = 5\frac{31}{32}.$$

(19)

$$\frac{1}{2} \text{ of } \frac{3}{7} \text{ of } \frac{2}{9} \text{ of } \frac{3^3}{4} \text{ of } \frac{5^2}{6} = \frac{1 \times 3 \times 2 \times 33 \times 62 \times 5}{2 \times 7 \times 9 \times 4 \times 33 \times 6} = 1\frac{55}{2}.$$

$$12\frac{319}{1764} + 1\frac{55}{2} = 12\frac{319}{1764} + 1\frac{485}{1764} = 12\frac{804}{1764} = 12\frac{541}{441} = 12\frac{29}{49}.$$

$$\frac{17\frac{9}{11}}{1\frac{23}{33}} = \frac{196 \times 33}{11 \times 56} = 2\frac{1}{2} = 10\frac{1}{2}.$$

$$12\frac{29}{49} - 10\frac{1}{2} = 12\frac{28}{49} - 10\frac{49}{49} = 2\frac{29}{49}.$$

(20)

$$3\frac{1}{2} + 8\frac{1}{2} + 5\frac{1}{2} + 6\frac{1}{2} = 3 + 8 + 5 + 6 + (\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}) = 22 + (\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}).$$

$$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{15}{30} + \frac{20}{30} + \frac{30}{30} + \frac{30}{30} = 1\frac{61}{30}.$$

$$22 + 1\frac{61}{30} = 22\frac{61}{30}.$$

$$3\frac{3}{10} + 2\frac{5}{6} + 16\frac{1}{4} = 3 + 2 + 16 + (\frac{3}{10} + \frac{5}{6} + \frac{1}{4}) = 21 + (\frac{3}{10} + \frac{5}{6} + \frac{1}{4}).$$

$$\frac{3}{10} + \frac{5}{6} + \frac{1}{4} = \frac{18}{60} + \frac{50}{60} + \frac{15}{60} = \frac{83}{60} = 1\frac{23}{60}. \quad 21 + 1\frac{23}{60} = 22\frac{23}{60}.$$

$$22\frac{61}{30} - 22\frac{23}{60} = 22\frac{61}{30} - 22\frac{46}{60} = \frac{92}{60} = \frac{23}{15}.$$



(21)

		r.	per.	yds.	ft.	in.
$\frac{1}{11}$ of an acre	=	1	18	5	4	72
$\frac{1}{9}$ of a per.	=			13	4	
		<hr/>				
		1	17	22	2	108

(22)

$$16\frac{1}{7} - 9\frac{1}{9} = 16\frac{19}{133} - 9\frac{98}{133} = 15 + 1\frac{19}{133} - 9\frac{98}{133} = 15\frac{152}{133} - 9\frac{98}{133} = 6\frac{54}{133}.$$

$$169\frac{17}{100} - 83\frac{17}{26} = 169\frac{321}{1300} - 83\frac{850}{1300} = 168 + 1\frac{321}{1300} - 83\frac{850}{1300} = 168\frac{1521}{1300} - 83\frac{850}{1300} = 85\frac{671}{1300}.$$

Page 173.

(6)

$$\frac{7}{12} \text{ of } \frac{5}{6} = \frac{7 \times 5}{12 \times 6} = 3\frac{5}{2}.$$

(7)

$$\frac{5}{8} \times \frac{4}{5} = \frac{1}{2}.$$

(8)

$$\frac{4}{15} \times \frac{5}{24} = 1\frac{1}{8}.$$

(9)

$$\frac{7}{8} \times \frac{5}{6} \times \frac{7}{16} = 3\frac{45}{16}.$$

$$\frac{14}{1} \times \frac{241}{16} \times \frac{32}{9} = \frac{14 \times 241 \times 2}{9} = 67\frac{48}{9} = 749\frac{1}{3}.$$

(10)

(11)

$$\frac{3}{10} \times \frac{7}{4} \times \frac{9}{11} \times \frac{11}{12} = \frac{3 \times 7 \times 9}{2 \times 4 \times 4} = 1\frac{81}{32} = 5\frac{39}{32}.$$

(12)

$$\frac{4}{5} \times \frac{6}{11} \times \frac{9}{17} \times \frac{182}{200} \times \frac{5}{9} = \frac{3 \times 182}{11 \times 17 \times 25} = 4\frac{16}{75}.$$

(13)

$$\frac{3}{6} \times \frac{11}{8} \times \frac{3}{6} \times \frac{3}{21} \times \frac{5}{5} \times \frac{5}{1} = \frac{3 \times 3 \times 3}{2} = \frac{27}{2} = 13\frac{1}{2}.$$

(14)

$$\frac{2}{6} \times \frac{5}{5} \times \frac{6}{11} \times \frac{4}{19} \times \frac{11}{209} = \frac{2 \times 6 \times 4}{5} = \frac{48}{5} = 9\frac{3}{5}.$$

(15)

$$\frac{13}{2} \times \frac{80}{7} \times \frac{2}{11} \times \frac{2}{13} \times \frac{7}{80} \times \frac{1}{80} = \frac{1}{11}.$$

(16)

$$\frac{4}{7} \times \frac{3}{11} \times \frac{9}{16} \times \frac{7}{1} \times \frac{5}{7} \times \frac{8}{13} \times \frac{13}{91} \times \frac{167}{24} \times \frac{3 \times 9 \times 167}{4} = \frac{4509}{4} = 1127\frac{1}{4}.$$

(17)

$$\frac{1}{7} \times \frac{8}{7} \times \frac{64}{9} \times \frac{14}{4} \times \frac{3}{27} \times \frac{8}{8} =$$

$$\frac{1}{7 \times 8} \times \frac{8 \times 2}{7 \times 19} \times \frac{8}{9 \times 8} \times \frac{19 \times 14}{101 \times 4} \times \frac{1}{9} \times \frac{8}{8} = \frac{1}{7 \times 101} = \frac{1}{707}.$$

(18)

$$\frac{1}{4} \times \frac{2}{8} \times \frac{2}{7} \times \frac{19}{1} = \frac{2 \times 2 \times 19}{7} = \frac{76}{7} = 10\frac{6}{7}.$$

(19)

$$\frac{9}{10} \times \frac{7}{1} \times \frac{11}{15} \times \frac{32}{11} = \frac{9 \times 7 \times 32}{5} = 201\frac{6}{5} = 403\frac{1}{5}.$$

(20)

$$\frac{27}{4} \times \frac{5}{8} \times \frac{4}{5} \times \frac{4}{7} = 2\frac{7}{10} = 2.7.$$

(21)

$$\frac{11}{3} \times \frac{13}{8} \times \frac{15}{1} = \frac{11 \times 13 \times 15}{8} = 214\frac{5}{8} = 268\frac{1}{2}.$$

(22)

$$\frac{1}{3} \times \frac{7}{4} \times \frac{3}{19} \times \frac{19}{2} \times \frac{11}{11} \times \frac{2}{17} \times \frac{49}{8} \times \frac{4}{5} \times \frac{27}{31} \times \frac{31}{2} \times \frac{191}{188} = \frac{7 \times 49 \times 27 \times 191}{2 \times 11 \times 17} = 4729\frac{305}{374}.$$

(23)

$$\frac{27}{37\frac{1}{2}} \times \frac{87\frac{1}{2}}{98\frac{1}{2}} \times \frac{7}{2\frac{1}{2}} \times \frac{81\frac{1}{2}}{128} = \frac{27}{188} \times \frac{185}{785} \times \frac{7}{3} \times \frac{165}{128} = \frac{27 \times 5}{188} \times \frac{185 \times 8}{8 \times 185} \times \frac{7 \times 8}{8 \times 7} \times \frac{165 \times 1}{11 \times 128} = \frac{5}{3 \times 11} = \frac{5}{33}.$$

(24)

$$\$ \frac{5}{11} \times \frac{1}{7} \times \frac{3}{5} \times \frac{17}{19} = \frac{3 \times 17}{11 \times 7} = \$1\frac{1}{7}.$$

(25)

$$\frac{75\frac{3}{8}}{6\frac{1}{11}} \times \frac{\frac{2}{7} \text{ of } 8\frac{1}{4} \times \frac{1}{15} \text{ of } 28}{\frac{2}{11} \text{ of } 6\frac{2}{3} \times \frac{1}{17} \text{ of } 24} \times \frac{7\frac{1}{2}}{15} \times \frac{\frac{2}{4}}{\frac{5}{7}} \times 14\frac{2}{7} \times \frac{100}{121} \times$$

$$\frac{4}{5\frac{1}{2}} \times \frac{5}{9} =$$

$$\frac{60\frac{3}{8}}{6\frac{1}{11}} \times \frac{\frac{2}{7} \times \frac{3\frac{2}{3}}{4} \times \frac{1}{15} \times \frac{28}{1}}{\frac{2}{11} \times \frac{5\frac{1}{3}}{8} \times \frac{1}{17} \times \frac{24}{1}} \times \frac{3\frac{6}{8}}{15\frac{1}{1}} \times \frac{\frac{2}{4}}{\frac{5}{7}} \times \frac{101}{7} \times \frac{100}{121} \times$$

$$\frac{\frac{4}{1}}{1\frac{6}{3}} \times \frac{5}{9} =$$

$$\frac{9 \times 11}{8 \times 67} \times \frac{11 \times 4}{3 \times 33 \times 28 \times 11 \times 8 \times 17} \times \frac{9}{5 \times 15} \times \frac{3 \times 7}{4 \times 5} \times$$

$$\frac{101}{7} \times \frac{20}{121} \times \frac{2}{4 \times 3} \times \frac{5}{7 \times 9} =$$

$$\frac{11 \times 9 \times 101}{5 \times 7 \times 16} = \frac{9999}{5600} = 17\frac{479}{5600}$$

Page 174.

(28)

$$\frac{1}{36} \text{ of } 4 \text{ days, } 5 \text{ hours, } = \frac{180 \text{ d. } 23 \text{ h.}}{36} = 5 \text{ d. } 0 \text{ h. } 38 \text{ min. } 20 \text{ sec.}$$

(29)

$$\frac{1}{42} \text{ of } £29 = \frac{£29 \times 13}{42} \times \frac{£377}{42} = £8 \text{ } 19\text{s. } 6\frac{2}{3}\text{d.}$$

(30)

$$\frac{7}{9} \text{ of } 186 \text{ a. } 3 \text{ r.} = \frac{186 \text{ a. } 3 \text{ r.} \times 7}{9} = \frac{1307 \text{ a. } 1 \text{ r.}}{9} = 145 \text{ a. } 1 \text{ r.}$$

(31)

$$\frac{1}{4} \text{ of } \frac{2}{7} \text{ of } \frac{1}{20} \text{ of } \frac{1}{2} \text{ of } 24 \text{ h. } 30 \text{ m.} = \frac{1}{140} \text{ of } 24 \text{ h. } 30 \text{ m.} = 1 \text{ h. } 38 \text{ m.}$$

(32)

$$\frac{2}{3} \text{ of } \frac{1}{2} \text{ of } \frac{2}{10} \text{ of } \frac{7}{9} \text{ of } 33 \text{ bu. } 2 \text{ p. } 1 \text{ ga.} = \frac{7}{90} \text{ of } 33 \text{ bu. } 2 \text{ p. } 1 \text{ ga.} =$$

$$\frac{33 \text{ bu. } 2 \text{ p. } 1 \text{ ga.} \times 7}{90} = \frac{235 \text{ b. } 1 \text{ p. } 1 \text{ g.}}{90} = 2 \text{ b. } 2 \text{ p. } 0 \text{ g. } 3 \text{ q. } 1 \frac{1}{3} \text{ p.}$$

Page 175.

(5)

$$\frac{1}{2} \text{ of } \frac{2}{3} \div \frac{1}{2} \text{ of } \frac{35}{4} = \frac{1}{2} \times \frac{2}{5} \times \frac{2}{2} \times \frac{4}{35} = \frac{2 \times 4}{5 \times 35} = \frac{8}{175}.$$

(6)

$$\frac{15}{2} \div \frac{2}{5} \div \frac{5}{11} = \frac{15}{2} \times \frac{5}{2} \times \frac{11}{5} = \frac{5}{2 \times 3} = \frac{5}{6}.$$

(7)

$$82 \frac{1}{17} \div 26 \frac{5}{11} = \frac{155}{17} \times \frac{41}{119} = \frac{155 \times 41}{17 \times 119} = \frac{6355}{2023} = 3 \frac{286}{2023}.$$

(8)

$$2 \frac{1}{2} \div \frac{1}{2} + \frac{1}{2} = \frac{5}{2} \div \frac{1}{2} = \frac{5}{2} \times \frac{2}{1} = \frac{5 \times 4}{11} = \frac{20}{11} = 1 \frac{9}{11}.$$

E

(9)

$$1\frac{3}{4} \div \frac{1}{7} \text{ of } 2\frac{3}{4} \text{ of } 16 \text{ of } \frac{3^5}{4} \text{ of } \frac{1}{70} = \frac{7}{\frac{4}{2}} \times \frac{7}{1} \times \frac{4}{11} \times \frac{1}{\frac{16}{\frac{4}{4}}} \times \frac{4}{35} \times$$

$$\frac{\frac{2}{70}}{1} = \frac{7 \times 7}{2 \times 11} = \frac{49}{22} = 2\frac{5}{22}.$$

(10)

$$2\frac{1}{3} \div (\frac{5}{9} \div \frac{6}{32} \text{ of } 9) = \frac{7}{3} \div (\frac{5}{9} \text{ of } \frac{3^2}{6} \text{ of } \frac{1}{9}) = \frac{7}{3} \times \frac{9}{5} \times \frac{\frac{3}{8}}{\frac{32}{16}} \times$$

$$\frac{\frac{3}{9}}{1} = \frac{7 \times 9 \times 3 \times 3}{5 \times 16} = \frac{567}{80} = 7\frac{7}{80}.$$

(11)

$$48\frac{1}{2} \div \frac{2}{9} + \frac{1}{3} \text{ of } 6 = \frac{97}{2} \div \frac{2}{9} + \frac{2}{3} = \frac{97}{2} \div \frac{2}{81} = \frac{97}{2} \times \frac{18}{89} =$$

$$\frac{97 \times 18}{89} = \frac{1746}{89} = 19\frac{54}{89}.$$

(12)

$$6\frac{1}{2} \div \frac{2}{8} \text{ of } \frac{9}{10} + \frac{8}{17} = \frac{13}{2} \div \frac{27}{80} + \frac{8}{17} = \frac{13}{2} \div \frac{858}{80} = \frac{13}{2} \times$$

$$\frac{425}{859} = \frac{13 \times 425}{859} = \frac{5525}{859} = 6\frac{371}{859}.$$

(13)

$$\frac{9}{2} \times \frac{10}{3} \div \frac{9}{4} \times \frac{5}{4} = \frac{9}{2} \times \frac{\frac{5}{10}}{3} \times \frac{4}{9} \times \frac{4}{\frac{25}{5}} = \frac{4 \times 4}{3 \times 5} = \frac{16}{15} = 1\frac{1}{15}.$$

(14)

$$\frac{\frac{57}{9}}{\frac{35}{2}} \div \frac{\frac{3}{7}}{\frac{33}{8}} = \frac{67 \times 3}{9 \times 35} \div \frac{3 \times 8}{7 \times 33} = \frac{67 \times 3}{3 \times 35} \times \frac{7 \times 33}{3 \times 8} =$$

$$\frac{67 \times 11}{3 \times 5 \times 8} = \frac{737}{120} = 6\frac{17}{20}.$$

(15)

$$\frac{5}{9} \text{ of } \frac{80}{11} \div \frac{1}{11} \text{ of } 1\frac{1}{2} = \frac{5}{9} \times \frac{10}{11} \times \frac{11}{4} \times \frac{7}{12} = \frac{5 \times 10 \times 7}{9 \times 61} = \frac{350}{61}.$$

(16)

$$\frac{1}{2} \text{ of } \frac{1}{3} \text{ of } \frac{1}{2} \text{ of } \frac{7}{8} \div \frac{5}{6} \text{ of } \frac{3}{2} \text{ of } \frac{1}{2} \text{ of } \frac{5}{1} = \frac{3}{28} \times \frac{2}{13} \times \frac{3}{4} \times \frac{7}{5} \times \frac{6}{5} \times$$

$$\frac{25}{3} \times \frac{4}{3} \times \frac{1}{5} = \frac{3 \times 2 \times 7 \times 6}{13 \times 5} = \frac{252}{65} = 3\frac{57}{65}.$$

(17)

$$\frac{\frac{7}{4}}{\frac{2}{2}} \div \frac{\frac{7}{3}}{\frac{4}{4}} = \frac{7 \times 2}{4 \times 9} \div \frac{7 \times 4}{3 \times 9} = \frac{7 \times 2}{4 \times 9} \times \frac{3 \times 9}{7 \times 4} = \frac{3}{2 \times 4} = \frac{3}{8}.$$

(18)

$$\frac{\frac{3}{25}}{\frac{3}{2}} \div \frac{\frac{21}{6}}{\frac{35}{2}} = \frac{3}{25} \div \frac{21 \times 2}{5 \times 35} = \frac{3}{25} \times \frac{5 \times 35}{21 \times 2} = \frac{1}{2}.$$

(19)

$$11\frac{1}{2} \times \frac{1}{9} \div \frac{3}{7} \times \frac{107}{13} \times \frac{13}{17} = \frac{113}{8} \times \frac{1}{9} \times \frac{7}{3} \times \frac{13}{107} \times$$

$$\frac{2 \times 17}{7 \times 13} = \frac{113 \times 2 \times 17}{9 \times 3 \times 107} = \frac{3842}{2889} = 1\frac{953}{2889}.$$

(20)

$$\begin{aligned} \frac{31}{2} \times \frac{\frac{2}{7}}{\frac{7}{9}} \times \frac{\frac{7}{3}}{\frac{7}{3}} \times \frac{\frac{7}{10}}{\frac{3}{1}} \div \frac{\frac{41}{9}}{\frac{7}{1}} \times \frac{\frac{3}{1}}{\frac{19}{4}} \times \frac{\frac{7}{8}}{\frac{7}{2}} \times \frac{\frac{11}{4}}{\frac{7}{1}} = \\ \frac{31}{2} \times \frac{2 \times 9}{7 \times 7} \times \frac{7 \times 3}{2} \times \frac{7}{10 \times 3} \div \frac{41}{9 \times 7} \times \frac{3 \times 4}{19} \times \frac{7 \times 2}{8 \times 7} \times \frac{11 \times 7}{4 \times 4} = \\ \frac{31}{2} \times \frac{2 \times 3}{7 \times 7} \times \frac{7 \times 3}{2} \times \frac{7}{10 \times 3} \times \frac{9 \times 7}{41} \times \frac{19}{3 \times 4} \times \frac{4}{7 \times 2} \times \frac{2}{11 \times 7} = \\ \frac{31 \times 3 \times 9 \times 19 \times 4}{5 \times 41 \times 11} = \frac{63612}{2255} = 28\frac{472}{2255}. \end{aligned}$$

Page 176.

(22)

$$\begin{aligned} \frac{19}{\frac{5}{3}} = \frac{19 \times 3}{11 \times 5} = \frac{57}{55}. \quad \text{£8 14s. 6}\frac{1}{2}\text{d.} \div \frac{57}{55} = \text{£8 14s. 6}\frac{1}{2}\text{d.} \times \frac{55}{57} = \\ \frac{\text{£8 14s. 6}\frac{1}{2}\text{d.} \times 55}{57} = \text{£8 8s. 5}\frac{1}{2}\text{d.} \end{aligned}$$

(23)

$$\begin{aligned} \frac{23}{5} \times \frac{20}{11} = 1\frac{1}{2}. \quad 1 \text{ m. 5 fur. 91 yds. 2 ft.} \div 1\frac{1}{2} = 1 \text{ m.} \\ 5 \text{ fur. 91 yds. 2 ft.} \times 1\frac{2}{5} = \\ 1 \text{ m. 5 fur. 91 yds. 2 ft.} \times 22 \\ \hline 115 = 2 \text{ fur. 124 yds. 2 ft.} \end{aligned}$$

(24)

$$\begin{aligned} 3 \text{ a. 3 r. 3 per.} \div \frac{2}{3} = 3 \text{ a. 3 r. 3 p.} \times \frac{3}{2} = \frac{3 \text{ a. 3 r. 3 p.} \times 5}{3} = \\ 6 \text{ a. 1 r. 5 per.} \end{aligned}$$

(25)

$$\begin{aligned} \text{£7 16s. 2d.} \div \frac{1}{4} = \text{£7 16s. 2d.} \times 4 = \frac{\text{£7 16s. 2d.} \times 9}{4} = \\ \text{£17 11s. 4}\frac{1}{2}\text{d.} \end{aligned}$$



Page 178.

(28)

$$\begin{array}{r}
 12\frac{1}{4} \\
 \hline
 7 \\
 \hline
 3\frac{1}{4} \\
 \hline
 9 \\
 \hline
 3 \\
 \hline
 5 \\
 \hline
 4\frac{1}{2}
 \end{array}
 =
 \begin{array}{r}
 4\frac{0}{4} \\
 \hline
 7 \\
 \hline
 13\frac{1}{4} \\
 \hline
 9 \\
 \hline
 3 \\
 \hline
 5 \\
 \hline
 2
 \end{array}
 =
 \begin{array}{r}
 7 \\
 \hline
 4 \\
 \hline
 13\frac{1}{4} \\
 \hline
 27 \\
 \hline
 7 \\
 \hline
 5 \\
 \hline
 2
 \end{array}
 =
 \begin{array}{r}
 7 \\
 \hline
 13 \\
 \hline
 243 \\
 \hline
 5 \\
 \hline
 2 \\
 \hline
 2
 \end{array}
 =
 \begin{array}{r}
 7 \\
 \hline
 13 \\
 \hline
 243 \\
 \hline
 2 \\
 \hline
 2
 \end{array}
 =
 \begin{array}{r}
 7 \\
 \hline
 13 \\
 \hline
 27 \\
 \hline
 35 \\
 \hline
 2
 \end{array}
 =
 \frac{7 \times 35}{13 \times 27}$$

$$\begin{array}{r}
 \frac{2}{3} \text{ of } 32 \\
 \hline
 7 \\
 \hline
 9\frac{1}{3} \\
 \hline
 3\frac{1}{3} \\
 \hline
 7 \\
 \hline
 7 \times 35 \\
 13 \times 27
 \end{array}
 =
 \begin{array}{r}
 64 \\
 \hline
 7 \\
 \hline
 28 \\
 \hline
 7 \\
 \hline
 3 \\
 \hline
 3
 \end{array}
 =
 \begin{array}{r}
 54 \\
 \hline
 3 \\
 \hline
 3 \\
 \hline
 7 \\
 \hline
 7
 \end{array}
 =
 \begin{array}{r}
 64 \\
 \hline
 7 \\
 \hline
 21 \\
 \hline
 21
 \end{array}
 = 3.$$

$$\frac{7 \times 35}{13 \times 27} \times \frac{3}{1} = \frac{735}{351} = 2\frac{11}{17} = 2\frac{11}{17}.$$

(29)

$$\begin{array}{r}
 \frac{1}{7} \\
 \hline
 6\frac{1}{7} \\
 \hline
 9\frac{1}{7} \\
 \hline
 3 \\
 \hline
 \frac{5}{7}
 \end{array}
 =
 \begin{array}{r}
 \frac{1}{7} \\
 \hline
 13 \\
 \hline
 19 \\
 \hline
 3 \\
 \hline
 5
 \end{array}
 =
 \begin{array}{r}
 \frac{1}{21} \\
 \hline
 13 \\
 \hline
 19 \\
 \hline
 7 \\
 \hline
 5
 \end{array}
 =
 \begin{array}{r}
 2 \\
 \hline
 21 \times 13 \\
 \hline
 19 \\
 \hline
 7 \times 13 \times 19
 \end{array}
 =
 \frac{8}{7 \times 13 \times 19}$$

$$\frac{\frac{5}{7}}{1} = \frac{5}{42} \cdot \frac{8}{7 \times 13 \times 19} \div \frac{5}{42} = \frac{8}{7 \times 13 \times 19} \times \frac{42}{5} = 1\frac{8}{133}.$$

(30)

$$\frac{12\frac{1}{2}}{5\frac{1}{4}} = \frac{2\frac{5}{2}}{2\frac{1}{4}} = \frac{5\frac{0}{21}}{1\frac{5}{22}} = \frac{220}{63}.$$

$$\frac{5\frac{1}{2}}{2\frac{1}{4}} = \frac{11}{2}$$

$$\frac{2\frac{1}{4}}{5} = \frac{\frac{9}{4}}{5} = \frac{9}{20}$$

$$\frac{4\frac{1}{2}}{3\frac{3}{4}} = \frac{\frac{9}{2}}{\frac{15}{4}} = \frac{\frac{9}{2}}{\frac{15}{4}} = \frac{10}{80} = \frac{1}{8}.$$

$$\frac{16\frac{2}{3}}{\frac{1}{2}} = \frac{50}{\frac{1}{3}} = \frac{100}{3}$$

$$\frac{220}{63} \div \frac{8}{9} = \frac{220}{63} \times \frac{9}{8} = \frac{55}{14} = 3\frac{3}{14}.$$

Page 180.

(1)

$$\frac{800}{2000} = \frac{2}{5}, \quad \frac{420}{2000} = \frac{21}{100}, \quad \frac{100}{2000} = \frac{1}{20}, \quad \frac{160}{2000} = \frac{2}{25}.$$

$$\frac{35}{2000} = \frac{7}{400}.$$

(2)

$$\frac{2}{5} \text{ of } \frac{5}{4} \text{ of } \frac{8}{5} \text{ of } \frac{1}{4} \text{ of } \frac{5}{2} \text{ of } \frac{1}{15} = \frac{2}{5} \times \frac{5}{4} \times \frac{8}{5} \times \frac{1}{4} \times \frac{5}{2} \times \frac{1}{15} = \frac{2}{45}.$$

(3)

$$6\frac{7}{8} \times 65\frac{3}{4} \text{ cts.} = \frac{55}{8} \times \frac{263}{4} \text{ cts.} = \frac{14416\frac{1}{2}}{32} \text{ cts.} = \$452\frac{1}{32}.$$

(4)

$$\frac{2}{3} + \frac{4}{17} = \frac{51}{136} + \frac{32}{136} = \frac{83}{136}.$$

(5)

$$\frac{1}{2} + \frac{1}{10} + \frac{1}{3} + \frac{1}{6} = \frac{15}{30} + \frac{3}{30} + \frac{10}{30} + \frac{5}{30} = \frac{33}{30} = \frac{11}{10}.$$

1 or  $\frac{10}{10} - \frac{30}{30} = \frac{10}{30} = \frac{1}{3}.$

(6)

$$\frac{5\frac{1}{2} - 2\frac{1}{4}}{3\frac{1}{2} + \frac{9}{20}} \text{ of } \frac{4\frac{1}{2} + 5\frac{1}{2}}{4\frac{1}{20}} \text{ of } \frac{2\frac{3}{4} + 1\frac{1}{2}}{7\frac{9}{24} - 2\frac{1}{4}} = \frac{5\frac{3}{8} - 2\frac{5}{40}}{3\frac{1}{8} + \frac{9}{20}} \text{ of } \frac{4\frac{26}{80} + 5\frac{38}{80}}{\frac{81}{20}} \text{ of } \frac{2\frac{3}{8} + 1\frac{1}{8}}{7\frac{9}{24} - 2\frac{6}{24}} = \frac{3\frac{27}{40}}{4\frac{4}{20}} \text{ of } \frac{10\frac{13}{80}}{\frac{81}{20}} \text{ of } \frac{4\frac{1}{5}}{5\frac{3}{4}} = \frac{1\frac{17}{40}}{\frac{84}{20}} \text{ of } \frac{5\frac{13}{80}}{\frac{81}{20}} \text{ of } \frac{6\frac{1}{5}}{1\frac{3}{4}} =$$

$$\frac{7}{8} \times \frac{2 \times \overset{8}{57}}{5 \times \underset{3}{9}} \times \frac{8 \times 64}{5 \times \underset{19}{183}} = \frac{2 \times 64}{5 \times 3 \times 5} = \frac{128}{75} = 1\frac{53}{75}$$

(7)

$$1670\frac{7}{13} \times 12\frac{1}{4} \text{ cts.} = \frac{21711}{13} \times \frac{51}{4} \text{ cts.} = \frac{1107567}{8} \text{ cts.} = \$212.99\frac{1}{2}.$$

(8)

$\frac{2}{3}$  of the longer =  $\frac{2}{3}$  of the shorter; therefore  $\frac{1}{3}$  of the longer =  $\frac{1}{3}$  of  $\frac{2}{3}$  =  $\frac{2}{9}$  of the shorter.

Hence the longer =  $\frac{2}{3} \times 3 = \frac{2}{9}$  of the shorter.

The whole tree = longer + shorter =  $\frac{2}{9} + \frac{8}{9}$  of shorter =  $\frac{10}{9}$  of the shorter.

If 136 ft. =  $\frac{10}{9}$  of the shorter,  $\frac{1}{10}$  of 136 = 8 =  $\frac{1}{9}$  of the shorter.

Hence shorter =  $8 \times 8 = 64$  ft.; and longer =  $136 - 64 = 72$  ft.

(9)

$$97\frac{1}{2} + 127\frac{1}{2} + 500\frac{1}{2} + 333\frac{1}{2} = 97\frac{30}{60} + 127\frac{18}{60} + 500\frac{15}{60} + 333\frac{10}{60} = 1057\frac{63}{60} = 1058\frac{1}{20}.$$

$$\$1000 + \$1375\frac{1}{2} + \$6831 + \$4013\frac{3}{4} = \$1000 + \$1375\frac{8}{16} + \$6831 + \$4013\frac{3}{4} = \$13219\frac{1}{4} = \$13219.68\frac{1}{2}.$$

(10)

$$12\frac{5}{6} + \frac{8}{16} = 13\frac{11}{30}. \quad 8\frac{3}{4} + 1\frac{1}{10} = 9\frac{17}{20}. \quad 13\frac{11}{30} - 9\frac{17}{20} = 3\frac{31}{60} = 2\frac{11}{60}.$$

$$7\frac{5}{12} - 6\frac{1}{2} = \frac{1}{12}. \quad 2\frac{11}{60} \times \frac{9}{2} \times \frac{11}{12} = 2\frac{321}{160} = 14\frac{81}{160}.$$

$$\frac{2}{3} \div \frac{1}{7} = \frac{2}{3} \times \frac{7}{1} = \frac{14}{3}. \quad \frac{5}{8} \div \frac{35}{11} = \frac{5}{8} \times \frac{11}{35} = \frac{11}{56}. \quad \frac{7}{8} - \frac{11}{56} = \frac{27}{56}.$$

(11)

$$19\frac{7}{8} \times \$6\frac{3}{4} = \frac{159}{8} \times \$\frac{27}{4} = \$\frac{4293}{32} = \$134.15\frac{1}{2}.$$

(12)

$$376\frac{1}{8} \times \$75\frac{3}{4} = \frac{6779}{8} \times \$\frac{603}{8} = \frac{4087737}{144} = \$28387.06\frac{1}{4}.$$

(13)

$$147\frac{3}{4} + 320\frac{1}{5} = 147\frac{6}{8} + 320\frac{2}{5} = 467\frac{13}{10}.$$

$$467\frac{13}{10} - 156\frac{1}{4} = 467\frac{26}{20} - 156\frac{5}{20} = 311\frac{21}{20}.$$

(14)

$$\frac{7 \left(1\frac{1}{2} \text{ of } \frac{3}{4}\right)}{\frac{1}{6} \left(\frac{3}{3\frac{1}{2}} \text{ of } 7\right)} \div 7\frac{7}{8} = \frac{7 \times \frac{3}{2} \times \frac{4}{3}}{\frac{1}{6} \times \frac{3}{\frac{7}{2}} \times 7} \div \frac{63}{8} = \frac{7 \times 3 \times 3}{1 \times 2 \times 4} \times \frac{8}{63} =$$

$$\frac{7 \times 3 \times 3}{1 \times 2 \times 4} \times \frac{2}{63} = 1. \quad \frac{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}}{1 \quad 1 \quad 1} = \frac{\frac{6}{12} + \frac{4}{12} + \frac{3}{12}}{1 \quad 1 \quad 1} =$$

$$\frac{13}{21 \quad 31 \quad 41} = \frac{\frac{5}{2} \quad \frac{13}{4} \quad \frac{9}{2}}{2176} =$$

$$\frac{13}{2+13+9} = \frac{13}{233+1880+139} = \frac{13}{544} = \frac{2535}{2176} = 1\frac{359}{176}.$$

(15)

$$17\frac{1}{2} \div 7\frac{1}{4} = \frac{17\frac{1}{2}}{7\frac{1}{4}} = \frac{17\frac{1}{2}}{7\frac{1}{4}} \times \frac{4}{4} = \frac{17\frac{1}{2}}{7\frac{1}{4}} = 2\frac{17}{8}.$$

(16)

$$3\frac{3}{4} + 4\frac{1}{2} + 4\frac{1}{2} = 3\frac{6}{6} + 4\frac{5}{6} + 4\frac{5}{6} = 13\frac{16}{6} = 7\frac{2}{3}.$$

$$7\frac{2}{3} - 5\frac{5}{6} = 7\frac{4}{6} - 5\frac{5}{6} = 2\frac{1}{6} = \frac{2}{6}.$$

$$94\frac{1}{2} + 93\frac{1}{2} = 94\frac{2}{4} + 93\frac{2}{4} = 187\frac{4}{4} = 187\frac{1}{1}.$$

$$7\frac{2}{3} \times \frac{85}{12} \div \frac{13481}{72} = \frac{593}{60} \times \frac{17}{85} \times \frac{6}{72} = \frac{1}{1}.$$

(17)

$$2\frac{3}{4} + \frac{1}{8} + 4 = 2\frac{6}{8} + \frac{1}{8} + 4 = 7\frac{7}{8} = 7\frac{1}{8}.$$

$$2 \div \frac{11}{15} = 2 \times \frac{15}{11} = \frac{30}{11}. \quad 1\frac{3}{4} - \frac{7}{9} = \frac{15}{9} - \frac{7}{9} = \frac{8}{9}.$$

$$\frac{15}{6} + \frac{8}{9} = \frac{583}{18}. \quad 5\frac{1}{2} - 4\frac{1}{2} = 4\frac{2}{10} - 4\frac{5}{10} = \frac{7}{10}.$$

$$\frac{583}{504} = \frac{7}{10} = \frac{583}{504}.$$

(18)

$$\frac{1}{2} + \frac{1}{3} = \frac{5}{6}. \quad 1\frac{1}{2} + 2\frac{3}{4} = 4\frac{1}{2} = 4\frac{2}{4}. \quad 2\frac{1}{4} - 1\frac{1}{2} = \frac{1}{4} = \frac{1}{4}.$$

$$3\frac{1}{10} - \frac{7}{10} = 2\frac{4}{10} = \frac{187}{100}. \quad \frac{5}{6} \times \frac{49}{12} \times \frac{2}{7} \times \frac{187}{70} = \frac{187}{3 \times 12} = \frac{187}{36} = 5\frac{7}{36}.$$

$$1\frac{1}{2} \div 2\frac{1}{2} = \frac{7}{4} \times \frac{2}{5} = \frac{7}{10}. \quad 5\frac{1}{2} \div 3\frac{1}{3} = \frac{11}{2} \times \frac{3}{8} = \frac{33}{8} = 4\frac{1}{8}.$$

$$\frac{7}{10} + 1\frac{1}{2} = 2\frac{3}{5}.$$

(19)

$$1 - (\frac{1}{2} + \frac{1}{3}) = \frac{1}{6}. \quad \frac{2}{3} \text{ of } \frac{1}{2} = \frac{1}{3}. \quad \frac{1}{2} - \frac{1}{3} = \frac{1}{6}. \quad \frac{1}{6} + \frac{1}{6} = \frac{2}{6}.$$

$$\frac{1}{2} - \frac{2}{6} = \frac{1}{6}. \quad \frac{1}{6} \text{ of } \$40000 = \$1333.33\frac{1}{3}.$$

Page 183.

(13)

$$\frac{1}{2} = 2)1 \quad \frac{3}{8} = 8)3$$


---


$$\cdot 5 \quad \cdot 375$$

(14)

$$\frac{2}{3} = 3)2 \quad \frac{1}{5} = 5)1$$


---


$$\cdot 36 = \frac{2}{5} \quad \cdot 25 = \frac{1}{5}$$

(15)

75)73 (.9733+	123)574(4.666+	34)15 (.44117+
<u>67.5</u>	<u>492</u>	<u>13.6</u>
5.50	82.0	1.40
<u>5.25</u>	<u>73.8</u>	<u>1.36</u>
.250	8.20	40
<u>.225</u>	<u>7.38</u>	<u>34</u>
250	.820	60
<u>225</u>	<u>.738</u>	<u>34</u>
25	82	260
		<u>238</u>
		22

(16)

7)6	12)5	9)4
<u>.857142</u>	<u>.4166+</u>	<u>.44444+</u>

(17)

112)17 (.15178571428+	1296)718 (.554012+
<u>11.2</u>	<u>648.0</u>
5.80	800
<u>5.60</u>	<u>784</u>
.200	160
<u>.112</u>	<u>112</u>
880	480
<u>784</u>	<u>448</u>
960	320
<u>896</u>	<u>224</u>
640	960
<u>560</u>	<u>896</u>
800	64

Page 184.

(20)	(21)	(22)
12)1·0 in.	12)17·0 grs.	20)7·0 grs.
<u>          </u>	<u>          </u>	<u>          </u>
3)2·083333 ft.	2)1·41666666	3)2·35 scr.
<u>          </u>	<u>          </u>	<u>          </u>
5½)3·694444 yd.	20)3·70833333 dwt.	8)·7833333 dr.
<u>  2          2</u>	<u>          </u>	<u>          </u>
11) 7·388888	12)·18541666 oz.	12)·0979166 oz.
<u>          </u>	<u>          </u>	<u>          </u>
40)·671717 per.	·01545138+ lb.	·0081597+ lb.
<u>          </u>		
·01679+ fur.		

(23)	(24)	(26)
12)9·0 in.	4)2·0 na.	60)21·0 sec.
<u>          </u>	<u>          </u>	<u>          </u>
3)2·75 ft.	4)3·5 qr.	60)55·35 min.
<u>          </u>	<u>          </u>	<u>          </u>
5½)2·91666	·875 yd.	12)12·9225 hr.
<u>  2          2</u>		<u>          </u>
11 )5·83333		2)1·076875
<u>          </u>		<u>          </u>
40)35·53030 per.	(25)	·5384375 day.
<u>          </u>		
8)5·88825 fur.	13s. 4d. = 160d.	
<u>          </u>	5s. = 60d.	
·73603+ mile.	$\frac{60}{160} = \frac{3}{8} = \cdot375$	

(27)	(28)
$\frac{7}{8}$ of $\frac{1}{2}$ of $6\frac{3}{4}$ d. = $\frac{7}{8}$ d. and $\text{£}\frac{1}{2}$ = 80d.	$\frac{2}{3}$ of $\frac{1}{2}$ of 1 mil. = 12672 in.
$\frac{7}{8}$ d. = $\frac{1}{80}$ of $\frac{7}{8}$ of $\text{£}\frac{1}{2}$ = $\frac{7}{2240}$ of $\text{£}\frac{1}{2}$ .	3½)12672
$27 \div 2240 = 0\cdot012053.$	<u>          </u>
	2      2
	<u>          </u>
	7 )25344
	<u>          </u>
	3620·571428+

(29)

 $\frac{1}{3}$  of  $\frac{2}{5}$  of  $\frac{1}{4}$  lbs. =  $\frac{1}{30}$  lb. =  $110\frac{1}{3}$  drs. =  $\frac{1664}{18}$  drs.

 $\frac{2}{3}$  of an oz. = 12 drs. =  $\frac{1664}{18} \div 12 = \frac{1664}{180}$ 

180)1664(9·2444+

1620

440

360

800

720

800

720

800

72080

(30)

2)1·0 pts.4)1·5 qt.2)1·375 gal.4)3·6875 pk.·921875 bush.

Page 186.

(33)

·3945

24

1578078909·4680 hrs.

60

28·0800 min.

60

4·8000 sec.

(34)

·3965

8

3·1720 fur.406·8800 per.

5½

4400044004·8400 yds,

3

2·5200 ft.

12

6·2400 in.

(35)

·309153

20

6·183060 dwt.247322403661204·393440 grs.



(36)

$$22 \cdot 75 = 22 \frac{75}{100} = 22 \frac{3}{4}.$$

$$£2 \text{ 2s. 6d.} \times 22 \frac{3}{4} = £48 \text{ 6s. } 10 \frac{1}{2} \text{d.}$$

(37)

$$7 \text{ b. } 1 \text{ p. } 1 \text{ g. } 1 \text{ qts.} = 237 \text{ qts.}$$

$$11 \cdot 17825 \times 237 = 2649 \cdot 24525 \text{ qt.} =$$

$$82 \text{ b. } 3 \text{ p. } 0 \text{ g. } 1 \text{ q. } 0 \cdot 4905 \text{ pts.}$$

(38)

$$\begin{array}{r} \cdot 2057 \\ \quad 12 \\ \hline 2 \cdot 4684 \text{ oz.} \\ \quad 20 \\ \hline 9 \cdot 3680 \text{ dwt.} \\ \quad 24 \\ \hline 14720 \\ 7360 \\ \hline 8 \cdot 8320 \text{ grs.} \end{array}$$

(39)

$$1 \text{ f. } 36 \text{ p. } 2 \text{ y. } 5 \text{ in.} = 15125 \text{ in.}$$

$$15125 \times \cdot 176 = 2662 \text{ in.} =$$

$$13 \text{ per. } 2 \text{ yds. } 1 \text{ ft. } 4 \text{ in.}$$

(40)

$$\begin{array}{r} \cdot 625 \\ \quad 3 \\ \hline 1 \cdot 875 \text{ mil.} \\ \quad 8 \\ \hline 7 \cdot 000 \text{ fur.} \end{array}$$

(41)

$$\begin{array}{r} \cdot 015625 \\ \quad 4 \\ \hline \cdot 062500 \text{ pk.} \\ \quad 2 \\ \hline \cdot 125000 \text{ gal.} \\ \quad 4 \\ \hline \cdot 500000 \text{ qt.} \\ \quad 2 \\ \hline 1 \cdot 000000 \text{ pt.} \end{array}$$

(42)

$$\begin{array}{r} \cdot 9378 \\ \quad 4 \\ \hline 3 \cdot 7512 \text{ r.} \\ \quad 40 \\ \hline 30 \cdot 0480 \text{ per.} \\ \quad 30 \frac{1}{4} \\ \hline 14400 \\ \quad 120 \\ \hline 1 \cdot 4520 \text{ yd.} \\ \quad 9 \\ \hline 4 \cdot 0680 \text{ ft.} \\ \quad 144 \\ \hline 2720 \\ \quad 2720 \\ \quad 680 \\ \hline \end{array}$$

(43)

$$1 \text{ sq. yd. } 3 \text{ ft. } 72 \text{ in.} = 1800 \text{ in.}$$

$$\cdot 2775 \times 1800 = 499 \cdot 5 \text{ in.} =$$

$$3 \text{ ft. } 67 \frac{1}{2} \text{ in.}$$

$$9 \cdot 7920 \text{ in.} = 9 \frac{99}{125} \text{ in.}$$

Page 191.

(54)

$$\cdot\dot{8} = \frac{8}{9}.$$

$$\cdot\dot{05} = \frac{5}{99}.$$

$$\cdot\dot{342} = \frac{342}{999} = \frac{38}{111}.$$

$$\cdot\dot{7004} = \frac{7004}{9999}.$$

$$\cdot\dot{002003} = \frac{2003}{999999}.$$

(55)

$$\cdot\dot{19} = \frac{19}{99}.$$

$$\cdot\dot{1067} = \frac{1067}{9999} = \frac{97}{909}.$$

$$\cdot\dot{11115} = \frac{11115}{99999} = \frac{1235}{11111}.$$

$$\cdot\dot{704103} = \frac{704103}{999999} = \frac{334701}{333333}.$$

(56)

$$\cdot\dot{102} = \frac{102}{999} = \frac{34}{333}.$$

$$\cdot\dot{0013} = \frac{13}{9999}.$$

$$\cdot\dot{00007103} = \frac{7103}{99999999}.$$

$$\cdot\dot{01020304} = \frac{1020304}{99999999}.$$

$$\cdot\dot{987654321} = \frac{987654321}{999999999} = \frac{109739369}{111111111}.$$

Page 192.

(58)

$$\begin{array}{r} \cdot\dot{8325} \\ 83 \\ \hline \end{array}$$

$$\frac{8325}{8300} = \frac{1121}{4900}$$

$$\begin{array}{r} \cdot\dot{147658} \\ 147 \\ \hline \end{array}$$

$$\frac{147658}{999000}$$

$$\begin{array}{r} \cdot\dot{4320075} \\ 432 \\ \hline \end{array}$$

$$\frac{4320075}{9999000} = \frac{1439881}{3333000}.$$

(59)

$$\begin{array}{r} \cdot\dot{875} \cdot \dot{4965} \\ 49 \\ \hline \end{array}$$

$$\frac{8754965}{99900} = 875\frac{1229}{2478}$$

$$\begin{array}{r} \cdot\dot{301} \cdot \dot{82756} \\ 82 \\ \hline \end{array}$$

$$\frac{30182756}{99900} = 301\frac{9186}{1100} = 301\frac{1531}{1820}.$$

(60)

$$\begin{aligned} & \begin{array}{r} \cdot \\ \cdot 083 \\ 8 \\ \hline \end{array} & \begin{array}{l} \frac{714285}{9999990} = \frac{79365}{1111110} = \frac{7215}{101010} = \frac{1443}{20202} = \\ \frac{481}{6734} = \frac{1}{14}. \end{array} \\ \\ & \begin{array}{r} \frac{75}{900} = \frac{1}{12} \\ \\ \cdot 123456 \\ \quad 123 \\ \hline \frac{123333}{999000} = \frac{41111}{333000} \end{array} \end{aligned}$$

(61)

$$\begin{aligned} & \begin{array}{r} \cdot \\ \cdot 7034 \\ 703 \\ \hline \frac{6331}{9000} \end{array} & \begin{array}{r} \cdot \cdot \cdot \\ \cdot 96432 \\ 96 \\ \hline \frac{96336}{99900} = \frac{10704}{11100} = \frac{3568}{3700} = \frac{892}{925} \end{array} \\ \\ & \begin{array}{r} \cdot \cdot \cdot \\ \cdot 00207 \\ 2 \\ \hline \frac{206}{99000} = \frac{41}{19300} \end{array} & \begin{array}{r} \cdot \cdot \cdot \\ \cdot 143271 \\ 1432 \\ \hline \frac{141839}{990000} \end{array} \end{aligned}$$

Page 194.

(63)

Dissimilar.                  Similar.                  Similar and Coterminous.

$$\begin{aligned} \cdot 9 & = \cdot 99999 = \cdot 999999999 \\ 6 \cdot 32\ddot{7} & = 6 \cdot 3272\ddot{7}2 = 6 \cdot 3272\dot{7}272\dot{7}2 \\ 19 \cdot 43 & = 19 \cdot 43000 = 19 \cdot 430000000 \\ 27 \cdot 027\ddot{8} & = 27 \cdot 0278\ddot{7}8 = 27 \cdot 0278\dot{7}878\dot{7}8 \\ \cdot 03471\ddot{2}3 & = \cdot 03471\dot{2}3 = \cdot 03471231\dot{2}3 \end{aligned}$$

2 carried.

---

Sum, = 53·8198638274

(64)

Dissimilar.	Similar.	Similar and Coterminous.
$7.\ddot{4}2\dot{7}$	$= 7.427\ddot{2}7$	$= 7.4272727272727\dot{2}7$
$9.123\dot{4}$	$= 9.1234\ddot{2}3$	$= 9.12342342342342\dot{3}$
$17.298\dot{7}64\dot{3}$	$= 17.298764\dot{3}$	$= 17.29876437643764\dot{3}$
$18.\ddot{6}7$	$= 18.676\ddot{7}6$	$= 18.6767676767676\dot{7}6$
		2 carried.
	Sum, =	<u>52.526228203901471</u>

(65)

Dissimilar.	Similar.	Similar and Coterminous.
$4.\ddot{9}5$	$= 4.959\ddot{5}95$	$= 4.959595959\dot{5}$
$7.16\dot{4}$	$= 7.1641\ddot{6}41$	$= 7.164164164\dot{1}$
$4.712\dot{3}$	$= 4.71231\ddot{2}3$	$= 4.712312312\dot{3}$
$.9731\dot{7}$	$= .9731\dot{7}$	$= .973177777\dot{7}$
		2 carried.
	Sum, =	<u>17.8092502138</u>

(66)

Dissimilar.	Similar.	Similar and Coterminous.
1.5	$= 1.500\dot{0}$	$= 1.50000000\dot{0}$
99.083	$= 99.083\dot{0}$	$= 99.08300000\dot{0}$
.162	$= .1621\ddot{6}2$	$= .162162162\dot{2}$
.814	$= .81481\ddot{4}$	$= .814814814\dot{4}$
2.93	$= 2.939\ddot{3}9$	$= 2.939393939\dot{9}$
3.769230	$= 3.769230\dot{7}69$	$= 3.769230769\dot{9}$
97.26	$= 97.266\dot{6}$	$= 97.26666666\dot{6}$
134.09	$= 134.090\ddot{9}0$	$= 134.09090909\dot{0}$
		3 carried.
	Sum, =	<u>339.626177443</u>

## Page 195.

(68)

Dissimilar.		Similar.		Similar and Coterminous.
729·3427̇	=	729·342742̇	=	729·342742̇
93·126	=	93·1260̇	=	<u>93·126000̇</u>
				636·216742̇

(69)

Dissimilar.		Similar.		Similar and Coterminous.
1·437291̇	=	1·43729137̇	=	1·4372913729137̇
·00713̇	=	·00713̇	=	<u>·007131313131313̇</u>
				1·4301600597824̇

(70)

Dissimilar.		Similar.		Similar and Coterminous.
1·12754̇	=	1·12754̇	=	1·12754754754754̇
·47384̇	=	·473847̇	=	<u>·47384738473847̇</u>
				·65370016280907̇

(71)

Dissimilar.		Similar.		Similar and Coterminous.
42·18763̇	=	42·1876333̇	=	42·1876333333̇
17·0000008432̇	=	17·0000008432̇	=	<u>17·0000008432̇</u>
				25·1876324900̇

Page 196.

(74)

$$2.\dot{9} = 2\frac{9}{9} = 3. \quad 7.25 \times 3 = 21.75.$$

(75)

$$\cdot 297 = \frac{297}{999} = \frac{1}{3} \text{ and } 7.72 = 7\frac{72}{100} = 7\frac{18}{25} = \frac{193}{25}.$$

$$\frac{1}{3} \times \frac{193}{25} = \frac{193}{75} = 2.29\dot{3}.$$

(76)

$$\cdot 818 = \frac{818}{990} = \frac{9}{11} \text{ and } \cdot 77 = \frac{77}{100}. \quad \frac{9}{11} \times \frac{77}{100} = \frac{63}{100} = \cdot 63.$$

(77)

$$1.735 = 1\frac{735}{990} = 1\frac{161}{210} = \frac{859}{210} \text{ and } \cdot 47053 = \frac{47053}{100000} = \frac{3529}{7500}.$$

$$\frac{859}{210} \times \frac{3529}{7500} = \frac{3031411}{371250} = \cdot 81654168350.$$

(78)

$$4.722 = 4\frac{722}{990} = 4\frac{1}{3} = \frac{13}{3} \text{ and } \cdot 198 = \frac{198}{999} = \frac{22}{111}.$$

$$\frac{13}{3} \times \frac{22}{111} = \frac{286}{333} = \cdot 935.$$

(80)

$$\cdot 082 = \frac{82}{999} \text{ and } \cdot 123 = \frac{123}{999} = \frac{41}{333}.$$

$$\frac{82}{999} \div \frac{41}{333} = \frac{82}{999} \times \frac{333}{41} = \frac{2}{3} = \cdot 6.$$

(81)

$$389.185 = 389\frac{185}{999} = \frac{388796}{999} \text{ and } 15.7 = 15\frac{7}{9} = \frac{142}{9}.$$

$$\frac{388796}{999} \div \frac{142}{9} = \frac{388796}{999} \times \frac{9}{142} = \frac{2738}{111} = 24.6.$$

(82)

$$\cdot 81654168350 = \frac{81654168350}{999999999999} = \frac{10206760837}{12499987800}.$$

$$\cdot 47053 = \frac{47053}{99999} = \frac{10587}{22500}.$$

$$\frac{10206760837}{12499987800} \div \frac{10587}{22500} = \frac{10206760837}{12499987800} \times \frac{22500}{10587} = \frac{10306760837}{8881660780} =$$

1.735.

(83)

$$\cdot\ddot{45} = \frac{45}{99} = \frac{5}{11} \text{ and } \cdot\dot{118881} = \frac{118881}{999999} = \frac{17}{143}.$$

$$\frac{5}{11} \div \frac{17}{143} = \frac{5}{11} \times \frac{143}{17} = \frac{65}{17} = 3.\dot{8}235294117647058.$$

---

 MISCELLANEOUS EXERCISES.

(84)

$$\frac{1}{2} \text{ of } \frac{2}{7} \text{ of } \frac{4}{16} \text{ of } 14 = \frac{1}{2} \times \frac{2}{7} \times \frac{4}{16} \times 14 = \frac{4}{7} = .8.$$

(85)

$$\cdot\dot{67} = \frac{67}{90} \text{ and } 2.\ddot{13} = 2\frac{13}{99} = \frac{211}{99}.$$

$$\frac{67}{90} \times \frac{211}{99} = \frac{14137}{990} = 1.4445566778 +$$

(86)

wk.

$$\cdot 678125 = 4 \text{ days } 17 \text{ hours } 55 \text{ minutes } 30 \text{ seconds.}$$

7

$$\underline{4.746875} \text{ days.}$$

24

(87)

$$\cdot 92437$$

92

$$\underline{2987500}$$

$$\underline{1493750}$$

$$\cdot 92347 = \frac{92347}{99900} = \frac{18469}{19980}.$$

$$\underline{17.925000} \text{ hours.}$$

60

$$\underline{55.500000} \text{ minutes.}$$

60

$$\underline{30.000000} \text{ seconds.}$$

(88)

Dissimilar.	Similar.	Similar and Coterminous.
$67\cdot\overset{\cdot\cdot}{234}$	$= 67\cdot\overset{\cdot\cdot}{2343434}$	$= 67\cdot\overset{\cdot\cdot}{23434343434}$
$98\cdot\overset{\cdot\cdot}{713}$	$= 98\cdot\overset{\cdot\cdot}{71371371}$	$= 98\cdot\overset{\cdot\cdot}{71371371371}$
$91\cdot\overset{\cdot\cdot}{03471234}$	$= 91\cdot\overset{\cdot\cdot}{03471234}$	$= \underline{\underline{91\cdot\overset{\cdot\cdot}{03471234234}}}$
	Sum,	$= 256\cdot\overset{\cdot\cdot}{98276949039}$

Dissimilar.	Similar and Coterminous.
$256\cdot\overset{\cdot\cdot}{98276949039}$	$= 256\cdot\overset{\cdot\cdot}{98276949039}$
$100\cdot\overset{\cdot\cdot}{123456789}$	$= \underline{\underline{100\cdot\overset{\cdot\cdot}{12345678945}}}$
Difference	$= 156\cdot\overset{\cdot\cdot}{85931270094}$

(89)

12) 9 in.  
          
 3) 2·75 ft.  
          
 5½) 2·916 yds.  
 2            2  
                   
 11) 5·833  
          
 40) 36·5303 rds.  
          
 8) 5·913257 fur.  
          
 ·739157196 miles.

(90)

$17\cdot\overset{\cdot\cdot}{428571}$  sq. ft.  $= 17\overset{\cdot\cdot}{428571}$  sq. ft.  $= 17\frac{3}{7}$  sq. ft.  $= 17$  sq. ft.  $61\frac{5}{7}$  in.  
 $100\cdot\overset{\cdot\cdot}{8}$  sq. in.  $= 100\frac{2}{3}$   
 Difference,  $= \underline{\underline{16$  sq. ft.  $104\frac{2}{3}$  in.}



(91)

$$\begin{array}{r} \cdot 91789772 \\ \underline{917897} \end{array}$$

$$\cdot 91789772 \text{ of } 2 \text{ a.} = \frac{90871875}{99000000} \times \frac{2}{1} \text{ a.} = \frac{90871875}{49500000} = \frac{3231}{1760} = 1 \text{ a. } 3 \text{ r. } 13 \text{ per. } 22 \text{ yds.}$$

(92)

$$\begin{array}{r} 11 \cdot 287 \\ \underline{2} \end{array}$$

$$11 \cdot 287 = 11 \frac{287}{990} = 11 \frac{10}{66}. \quad 1 \cdot 0428571 = 1 \frac{428571}{9999990} = 1 \frac{2}{70}.$$

(93)

$$47 \cdot 345 = \frac{47345}{1000} \text{ and } 1 \cdot 76 = 1 \frac{76}{99} = \frac{175}{99}.$$

$$\frac{47345}{1000} \div \frac{175}{99} = \frac{47345}{1000} \times \frac{99}{175} = \frac{237431}{25000} = 26 \cdot 7837428571.$$

(94)

Dissimilar.                      Similar.                      Similar and Coterminous.

$$85 \cdot 62 = 85 \cdot 626 = 85 \cdot 62626$$

$$13 \cdot 76432 = 13 \cdot 76432 = 13 \cdot 76432$$

$$\text{Difference,} = 71 \cdot 86193$$

(95)

(96)

$$\cdot 734 \text{ of a lb.} = 11 \cdot 744 \text{ oz.} \quad 2 \text{ ft. } 5\frac{1}{2} \text{ in.} = 29\frac{1}{2} \text{ in.} = \frac{59}{2} \text{ in.}$$

$$\cdot 198 \text{ of an oz.} = \cdot 198 \text{ oz.} \quad 27 \cdot 3 \text{ ft.} = 27\frac{3}{10} \text{ ft.} = 328 \text{ in.}$$

$$\text{Difference,} = 11 \cdot 546 \text{ oz.} \quad 20 \cdot 16 \text{ ft.} = 20\frac{16}{100} \text{ ft.} = 242 \text{ in.}$$

$$328 \times 242 \div \frac{59}{2} = \frac{358}{1} \times \frac{242}{1} \times \frac{2}{59} = 2706 \text{ in.} = 75\frac{1}{6} \text{ yds.}$$

(97)

$$3 \cdot 145 = 3 \frac{145}{990} = 3 \frac{28}{33} = \frac{173}{53} \text{ and } 4 \cdot 297 = 4 \frac{297}{99} = 4 \frac{1}{3} = \frac{159}{37}.$$

$$\frac{173}{53} \times \frac{159}{37} = \frac{27507}{2033} = 13 \cdot 5169533.$$

(98)

$\frac{3}{40}$ . Here  $40 = 2^3 \times 5$ . Therefore the equivalent decimal will contain 3 places.

$\frac{7}{24}$ .	"	$24 = 2^3 \times 3$ .	"	"	"	"	3	"
$\frac{8}{15}$ .	"	$15 = 5 \times 3$ .	"	"	"	"	1	"
$\frac{11}{144}$ .	"	$144 = 2^4 \times 3^2$ .	"	"	"	"	4	"
$\frac{6}{90}$ .	"	$90 = 2 \times 5 \times 3^2$ .	"	"	"	"	1	"
$\frac{119}{3584}$ .	"	$3584 = 2^9 \times 7$ .	"	"	"	"	9	"

(99)

$$81\frac{2}{3} = 81.\dot{6} \text{ and } 328\frac{2}{3} = 328.\ddot{2}\ddot{3}.$$

Dissimilar.                      Similar.                      Similar and Coterminous.

$81.\dot{6}$	=	$81.6\dot{6}\dot{6}$	=	$81.666666\dot{6}$
$61.12\dot{6}$	=	$61.126\dot{6}$	=	$61.126666\dot{6}$
$328.\ddot{2}\ddot{3}$	=	$328.23\ddot{2}\ddot{3}$	=	$328.232323\ddot{2}\ddot{3}$
$5.624$	=	$5.6246\dot{2}$	=	$5.6246246\dot{2}$
				2 carried.
		Sum,	=	$476.6502811\dot{9}$

(100)

$$\begin{aligned} & \left( \frac{4.4 - 2.8\dot{3}}{1.\dot{6} + 2.\dot{6}\dot{2}\dot{9}} \times \frac{6.8 \times 3}{2.25} \right) + \frac{2.8 \times 2.\ddot{2}\ddot{7}}{1.1\dot{3}\dot{6}} \\ &= \left( \frac{1.61}{4.29\dot{6}} \times \frac{20.4}{2.25} \right) + \frac{2\frac{4}{5} \times 2\frac{2}{3}}{1\frac{1}{3}\frac{2}{3}} \\ &= \left( \frac{1\frac{5}{9}}{4\frac{29}{99}} \times \frac{20\frac{2}{5}}{2\frac{1}{4}} \right) + \frac{2\frac{4}{5} \times 2\frac{2}{3}}{1\frac{2}{3}} \\ &= \left( \frac{1\frac{1}{8}}{1\frac{29}{99}} \times \frac{10\frac{2}{5}}{\frac{9}{4}} \right) + \frac{1\frac{4}{5} \times \frac{2}{3}}{\frac{2}{3}} \\ &= \left( \frac{2\frac{2}{8}}{4\frac{29}{99}} \times \frac{3\frac{4}{5}}{\frac{3}{4}} \right) + \frac{1\frac{4}{5} \times \frac{2}{3}}{\frac{2}{3}} \\ &= \left( \frac{\frac{1}{2}}{1\frac{11}{11}} \times \frac{3\frac{4}{5}}{\frac{3}{4}} \right) + \frac{\frac{7}{11}}{\frac{2}{3}} = \left( \frac{1\frac{11}{11}}{1\frac{11}{11}} \times \frac{1\frac{3}{6}}{1\frac{3}{6}} \right) + \frac{2\frac{8}{8}}{2\frac{8}{8}} \\ &= \left( \frac{3}{3} \times \frac{1\frac{3}{6}}{1\frac{3}{6}} \right) + \frac{2\frac{8}{8}}{2\frac{8}{8}} = \frac{1\frac{3}{6}}{1\frac{3}{6}} + \frac{2\frac{8}{8}}{2\frac{8}{8}} = \frac{4\frac{6}{6}}{4\frac{6}{6}} = 9. \end{aligned}$$

Page 198.

(1)

V	V	V
9)4312131	3)4312131	8)4312131
<u>          </u>	<u>          </u>	<u>          </u>
9)224322..8	3)1234023..2	8)242343..7
<u>          </u>	<u>          </u>	<u>          </u>
9)12043..5	3)224322..2	8)14022..2
<u>          </u>	<u>          </u>	<u>          </u>
9)344..7	3)41240..2	8)1032..1
<u>          </u>	<u>          </u>	<u>          </u>
9)21..0	3)12043..1	8)32..6
<u>          </u>	<u>          </u>	<u>          </u>
1..2	3)2144..1	2..1
	<u>          </u>	
	3)344..2	
	<u>          </u>	
	3)113..0	
	<u>          </u>	
	3)21..0	
	<u>          </u>	
	3)3..2	
	<u>          </u>	
	1..0	

V	IX	III	VIII
4312131 =	120758 =	10200211222 =	216127
5	9	3	8
<u>          </u>	<u>          </u>	<u>          </u>	<u>          </u>
23	11	3    299	17
5	9	3    3	8
<u>          </u>	<u>          </u>	<u>          </u>	<u>          </u>
116	99	11   898	142
5	9	3    3	8
<u>          </u>	<u>          </u>	<u>          </u>	<u>          </u>
582	898	33   2695	1137
5	9	3    3	8
<u>          </u>	<u>          </u>	<u>          </u>	<u>          </u>
2911	8087	99   8087	9098
5	9	3    3	8
<u>          </u>	<u>          </u>	<u>          </u>	<u>          </u>
14558	72791 dec.	299   24263	72791 dec.
5		3	
<u>          </u>		<u>          </u>	
72791 decimals.		72791 dec.	

(3)

$$976 \cdot 432 \div \cdot 00000096 = 97643200000 \div 96 \text{ and } 96 = 12 \times 8.$$

$$12)97643200000$$

$$\begin{array}{r} \underline{\quad\quad\quad} \\ 8)8136933333 \cdot 3 \\ \underline{\quad\quad\quad} \end{array}$$

$$1017116666 \cdot 6$$

(4)

$$\frac{(2\frac{7}{8} + \cdot 5625 - 1 \cdot 5 + \frac{1}{16}) \div \frac{11}{8}}{(1\frac{8}{11} \times \frac{4}{9} \times 296 \times \frac{1}{101} \div \frac{11}{8}) \div \cdot 9472947} =$$

$$\frac{\frac{19}{6}}{\frac{19}{6}}$$

$$\frac{(2\frac{7}{8} + \frac{9}{16} - 1\frac{1}{2} + \frac{1}{16}) \times \frac{8}{11}}{\frac{7}{8} \times \frac{8}{11}} =$$

$$\frac{(1\frac{9}{11} \times \frac{4}{9} \times 296 \times \frac{1}{101} \times \frac{8}{11}) \div \frac{9472}{9999}}{11 \times \frac{4}{9} \times 296 \times \frac{1}{101} \times \frac{8}{11} \times \frac{9999}{9472}} =$$

$$\frac{\frac{19}{6}}{\frac{19}{6}}$$

$$\frac{\frac{16}{11}}{\frac{19}{11}} = \frac{\frac{16}{11}}{\frac{19}{11}} = \frac{16}{19} = 2\frac{2}{19} \text{ Ans.}$$

$$\frac{19}{6}$$

(5)

lbs. oz. dr. scr.	lbs. oz. dr. scr. grs.
9 7 7 2 )	97 3 4 1 17
12	12
<u>115</u>	<u>1167</u>
8	8
<u>927</u>	<u>9340</u>
3	3
<u>2783</u>	<u>28021</u>
20	20
<u>55660</u>	<u>560437</u>
)	$(10\frac{3837}{55660})$
	<u>55660</u>
	3837

(6)

15 yds. = 540 in. and 7 ft. = 84 in.

6 ft. = 72 in. and 4 ft. = 48 in.

$$(540 \times 84 \times 13) - (72 \times 48 \times 13) = 589680 - 44928 = 544752.$$

$$544752 \div 108 = 5044.$$

(7)

9 ft.	6'	4''	7'''		
11	7	9	11		
		8	8	10''''	2'''' 5''''
	7	1	9	5	3
5	6	8	8	1	
104	10	2	5		
111	0	9	7	4	5 5

(8)

$$\frac{4\frac{2}{7} + \frac{8}{9} - \frac{7}{12}}{\frac{2}{3} \text{ of } \frac{8}{13} + \frac{1}{6} \text{ of } \frac{5}{9}} = \frac{4\frac{7}{13} - \frac{7}{12}}{\frac{6}{13} + \frac{5}{54}} = \frac{\frac{1157}{252}}{\frac{389}{702}} = \frac{\frac{1157}{14}}{\frac{389}{39}} = \frac{45123}{6446} = 8\frac{555}{446}.$$

(9)

(10)

pts.  
 2)782436  
 -----  
 4)391218..0 pt.  
 -----  
 2)97804..2 qt.  
 -----  
 4)48902..0 gal.  
 -----  
 12225..2 pks.  
 12225 bush. 2 pks. 0 gal. 2 qts.

77	77..42..27..21..33..14..7..11..63..30
27	6..37..3..3..2 9..30
10	2 2 10

$$77 \times 27 \times 10 = 20790 = 1. \text{ c. m.}$$

(11)

XII	IX
28e4)36t87942(1375t·12	3762814
<u>28e4</u>	<u>9</u>
9e47	34
<u>82t0</u>	<u>9</u>
18679	312
<u>17274</u>	<u>9</u>
14054	2810
<u>11888</u>	<u>9</u>
23882	25298
<u>23554</u>	<u>9</u>
32t·0	227683
<u>28e·4</u>	<u>9</u>
5t·80	2049151
<u>55·t8</u>	
4·94	

(12)

$$150528 = 2^{10} \times 3 \times 7^2.$$

$$10 + 1 = 11$$

$$1 + 1 = 2$$

$$2 + 1 = 3$$

$$11 \times 3 \times 2 = 66.$$

(13)

$$2 \text{ wks. } 2 \text{ dys.} = 16 \text{ dys.}$$

$$\cdot 1234625$$

$$16$$

$$\underline{7407750}$$

$$1234625$$

$$1 \cdot 9754000 \text{ dys.}$$

$$24$$

$$\underline{39016000}$$

$$19508000$$

$$23 \cdot 4096000 \text{ hrs.}$$

$$60$$

$$\underline{24 \cdot 5760000} \text{ min.}$$

$$60$$

$$\underline{34 \cdot 5600000} = 34\frac{1}{2} \text{ sec.}$$

(14)

$$728\frac{1}{2} = 8\frac{1}{2} + 2 \times 10 + 7 \times 10 \times 10.$$

$$\text{lbs. oz. dr.}$$

$$\text{lbs. oz. dr.}$$

$$27 \ 4 \ 3 \times 8\frac{1}{2} =$$

$$231 \ 11 \ 9\frac{1}{2}$$

$$10$$

$$\underline{272 \ 9 \ 14} \times 2 = 545 \ 3 \ 12$$

$$10$$

$$\underline{2726 \ 2 \ 12} \times 7 = 19083 \ 3 \ 4$$

$$\underline{19860 \ 2 \ 9\frac{1}{2}}$$

(15)

$$\begin{aligned} \text{£}16\ 3\text{s.}\ 8\frac{1}{2}\text{d.} &= \$64\cdot74\frac{1}{2} \text{ and } \text{£}67\ 17\text{s.}\ 7\frac{1}{2}\text{d.} = \$271\cdot52\frac{1}{2}. \\ \$98\cdot17 + \$42\cdot29 + \$64\cdot74\frac{1}{2} + \$97\cdot19 + \$127\cdot87\frac{1}{2} &= \$430\cdot27\frac{1}{2}. \\ \$430\cdot27\frac{1}{2} - \$271\cdot52\frac{1}{2} &= \$158\cdot75. \end{aligned}$$

(16)

$$\begin{aligned} \cdot\dot{8} = \frac{8}{9}. \quad \cdot\ddot{7}6 = \frac{76}{99}. \quad \cdot\ddot{9}123 &= \frac{9123-91}{9900} = \frac{9032}{9900} = \frac{2258}{2475}. \\ \cdot\ddot{0}03327 &= \frac{3327-3}{999000} = \frac{3324}{999000} = \frac{277}{83250}. \end{aligned}$$

(18)

$$\begin{aligned} & \frac{[\{(2\frac{1}{2} \times \cdot 5 \text{ of } 1\frac{1}{7}) + 9\frac{1}{2}\ddot{7} + \cdot 09 + \frac{23}{31}\} - 11\frac{6}{7}] \div (\frac{1}{11} \text{ of } \cdot 16)}{[(\cdot 7632763 \times 11) \times \frac{1}{4} \text{ of } \frac{101}{106}] \times (\frac{1}{4} \text{ of } \cdot 2 \text{ of } \cdot 3 \text{ of } \cdot 25 \text{ of } 96) \div \cdot 2} \\ & \frac{\frac{1}{4} \text{ of } \cdot 6732467 \div \frac{1}{9}}{} \end{aligned}$$

$$\begin{aligned} & \frac{[\{(\frac{7}{3} \times \frac{1}{2} \times 1\frac{2}{7}) + 9\frac{1}{2}\ddot{7} + \frac{1}{11} + \frac{23}{31}\} - 11\frac{6}{7}] \div (\frac{1}{11} \text{ of } \frac{1}{6})}{(\frac{7632}{9999} \times \frac{1}{11} \times \frac{1}{4} \times \frac{101}{106} \times \frac{1}{4} \times \frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} \times \frac{96}{1}) \div \frac{2}{9}} \\ & \frac{\frac{1}{4} \times \frac{67324}{99999} \div \frac{1}{9}}{} \end{aligned}$$

$$\begin{aligned} & \frac{(2 + 9\frac{1}{2}\ddot{7} + \frac{1}{11} + \frac{23}{31}) - 11\frac{6}{7} \div \frac{1}{11} \times \frac{1}{6}}{\frac{7632}{9999} \times \frac{1}{11} \times \frac{1}{4} \times \frac{101}{106} \times \frac{1}{4} \times \frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} \times \frac{96}{1} \times \frac{2}{9}} \\ & \frac{\frac{1}{4} \times \frac{67324}{99999} \times \frac{9}{1}}{} \end{aligned}$$

$$\begin{aligned} & \frac{(12 - 11\frac{6}{7}) \div \frac{1}{11} \times \frac{1}{6}}{\frac{18}{9}} = \frac{\frac{1}{11} \times \frac{5}{11} \times \frac{6}{1}}{\frac{18}{9}} = \frac{\frac{18}{9}}{\frac{18}{9}} = \frac{\frac{5}{1}}{\frac{16831}{11111}} \\ & \frac{16831}{11111} = \frac{16831}{11111} = \frac{16831}{11111} = \frac{5}{16831} \end{aligned}$$

$$\frac{55555}{16831} = 3\frac{5062}{16831}.$$

(19)

8 children will have 8 children's shares.

One woman will have 3 children's shares  $\therefore$  6 women will have  
 $6 \times 3 = 18$  children's shares.

One man will have 6 children's shares  $\therefore$  4 men will have  
 $4 \times 6 = 24$  children's shares.

4 men, 6 women, and 8 child. will therefore have 50 child. shares.

$\pounds 550$  3s.  $1\frac{1}{2}$ d.  $\div 50 = \pounds 11$  0s.  $0\frac{3}{4}$ d. = child's share.

$\pounds 11$  0s.  $0\frac{3}{4}$ d.  $\times 3 = \pounds 33$  0s.  $2\frac{1}{4}$ d. = woman's share.

$\pounds 33$  0s.  $2\frac{1}{4}$ d.  $\times 2 = \pounds 66$  0s.  $4\frac{1}{2}$ d. = man's share.

(20)

$$16\frac{7}{11} + 19\frac{1}{2} + 23\frac{7}{8} + 129\frac{6}{7} = 16 + 19 + 23 + 129 + \\ (\frac{7}{11} + \frac{1}{2} + \frac{7}{8} + \frac{6}{7}) = 187 + 3\frac{519}{3080} = 190\frac{519}{3080}.$$

(21)

$$8100 = 2^2 \times 3^4 \times 5^2.$$

1..3..9..27..81

1..2..4

1..3..9..27..81..2..6..18..54..162..4..12..36..108..324

1..5..25

1..3..9..27..81..2..6..18..54..162..4..12..36..108..324..

5..15..45..135..405..10..30..90..270..810..20..60..180..

540..1620..25..75..225..675..2025..50..150..450..1350..

4050..100..30..900..2700..8100.

Therefore the divisors of 8100 are 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 25, 27, 30, 36, 45, 50, 54, 60, 75, 81, 90, 100, 108, 135, 150, 162, 180, 225, 270, 300, 324, 405, 450, 540, 675, 810, 900, 1350, 1620, 2025, 2700, 4050, 8100.



<p>(22)</p> $\begin{array}{r} 2691)11817(4 \\ \underline{10764} \\ 1053)2691(2 \\ \underline{2106} \\ 585)1053(1 \\ \underline{585} \\ 468)585(1 \\ \underline{468} \\ 117)468(4 \\ \underline{468} \end{array}$	<p>(23)</p> <p>sec.</p> $\begin{array}{r} 60)2551443 \\ \underline{60)42524} \dots 3 \\ \underline{24)708} \dots 44 \\ \underline{29} \dots 12 \end{array}$ <p>29 d., 12 h., 44 m., 3 sec.</p> <p>sec.</p> $\begin{array}{r} 60)31556928 \\ \underline{60)525948} \dots 48 \\ \underline{24)8765} \dots 48 \\ \underline{365} \dots 5 \end{array}$ <p>365 d., 5 h., 48 m., 48 sec.</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

9828 is divisible by 117  $\therefore$  117 is the G. C. M.

(24)

$$\begin{aligned} 14 \text{ ft. } 11 \text{ in.} &= 179 \text{ in.} \\ 38 \text{ miles} &= 2407680 \text{ in.} \\ 2407680 \div 179 &= 13450\frac{1}{3}. \end{aligned}$$

(25)

11 ft.  $\times$  13 ft.  $\times$  15 ft. = 2145 cub. ft.  
 One cubic foot weighs  $62\frac{1}{2}$  lbs.  $2145 \times 62\frac{1}{2} = 134062\frac{1}{2}$  = weight  
 of 2145 cub. ft.  
 One gallon weighs 10 lbs.  $134062\frac{1}{2} \div 10 = 13406\frac{1}{2}$  = gals. in  
 $134062\frac{1}{2}$  lbs.

(26)

$$\begin{aligned} \text{£}73 \times 400 &= \text{\$}292.00 \\ 17\text{s.} \times 20 &= 3.40 \\ 11\frac{1}{2}\text{d.} = 47\text{far.} \times 5 \div 12 &= 19\frac{7}{12} \end{aligned}$$


---


$$\text{£}73 \text{ } 17\text{s.} \text{ } 11\frac{1}{2}\text{d.} = \text{\$}295.59\frac{7}{12}$$

(27)

$$\begin{aligned} 93\frac{4}{11} - 76\frac{1}{3} &= 92\frac{15}{11} - 76\frac{1}{3} = 16\frac{158}{33} = 4\frac{206}{33} \\ & \quad \quad \quad \frac{4206}{258} \quad \quad \quad \frac{258}{17} \\ 4\frac{206}{33} \div 17\frac{1}{3} &= \frac{4206}{258} \times \frac{258}{17} = 4\frac{206}{17} = 247\frac{7}{17}. \end{aligned}$$

(28)

$$\frac{5\frac{1}{2} \div \frac{2}{3}}{1\frac{1}{2} \text{ of } \frac{5}{9} \div 10\frac{1}{2}} \times \frac{\frac{2}{5} \text{ of } \frac{1\frac{1}{2} \text{ of } 4\frac{1}{9}}{13\frac{7}{8} \text{ of } 5\frac{1}{2}}}{\frac{45 \times 2}{16}} = \frac{\frac{45}{8} \times \frac{3}{2}}{\frac{6}{8} \times \frac{5}{9} \times \frac{31}{31}} \times \frac{\frac{2}{5}}{\frac{2}{5}} \times \frac{\frac{3}{2} \times \frac{37}{9}}{\frac{111}{8} \times \frac{16}{3}} =$$

$$\frac{\frac{45 \times 2}{16}}{\frac{2}{1} \times \frac{1}{31}} \times \frac{\frac{2}{5}}{\frac{2}{5}} \times \frac{\frac{37}{2 \times 3}}{\frac{37 \times 2}{1}} =$$

$$\frac{9}{45 \times 3 \times 31} \times \frac{3}{5} \times \frac{37}{2 \times 3 \times 37 \times 2} = \frac{3 \times 9 \times 31}{16 \times 2 \times 2 \times 2} =$$

$$\frac{837}{128} = 6\frac{69}{128}.$$

(29)

XI	XI	XI
5)91342	12)91342	2)91342
5)19074..4	12)834..9	2)46176..1
5)4015..1	12)773..1	2)23093..0
5)891..0	12)70..3	2)11541..1
5)184..3	6..5	2)6246..0
5)39..3		2)3153..0
5)8..2		2)1627..0
1..3		2)869..0
		2)434..1
		2)217..1
		2)109..0
		2)54..0
		2)27..1
		2)15..0
		2)8..0
		2)4..0
		2)2..0
		1..0

(29 continued.)

XI	V	XII	II	
91342	13233014	65319	100000100110000101	
11	5	12	2	
<u>100</u>	8	77	2	260
11	5	12	2	2
<u>1103</u>	42	927	4	521
11	5	12	2	2
<u>12137</u>	213	11125	8	1043
11	5	12	2	2
<u>133509 dec.</u>	1068	133509 dec.	16	2086
	5		2	2
	<u>5340</u>		32	4172
	5		2	2
	<u>26701</u>		65	8344
	5		2	2
	<u>133509 dec.</u>		130	16688
			2	2
			260	33377
				2
				<u>66754</u>
				2
				<u>133509 dec.</u>

(30)  
 $2) 7680 = 2^9 \times 3 \times 5$

$2) 3840$

$2) 1920$

$2) 960$

$2) 480$

$2) 240$

$2) 120$

$2) 60$

$2) 30$

$3) 15$

5

(31)  
 m. f. p. y. ft. in.  
 $72 \ 3 \ 7 \ 2 \ 1 \ 7$

8

579 fur.

40

23167 per.

$5\frac{1}{2}$

115837

11583 $\frac{1}{2}$

127420 $\frac{1}{2}$  yds.

3

382262 $\frac{1}{2}$  ft.

12

4587157 in.

12

55045884 lines

(32)

$\$ \cdot 47 \times 97 = \$45 \cdot 59.$

(33)

$(73 \times 4 \times 11) \div 128 = 25\frac{3}{8}.$

$\$3 \cdot 62\frac{1}{2} \times 25\frac{3}{8} = \$90 \cdot 96\frac{3}{4}.$

(34)

$93 \cdot 72\dot{3} - 93\dot{7}1\dot{6} = \frac{92786}{990}$  and  $29 \cdot 41\dot{7}\dot{3} = \frac{294169}{9990} = \frac{293879}{9990}.$

$\frac{92786}{990} \div \frac{293879}{9990} = \frac{92786}{990} \times \frac{111}{293879} = \frac{92786 \times 111}{11 \times 293879} =$

$\frac{10299246}{3232669} = 3 \cdot 185988 +$

(35)

One bushel of oats weighs 34 lbs.  $\therefore$  in 73429 lbs. there are  $73429 \div 34 = 2159\frac{3}{4}$  bushels.

(36)

In 719630 lbs. of wheat there are  $719630 \div 60 = 11993\frac{1}{2}$  bus

$\$1 \cdot 80 \times 11993\frac{1}{2} = \$21588 \cdot 90.$

Or  $\$1 \cdot 80$  per bushel = 3 cents per lb.

$719630 \times 3 = 2158890$  cents. =  $\$21588 \cdot 90.$

(38)

21389)180781(8

171112

(37) 9669)21389(2

19338

$$\$72.14 + \$93.76 = \$165.90$$

2051)9669(4

$$\$165.90 \times 9.47 = \$1571.0730$$

8204

$$\$1571.0730 \div 11 = \$142.8248+$$

1465)2051(1

1465

586)1465(2

1172

293)586(2

586

Last divisor 293 = G. C. M.

(39)

$$\frac{7}{11}, \frac{4}{5}, \frac{3}{7}, \frac{8}{33}, \frac{11}{14}, \frac{7}{10}, \frac{1}{2}$$

The least common multiple of 11, 5, 7, 33, 14, 10 and 2 is 2310.

The multiplier for both terms of the first fraction is  $231 \div 7 = 210$ ; for the second,  $231 \div 5 = 462$ ; for the third,  $231 \div 3 = 330$ ; for the fourth,  $231 \div 11 = 21$ ; for the fifth,  $231 \div 14 = 16.5$ ; for the sixth,  $231 \div 10 = 23.1$ ; for the seventh,  $231 \div 2 = 115.5$ .

Multiplying by these numbers, we obtain  $\frac{1470}{2310}$ ,  $\frac{1848}{2310}$ ,  $\frac{2970}{2310}$ ,  $\frac{560}{2310}$ ,  $\frac{1815}{2310}$ ,  $\frac{1617}{2310}$ , and  $\frac{1155}{2310}$  for the required fraction.

(40)

$$\begin{aligned} \$ \cdot 11 \times 17 &= \$1 \cdot 87. & \$ \cdot 37\frac{1}{2} \times 19 &= \$7 \cdot 12\frac{1}{2}. & \$2 \cdot 17 \times 14\frac{1}{2} &= \\ & \$31 \cdot 46\frac{1}{2}. & \$ \cdot 27 \times 67 &= \$18 \cdot 09. & \$1 \cdot 37\frac{1}{2} \times 15 &= \$20 \cdot 62\frac{1}{2}. \\ \$1 \cdot 87 + \$7 \cdot 12\frac{1}{2} + \$31 \cdot 46\frac{1}{2} + \$4 \cdot 75 + \$11 \cdot 50 + \$18 \cdot 09 + \\ & \$20 \cdot 62\frac{1}{2} + \$7 \cdot 93 &= \$103 \cdot 35\frac{1}{2}. \end{aligned}$$

G

Page 210.

(17)

$$\begin{array}{r} \text{Baskets.} \\ 11 : 87 :: \$13.42 : \frac{1.22 \times \$13.42 \times 87}{11} = \$106.14 \text{ Ans.} \end{array}$$

(18)

$$\begin{array}{r} \text{Cords.} \\ 28 : 25 :: \$266 : \frac{19 \times \$266 \times 25}{28} = \$237.50 \text{ Ans.} \end{array}$$

(19)

$$\begin{array}{r} \text{days} \\ \$29.20 : \$83.60 :: 16 : \frac{4 \times 16 \times 83.60}{29.20} = 45\frac{2}{3} \text{ days. Ans.} \end{array}$$

(20)

$$\begin{array}{r} \text{Bags.} \\ 16 : 156 :: \$12.80 : \frac{.8 \times \$12.80 \times 156}{16} = \$124.80 \text{ Ans} \end{array}$$

(21)

$$\begin{array}{r} \text{Feet.} \\ 5 : 112 :: 7 : \frac{7 \times 112}{5} = 156\frac{2}{5} \text{ ft. Ans.} \end{array}$$

(22)

$$\begin{array}{r} \text{Cows.} \\ 55 : 27 :: 99 : \frac{9 \times 99 \times 27}{55} = 48\frac{3}{5} \text{ days. Ans.} \end{array}$$

(23)

$$\begin{array}{r} \text{Acres.} \\ 5 : 48 :: 9 : \frac{9 \times 48}{5} = 86\frac{2}{5} \text{ bush. Ans.} \end{array}$$

(24)

$$\begin{array}{r} 11 \\ \text{Perches. days. } 2 \times 803 \\ 73 : 803 :: 2 : \frac{\quad}{73} = 22 \text{ days. Ans.} \end{array}$$

(25)

$$\begin{array}{r} 141 \\ \text{Pails. lbs. } 100 \times 1128 \\ 176 : 1128 :: 100 : \frac{\quad}{176} = 640\frac{1}{2} \text{ lbs. Ans.} \\ 22 \end{array}$$

(26)

$$\begin{array}{r} .58 \quad 155 \\ \$20.88 \times 465 \\ 108 : 465 :: \$20.88 : \frac{\quad}{108} = \$89.90 \text{ Ans.} \\ 36 \end{array}$$

(27)

$$\begin{array}{r} 9 \quad 639 \\ \$ \quad \$ \quad \text{brls. } 72 \times 1278 \\ 16 : 1278 :: 72 : \frac{\quad}{16} = 5751 \text{ barrels. Ans.} \\ 2 \end{array}$$

(28)

$$\begin{array}{r} 15 \\ \text{Men. Acres } 165 \times 3 \\ 11 : 3 :: 165 : \frac{\quad}{11} = 45 \text{ acres. Ans.} \end{array}$$

(29)

$$\begin{array}{r} 125 \\ \text{Barrels. loaves } 250 \times 67 \\ 4 : 67 :: 250 : \frac{\quad}{4} = 4187\frac{1}{2} \text{ loaves. Ans.} \\ 2 \end{array}$$

(30)

$$\begin{array}{r} 16 \times 38 \\ \text{Bushels. brls. } 16 \times 38 \\ 190 : 38 :: 16 : \frac{\quad}{190} = 3\frac{1}{5} \text{ barrels. Ans.} \\ 5 \end{array}$$

(31)

$$\begin{array}{l} \text{Days.} \quad \text{men} \quad 6 \\ 15 : 12 :: 90 : \frac{90 \times 12}{15} = 72 \text{ men. Ans.} \end{array}$$

(32)

$$\begin{array}{l} \text{D'. work. brls.} \quad 2 \times 279 \\ 17 : 279 :: 2 : \frac{2 \times 279}{17} = 32\frac{4}{17} \text{ barrels. Ans.} \end{array}$$

(33)

$$\begin{array}{l} \text{Hours.} \quad \text{miles.} \\ 1 : 24 :: 27 : 27 \times 24 = 648 \text{ miles. Ans.} \end{array}$$

(34)

$$\begin{array}{l} \text{Cows.} \quad \text{lbs.} \quad 30 \times 23 \\ 7 : 23 :: 30 : \frac{30 \times 23}{7} = 98\frac{4}{7} \text{ lbs. Ans.} \end{array}$$

(37)

$$\begin{array}{l} \frac{3}{16} : \frac{21}{26} :: \$9750 : \frac{375}{1} \times \frac{7}{26} \times \frac{16}{3} = \$42000 \text{ Ans.} \end{array}$$

(38)

$$\begin{array}{l} \text{Yard.} \quad \text{s.} \quad 5 \quad 1 \quad 8 \quad \text{s.} \\ \frac{7}{8} : \frac{1}{4} :: \frac{5}{6} : \frac{1}{6} \times \frac{1}{4} \times \frac{8}{7} = \frac{5}{21} = 2\frac{6}{7} \text{d. Ans.} \end{array}$$

(39)

$$\begin{array}{l} \text{Tons.} \\ \frac{7}{9} : 8\frac{1}{2} :: \$7.49 : \frac{\$7.49 \times 8\frac{1}{2}}{9} = \frac{1.07}{1} \times \frac{25}{8} \times \frac{3}{7} = \$80.25 \text{ Ans.} \end{array}$$

(40)

$$\begin{array}{l} \text{Yards.} \\ 5\frac{1}{2} : 4 :: \$28.42 : \frac{.14}{1} \times \frac{4}{7} \times \frac{5}{29} = \$2.80 \text{ Ans.} \end{array}$$



(41)

$$\text{Dollar. bag } \frac{4}{5} : \frac{7}{5} :: \frac{1}{5} : - \times \frac{7}{20} \times \frac{5}{12} = \frac{1}{12} \text{ of a bag. Ans.}$$

(42)

$$\begin{matrix} \$ & \$ & \$ & 98\frac{7}{8} \times 472\frac{1}{2} & 98 \cdot 875 \times 472 \cdot 44 \\ 100 : 472\frac{1}{2} :: 98\frac{7}{8} : \end{matrix} \frac{\quad}{100} = \frac{\quad}{100} = \$467 \cdot 12\frac{1}{2} \text{ Ans.}$$

(43)

$$\begin{matrix} \text{Tons.} & \text{days} & 107\frac{3}{4} \times 11\frac{1}{2} & 1180 & 198 & 5 \\ 17\frac{2}{3} : 11\frac{1}{2} :: 107\frac{3}{4} : \end{matrix} \frac{\quad}{17\frac{2}{3}} = \frac{\quad}{11} \times \frac{\quad}{17} \times \frac{\quad}{88} = 70\frac{1}{8} \text{ dys. Ans.}$$

(44)

$$\begin{matrix} \text{Tons.} & \text{cords.} & 22\frac{1}{3} \times 11\frac{0}{26} & 202 & 295 & 18 \\ 15\frac{1}{3} : 11\frac{0}{26} :: 22\frac{1}{3} : \end{matrix} \frac{\quad}{15\frac{1}{3}} = \frac{\quad}{9} \times \frac{\quad}{26} \times \frac{\quad}{202} = 16\frac{7}{8} \text{ cords. Ans.}$$

(45)

$$\begin{matrix} \text{Yds.} & \text{yds.} & \$ & \frac{7}{8} \text{ of } \frac{3}{4} \text{ of } 4\frac{1}{2} \times \frac{1}{2} \text{ of } \frac{1}{2} \text{ of } \frac{5}{8} \\ \frac{1}{2} \text{ of } \frac{3}{4} \text{ of } 3\frac{1}{2} : \frac{3}{4} \text{ of } \frac{1}{2} \text{ of } \frac{5}{8} :: \frac{7}{8} \text{ of } \frac{3}{4} \text{ of } 4\frac{1}{2} : \end{matrix} \frac{\quad}{\frac{1}{2} \text{ of } \frac{3}{4} \text{ of } 3\frac{1}{2}} =$$

$$\frac{4}{11} \times \frac{15}{896} = \$\frac{15}{224} \text{ Ans.}$$

(47)

37 sq. yds. 4 ft. 120 in. = 48648 in., and 9 sq. yds. 2 ft. = 11952 in.

$$\begin{matrix} \text{Inches.} & 3 \cdot 50 \times 48648 \\ 11952 : 48648 :: \$3 \cdot 50 : \end{matrix} \frac{\quad}{11952} = \$14 \cdot 245 + \text{ Ans.}$$

(48)

12 lbs. 10 oz. = 154 oz.

Ounces.

$$1 : 154 :: \$1.25 : 1.25 \times 154 = \$192.50 \text{ Ans.}$$

(49)

10 yds. = 40 qrs., and 3 yds. 2 qrs. = 14 qrs.

$$\begin{array}{r} \text{Quarters.} \\ 40 : 14 :: \$3.40 : \frac{\begin{array}{r} .17 \quad 7 \\ \$3.40 \times 14 \\ \hline 40 \\ 20 \end{array}}{20} = \$1.19 \text{ Ans.} \end{array}$$

(50)

15 lbs. 12 dwt. 16 grs. = 7504 grs., and 13 oz. 14 grs. = 6254 grs.

$$\begin{array}{r} \text{Grains.} \\ 7504 : 6254 :: \$3.80 : \frac{\begin{array}{r} .95 \quad 3127 \\ \$3.80 \times 6254 \\ \hline 7504 \\ 1876 \\ 938 \end{array}}{7504} = \$3.167+ \text{ Ans.} \end{array}$$

(51)

3 lbs. 1 oz. 11 dwt. = 751 dwt. and 12 lbs. 6 oz. 4 dwt. = 3004 dwt.

$$\begin{array}{r} \text{Dwt.} \\ 3004 : 751 :: 600 : \frac{\begin{array}{r} 150 \\ 600 \times 751 \\ \hline 3004 \\ 4 \end{array}}{3004} = \$150 \text{ Ans.} \end{array}$$

(52)

$$\begin{array}{r} \text{Barrels.} \quad \text{h. m. s.} \\ 54 : 24 :: 2 \text{ h. } 46 \text{ m. } 30 \text{ s.} : \frac{\begin{array}{r} 4 \\ 24 \times 24 \\ \hline 54 \\ 9 \end{array}}{54} = 1 \text{ hr. } 14 \text{ min. Ans.} \end{array}$$

(53)

73 yds. 3 qrs. 2 na. 1 in. = 2660½ in. 3 Fl. e. 2 qrs. 1 na. = 101½ in.  
 And £4 17s. 8½d. = 1172½d.

$$\begin{array}{l} \text{Inches.} \quad \text{d.} \quad 1172\frac{1}{2} \times 2660\frac{1}{2} \\ 101\frac{1}{2} : 2660\frac{1}{2} :: 1172\frac{1}{2} : \frac{1172\frac{1}{2} \times 2660\frac{1}{2}}{101\frac{1}{2}} = \frac{521}{4} \times \frac{5321}{2} \times \frac{4}{45} = \end{array}$$

$$2773241 \text{ d.} = \text{£}128 \text{ 6s. } 10\frac{1}{30} \text{d. Ans.}$$

(54)

8½ lbs. = 136½ oz.

$$\begin{array}{l} \text{Ounces.} \quad \text{s.} \quad 7 \quad 205 \quad 3 \\ 4\frac{2}{3} : 136\frac{1}{2} :: 8\frac{1}{2} : \frac{7}{16} \times \frac{205}{8} \times \frac{3}{41} = \frac{1505}{16} = \text{£}13 \text{ 9s. } 0\frac{1}{2} \text{d. Ans.} \end{array}$$

(55)

$$\begin{array}{l} \text{Pages.} \quad 52 \\ 327 : 400 :: 156 : \frac{156 \times 400}{327} = 190\frac{20}{109}, \text{ i.e. on the } 191^{\text{st}} \text{ p. Ans.} \end{array}$$

(56)

46 a., 3 r., 14 p. = 7294 p., and 35 a., 2 r., 10 p. = 5690 p.

$$\begin{array}{l} \text{Perches.} \quad \text{£} \quad 50 \\ 7494 : 5690 :: 100 : \frac{100 \times 5690}{7494} = \text{£}75 \text{ 18s. } 6\frac{3}{4}\text{d. Ans.} \end{array}$$

(57)

$$\begin{array}{l} \text{Days.} \quad \text{miles.} \quad 17 \\ 48 : 68 :: 12 : \frac{12 \times 68}{48} = 17 \text{ miles per day. Ans.} \end{array}$$

(58)

$$\begin{array}{r} \text{Shillings. lbs. } 113 \\ 21\frac{1}{2} : 32\frac{7}{8} :: 16\frac{1}{2} : \frac{113}{7} \times \frac{226}{7} \times \frac{3}{64} = \frac{34307}{1668} = 24\frac{675}{68} \text{ lbs. Ans.} \end{array}$$

(59)

$$17493 \times 1000 \times 5 \text{ cub. ft.} = 87465000 \text{ cub. ft.}$$

$$192724 \times 1000 \times 4 \text{ cub. ft.} = 770896000 \text{ cub. ft.}$$

$$87465000 + 770896000 = 858361000 \text{ cub. ft.}$$

$$\begin{array}{r} \text{Cubic feet.} \quad \text{ton. } 858361000 \\ 9000 : 858361000 :: 1 : \frac{858361000}{9000} = 95373\frac{1}{3} \text{ tons. Ans.} \end{array}$$

(60)

$$50000 \times 9000 = 450000000 = \text{cub. ft. of gas in 50000 tons of coal.}$$

$$\begin{array}{r} \text{Cubic feet. hour.} \quad \quad \quad \text{Ans.} \\ 4 : 450000000 :: 1 : \frac{450000000}{4} = 112500000 \text{ h.} = 12842 \text{ y. } 170 \text{ d.} \end{array}$$

(61)

$$\text{lbs. lbs. lbs. lb. lb.}$$

$$4 + 3 + 2 + 1 + \frac{1}{2} = 10\frac{1}{2} \text{ lbs.}$$

$$\begin{array}{r} \text{lbs.} \quad \quad \quad 11270 \\ 10\frac{1}{2} : 11270 :: 1 : \frac{11270}{10\frac{1}{2}} = 1073, \text{ and } 3\frac{1}{2} \text{ lbs. remaining. Ans.} \end{array}$$

(62)

$$180 \text{ miles} = 180 \times 1760 = 316800 \text{ yards.}$$

$$\begin{array}{r} \text{Yards.} \quad \text{day.} \\ 100 : 316800 :: 1 : \frac{316800 \times 1}{100} = 3168 \text{ dys. or about } 8\frac{2}{3} \text{ yrs. Ans.} \end{array}$$

Page 216.

(4)

$$\left. \begin{array}{l} 120 : 90 \text{ bush.} \\ 6 : 14 \text{ horses.} \end{array} \right\} :: 56 \text{ days} : \frac{7 \quad 15}{56 \times 90 \times 14} = 7 \times 14 = 98 \text{ days.}$$

$$\frac{120 \times 6}{8}$$

(5)

$$\left. \begin{array}{l} 28 : 32 \text{ ft. high.} \\ 8 : 15 \text{ days.} \end{array} \right\} :: 63 \text{ men} : \frac{9 \quad 4}{63 \times 32 \times 15} = 9 \times 15 = 135 \text{ men.}$$

$$\frac{8 \times 28}{7}$$

(6)

$$\left. \begin{array}{l} 3 : 45 \text{ length.} \\ 1\frac{1}{4} : 1 \text{ width.} \end{array} \right\} :: 1 \text{ lb.} : \frac{45 \quad 45 \quad 3}{3 \times 1\frac{1}{4} \quad 1\frac{1}{4} \quad 15} = \frac{45 \times 4}{15} = 3 \times 4 = 12 \text{ lbs.}$$

(7)

$$\left. \begin{array}{l} 10 : 100 \text{ length.} \\ 1\frac{1}{2} : 1\frac{1}{2} \text{ width.} \end{array} \right\} :: 3 \text{ lbs.} : \frac{3 \times 1\frac{1}{2} \times 100}{1\frac{1}{2} \times 10} = 2 \times 1\frac{1}{2} \times 10 = 25 \text{ lbs.}$$

(8)

$$\left. \begin{array}{l} 44 : 132 \text{ tons.} \\ 18 : 5 \text{ days.} \end{array} \right\} :: 12 \text{ horses} : \frac{2 \quad 3}{12 \times 5 \times 18} = 2 \times 5 = 10 \text{ horses.}$$

$$\frac{44 \times 18}{6}$$

(9)

$$\left. \begin{array}{l} 4 : 14 \text{ men.} \\ 7 : 10 \text{ days} \end{array} \right\} :: 27s. : \frac{2 \quad 5}{27 \times 14 \times 10} = 27 \times 5 = 135s. = \text{£}6 \text{ } 15s.$$

$$\frac{4 \times 7}{2}$$

(10)

$$\begin{array}{l}
 3:5 \text{ masters.} \\
 8:10 \text{ apprentices.} \\
 5:8 \text{ weeks.} \\
 6:5\frac{1}{2} \text{ days per wk.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 3:5 \\ 8:10 \\ 5:8 \\ 6:5\frac{1}{2} \end{array}} \right\} :: \$144 : \frac{\overset{8}{\underset{24}{144}} \times \overset{2}{\underset{5}{5\frac{1}{2}}} \times \overset{2}{\underset{8}{8}} \times \overset{2}{\underset{10}{10}} \times \overset{2}{\underset{5}{5}}}{\underset{3}{3} \times \underset{8}{8} \times \underset{5}{5} \times \underset{6}{6}} = \$440.$$

(11)

$$\begin{array}{l}
 6 : 18 \text{ s.mak.} \\
 4 : 5 \text{ weeks.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 6 : 18 \\ 4 : 5 \end{array}} \right\} :: 36 \text{ pairs of men's shoes} : \frac{\overset{9}{36} \times \overset{3}{18} \times \overset{5}{5}}{\underset{6}{6} \times \underset{4}{4}} =$$

135 pairs men's and the women's =  $\frac{2}{3} \times 135 = 90$  pairs.

(12)

$$\begin{array}{l}
 9 : 18 \text{ feet high.} \\
 4 : 6 \text{ days.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 9 : 18 \\ 4 : 6 \end{array}} \right\} :: 12 \text{ men} : \frac{\overset{3}{12} \times \overset{2}{18} \times \overset{6}{6}}{\underset{9}{9} \times \underset{4}{4}} = 3 \times 2 \times 6 = 36 \text{ men.}$$

(13)

$$\begin{array}{l}
 130 : 390 \text{ miles.} \\
 7 : 14 \text{ hours.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 130 : 390 \\ 7 : 14 \end{array}} \right\} :: 3 \text{ days} : \frac{\overset{2}{3} \times \overset{3}{14} \times \overset{3}{390}}{\underset{130}{130} \times \underset{7}{7}} = 3 \times 2 \times 3 = 18 \text{ days.}$$

(14)

$$\begin{array}{l}
 10 : 60 \text{ oz.} \\
 22\frac{1}{2} : 30 \text{ d.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 10 : 60 \\ 22\frac{1}{2} : 30 \end{array}} \right\} :: 1 \text{ d.} : \frac{60 \times 30}{10 \times 22\frac{1}{2}} = \frac{\overset{4}{60} \times \overset{3}{30}}{\underset{1}{10} \times \underset{1}{22\frac{1}{2}}} \times \frac{\overset{1}{10}}{\underset{1}{10}} \times \frac{\overset{2}{2}}{\underset{15}{15}} = 4 \times 2 = 8 \text{ d.}$$

(15)

$$\begin{array}{l}
 10 : 5 \text{ compositors} \\
 7 : 14 \text{ hours.} \\
 20 : 40 \text{ sheets.} \\
 24 : 16 \text{ pages.} \\
 50 : 60 \text{ lines.} \\
 40 : 50 \text{ letters.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 10 : 5 \\ 7 : 14 \\ 20 : 40 \\ 24 : 16 \\ 50 : 60 \\ 40 : 50 \end{array}} \right\} :: 16 \text{ days} : \frac{\overset{2}{16} \times \overset{2}{5} \times \overset{2}{14} \times \overset{2}{40} \times \overset{2}{16} \times \overset{2}{60} \times \overset{2}{50}}{\underset{10}{10} \times \underset{7}{7} \times \underset{20}{20} \times \underset{24}{24} \times \underset{50}{50} \times \underset{40}{40}} =$$

$2 \times 16 = 32$  days.

(16)

$$\begin{array}{l}
 336 : 240 \text{ men.} \\
 5 : 9 \text{ days.} \\
 10 : 12 \text{ hours.} \\
 6 : 5 \text{ degrees.} \\
 5 : 3 \text{ yards wide} \\
 3 : 2 \text{ yards deep}
 \end{array}
 \left. \vphantom{\begin{array}{l} 336 : 240 \text{ men.} \\ 5 : 9 \text{ days.} \\ 10 : 12 \text{ hours.} \\ 6 : 5 \text{ degrees.} \\ 5 : 3 \text{ yards wide} \\ 3 : 2 \text{ yards deep} \end{array}} \right\} :: 70 \text{ yards} : \frac{\overset{7}{70} \times \overset{5}{240} \times 9 \times \overset{2}{12} \times 5 \times 3 \times 2}{\underset{48}{336} \times 5 \times 10 \times 6 \times 5 \times 3} =$$

$$9 \times 2 \times 2 = 36 \text{ yards.}$$

(17)

$$\begin{array}{l}
 6 : 12 \text{ horses.} \\
 4 : 9 \text{ months.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 6 : 12 \text{ horses.} \\ 4 : 9 \text{ months.} \end{array}} \right\} :: 16 \text{ acres} : \frac{\overset{4}{16} \times \overset{2}{12} \times 9}{\underset{6 \times 4}{6} \times 4} = 4 \times 2 \times 9 = 72 \text{ acres.}$$

(18)

$$\begin{array}{l}
 25 : 139 \text{ persons} \\
 1 : 7 \text{ years.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 25 : 139 \text{ persons} \\ 1 : 7 \text{ years.} \end{array}} \right\} :: 300 \text{ bus.} : \frac{\overset{12}{300} \times 139 \times 7}{\underset{25}{25}} = 11676 \text{ bushels.}$$

(19)

$$\begin{array}{l}
 48 : 32 \text{ men.} \\
 36 : 864 \text{ feet long.} \\
 8 : 5 \text{ feet high.} \\
 4 : 3 \text{ feet wide.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 48 : 32 \text{ men.} \\ 36 : 864 \text{ feet long.} \\ 8 : 5 \text{ feet high.} \\ 4 : 3 \text{ feet wide.} \end{array}} \right\} :: 4 \text{ days} : \frac{\overset{3}{4} \times \overset{2}{32} \times \overset{108}{864} \times 5 \times 3}{\underset{16}{48} \times \overset{3}{36} \times 8 \times 4} = 30 \text{ days.}$$

(20)

$$\begin{array}{l}
 679 : 22407 \text{ sold's.} \\
 336 : 112 \text{ days.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 679 : 22407 \text{ sold's.} \\ 336 : 112 \text{ days.} \end{array}} \right\} :: 702 \text{ bushels} : \frac{\overset{234}{702} \times \overset{33}{22407} \times 112}{\underset{3}{679} \times \overset{3}{336}} =$$

$$234 \times 33 = 7722 \text{ bushels.}$$

(21)

$$\begin{array}{l}
 13 : 494 \text{ suits.} \\
 19 : 27 \text{ days.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 13 : 494 \text{ suits.} \\ 19 : 27 \text{ days.} \end{array}} \right\} :: 12 \text{ tailors} : \frac{\overset{2}{12} \times \overset{26}{494} \times 27}{\underset{19}{19} \times 19} = 648 \text{ tailors.}$$

(22)

$$\begin{array}{l}
 17:40 \text{ head of cattle} \\
 30:51 \text{ days.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 17:40 \\ 30:51 \end{array}} \right\} :: 5 \text{ a. } 2 \text{ r. } 10 \text{ p.} : \frac{5 \text{ a. } 2 \text{ r. } 10 \text{ p.} \times \overset{4}{\cancel{40}} \times \overset{3}{\cancel{51}}}{17 \times \underset{10}{\cancel{30}}} = \\
 5 \text{ a. } 2 \text{ r. } 10 \text{ p.} \times 4 = 22 \text{ a. } 1 \text{ r.}$$

(23)

$$\begin{array}{l}
 20 : 100 \text{ ft. long} \\
 6 : 4 \text{ feet wide.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 20 \\ 6 \end{array}} \right\} :: 180 \text{ bricks} : \frac{180 \times \overset{30}{\cancel{100}} \times 4}{20 \times 6} = \\
 30 \times 5 \times 4 = 600 \text{ bricks.}$$

Page 219.

(4)

$$\begin{array}{l}
 17 \text{ cords} = 116 \text{ lbs.} \\
 87 \text{ lbs.} = 23 \text{ barrels} \\
 19 \text{ barrels} = 34 \text{ days' work} \\
 92 \text{ days' work} = 57 \text{ baskets peaches} \\
 31 \text{ baskets peaches} = 24 \text{ dollars} \\
 12 \text{ dollars} = 2 \text{ tons} \\
 35 \text{ tons} = x \text{ cords}
 \end{array}
 \left. \vphantom{\begin{array}{l} 17 \\ 87 \\ 19 \\ 92 \\ 31 \\ 12 \\ 35 \end{array}} \right\} =$$

$$\frac{17 \times \overset{3}{\cancel{87}} \times \overset{23}{\cancel{19}} \times \overset{34}{\cancel{92}} \times 31 \times 12 \times 35}{116 \times \underset{4}{\cancel{23}} \times \underset{2}{\cancel{34}} \times \underset{3}{\cancel{57}} \times \underset{2}{\cancel{24}} \times 2} = \frac{31 \times 35}{4 \times 2} = \frac{1085}{8} = 135 \frac{5}{8}.$$

(5)

$$\begin{array}{l}
 6 \text{ lbs. tea} = 29 \text{ lbs. sugar} \\
 17 \text{ lbs. sugar} = 1 \text{ bushel} \\
 27 \text{ bushels} = 4 \text{ tons} \\
 34 \text{ tons} = 15 \text{ cows} \\
 29 \text{ cows} = 1160 \text{ dollars} \\
 20 \text{ dollars} = x \text{ lbs. tea.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 6 \\ 17 \\ 27 \\ 34 \\ 29 \\ 20 \end{array}} \right\} =$$

$$\frac{\overset{3}{6} \times \overset{9}{17} \times \overset{17}{27} \times \overset{15}{34} \times 29 \times 20}{29 \times 1 \times 4 \times 15 \times 1160} = \frac{17 \times 17 \times 27}{5 \times 58} = \frac{7803}{290} = 26 \frac{23}{29}$$



(6)

11 bush. barley	=	21 bush. potatoes	}
19 " potatoes	=	29 " oats	
115 " oats	=	44 " wheat	
14½ " wheat	=	38 " peas	
60 " peas	=	55 " rye	
75 " rye	=	11½ " clover sd.	
36 " clover sd.	=	x " barley	

$$\frac{11 \times 19 \times 115 \times 14\frac{1}{2} \times 60 \times 75 \times 36}{2 \times 28 \times 29 \times 18} = \frac{5 \times 75 \times 18}{7 \times 11} = \frac{6750}{77} = 87\frac{51}{77}$$

$$\frac{21 \times 29 \times 44 \times 38 \times 55 \times 11\frac{1}{2}}{7 \times 2 \times 11 \times 2 \times 5}$$

(7)

16 baskets pears	=	29 turkeys	}	=
17 turkeys	=	7 days' work		
7½ days' work	=	187 loaves		
3½ loaves	=	4 lbs. veal		
1 lb. veal	=	11 cents		
792 cents	=	63 lbs. sugar		
x lbs. sugar	=	21 baskets pears		

$$\frac{29 \times 7 \times 187 \times 4 \times 11 \times 63 \times 21}{4 \times 11 \times 7 \times 2} = \frac{11 \times 7 \times 21}{4} = \frac{1617}{4} = 404\frac{1}{4}$$

$$\frac{16 \times 17 \times 7\frac{1}{2} \times 3\frac{1}{2} \times 1 \times 792}{4 \times 7 \times 2}$$

(8)

7 A = 11 B	}	=	=	=	=
5 B = 8 C					
15 C = 21 D					
11 D = 5 E					
42 E = x A					

$$\frac{7 \times 5 \times 15 \times 11 \times 42}{11 \times 8 \times 21 \times 5} = \frac{7 \times 15}{4} = \frac{105}{4} = 26\frac{1}{4}$$

(9)

7 barrels flour	= 23 cords	}	=
6 cords	= 11 cwt.		
46 cwt.	= £28		
£77	= 9 sheep		
5 sheep	= 8 tons		
9 tons	= $x$ barrels flour		

$$\frac{7 \times 6 \times 46 \times 77 \times 5 \times 9}{28 \times 11 \times 28 \times 9 \times 8} = \frac{3 \times 7 \times 5}{8} = \frac{105}{8} = 13\frac{1}{8}$$

(10)

15 N. England	= 20 New York	}	=
24 New York	= 22½ N. Jersey		
30 New Jersey	= 20 Canada		
4807½ Canada	= $x$ N. England		

$$\frac{15 \times 24 \times 30 \times 4807\frac{1}{2}}{20 \times 22\frac{1}{2} \times 20} = 961\frac{1}{2} \times 6 = 5769 \text{ s.} = \text{£}288 \text{ 9s.}$$

Page 222.

(1)

$$\frac{7}{8} \times \frac{17}{11} \times \frac{23}{29} \times \frac{319}{119} \times \frac{16}{69} = \frac{2}{3} = 2 : 3$$

(2)

£119 × 400	= \$476.00
16s. × 20	= 3.20
6½d. = 26 far. × 5 ÷ 12 =	·10½
£119 16s. 6½d. =	\$479.30½

(4)

$$\left. \begin{array}{l} 9 : 13 = 9 \div 13 = \cdot 692 \\ 21 : 27 = 21 \div 27 = \cdot 777 \\ 7 : 10 = 7 \div 10 = \cdot 7 \\ 11 : 15 = 11 \div 15 = \cdot 733 \end{array} \right\} \text{Hence } 21 : 27 \text{ is the greatest,} \\ \text{and } 9 : 13 \text{ the least.}$$

(5)

Dissimilar.	=	Similar.	=	Similar and Coterminous.
76·23478	=	76·234784	=	76·234784784784784
19·1342291	=	19·1342291	=	19·134229122912291
				<u>57·100555661872493</u>
Difference,				= 57·100555661872493

(6)

71324t undenary = 1146287 denary, 23421 quinary = 1736 denary, and t4e7 duodenary = 17995 denary.

1146287 × 1736 = 1989954232 ÷ 17995 = 110583 $\frac{3147}{17995}$ .  
 110583 $\frac{3147}{17995}$  denary \* = 53ee3 $\frac{7737}{447}$  duodenary, 12014313 $\frac{11943}{1033440}$  quinary, and 760t0 $\frac{9873}{1257}$  undenary.

(7)

$$\left. \begin{array}{l} 5.63 : 7.9 \text{ cubic inches.} \\ 1 : 1.220 \text{ spec. grav.} \end{array} \right\} \begin{array}{l} \text{oz.} \\ \text{:: } 3.254 : \frac{3.254 \times 7.9 \times 1.220}{5.63} = \end{array}$$

$$\frac{31.362052}{5.63} = 5.57052 \text{ oz. Ans.}$$

---

\* To reduce the fractional part, reduce both numerator and denominator separately.

(8)

yds. qrs. na. in. yds. qrs. na. in.  
 17)63 3 2 1 ( 3 3 0 0  $\frac{11}{34}$  (9)

51  
 —  
 12  
 4  
 —  
 51  
 51

·916325 of an acre = ·916325 × 4840 =  
 4421·945 sq. yds.  
 4421·945 × \$·67 = \$2962·70+

(10)

0  
 4  
 —  
 2  
 2  $\frac{1}{2}$

$\frac{1}{2}$  of  $\frac{3}{8}$  of  $\frac{7}{8}$  of 20 bush. × ·5 × ·6 ×  $\frac{7}{8}$  =  
 $\frac{1}{2} \times \frac{3}{8} \times \frac{7}{8} \times 20 \times \frac{1}{2} \times \frac{6}{10} \times \frac{7}{8}$  =  
 $\frac{49}{32}$  bush. = 1 bush. 2 pks. 0 gal. 1 qt.

$5\frac{1}{2} = \frac{11}{2} \div 17 = \frac{11}{34}$ .

(12)

Whole amount of increase = 2571437 — 1842265 = 729172.  
 $1842265 : 100 :: 729172 : \frac{729172 \times 100}{1842265} = 39$  per cent.

(13)

$\frac{1}{2}$  of  $\frac{3}{4}$  of  $\frac{12}{25} - \frac{1}{3}$  of  $\frac{3}{4}$  of  $\frac{5}{7} = \frac{6}{25} - \frac{5}{84} = \frac{359}{2100}$ .

(14)

100 : 7 :: 11 :  $\frac{11 \times 7}{100} = \frac{77}{100}$ . 11 —  $\frac{77}{100} = 10\frac{23}{100}$ .

(15)

$79 \times 16 \times £·00163 = £2·06032 = £2$  ls.  $2\frac{29}{100}$  d.

(16)

4 : 3 men }  
 10 : 12 hours } :: 2  $\frac{1}{2}$  days :  $\frac{2\frac{1}{2} \times 3 \times 12 \times 35}{4 \times 10 \times 20} = \frac{63}{8} = 3\frac{3}{8}$  days.  
 20 : 35 acres }

(17)

$$\left(\frac{1}{5} \text{ of } \frac{2}{11} \times .02 \times .456\right) \div \left(\frac{1}{7} \text{ of } \frac{2}{3} \text{ of } \frac{1}{4} \text{ of } 51\right) =$$

$$\frac{\overset{2}{\cancel{4}} \overset{2}{\cancel{11}} \overset{38}{\cancel{152}} \overset{17}{\cancel{17}} \overset{2}{\cancel{2}} \overset{8}{\cancel{8}} \overset{1}{\cancel{1}}}{5 \cdot 11 \cdot 25 \cdot 111 \cdot 8 \cdot 51} = \frac{2 \times 38}{5 \times 11 \times 25 \times 37} = 30\frac{76}{373}$$

(18)

$$\frac{2}{1} \times \frac{4}{7} \times \frac{13}{5} \times \frac{7}{2} \times \frac{5}{1} = 4 \times 13 = 52.$$

(19)

50 barrels = 125 yards  
 80 yards = 6 bales  
 13 bales = 3½ hogsheads  
 x hogsheads = 1000 barrels

$$\frac{\overset{5}{125} \times \overset{3}{6} \times \overset{125}{3\frac{1}{2}} \times 1000}{\underset{\overset{2}{2} \cdot \overset{16}{16}}{2}} = \frac{125 \times 3 \times 3\frac{1}{2}}{2 \times 13} = 50\frac{1}{2}.$$

(20)

$$73.47 \times .0063 \div 17.2345 = \frac{7347}{100} \times \frac{63}{10000} \div \frac{57391}{3330} = \frac{7347}{100} \times \frac{63}{10000} \times \frac{3330}{57391} = \frac{154132713}{3739100000} = .026856599989+$$

(21)

2 roods 7 per. 4 yds. 3 ft. 117 in. = 3416481 in. and 7 acres = 43908480 inches.

$$3416481 \div 43908480 = .0778+$$

(22)

$$\begin{aligned} \frac{2}{7} \text{ of } \frac{1}{5} \text{ of } \frac{1}{3} \text{ of } 70 \text{ miles} &= \frac{1}{3} \frac{2}{5} \text{ miles} = 5.33333\text{---} \text{ miles.} \\ \cdot 73 \text{ of } 11 \text{ fur.} &= 8.03 \text{ fur.} = 1.00375 \text{ mile.} \\ 5.33333 - 1.00375 &= 4.32958 \text{ miles.} \end{aligned}$$

(23)

$$\begin{aligned} 274312 \text{ nonary} &= 167195 \text{ denary, } 1101011010 = 858 \text{ denary, and} \\ \cdot 5555 \text{ septenary} &= 2000 \text{ denary.} \\ 167195 - 858 &= 166337 \times 2000 = 332674000. \\ 332674000 \text{ denary} &= 764876837 \text{ nonary,} \\ &= 10011110101000011001111010000 \text{ binary,} \\ &= 11146453021 \text{ septenary.} \end{aligned}$$

(24)

$$\begin{array}{r|l} 275 & 275 \dots 275 \dots 18 \dots 18 \dots 200 \dots 200 \dots 225 \\ 38 & 2 \dots 18 \dots 38 \dots 18 \dots 9 \\ 18 & 2 \dots 9 \dots 9 \dots 9 \end{array}$$

$$275 \times 38 \times 18 = 188100 = \text{l. c. m.}$$

(25)

10 : 6 weeks	}	men	6	2914	2
6 : 5 days			$60 \times 6 \times 5 \times 10 \times 8742 \times 20 \times 8$	=	
11 : 10 hours			:: 60 :	$\frac{6 \times 2914 \times 2}{10 \times 6 \times 11 \times 2400 \times 18 \times 11}$	=
2400 : 8742 feet long			$\frac{240}{12}$	$\frac{8}{3}$	
18 : 20 feet wide			$\frac{12}{3}$		
11 : 8 feet high					

$$\frac{5 \times 2914 \times 2}{11 \times 3 \times 11} = \frac{29140}{363} = 80 \frac{10}{363}$$

(26)

172000 = 2<sup>5</sup> × 3<sup>3</sup> × 43. Increasing each exponent by 1 and multiplying them together we obtain 6 × 4 × 2 = 48.

(27)

$$42\dot{7} = 42\frac{7}{9} = \frac{385}{9} \text{ and } 9\dot{7}123 = 9\frac{7116}{9990} = 9\frac{1186}{1665} = \frac{16171}{1665}$$

$$\frac{385}{9} \times \frac{16171}{1665} = \frac{6225835}{14985} = 415\cdot471137804.$$

(28)

$$100 : 27 :: \$73\cdot42 : \frac{73\cdot42 \times 27}{100} = \$19\cdot8234.$$

$$\$73\cdot42 - \$19\cdot8234 = \$53\cdot5966.$$

(29)

$$6300 = 2^2 \times 3^2 \times 5^2 \times 7.$$

1..5..25

1..2.. 4

1..5..25..2..10..50..4..20..100

1..3.. 9

1..5..25..2..10..50..4..20..100..3..15..75..6..30..150..

12..60..300..9..45..225..18..90..450..36..180..900

1..7

1..5..25..2..10..50..4..20..100..3..15..75..6..30..150..

12..60..300..9..45..225..18..90..450..36..180..900 ..7..

35..175..14..70..350..28..140..700..21..105 ..525 ..42..

210..1050..84..420..2100..63..315..1575..126..630 ..3150

..252..1260..6300.

Therefore the divisors of 6300 are 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 14, 15, 18, 20, 21, 25, 28, 30, 35, 36, 42, 45, 50, 60, 63, 70, 75, 84, 90, 100, 105, 126, 140, 150, 175, 180, 210, 225, 252, 300, 315, 350, 420, 450, 525, 630, 700, 900, 1050, 1260, 1575, 2100, 3150, 6300.

(30)

$$\frac{2}{7} \text{ of } \frac{3}{8} \text{ of } 3\frac{1}{2} \text{ lbs.} = \frac{3}{8} \text{ lbs.,} \quad \frac{2}{7} \text{ of } \frac{3}{8} \text{ of } \frac{1}{17} \text{ of } \frac{1}{2} \text{ of } \$1 = \$\frac{3}{7},$$

$$\text{and } \frac{3}{8} \text{ of } \frac{1}{9} \text{ of } \frac{1}{10} \text{ of } \frac{2}{5} \text{ of } 90 \text{ lbs.} = \frac{1}{200} \text{ lbs.}$$

$$\frac{3}{8} \text{ lbs.} : \frac{1}{200} \text{ lbs.} :: \frac{2}{7} : \frac{\$}{\frac{3}{8}} \times \frac{1}{200} = \frac{2}{7} \times \frac{8}{200} \times \frac{3}{8} = \frac{1}{250} = \$5\cdot04.$$

(31)

7 men will have 7 men's shares.

One woman has  $\frac{3}{7}$  of a man's share;  $\therefore$  2 women will have  $2 \times \frac{3}{7} = \frac{6}{7}$  of a man's share.

One child has  $\frac{2}{7}$  of  $\frac{3}{7} = \frac{6}{49}$  of a man's share;  $\therefore$  11 children will have  $11 \times \frac{6}{49} = \frac{6}{7}$  of a man's share.

7 men, 2 women and 11 children will have  $7 + \frac{6}{7} + \frac{6}{7} = 8\frac{2}{7}$  men's shares.

$$\$2739 \cdot 18 \div 8\frac{2}{7} = \$325 \cdot 99\frac{33}{47} = \text{a man's share.}$$

$$\frac{3}{7} \text{ of } \$325 \cdot 99\frac{33}{47} = \$88 \cdot 90\frac{448}{47} = \text{a woman's share.}$$

$$\frac{2}{7} \text{ of } \$88 \cdot 90\frac{448}{47} = \$25 \cdot 40\frac{288}{47} = \text{a child's share.}$$

(33)

yds. ft. in.

$\frac{4}{9}$ of $6\frac{1}{2}$ yds.	$= \frac{2}{9}$ yds.	$= 2 \ 2 \ 8$	$2 \ 28 : 7 \ 2$	}	= 104 : 5.
$\frac{3}{8}$ of $\frac{4}{7}$ of $8\frac{3}{4}$ ft.	$= 1 \ 0 \ 0$		$4 : 11$		
$\frac{2}{7}$ of $\frac{3}{7}$ of $7\frac{7}{10}$ in.	$= \frac{3}{10}$	$2 \ 8 : 5$			
			$13 : 11\frac{1}{2}$		
Sum	$= 3 \ 2 \ 8\frac{3}{10}$	$2\frac{1}{2} \ 28\frac{1}{2} : 3$			

(34)

(35)

23 bush. 2 pks. 1 gal. 1 qt. 1 pt. = 1515 pts.

$1515 \times 9000 \times \frac{1}{3} = 4545000$  in. = 71 miles 5 fur. 34 per. 3 yds.

(36)

$$\frac{4158}{10395} = \frac{462}{1155} = \frac{66}{165} = \frac{22}{55} = \frac{2}{5}.$$

(37)

VIII.

$\frac{1}{2}, \frac{2}{3}, \frac{1}{5}, \frac{2}{7}$ . Here the common denominator is  $2 \times 3 \times 5 \times 7 = 322$ . The numerators of the fractions are, for the first,  $1 \times 3 \times 5 \times 7 = 151$ ; for the second,  $2 \times 2 \times 5 \times 7 = 214$ ; for the third,  $4 \times 2 \times 3 \times 7 = 250$ ; for the fourth,  $2 \times 2 \times 3 \times 5 = 74$ ; and the equivalent fractions are,  $\frac{151}{322}, \frac{214}{322}, \frac{250}{322}$  and  $\frac{74}{322}$ , which when added together  $= \frac{731}{322} = 2\frac{65}{322}$ , the numbers all through being in the octenary scale.



(38)

$$\begin{array}{l}
 17 \text{ sheep} = 6 \text{ cows} \\
 26 \text{ cows} = 27\frac{1}{2} \text{ acres} \\
 12 \text{ acres} = 13 \text{ horses} \\
 11 \text{ horses} = 28 \text{ goats} \\
 x \text{ goats} = 68 \text{ sheep}
 \end{array}
 \left. \vphantom{\begin{array}{l} 17 \text{ sheep} \\ 26 \text{ cows} \\ 12 \text{ acres} \\ 11 \text{ horses} \\ x \text{ goats} \end{array}} \right\} = \frac{3}{6} \times \frac{2\frac{1}{2}}{27\frac{1}{2}} \times \frac{13}{17} \times \frac{28}{11} \times \frac{17}{68} =$$

$$2\frac{1}{2} \times 28 = 70 \text{ goats.}$$

(39)

$$\begin{array}{l}
 27:54 \text{ days} \\
 24:18 \text{ cel.} \\
 36:48 \text{ ft. l.} \\
 21:28 \text{ ft. w.} \\
 10:9 \text{ ft. d.} \\
 3:5 \text{ hrs.}
 \end{array}
 \left. \vphantom{\begin{array}{l} 27:54 \text{ days} \\ 24:18 \text{ cel.} \\ 36:48 \text{ ft. l.} \\ 21:28 \text{ ft. w.} \\ 10:9 \text{ ft. d.} \\ 3:5 \text{ hrs.} \end{array}} \right\} :: 50 \text{ men} : \frac{50 \times 5\frac{1}{2} \times 18 \times 48 \times 28 \times 9 \times 5}{27 \times 24 \times 36 \times 21 \times 10 \times 3} = 200 \text{ men.}$$

Page 226.

(7)

$$\$ \cdot 35 \times 92647 = \$32426 \cdot 45.$$

(8)

	£	s.	d.	
4d.   $\frac{1}{4}$	4746	17	0	= cost of 94937 pails at 1s.
1d.   $\frac{1}{4}$	1582	5	8	= " " " at 4d.
	395	11	5	= " " " at 1d.
<hr/>				
	£6724	14	1	= cost of 94937 pails at 1s. 5d.

(9)

(10)

$$\$ \cdot 07\frac{1}{2} \times 95974 = \$7197 \cdot 90 \quad \$28 \cdot 80 \times 62 = \$1785 \cdot 60.$$

(11)

(12)

$$\$ \cdot 32\frac{1}{2} \times 2310 = \$750 \cdot 75. \quad \$ \cdot 37\frac{1}{2} \times 2117 = \$793 \cdot 87\frac{1}{2}.$$

(13)

	£	s.	d.	
6d.   $\frac{1}{2}$	375	6	0	= price of 7506 pairs at 1s.
3d.   $\frac{1}{2}$	187	13	0	= " " " at 6d.
$\frac{3}{4}$ d.   $\frac{1}{2}$	93	16	6	= " " " at 3d.
	23	9	1 $\frac{1}{2}$	= " " " at $\frac{3}{4}$ d.
<hr/>				
	£680	4	7 $\frac{1}{2}$	= price of 7506 pairs at 1s. 9 $\frac{1}{4}$ d.

(14)

$$\$ \cdot 17\frac{1}{2} \times 1217 = \$212 \cdot 97\frac{1}{2}.$$

(15)

$$\$3 \cdot 07\frac{1}{2} \times 2103 = \$6466 \cdot 72\frac{1}{2}.$$

(16)

10s.	$\frac{1}{2}$	2096			
		3			
		6288	0	0	= cost of 2096 oz. at £3.
5s.	$\frac{1}{2}$	1048	0	0	= " " at 0 10s.
2s. 6d.	$\frac{1}{2}$	524	0	0	= " " at 0 5s.
1s. 3d.	$\frac{1}{2}$	262	0	0	= " " at 0 2s. 6d.
1½d.	$\frac{1}{10}$	131	0	0	= " " at 0 1s. 3d.
		13	2	0	= " " at 0 0 1½d.
		£8266	2	0	= " " at £3 18s. 10½d.

(17)

10 dwt.	$\frac{1}{2}$	\$1·55			
		6			
		\$9·30	=	cost of 6 oz.	
5 dwt.	$\frac{1}{2}$	·77½	=	" 10 dwt.	
2 dwt. 12 grs.	$\frac{1}{2}$	·38½	=	" 5 dwt.	
1 dwt. 6 grs.	$\frac{1}{2}$	·19½	=	" 2 dwt. 12 grs.	
2 grs.	$\frac{1}{10}$	·09½	=	" 1 dwt. 6 grs.	
		·00¾	=	" 2 grs.	

$$\$10 \cdot 75\frac{3}{4} = \text{cost of 6 oz. 18 dwt. 20 grs.}$$

(18)

10s.	$\frac{1}{2}$	£98	0	0	= cost of 98 yards at £1.
5s.	$\frac{1}{2}$	49	0	0	= " " " 0 10s.
		24	10	0	= " " " 0 5s.

$$£171 \ 10 \ 0 = \text{cost of 98 yards at £1 15s.}$$

2 qrs.	$\frac{1}{2}$	£1	15		
		17	6	=	cost of 2 qrs.
1 qr.	$\frac{1}{2}$	8	9	=	" 1 qr.
1 na.	$\frac{1}{4}$	2	2½	=	" 1 na.

$$£1 \ 8 \ 5\frac{1}{4} = \text{cost of 3 qrs. 1 na.}$$

$$\text{Then } £171 \ 10 \ 0 = \text{cost of 98 yards at £1 15s.}$$

$$1 \ 8 \ 5\frac{1}{4} = \text{cost of 3 qrs. 1 na. at £1 15s. per yard.}$$

$$£172 \ 18 \ 5\frac{1}{4} = \text{cost of 98 yds. 3 qrs. 1 na. at £1 15s per yd.}$$

(19)

1s.	$\frac{1}{20}$	344			
		4			
		£1376	0	0	= rent of 344 acres at £4
1d.	$\frac{1}{12}$	17	4	0	= " " at 0 ls.
		1	8	8	= " " at 0 0 ld.
		£1394	12	8	= rent of 344 acres at £4 ls. ld.

2 r.	$\frac{1}{2}$	£4	1	1		
1 r.	$\frac{1}{2}$	2	0	$6\frac{1}{2}$	= rent of 2 roods.	
10 per.	$\frac{1}{4}$	1	0	$3\frac{1}{4}$	= " 1 rood.	
5 per.	$\frac{1}{2}$	5	$0\frac{1}{8}$	= " 10 perches.		
		2	$6\frac{3}{8}$	= " 5 perches.		
		£3	8	$4\frac{3}{8}$	= " 3 roods 15 perches.	

£1394	12	8	= rent of 344 acres at £4 ls. ld.		
3	8	$4\frac{3}{8}$	= " 3 roods 15 per. at £4 ls. ld. per ac.		
£1398	1	$0\frac{3}{8}$	= " 344 a. 3 r. 15 per. at £4 ls. ld.		

(20)

5 dwt.	$\frac{1}{4}$	5	10			
			5			
		£1	9	2	= price of 5 oz. at 5s. 10d. per oz.	
1 dwt.	$\frac{1}{8}$	1	$5\frac{1}{2}$	= " 5 dwt. " "		
12 grs.	$\frac{1}{2}$	3	$\frac{1}{2}$	= " 1 dwt. " "		
4 grs.	$\frac{1}{3}$	1	$\frac{1}{4}$	= " 12 grs. " "		
1 gr.	$\frac{1}{4}$	$0\frac{7}{12}$	= " 4 grs. " "			
		$0\frac{7}{8}$	= " 1 gr. " "			
		£1	11	$1\frac{2}{3}$	= " 5 oz. 6 dwt. 17 grs. at 5s. 10d. per oz.	

(21)

2 grs.	$\frac{1}{2}$	£1 2 4			
		4			
		£4 9 4	= price of 4 yards at £1 2 4 per yard.		
2 na.	$\frac{1}{4}$	11 2	=	" 2 qrs.	" "
1 na.	$\frac{1}{2}$	2 9 $\frac{1}{2}$	=	" 2 na.	" "
		1 4 $\frac{3}{4}$	=	" 1 na.	" "
		£5 4 8 $\frac{1}{4}$	= price of 4 yds. 2 qrs. 3 na.	"	"

(22)

1 rood	$\frac{1}{4}$	£1 16			
		32			
		£57 12 0	= price of 32 acres at £1 16s.		
10 per.	$\frac{1}{4}$	9 0	=	" 1 rood.	"
2 per.	$\frac{1}{8}$	2 3	=	" 10 per.	"
2 per.	$\frac{1}{8}$	5 $\frac{3}{8}$	=	" 2 per.	"
		5 $\frac{3}{8}$	=	" 2 per.	"
		£58 4 1 $\frac{1}{8}$	= price of 32 acres 1 rood 14 per.		

(23)

4 pts.	$\frac{1}{2}$	7 6			
		3			
		£1 2 6	= price of 3 gals. at 7s.6d. per gal.		
1 pt.	$\frac{1}{4}$	3 9	=	" 4 pts.	"
		11 $\frac{1}{4}$	=	" 1 pt.	"
		£1 7 2 $\frac{1}{4}$	= price of 3 gals. 5 pts.		

(24)

$$\$1.67\frac{1}{2} \times 724 = \$1212.70.$$

(25)

$$\$1.93\frac{1}{2} \times 721 = \$1396.93\frac{1}{2}.$$

(26)

10s.	$\frac{1}{2}$	4514					
		2					
		<hr/>					
		£9028	0	0	= cost of 4514 rods at £2		
6s. 8d.	$\frac{1}{3}$	2257	0	0	= " " at 0 10		
10d.	$\frac{1}{8}$	1504	13	4	= " " at 0 6 8		
1d.	$\frac{1}{10}$	188	1	8	= " " at 0 0 10		
$\frac{1}{2}$ d.	$\frac{1}{2}$	18	16	2	= " " at 0 0 1		
		9	8	1	= " " at 0 0 0 $\frac{1}{2}$		
		<hr/>					
		£13005	19	3	= " " at £2 17 7 $\frac{1}{2}$		

(27)

10s.	$\frac{1}{2}$	3749	7	6			
				3			
		<hr/>					
		£11248	2	6	= price of 3749 $\frac{3}{8}$ acres at £3		
5s.	$\frac{1}{2}$	1874	13	9	= " " at 0 10		
6d.	$\frac{1}{10}$	937	6	10 $\frac{1}{2}$	= " " at 0 5		
		93	14	8 $\frac{1}{2}$	= " " at 0 0 6		
		<hr/>					
		£14153	17	9 $\frac{1}{2}$	= price of 3749 $\frac{3}{8}$ acres at £3 15 6		

(28)

4s.	$\frac{1}{2}$	£17	0	0	= cost of 17 cwt. at £1		
8d.	$\frac{1}{6}$	3	8	0	= " " at 0 4		
1d.	$\frac{1}{8}$	11	4	= " " at 0 0 8			
		1	5	= " " at 0 0 1			
		<hr/>					
		£21	0	9	= cost of 17 cwt. at £1 4 9		
1 qr.	$\frac{1}{4}$	£1	4	9			
		<hr/>					
16 lbs.	$\frac{1}{4}$	6	2 $\frac{1}{2}$	= cost of 1 qr.			
1 lb.	$\frac{1}{16}$	3	6 $\frac{3}{4}$	= " 16 lbs.			
		0	2 $\frac{7}{16}$	= " 1 lb.			
		<hr/>					
		9	11 $\frac{37}{16}$	= " 1 qr. 17 lbs.			
£21	0	9	= cost of 17 cwt. at	£1 4s. 9d. per cwt.			
	9	11 $\frac{37}{16}$	= " 1 qr. 17 lbs.	" "			
		<hr/>					
£21	10	8 $\frac{37}{16}$	= " 17cwt. 1qr. 17lbs.	" "			

(29)

2 qrs.	$\frac{1}{2}$	\$11.55				
		78				
		9240				
		8085				
		\$900.90	=	cost of 78 cwt. at \$11.55 per cwt.		
1 qr.	$\frac{1}{2}$	5.77 $\frac{1}{2}$	=	"	2 qrs.	" "
7 lbs.	$\frac{1}{4}$	2.88 $\frac{3}{4}$	=	"	1 qr.	" "
4 lbs.	$\frac{1}{8}$	.72 $\frac{3}{16}$	=	"	7 lbs.	" "
1 lb.	$\frac{1}{16}$	.41 $\frac{1}{16}$	=	"	4 lbs.	" "
		.10 $\frac{5}{16}$	=	"	1 lb.	" "
		\$910.80	=	cost of 78 cwt. 3 qrs. 12 lbs.		

(30)

£10 10  
20

£210 0 = price of 20 tons at £10 10s.

19 cwt. 3 qrs. 27 $\frac{1}{2}$  lbs. = 1 ton —  $\frac{1}{2}$  lb. The price of 1 ton is £10 10s., and the price of  $\frac{1}{2}$  lb. =  $\frac{1}{4480}$  of £10 10s. =  $\frac{63}{112}$ d. ∴ the price of 19 cwt. 3 qrs. 27 $\frac{1}{2}$  lbs. = £10 10s. —  $\frac{63}{112}$ d. = £10 9s. 11 $\frac{49}{112}$ d.

£210 0 0 = price of 20 tons at £10 10s.

10 9 11 $\frac{49}{112}$  = " 19 cwt. 3 qrs. 27 $\frac{1}{2}$  lbs.

£220 9 11 $\frac{49}{112}$  = price of 20 tons 19 cwt. 3 qrs. 27 $\frac{1}{2}$  lbs. at £10 10s. per ton.

(31)

10 cwt.	½	\$45.50			
		219			
		<hr/>			
		40950			
		4550			
		9100			
		<hr/>			
		\$9964.50	=	price of 219 tons at \$45.50 per ton.	
5 cwt.	½	22.75	=	"	10 cwt. " "
1 cwt.	⅛	11.37½	=	"	5 cwt. " "
2 qrs.	½	2.27½	=	"	1 cwt. " "
1 qr.	¼	1.13¾	=	"	2 qrs. " "
		.56¾	=	"	1 qr. " "

\$10002.60½ = price of 219 tons 16 cwt. 3 qrs.

Page 228.

BILLS OF PARCELS.

(No. 2.)

	s.	d.	£	s.	d.	
9 pair of worsted stockings, at.....	4	6	per pair	2	0	6
6 pair of silk ditto, at .....	15	9	"	4	14	6
17 pair of thread ditto, at.....	5	4	"	4	10	8
23 pair of cotton ditto, at.....	4	10	"	5	11	2
14 pair of yarn ditto, at .....	2	4	"	1	12	8
18 pair of women's silk gloves, at...	4	2	"	3	15	0
19 yards of flannel, at .....	1	7½	per yard	1	10	10½

Ans. £23 15 4½

(No. 3.)

75½ lbs. of sugar, at.....	7½	cents per lb.	\$5.85½
63 lbs. of tea, at.....	93	"	58.59
126 lbs. of butter, at.....	13	"	16.38
35½ lbs. of raisins, at .....	18½	"	6.71½
17 lbs. of sago, at .....	15	"	2.55
23 lbs. of rice, at .....	9	"	2.07
58½ lbs. of starch, at.....	22	"	12.87

Ans. \$105.02½

## (No. 4.)

198 Sangster's National Arithmetic, at.....	\$0.60	\$118.80
197 Robertson's Philosophy of Grammar, at ...	0.50	98.50
83 Hodgins' Geography, at .....	1.00	83.00
57 Sangster's Algebraic Formula, at .....	0.12½	7.12½
217 Strachan's Canadian Penmanship, at.....	0.37½	81.37½
143 Hodgins' Geography of British Provinces, at	0.45	64.35
227 Sangster's First Arithmetic, at.....	0.30	68.10

---

*Ans.* \$521.25

## (No. 5.)

	s.	d.	£	s.	d.
9½ yards of silk, at .....	12	9	6	1	1½
13 yards of flowered ditto, at...15	6	"	10	1	6
11½ yards of lustring, at.....	6	10	4	0	3½
14 yards of brocade, at.....11	3	"	7	17	6
12¼ yards of satin, at .....	10	8	6	10	8
11¾ yards of velvet, at .....	18	0	10	4	9

---

*Ans.* £44 15 10

## (No. 6.)

14 oz. ipecacuanha, at .....	0.67	9.38
23 " laudanum, at.....	0.89	20.47
17 " emetic tartar, at.....	1.25	21.25
25 " cantharides, at .....	2.17	54.25
27 " gum mastic, at .....	0.61	16.47
56 " gum camphor, at .....	0.27	15.12

---

*Ans.* \$136.94

## (No. 7.)

	s.	d.	£	s.	d.
15½ lbs. of currants, at .....	0	4	5	2	
17¼ lbs. of Malaga raisins, at.....	0	5½	7	10	7⁄8
19¾ lbs. of sun raisins, at .....	0	6	9	10	½
17 lbs. of rice, at .....	0	3½	4	11	½
8½ lbs. of pepper, at.....	1	6	12	9	
3 loaves of sugar, weight 32½ lbs. at.	0	8½	1	3	0¼
13 oz. of cloves, at.....	0	9	9	9	

---

*Ans.* £3 13 5



## Page 231.

## MISCELLANEOUS EXERCISES.

(2)

$$427.1 \div .0000637 = 427100000 \div 637 = 6704866.561 +.$$

(3)

10s.	$\frac{1}{2}$	£19					
		19					
		<hr/>					
		171					
		19					
		<hr/>					
		£361	0	0	= cost of 19 tons at £19		
5s.	$\frac{1}{2}$	9	10	0	=	"	" at 0 <sup>m</sup> 10
4s.	$\frac{1}{8}$	4	15	0	=	"	" at 0 5
6d.	$\frac{1}{8}$	3	16	0	=	"	" at 0 4
3d.	$\frac{1}{2}$	9	6		=	"	" at 0 0 6
2d.	1	4	9		=	"	" at 0 . 0 3
$\frac{1}{2}$ d.	$\frac{1}{4}$	3	2		=	"	" at 0 0 2
$\frac{1}{4}$ d.	$\frac{1}{2}$	9 $\frac{1}{2}$			=	"	" at 0 0 0 $\frac{1}{2}$
		4 $\frac{3}{4}$			=	"	" at 0 0 0 $\frac{1}{4}$
		<hr/>					
		£379	19	7 $\frac{1}{4}$	= cost of 19 tons at £19 19 11 $\frac{3}{4}$		

19 cwt. 3 qrs. 27 $\frac{1}{2}$  lbs. = 1 ton —  $\frac{1}{2}$  lb. The price of 1 ton is £19 19s. 11 $\frac{3}{4}$ d., and the cost of  $\frac{1}{2}$  lb. =  $\frac{1}{4480}$  of £19 19s. 11 $\frac{3}{4}$ d. =  $1\frac{1279}{17920}$ d.;  $\therefore$  the cost of 19 cwt. 3 qrs. 27 $\frac{1}{2}$  lbs. = £19 19s.

11 $\frac{3}{4}$ d. —  $1\frac{1279}{17920}$ d. = £19s. 19s. 10 $\frac{12161}{17920}$ .

£379 19 7 $\frac{1}{4}$  = cost of 19 tons.

19 19 10 $\frac{12161}{17920}$  = " 19 cwt. 3 qrs. 27 $\frac{1}{2}$  lbs.

£399 19 5 $\frac{1}{17920}$  = " 19 tons 19 cwt. 3 qrs. 27 $\frac{1}{2}$  lbs.

(4)

Dissimilar.		Similar.		Similar and Coterminous.
$73 \cdot \overset{\cdot}{7}2\overset{\cdot}{3}$	=	$73 \cdot \overset{\cdot}{7}23\overset{\cdot}{7}2\overset{\cdot}{3}$	=	$73 \cdot \overset{\cdot}{7}23\overset{\cdot}{7}23\overset{\cdot}{7}2\overset{\cdot}{3}$
$11 \cdot \overset{\cdot}{3}4\overset{\cdot}{2}$	=	$11 \cdot \overset{\cdot}{3}42\overset{\cdot}{2}$	=	$11 \cdot \overset{\cdot}{3}422222\overset{\cdot}{2}$
$16 \cdot \overset{\cdot}{7}1\overset{\cdot}{3}$	=	$16 \cdot \overset{\cdot}{7}13\overset{\cdot}{0}$	=	$16 \cdot \overset{\cdot}{7}1300000\overset{\cdot}{0}$
$19 \cdot \overset{\cdot}{0}3\overset{\cdot}{4}$	=	$19 \cdot \overset{\cdot}{0}340\overset{\cdot}{3}4$	=	$19 \cdot \overset{\cdot}{0}340\overset{\cdot}{3}40\overset{\cdot}{3}4$
$713 \cdot \overset{\cdot}{2}134\overset{\cdot}{3}7$	=	$713 \cdot \overset{\cdot}{2}134\overset{\cdot}{3}7$	=	$713 \cdot \overset{\cdot}{2}134\overset{\cdot}{3}721\overset{\cdot}{3}$
$12 \cdot \overset{\cdot}{3}456\overset{\cdot}{7}8$	=	$12 \cdot \overset{\cdot}{3}456\overset{\cdot}{7}834\overset{\cdot}{5}$	=	$12 \cdot \overset{\cdot}{3}456\overset{\cdot}{7}834\overset{\cdot}{5}$ 2 carried.
		Sum	=	$846 \cdot \overset{\cdot}{3}72095\overset{\cdot}{7}6\overset{\cdot}{3}$

(5)

$5 : 7 = 5 \div 7 = .714 +$   
 $9 : 13 = 9 \div 13 = .692 +$   
 $12 : 17 = 12 \div 17 = .705 +$   
 $7 : 10 = 7 \div 10 = .7$

} Hence 5 : 7 is the greatest,  
and 9 : 13 least.

$$\frac{5}{7} \times \frac{9}{13} \times \frac{12}{17} \times \frac{7}{10} = \frac{54}{221} = 54 : 221.$$

(6)

1 acre = 160 rods, and 25 acres 2 roods 35 rods = 4115 rods.

$$160 : 4115 : \$80 \cdot 50 : \frac{40 \cdot 25 \quad 83}{80 \cdot 50 \times 415} = \$2070 \cdot 3593.$$

$$\begin{array}{r} 160 \\ 80 \\ 16 \end{array}$$

(8)

$$\$3 \cdot 68\frac{1}{2} \times 7439 = \$27431 \cdot 31\frac{1}{2}.$$

(9)

$\frac{135795}{222210}$ . The G. C. M. of 135795 and 222210 is 12345; when both terms of the fraction are divided by 12345, it becomes  $\frac{11}{18}$ .

$\frac{714235}{999999}$ . Here 714235 and 999999 have no G. C. M.;  $\therefore$  the fraction cannot be reduced.

$\frac{109375}{100000}$ . The G. C. M. of 109375 and 100000 is 3125; when both terms of the fraction are divided by 3125, it becomes reduced to  $\frac{35}{32}$ .

$\frac{20301}{33633}$ . The G. C. M. of 20301 and 33633 is 303; when both terms of the fraction are divided by 303, it is reduced to its lowest terms, viz.,  $\frac{67}{111}$ .

(10)

34½ bushels turnips	= 17 bushels potatoes	}	=
9 " potatoes	= 59½ lbs. tea		
6 lbs. tea	= 11½ stone flour		
13 stone flour	= 360 cents		
38 cents	= 12 loaves		
119 loaves	= x bushels turnips		

$$\frac{3}{17} \times \frac{9}{59\frac{1}{2}} \times \frac{6}{11\frac{1}{2}} \times \frac{13}{360} \times \frac{19}{12} \times \frac{7}{1} = \frac{3 \times 13 \times 19}{8\frac{1}{2} \times 40} = 2\frac{61}{40}.$$

(11)

54 : 27 men	}	:: 7 days :	
11 : 8 hours			
42 : 77 floors			
20 : 24 feet long			
16 : 22 feet wide			
3 : 5 coats paint			

$$= \frac{7 \times 11}{2 \times 3} = 12\frac{1}{2} \text{ days.}$$

(13)

IX.	IX.	IX.
12)72342	6)72342	3)72342
<u>        </u>	<u>        </u>	<u>        </u>
12)5403..2	6)11806..2	3)23713..2
<u>        </u>	<u>        </u>	<u>        </u>
12)407..0	6)1731..0	3)7234..0
<u>        </u>	<u>        </u>	<u>        </u>
12)30..7	6)264..4	3)2371..1
<u>        </u>	<u>        </u>	<u>        </u>
2..3	6)40..4	3)723..1
	<u>        </u>	<u>        </u>
	6)6..0	3)237..0
	<u>        </u>	<u>        </u>
	1..0	3)72..1
		<u>        </u>
		3)23..2
		<u>        </u>
		3)7..0
		<u>        </u>
		2..1

IX.	XII.	VI.	III.
72342 =	23702 =	1004402 =	2102101102
9	12	6	3
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
65	27	6	7
9	12	6	3
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
588	331	36	21
9	12	6	3
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
5296	3972	220	65    1766
9	12	6	3    3
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
47666	47666	1324	196    5296
		6	3    3
		<u>        </u>	<u>        </u>
		7944	588    15888
		6	3    3
		<u>        </u>	<u>        </u>
		47666	1765    47666

(14)

II.	II.	IV.	IV.
111111	100000	333333	100000
2	2	4	4
-	-	-	-
3	2	15	4
2	2	4	4
-	-	-	-
7	4	63	16
2	2	4	4
<hr/>	<hr/>	<hr/>	<hr/>
15	8	255	64
2	2	4	4
<hr/>	<hr/>	<hr/>	<hr/>
31	16	1023	256
2	2	4	4
<hr/>	<hr/>	<hr/>	<hr/>
63 Greatest.	32 Least.	4095 Greatest.	1024 Least.

VI.	VI.	VIII.	VIII.
555555	100000	777777	100000
6	6	8	8
<hr/>	<hr/>	<hr/>	<hr/>
35	6	63	8
6	6	8	8
<hr/>	<hr/>	<hr/>	<hr/>
215	36	511	64
6	6	8	8
<hr/>	<hr/>	<hr/>	<hr/>
1295	216	4095	512
6	6	8	8
<hr/>	<hr/>	<hr/>	<hr/>
7775	1296	32767	4096
6	6	8	8
<hr/>	<hr/>	<hr/>	<hr/>
46655 Greatest.	7776 Least.	262143 Greatest.	32768 Least.

(Continued on next page.)

(14 continued.)

XII	XII
e e e e e e	100000
<u>12</u>	<u>12</u>
143	12
<u>12</u>	<u>12</u>
1727	144
<u>12</u>	<u>12</u>
20735	1728
<u>12</u>	<u>12</u>
248831	20736
<u>12</u>	<u>12</u>
2985983 Greatest.	248832 Least.

(15)

$$1728 = 2^6 \times 3^3.$$

1..2..4..8..16..32..64  
1..3..9..27

1..2..4.. 8..16..32..64..3..6..12..24..48..96..192 .. 9 ..  
 18..36..72..144..288..576..27..54..108..216..432 .. 864 ..  
 1728.

Therefore the divisors of 1728 are 1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 27, 32, 36, 48, 54, 64, 72, 96, 108, 144, 192, 216, 288, 432, 576, 864, 1728.

(16)

30	2..4..6..8..10..12..14..16..18..20..22..24..26..28..30
14	2            4            2.. 7.. 8.. 3.. 2..11.. 4..13..14
12	2                            4.. 3        11.. 2..13
143	11        13

$$30 \times 14 \times 12 \times 143 = 720720 = l. m. c.$$

(17)

Dissimilar.	Similar.	Similar and Coterminous.
97-91342̇ =	97-913423̇ =	97-913423423423423̇
18-1234567̇ =	19-1234567̇ =	18-123456745674567̇
	Difference =	18-789966677748855̇

(18)

20 ft. 7'
19 ft. 5 7"
<hr/>
1 0 0 1'''
8 6 11
391 1
<hr/>

$$400 \quad 7 \quad 11 \quad 1 = 44 \text{ sq. yds.} + \frac{1}{3} + \frac{7}{103} + \frac{11}{1296} + \frac{1}{13862} =$$

$$44\frac{8053}{18662} \text{ sq. yds.} = 44.517 + \text{sq. yds.}$$

$$\$2.87\frac{1}{2} \times 44.517 = \$127.98 +.$$

(19)

916 acres 3 roods 17 per 7 yds. = 4437591 $\frac{1}{2}$  sq. yds., and 43 acres 1 rood 2 per 17 yds. = 209407 $\frac{1}{2}$  sq. yds.

$$4437591\frac{1}{2} \div 209407\frac{1}{2} = 4437591.25 \div 207407.5 = 21.19117 +.$$

Page 233.

(14)

$$\$742.10 \times .05 = \$37.10\frac{1}{2}.$$

(15)

$$\$1000 \times .11 = \$110.$$

(16)

$$\$734.19 \times .10 = \$73.419.$$

(17)

$$\$1624.50 \times .875 = \$1421.4375.$$

(18)

$$\$994.70 \times .125 = \$124.3375.$$

(19)

$$\$777.50 \times .0875 = \$68.03125, \text{ or } \$68.03\frac{1}{2}.$$

(20)

$$\$7135.80 \times .0225 = \$160.5555.$$

(21)

$$2740 \times .20 = 548.$$

(22)

$$\$7490 \times .10 = \$749$$

$$\$7490 \times .17 = \$1273.30$$

$$\$7490 \times .27 = \$2022.30$$

$$\$7490 \times .46 = \$4445.40$$

(23)

$$\$740 \times .045 = \$33.30$$

$$\$1680 \times .025 = \$42.00$$

$$\$42.00 - \$33.30 = \$8.70$$

(24)

$$729 \times .11 = 80.19$$

$$729 - 80.19 = 648.81 = 648\frac{81}{100}$$

$$\$847.16 \times 16 = 135.5456$$

$$\$1234.17 \times .0625 = 77.135625$$

$$\text{Sum} = \underline{\underline{\$403.486225}}$$

(25)

$$\$763.22 \times 25 = \$190.8050$$

$$\$847.16 \times 16 = 135.5456$$

$$\$1234.17 \times .0625 = 77.135625$$

$$\text{Sum} = \underline{\underline{\$403.486225}}$$

(26)

$$\$17429.40 \times .43 = \$7494.64\frac{1}{2}$$

$$\$17429.40 \times .37 = 6448.87\frac{1}{2}$$

$$\underline{\underline{\$13943.52}}$$

$$\$17429.40 - \$13943.52 = \$3485.88.$$

(27)

$$68978 \times .36 = 24832.08.$$

(28)

$$29800 \times .17 = 5066$$

$$29800 - 5066 = 24734$$

(3)

$$\$1000 \times .045 = \$45.$$

(4)

$$\$1678.30 \times .0225 = \$37.76175.$$



(5)

(6)

$$\$7531.19 \times .0375 = \$282.419625. \quad \$508.60 \times .0125 = \$6.3575$$

(7)

(8)

$$\$7863.50 \times .0175 = \$137.61125. \quad \$878.30 \times .025 = \$21.9575$$

(9)

(10)

$$\$7193.16 \times .03125 = \$224.78625. \quad \$6734.10 \times .17 = \$1144.797.$$

(11)

$$\$7.13 \times 718 \div .0425 = \$217.57195.$$

(12)

$$\$1.85 \times 8243 \times .05625 = \$857.7871875.$$

---

 Page 236.

(13)

(14)

$$\$7893.87 \times .02 = \$157.8774. \quad \$8000 \times .00875 = \$70.$$

(15.)

$$\$8643.22 \times .0125 = \$108.04025.$$

(16.)

$$\$78963.80 \times .00875 = \$690.93325.$$

(17)

$$\$1987.27 \times .0375 = \$74.522625.$$

Page 237.

(19)

$$\$4000 \div 1.0125 = \$3950.61728 + = \text{sum to be invested.}$$

$$\$4000 - 3950.61728 = \$49.38271 = \text{commission.}$$

(20)

$$\$7500 \div 1.045 = \$7177.03349 = \text{sum to be expended in laces.}$$

$$\$7500 - \$322.96651 = \$322.96651 = \text{commission.}$$

(21)

$$\$8470 \div 1.05 = \$8066.66\frac{2}{3} = \text{sum to be invested.}$$

$$\$8066.66\frac{2}{3} \div \$6.40 = 1260\frac{1}{2}. \text{ Ans.}$$

(22)

$$\$11000 \div 1.00875 = \$10904.584882 = \text{sum to be invested.}$$

(23)

$$\$13000 \div 1.045 = \$12440.1913 + = \text{sum to be invested.}$$

$$\$13000 - \$12440.1913 = \$559.8086 + = \text{commission.}$$

$$\$12440.1913 + \div \$3.63 = 3427.0499 \text{ yds. Ans.}$$

Page 238.

(4)

(5)

$$\$9000 \div 0.83 = \$10843.373. \quad \$8500 \div 1.11 = \$7657.6576.$$

(6)

$$\$17500 \div 1.0125 = \$17283.951 = \text{amount to be invested.}$$

$$\$17283.951 \div 1.07 = \$16153.22 = \text{stock,}$$

(7)

$\$20000 \div 1.0175 = \$19656.01965 =$  amount to be invested.

$\$19656.01985 \div 0.97 = \$20263.937 =$  stock remitted.

(8)

$\$200 \times 100 = \$20000 =$  par value of 200 shares.

$\$1$  stock costs  $\$1.055$ .  $\$1.055 \times 20000 = \$21100 =$  cost of stock.

$\$21100 \times .00875 = \$184.625 =$  brokerage.

$\$21100 + \$184.625 = \$21284.625 =$  whole cost.

---

Page 240.

(2)

(3)

$\$7500 \times .0175 = \$131.25.$

$\$8375 \times .0075 = \$62.8125.$

(4)

(5)

$\$6000 \times .01875 = \$112.50.$

$\$5000 \times .0117 = \$58.50.$

(6)

(7)

$\$6400 \times .0090 = \$57.60.$

$\$4500 \times .0035 = \$15.75.$

(8)

(9)

$\$36000 \times .03 = \$1080.$

$\$27000 \times 4.82 \times 4 = \$5205.60.$

(10)

(11)

$\$39000 \times .022 = \$858.$

$\$17800 \times .005 = \$89.$

(12)

$\$12350 \times .01\frac{1}{2} \times 7 = \$1235.$

Page 241.

(15)

$$\$17000 \div .965 = \$17616.58.$$

(16)

$$\$22750 \div .94 = \$24202.127.$$

(17)

$$\$15000 \div .9775 = \$15345.2685.$$

(18)

$$\$33000 \div .9425 = \$35013.2625.$$

Page 243.

(3)

$$1347 \times 5 = 6735 \text{ lbs.} = \text{gross weight.}$$

$$6735 \times .06 = 404.1 \text{ lbs. tare.}$$

$$\begin{array}{r} \hline 6330.9 \text{ lbs.} = \text{net at } 3\frac{1}{2} \text{ cents per lb.} = 6330.9 \\ \times 3\frac{1}{2} = \$221.58. \end{array}$$

(4)

$$127 \times 11 = 1397 \text{ lbs.} = \text{gross weight.}$$

$$1397 \times .03 = 41.91 \text{ lbs.} = \text{tare.}$$

$$\begin{array}{r} \hline 1355.09 \text{ lbs.} = \text{net at } \$\cdot012 \text{ per lb.} = 1355.09 \\ \times .012 = \$16.26. \end{array}$$

(5)

$$129 \times .13 = \$16.77.$$

(6)

$$31 \times 207 = 6417 \text{ lbs.} = \text{gross weight.}$$

$$207 \times 2\frac{1}{4} = 465\frac{1}{4} \text{ lbs.} = \text{tare.}$$

$$\begin{array}{r} \hline 5951\frac{1}{4} \text{ lbs.} = \text{net at } 5\frac{1}{2} \text{ cents per lb.} = 5951\frac{1}{4} \times \\ 5\frac{1}{2} = \$342.1968, \end{array}$$

(7)

$$214 \times .47 = \$100.58.$$

(10)

(11)

$$\$17429.80 \times .21 = \$3660.2580. \quad \$2920.16 \times .075 = \$219.012.$$

(12)

(13)

$$\$71342.90 \times .25 = \$17835.725. \quad \$913.73 \times .2 = \$182.746.$$

(14)

$$\$14713.19 \times .33 = \$4855.3527.$$

Page 244.

(2)

$$\begin{aligned} \$23900 \div 7142300 &= \$0.0033462 = \text{rate per dollar.} \\ \$0.0033462 \times 14729.50 &= \$49.2878 \text{ +. } \textit{Ans.} \end{aligned}$$

(3)

$$\begin{aligned} \$100000 \div 5793000 &= \$0.017262 = \text{rate per dollar.} \\ \$0.017262 \times 18600 &= \$321.0732. \textit{ Ans.} \end{aligned}$$

(4)

$$\begin{aligned} \$100000 \div 5793000 &= \$0.017262 = \text{rate per dollar.} \\ \$0.017262 \times 7500 &= \$129.465. \textit{ Ans.} \end{aligned}$$

(5)

$$\begin{aligned} \$100000 \div 5793000 &= \$0.017262 = \text{rate per dollar.} \\ \$0.017262 \times 11400 &= \$196.7868. \textit{ Ans.} \end{aligned}$$

Page 252.

(13)

Here  $P = \$723.19$ ,  $r = .067$ , and  $t = 7.32$ .Then  $I = Prt = 723.19 \times .067 \times 7.32 = \$354.6813036$ .

(14)

Here  $P = \$857.19$ ,  $r = .065$ , and  $t = 6\frac{1}{2}$  or  $6.5$ .Then  $A = P(1 + rt) = \$857.19 \times 1.4225 = \$1219.352775$ .

(15)

Here  $t = 11$ , and  $r = .725$ .Then  $n = tr + 1 = 11 \times .725 + 1 = 8.975$ .

(16)

Here  $P = \$654.32$ ,  $I = \$234.56$ , and  $r = .07$ .Then  $t = \frac{I}{Pr} = \frac{234.56}{654.32 \times .07} = 5.12112$  or 5 years 1 m. 13 d.

(17)

Here  $A = \$1200$ ,  $P = \$700$ , and  $t = 5$ .Then  $r = \frac{A - P}{Pt} = \frac{1200 - 700}{700 \times 5} = \frac{1}{7} =$  rate per unit  $\therefore 14\frac{2}{7} =$   
rate per cent.

(18)

Here  $n = 4$ , and  $r = .23$ .Then  $t = \frac{n-1}{r} = \frac{4-1}{.23} = 13$  years 15 days.

(19)

Here  $P = \$270$ ,  $I = \$87$ , and  $r = .07$ .Then  $t = \frac{I}{Pr} = \frac{87}{270 \times .07} = 4$  years  $7\frac{5}{7}$  months.

(20)

Here  $P = \$680$ ,  $t = 11\frac{1}{2}$ , and  $r = .11$ .Then  $A = P(1 + rt) = 680 \times 2.265 = \$1540.20$ .

(21)

Here  $A = \$2000$ ,  $t = 20$ , and  $r = .08$ .Then  $P = \frac{A}{1 + rt} = \frac{2000}{2.6} = \$769.23\frac{1}{3}$ .

(22)

Here  $n = 21$ , and  $t = 24$ .Then  $r = \frac{n-1}{t} = \frac{21-1}{24} = .83\frac{1}{3} =$  rate per unit.  $\therefore 83\frac{1}{3} =$   
rate per cent.

(23)

Here  $n = 23$ , and  $r = .16$ .Then  $t = \frac{n-1}{r} = \frac{23-1}{.16} = 137\frac{1}{2}$  years.

(24)

Here  $P = \$679.18$ ,  $r = .0775$ , and  $t = 11.73$ .Then  $I = Prt = 679.18 \times .0775 \times 11.73 = \$617.4255$ .

(25)

Here  $P = \$950$ ,  $A = \$1763.42$ , and  $t = .10$ .Then  $r = \frac{A - P}{Pt} = \frac{1763.42 - 950}{950 \times 10} = .08562 =$  rate per unit  
 $\therefore 8.562 =$  rate per cent.

(26)

Here  $P = \$666$ ,  $A = \$1347.50$ , and  $r = .06$ .

$$\text{Then } t = \frac{A - P}{Pr} = \frac{1347.50 - 666}{666 \times .06} = 17.054+ \text{ years, or 17 years 19 days.}$$

(27)

Here  $P = \$273$ ,  $I = \$100$ , and  $r = .09$ .

$$\text{Then } t = \frac{I}{Pr} = \frac{100}{273 \times .09} = 4.07 \text{ years} = 4 \text{ years 25 days.}$$

(28)

Here  $P = \$476.30$ ,  $A = \$500$ , and  $t = 2$ .

$$\text{Then } r = \frac{A - P}{Pt} = \frac{500 - 476.30}{476.30 \times 2} = .0248 = \text{rate per unit.}$$

$\therefore 2\frac{1}{2}\% = \text{rate per cent.}$

(29)

Here  $P = \$749.49$ ,  $I = \$257$ , and  $t = 7$ .

$$\text{Then } r = \frac{I}{Pt} = \frac{257}{749.49 \times 7} = .04898 = \text{rate per unit.}$$

$\therefore 4.898 = \text{rate per cent.}$

(30)

Here  $A = \$1111.11$ ,  $t = 11$ , and  $r = .11$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{1111.11}{2.21} = \$502.7647.$$

(31)

 $P = £167.47$ ,  $r = .11$ , and  $t = 9$ .

$$I = Prt = 167.47 \times .11 \times 9 = £165.7953 = £165 \text{ 15s. } 10\frac{1}{2}\text{d.}$$



Page 253.

(34)

$$11 \div 2 = 5\frac{1}{2} \text{ cents.}$$

(35)

$$16 \div 2 = 8 \text{ cents} = \$0.08.$$

(36)

$$9 \text{ years and 8 months} = 116 \text{ months, and } 116 \div 2 = 58 \text{ cents} \\ = \$0.58.$$

(37)

$$16 \text{ years and 3 months} = 195 \text{ months, and } 195 \div 2 = 97\frac{1}{2} \text{ cents} \\ = \$0.97\frac{1}{2}.$$

(38)

$$11 \text{ years and 7 months} = 139 \text{ months, and } 139 \div 2 = 69\frac{1}{2} \text{ cents} \\ = \$0.695.$$

(39)

$$12 \text{ years and 5 months} = 149 \text{ months, and } 149 \div 2 = 74\frac{1}{2} \text{ cents} \\ = \$0.745.$$

(40)

$$3 \text{ years and 2 months} = 38 \text{ months, and } 38 \div 2 = 19 \text{ cents} = \\ \text{interest of } \$1 \text{ for given rate and time.} \\ \$0.19 \times 279.40 = \$53.086.$$

(41)

$$6 \text{ years and 7 months} = 79 \text{ months, and } 79 \div 2 = 39\frac{1}{2} \text{ cents} = \\ \text{interest of } \$1 \text{ for given rate and time.} \\ \$0.395 \times 189.70 = \$74.9315.$$

(42)

3 years and 11 months = 47 months, and  $47 \div 2 = 23\frac{1}{2}$  cents = interest of \$1 for given rate and time.

$$\$0.235 \times 1463 = \$343.805.$$

(43)

11 years and 1 month = 133 months, and  $133 \div 2 = 66\frac{1}{2}$  cents = interest of \$1 for given rate and time.

$$\$0.665 \times 28967.50 = \$19263.3875.$$

---

Page 254.

(45)

$$2 \div 6 = \frac{1}{3} \text{ mill} = \$0.000\dot{3}.$$

(46)

$$7 \div 6 = 1\frac{1}{6} \text{ mills} = \$0.001\dot{1}\frac{1}{6}.$$

(47)

$$11 \div 6 = 1\frac{5}{6} \text{ mills} = \$0.001\dot{1}\frac{5}{6}.$$

(48)

$$27 \div 6 = 4\frac{1}{2} \text{ mills} = \$0.004\dot{1}\frac{1}{2}.$$

(49)

$$47 \div 6 = 7\frac{5}{6} \text{ mills} = \$0.007\dot{1}\frac{5}{6}.$$

(50)

$$8 \div 2 = 4 \text{ cents} = \$0.04.$$

$$12 \div 6 = 2 \text{ mills} = \$0.002 \text{ and } \$0.04 + \$0.002 = \$0.042.$$

(51)

$$66 \div 6 = 11 \text{ mills} = \$0.011.$$

(52)

$$2 \text{ years } 2 \text{ m'ths} = 26 \text{ months, and } 26 \div 2 = 13 \text{ cents} = \$0.13.$$

$$19 \div 6 = 3\frac{1}{6} \text{ mills} = \$0.003\dot{1}\frac{1}{6} \text{ and } \$0.13 + \$0.003\dot{1}\frac{1}{6} = \$0.133\dot{1}\frac{1}{6}.$$

(53)

7 years 8 m'ths = 92 months, and  $92 \div 2 = 46$  cents =  $\$0.46$ .  
 $9 \div 6 = 1\frac{1}{2}$  mills =  $\$0.001\frac{1}{2}$  and  $\$0.46 + \$0.001\frac{1}{2} = \$0.461\frac{1}{2}$ .

(54)

17 years 11 months = 215 months, and  $215 \div 2 = 107\frac{1}{2}$  cents =  
 $\$1.075$ .

$23 \div 6 = 3\frac{5}{6}$  mills =  $\$0.003\frac{5}{6}$ , and  $\$1.075 + \$0.003\frac{5}{6} = \$1.078\frac{5}{6}$ .

(55)

12 years 7 months = 151 months, and  $151 \div 2 = 75\frac{1}{2}$  cents =  
 $\$0.755$ .

$17 \div 6 = 2\frac{5}{6}$  mills =  $\$0.002\frac{5}{6}$ , and  $\$0.755 + \$0.002\frac{5}{6} = \$0.757\frac{5}{6}$ .

---

Page 255.

(57)

Interest on \$1 for 7 months =  $\$0.035$

Interest on \$1 for 17 days =  $\underline{\quad 2\frac{1}{2}}$

Therefore interest on \$1 for 7 months 17 days, =  $\$0.037\frac{1}{2}$

Then  $\$0.037\frac{1}{2} \times 917.30 = \$34.704516$ .

(58)

Interest on \$1 for 3 months =  $\$0.015$

Interest on \$1 for 13 days =  $\underline{\quad 2\frac{1}{2}}$

Therefore interest on \$1 for 3 months 13 days =  $\$0.017\frac{1}{2}$

Then  $\$0.017\frac{1}{2} \times 842.50 = \$14.462916$ .

(59)

Interest on \$1 for 2 years 11 months =  $\$0.175$

Interest on \$1 for 10 days =  $\underline{\quad 1\frac{1}{2}}$

Therefore interest on \$1 for 2 yrs. 11 m'ths 10 days =  $\$0.176\frac{1}{2}$

Then  $\$0.176\frac{1}{2} \times 573.83 = \$101.3766$ .

(60)

$$\text{Interest on \$1 for 6 years 9 months} = \$0.405$$

$$\text{Interest on \$1 for 19 days} = \underline{\quad 3\frac{1}{6}}$$

$$\text{Therefore interest on \$1 for 6 years 9 m'ths 19 days} = \$0.408\frac{1}{6}$$

$$\text{Then } \$0.408\frac{1}{6} \times 642.30 = \$262.16545.$$

(61)

$$\text{Interest on \$1 for 5 years 5 months} = \$0.325$$

$$\text{Interest on \$1 for 7 days} = \underline{\quad 1\frac{1}{6}}$$

$$\text{Therefore interest on \$1 for 5 years 5 months 7 days} = \$0.326\frac{1}{6}$$

$$\text{Then } \$0.326\frac{1}{6} \times 1427.875 = \$465.7252.$$

(62)

$$\text{Interest on \$1 for 4 years 7 months} = \$0.275$$

$$\text{Interest on \$1 for 16 days} = \underline{\quad 2\frac{3}{4}}$$

$$\text{Therefore interest on \$1 for 4 years 7 m'ths 16 days} = \$0.277\frac{3}{4}$$

$$\text{Then } \$0.277\frac{3}{4} \times 709.63 = 197.040596.$$

(63)

$$\text{Interest on \$1 for 7 years 7 months} = \$0.455$$

$$\text{Interest on \$1 for 22 days} = \underline{\quad 3\frac{3}{4}}$$

$$\text{Therefore interest on \$1 for 7 years 7 m'ths 22 days} = \$0.458\frac{3}{4}$$

$$\text{Then } \$0.458\frac{3}{4} \times 2463.20 = \$1129.7877 + \$2463.20 = \$3592.9877.$$

(64)

$$\text{Interest on \$1 for 9 years 9 months} = \$0.585$$

$$\text{Interest on \$1 for 9 days} = \underline{\quad 1\frac{1}{2}}$$

$$\text{Therefore interest on \$1 for 9 years 9 m'ths 9 days} = \$0.586\frac{1}{2}$$

$$\text{Then } \$0.586\frac{1}{2} \times 999.99 = \$586.494135.$$

(65)

$$\begin{array}{r} \text{Interest on \$1 for 3 years 4 months} = \$0.20 \\ \text{Interest on \$1 for 27 days} = \quad \quad 4\frac{1}{2} \end{array}$$

$$\begin{array}{l} \text{Therefore interest on \$1 for 3 years 4 m'ths 27 days} = \$0.204\frac{1}{2} \\ \text{Then } \$0.2045 \times 68.70 = \$14.04915. \end{array}$$

(66)

$$\begin{array}{r} \text{Interest on \$1 for 3 years} = \$0.18 \\ \text{Interest on \$1 for 28 days} = \quad \quad 4\frac{3}{4} \end{array}$$

$$\begin{array}{l} \text{Therefore interest on \$1 for 3 years 28 days} = \$0.184\frac{3}{4} \\ \text{Then } \$0.184\frac{3}{4} \times 742.63 = \$137.139. \end{array}$$

(67)

$$\begin{array}{r} \text{Interest on \$1 for 7 years 4 months} = \$0.44 \\ \text{Interest on \$1 for 11 days} = \quad \quad 1\frac{1}{2} \end{array}$$

$$\begin{array}{l} \text{Therefore interest on \$1 for 7 years 4 m'ths 11 days} = \$0.441\frac{1}{2} \\ \text{Then } \$0.441\frac{1}{2} \times 200 = \$88.366 + \$200 = \$288.366. \end{array}$$

(68)

$$\begin{array}{r} \text{Interest on \$1 for 9 years 3 months} = \$0.555 \\ \text{Interest on \$1 for 9 days} = \quad \quad 1\frac{1}{2} \end{array}$$

$$\begin{array}{l} \text{Therefore interest on \$1 for 9 years 3 months 9 days} = \$0.556\frac{1}{2} \\ \text{Then } \$0.5565 \times 743.63 = \$413.830095 + \$743.63 = \$1157.460095. \end{array}$$

Page-256.

(70)

$$\begin{array}{l} \text{Interest on \$1 at 6 per cent. for given time} = \$0.526\frac{2}{3}. \\ \text{Interest on \$1234.56 at 6 per cent. for given time} = \$0.526\frac{2}{3} \times \\ 1234.56 = \$650.2016. \\ \text{Hence interest on \$1234.56 at 7 per cent for given time} = \\ \$650.2016 + \text{one sixth of } \$650.2016 = \$758.5685. \end{array}$$

K

(71)

Interest on \$1 at 6 per cent. for given time =  $\$0.126\frac{1}{2}$ .

Interest on \$9876.54 at 6 per cent. for given time =  $\$0.126\frac{1}{2} \times 9876.54 = \$1252.67449$ .

Hence interest on \$9876.54 at 3 per cent. for given time =  $\$1252.67449 \div 2 = \$626.337245$ .

(72)

Interest on \$1 at 6 per cent. for given time =  $\$0.216\frac{1}{3}$ .

Interest on \$715.30 at 6 per cent. for given time =  $\$0.216\frac{1}{3} \times 715.30 = \$154.98166$ .

Hence interest on \$715.30 at 8 per cent. for given time =  $\$154.98166 + \text{one third of } \$154.98166 = \$206.6422$ .

(73)

Interest on \$1 at 6 per cent. for given time =  $\$0.141\frac{1}{3}$ .

Interest on \$555.55 at 6 per cent. for given time =  $\$0.141\frac{1}{3} \times 555.55 = \$78.51773$ .

Hence interest on \$555.55 at 12 per cent. for given time =  $\$78.51773 \times 2 = \$157.03546 + \$555.55 = \$712.58546$ .

(74)

Interest on \$1 at 6 per cent. for given time =  $\$0.016\frac{1}{3}$ .

Interest on \$7766.55 at 6 per cent. for given time =  $\$0.016\frac{1}{3} \times 7766.55 = \$129.4425$ .

Hence interest on \$7766.55 at 5 per cent. for given time =  $\$129.4425 - \text{one sixth of } \$129.4425 = \$104.86875$ .

Amount =  $\$104.86875 + \$7766.55 = \$7871.41875$ .

(75)

Interest on \$1 at 6 per cent. for given time =  $\$0.521\frac{1}{3}$ .

Interest on \$500 at 6 per cent. for given time =  $\$0.521\frac{1}{3} \times 500 = \$260.666\frac{1}{3}$ .

Hence interest on \$500 at 16 per cent. for given time =  $\$260.666\frac{1}{3} \times 2\frac{1}{3} = \$695.111 + \$500 = \$1195.111$ .

(76)

Interest on \$1 at 6 per cent. for given time =  $\$0.206\frac{1}{8}$ .

Interest on \$576 at 6 per cent. for given time =  $\$0.206\frac{1}{8} \times 576 = \$118.752$ .

Hence interest on \$576 at 5 per cent. for given time =  $\$118.752$   
 — one sixth of  $\$118.752 = \$98.96$ .

(77)

Interest on \$1 at 6 per cent. for given time =  $\$0.151\frac{5}{8}$ .

Interest on \$2478.91 at 6 per cent. for given time =  $\$0.151\frac{5}{8} \times 2478.91 = \$376.38116$ .

Hence interest on \$2478.91 at  $4\frac{1}{2}$  per cent. for given time =  
 $\$376.38116$  — one fourth of  $\$376.38116 = \$282.285$ .

(78)

From May 9th to December 11th = 216 days. Interest on \$1  
 at 6 per cent. for 216 days =  $\$0.036$ .

Interest on \$780 at 6 per cent. for 216 days =  $\$0.036 \times 780 =$   
 $\$28.08$ .

(79)

From August 16th 1851 to June 19th 1852 = 308 days.

Interest on \$1 at 6 per cent. for given time =  $\$0.051\frac{1}{2}$ .

Interest on \$1830.63 at 6 per cent. for given time =  $\$0.051\frac{1}{2} \times$   
 $1830.63 = \$93.97234$ .

Hence interest on \$1830.63 at 7 per cent. for given time =  
 $\$93.97234 +$  one sixth of  $\$93.97234 = \$109.63439$ .

(80)

From September 3rd 1858 to January 9th 1859 = 128 days.

Interest on \$1 at 6 per cent. for given time =  $\$0.021\frac{1}{2}$ .

Interest on \$6200 at 6 per cent. for given time =  $\$0.021\frac{1}{2} \times$   
 $6200 = \$132.266$ .

Amount =  $\$132.266 + \$6200 = \$6332.266$ .



Page 258.

(82)

From June	2nd to July	17th there are 45 days.
" July	17th to October	6th " 81 "
" October	6th to December	11th " 66 "
" December	11th to March	29th " 109 "
" March	29th to October	7th " 192 "

Whole sum \$1217.30 for 45 days = \$54778.50 for 1 day.  
 1st endorsement 207.80

Balance \$1009.50 for 81 days = \$81769.50 for 1 day.  
 2nd endorsement 209.60

Balance \$799.90 for 66 days = \$52793.40 for 1 day.  
 3rd endorsement 320.90

Balance \$479.00 for 109 days = \$52211.00 for 1 day.  
 4th endorsement 421.83

Balance \$57.17 for 192 days = \$10976.64 for 1 day.

Whole interest = that of \$252529.04 for 1 day.

Interest on \$252529.04 at 6 per cent. for 1 year = \$15151.7424.

Hence interest for 1 day =  $\$15151.7424 \div 365 = \$41.5116$ .

Then interest due = \$41.5116

Balance on Note = \$57.17

Principal and interest due = \$98.6816



(83)

From 17th June	to 5th September	there are 80 days.
" 5th September	to 7th December	" 93 "
" 7th December	to 11th June	" 186 "
" 11th June	to 7th February	" 241 "
" 7th February	to 19th December	" 315 "
" 19th December	to 1st May	" 133 "

Whole sum \$7348.25 for 80 days = \$587860.00 for 1 day.  
1st endorsement 2463.80

Balance \$4884.45 for 93 days = \$454253.85 for 1 day.  
2nd endorsement 392.20

Balance \$4492.25 for 186 days = \$835558.50 for 1 day.  
3rd endorsement 982.20

Balance \$3510.05 for 241 days = \$845922.05 for 1 day.  
4th endorsement 2842.90

Balance \$667.15 for 315 days = \$210152.25 for 1 day.  
5th endorsement 317.23

Balance \$349.92 for 133 days = \$46539.36 for 1 day.

• Whole interest = that of \$2980286.01 for 1 day.

Interest on \$2980286.01 at 8 per cent. for 1 year = \$238422.8808.

Hence interest for 1 day =  $\$238422.8808 \div 365 = \$653.2133$ .

Then interest due = \$653.2133

Balance on Note = \$349.92

Principal and interest due = \$1003.1333

Page 259.

(2)

\$1800	Principal.
108	Interest for 1st year.
<hr/>	
\$1908	Amount for 1 year = principal for 2nd year.
114·48	Interest for 2nd year.
<hr/>	
\$2022·48	Amount for 2 years = principal for 3rd year.
121·3488	Interest for 3rd year.
<hr/>	
\$2143·8288	Amount for 3 years = principal for 4th year.
128·629728	Interest for 4th year.
<hr/>	
\$2272·458528	Amount for 4 years = principal for 5th year.
136·347511	Interest for 5th year.
<hr/>	
\$2408·806039	Amount for 5 years.
1800	Given Principal.
<hr/>	
\$608·806 =	Compound interest required.
(3)	
\$700	Principal.
49	Interest for 1st half year.
<hr/>	
\$749	Amount for 1 half y. = principal for 2nd half y.
52·43	Interest for 2nd half year.
<hr/>	
\$801·43	Amount for 1 year = principal for 3rd half y.
56·1001	Interest for 3rd half year.
<hr/>	
\$857·5301	Amount for 1½ years = principal for 2nd year.
60·027107	Interest for 2nd year.
<hr/>	
\$917·557207	Amount for 2nd year = principal for 5th half y.
64·229004	Interest for 5th half year.
<hr/>	
\$981·786211	Amount for 2½ years = principal for 3rd year.
68·725034	Interest for 3rd year.
<hr/>	
\$1050·511245	Amount for 3 years = principal for 7th half y.
73·535787	Interest for 7th half year.
<hr/>	
\$1124·047032	Amount for 3½ years.
700	Given Principal.
<hr/>	
\$424·047 =	Compound interest required.

(4)

\$673·40	Principal.
<u>20·202</u>	Interest for 1st quarter.
\$693·602	Amount for 1 quar. = principal for 1st half y.
<u>20·80806</u>	Interest for 1st half year.
\$714·41006	Am't for 1 half y. = principal for 3rd quarter.
<u>21·4323018</u>	Interest for 3rd quarter.
\$735·8423618	Amount for 3 quarters = principal for 1st year.
<u>22·0752708</u>	Interest for 1st year.
\$757·9176326	Amount for 1 year = principal for 5th quarter.
<u>22·7375289</u>	Interest for 5th quarter.
\$780·6551615	Am't for 5 quarters = principal for 3rd half y.
<u>23·4196548</u>	Interest for 3rd half year.
\$804·0748163	Am't for 3 half y. = principal for 7th quarter.
<u>24·1222444</u>	Interest for 7th quarter.
\$828·1970807	Amount for 7 quarters = principal for 2nd year.
<u>24·8459124</u>	Interest for 2nd year.
\$853·0429 =	Amount for 2 years required.
<u>673·40</u>	Given Principal.
\$179·6429 =	Compound Interest required.

(5)

\$860	Principal.
<u>34·4</u>	Interest for 1st half year.
\$894·4	Amount for 1 half year = principal for 1st year.
<u>35·776</u>	Interest for 1st year.
\$930·176	Amount for 1 year = principal for 3rd half year.
<u>37·20704</u>	Interest for 3rd half year.
\$967·38304	Amount for 3 half years = principal for 2nd y.
<u>38·69532</u>	Interest for 2nd year.
\$1006·07836	Amount for 2 years = principal for 5th half year.
<u>40·24313</u>	Interest for 5th half year.
\$1046·32149	Amount for 5 half years = principal for 3rd year.
<u>41·85285</u>	Interest for 3rd year.
\$1088·17434	= Amount for 3 years required.
<u>860</u>	Given Principal.
\$228·1743	= Compound Interest required.

Page 261.

(8)

By the table the am't of \$1 at 6 per cent. for 11 years = \$1.8983.

Then  $\$1.8983 \times 875 = \$1661.0125 =$  Amount.

875	Principal.
<hr style="width: 100px; margin: 0 auto;"/>	

 $\$786.0125 =$  Interest.

(9)

By the table the am't of \$1 for the given time and rate = \$2.77247.

Then  $\$2.77247 \times 643.98 = \$1785.41523 =$  Amount.

643.98	Principal.
<hr style="width: 100px; margin: 0 auto;"/>	

 $\$1141.43523 =$  Interest.

(10)

By the table the am't of \$1 at 6 per cent. for 45 years = \$13.76461.

Then  $\$13.76461 \times .01 = \$.137646 =$  Amount.

.01	Principal.
<hr style="width: 100px; margin: 0 auto;"/>	

 $\$.127646 =$  Interest.

(11)

By the table the am't of \$1 for the given time and rate = \$2.28793.

Then  $\$2.28793 \times 78.2 = \$178.916 =$  Amount.

78.2	Principal.
<hr style="width: 100px; margin: 0 auto;"/>	

 $\$100.716 =$  Interest.

(12)

By the table the am't of \$1 for the given rate and time = \$2.40662.

Then  $\$2.40662 \times 777.77 = \$1871.7968 =$  Amount.

777.77	Principal.
<hr style="width: 100px; margin: 0 auto;"/>	

 $\$1094.0268 =$  Interest.

(13)

$$£44 \text{ 5s. } 9\text{d.} = £44.2875.$$

By the table the am't of £1 at 6 per cent. for 11 years = £1.8983.

$$\begin{aligned} \text{Then } £1.8983 \times 44.2875 &= £84.07096 = £84 \text{ 1 } 5 = \text{Amount.} \\ &44 \text{ 5 } 9 \text{ Principal.} \\ \hline &£39 \text{ 15 } 8 = \text{Interest.} \end{aligned}$$

(14)

$$£32 \text{ 4s. } 9\frac{1}{2}\text{d.} = £32.240625.$$

By the table the amount of £1 for the given time and rate =

$$\begin{aligned} £1.26532. \text{ Then } £1.26532 \times 32.240625 &= \\ £40.7947076 &= £40 \text{ 15 } 10\frac{1}{2} \text{ nearly} = \text{Amount.} \\ &32 \text{ 4 } 9\frac{1}{2} \text{ Principal.} \\ \hline &£8 \text{ 11 } 1 = \text{Interest.} \end{aligned}$$

---

Page 262.

(16)

Amount of \$1 for 7 years at 4 per cent = \$1.31593.

$$\$7439.87 \div 1.31593 = \$5653.697.$$

(17)

Amount of \$1 at 5 per cent for 20 years = \$2.6533.

$$\$9193.90 \div 2.6533 = \$3465.081.$$

(18)

$$£595 \text{ 10s. } 2\frac{1}{2}\text{d.} = £595.51.$$

Amount of £1 at 6 per cent for 3 years = £1.19102.

$$£595.51 \div 1.19102 = £500.$$

(19)

Amount of \$1 at 6 per cent for 7 years = \$1.50363.

$$\$7111.11 \div 1.50363 = \$4729.295.$$

(20)

$$£268 \text{ 0s. } 4\frac{1}{2}\text{d.} = £268.02.$$

Amount of £1 at 5 per cent for 6 years = £1.3401.

$$£268.02 \div 1.3401 = £200.$$

Page 263.

(3)

Here  $A = \$962$ ,  $r = .04$ , and  $t = 1$ . Whence  $1 + rt = 1.04$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{962}{1.04} = \$925.$$

(4)

Here  $A = \$2202$ ,  $r = .06$ , and  $t = 5.75$ . Whence  $1 + rt = 1.345$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{2202}{1.345} = \$1637.174.$$

(5)

Here  $A = \$1003.50$ ,  $r = .06$ , and  $t = \frac{3}{4}$  year. Whence  $1 + rt = 1.04$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{1003.50}{1.04} = \$964.9038.$$

(6)

Here  $A = \$716$ ,  $r = .08$ , and  $t = \frac{7}{2}$  year. Whence  $1 + rt = 1.04\frac{1}{2}$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{716}{1.04\frac{1}{2}} = \$684.0764.$$

(7)

Here  $A = \$1342.50$ ,  $r = .065$ , and  $t = \frac{25}{3}$  year. Whence  $1 + rt = 1.022\frac{2}{3}$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{1342.50}{1.022\frac{2}{3}} = \$1313.266.$$

(8)

Here  $A = \$2400$ ,  $r = .05$ , and  $t = 3\frac{6}{5}$  year. Whence  $1 + rt = 1.03\frac{1}{3}$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{2400}{1.03\frac{1}{3}} = \$2324.84.$$

(9)

Here  $A = \$2202$ ,  $r = .05$ , and  $t = .75$  year. Whence  $1 + rt = 1.0375$ .

$$\$2202 \div 1.0375 = \$2122.40963+ = \text{Present worth.}$$

$$\$2202 - \$2122.40963+ = \$79.59036 = \text{Discount.}$$

(10)

Here  $A = \$4360$ ,  $r = .06$ , and  $t = 1\frac{5}{2}$ . Whence  $1 + rt = 1.085$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{4360}{1.085} = \$4018.43317.$$

(11)

Here  $A = \$1647$ ,  $r = .06$ , and  $t = \frac{11}{2}$  year. Whence  $1 + rt = 1.055$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{1647}{1.055} = \$1561.13744.$$

(12)

Here  $A = \$2000$ ,  $r = .06$ , and  $t = 3\frac{1}{2}$ . Whence  $1 + rt = 1.215$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{2000}{1.215} = \$1646.09053.$$



(13)

Here  $A = \$2070.90$ ,  $r = .05$ , and  $t = 1\frac{7}{12}$ . Whence  $1 + rt = 1.07\frac{1}{2}$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{2070.90}{1.07\frac{1}{2}} = \$1918.9806.$$

$\$2070 - \$1918.9806 = \$151.919 =$  Discount required.

(14)

Here  $A = \$970.63$ ,  $r = .08$ , and  $t = 1\frac{1}{2}$  year. Whence  $1 + rt = 1.07\frac{1}{2}$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{970.63}{1.07\frac{1}{2}} = \$904.313.$$

(15)

Here in first case  $A = \$1512$ ,  $r = .07$ , and  $t = .5$  year. Whence  $1 + rt = 1.035$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{1512}{1.035} = \$1460.8695.$$

Also  $A = 1512$ ,  $r = .07$ , and  $t = 1$ . Whence  $1 + rt = 1.07$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{1512}{1.07} = \$1413.0841.$$

$\$1460.8695 + \$1413.0841 = \$2873.9536 =$  Present worth of whole amount.

$\$3024 - \$2873.9536 = \$150.0464 =$  Discount required.

(16)

Here in first case  $A = \$440$ ,  $r = .08$ , and  $t = 1.25$ . Whence  $1 + rt = 1.1$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{440}{1.1} = \$400.$$

In second case  $A = \$896$ ,  $r = .08$ , and  $t = 1.5$ . Whence  $1 + rt = 1.12$ .

$$\text{Then } P = \frac{A}{1 + rt} = \frac{896}{1.12} = \$800.$$

$\$400 + \$800 = \$1200.$



Page 265.

(18)

Here the time the note has to run is 2 years, 3 months, 3 days.

Interest of \$1 at 7 per cent for 2 yrs., 3 m., 3 days =  $\$0.1580\frac{1}{2}$ .

Interest of \$986 at 7 per cent for 2 years, 3 months, 3 days =  
 $\$0.1580\frac{1}{2} \times 986 = \$155.8701$ .

(19)

Here the time the note has to run is 103 days = 3 months 13 days.

Interest of \$1 at 8 per cent for 3 months 13 days =  $\$0.022\frac{2}{3}$ .

Interest of \$640 at 8 per cent for 3 months, 13 days =  
 $\$0.022\frac{2}{3} \times 640 = \$14.6488$ .

(20)

Here the time the note has to run is 94 days = 3 months 4 days.

Interest of \$1 at 6 per cent for 3 months 4 days =  $\$0.015\frac{1}{3}$ .

Interest of \$563.80 at 6 per cent for 3 months 4 days =  
 $\$0.015\frac{1}{3} \times 563.80 = \$8.8328$  and  $\$563.80 - \$8.8328 = \$554.967$ .

---

 Page 266.

(22)

Interest on \$1 for 93 days at 7 p. c. =  $\$0.0180\frac{1}{2}$ , and this taken  
 from \$1 gives a remainder of  $\$0.9819\frac{1}{2}$  = present worth of \$1.

Then  $\$3755 \div 0.9819\frac{1}{2} = \$3824.15$ .

(23)

Interest on \$1 for 6 months 3 days at 5 per cent =  $\$0.0254\frac{1}{2}$ ,  
 and this taken from \$1 gives a remainder  $\$0.9745\frac{1}{2}$  = present  
 worth of \$1.

Then  $\$1147.80 \div 0.9745\frac{1}{2} = \$1177.734$ .

(24)

Interest on \$1 for 48 days at  $3\frac{1}{2}$  per cent =  $\$0.004\frac{1}{2}$ , and this taken from \$1 gives a remainder  $\$0.995\frac{1}{2}$  = present worth of \$1.

$$\text{Then } \$713.90 \div 0.995\frac{1}{2} = \$717.2471.$$

---

Page 268.

(4)

$$\begin{array}{r} \$200 \times 3 = 600 \\ 150 \times 4 = 600 \\ 250 \times 6 = 1500 \\ \hline 600 \quad 600)2700(4\frac{1}{2} \text{ months.} \\ \quad \quad \quad 2400 \\ \hline \quad \quad \quad 300 \\ \quad \quad \quad \hline \quad \quad \quad 600 \end{array} \left. \vphantom{\begin{array}{r} 600 \\ 600 \\ 1500 \\ 2700 \\ 2400 \\ 300 \\ 600 \end{array}} \right\} = \frac{1}{2}$$

(5)

$$\begin{array}{r} \frac{1}{4} \times 0 = 0 \\ \frac{1}{4} \times 3 = \frac{3}{4} \\ \frac{1}{4} \times 6 = 1\frac{1}{2} \\ \frac{1}{4} \times 9 = 2\frac{1}{4} \\ \hline 1 \quad 1)4\frac{1}{2} \\ \hline \end{array} \left. \vphantom{\begin{array}{r} 0 \\ \frac{3}{4} \\ 1\frac{1}{2} \\ 2\frac{1}{4} \\ 4\frac{1}{2} \end{array}} \right\} = 4\frac{1}{2} \text{ months.}$$

(6)

$$\begin{array}{r} \$50 \times 2 = 100 \\ 40 \times 5 = 200 \\ 30 \times 7 = 210 \\ \hline 120 \quad 120)510(4\frac{1}{4} \text{ months.} \\ \quad \quad \quad 480 \\ \hline \quad \quad \quad 30 \\ \quad \quad \quad \hline \quad \quad \quad 120 \end{array} \left. \vphantom{\begin{array}{r} 100 \\ 200 \\ 210 \\ 510 \\ 480 \\ 30 \\ 120 \end{array}} \right\} = \frac{1}{4}$$

(7)

$$\begin{array}{r} \$1000 \times 0 = 0 \\ 1500 \times 1 = 1500 \\ 600 \times 3 = 1800 \\ 700 \times 5 = 3500 \\ 1400 \times 7 = 9800 \\ \hline 5200 \quad 5200)16600(3\frac{5}{26} \text{ months.} \\ \quad \quad \quad 15600 \\ \hline \quad \quad \quad 1000 \\ \quad \quad \quad \hline \quad \quad \quad 5200 \end{array} \left. \vphantom{\begin{array}{r} 0 \\ 1500 \\ 1800 \\ 3500 \\ 9800 \\ 16600 \\ 15600 \\ 1000 \\ 5200 \end{array}} \right\} = \frac{5}{26}$$

(8)

Six months from 15th January = 15th July, and from 1st July to 15th July there are 14 days.

Six months from 10th February = 10th August, and from 1st July to 10th August there are 40 days.

Six months from 6th March = 6th September, and from 1st July to 6th September there are 67 days.

Six months from 8th June = 8th December, and from 1st July to 8th December there are 160 days.

$$\begin{array}{r}
 \$3750 \times 14 = 52500 \\
 3000 \times 40 = 120000 \\
 2400 \times 67 = 160800 \\
 2250 \times 160 = 360000 \\
 \hline
 11400 \quad 11400)693300(60\frac{3}{8} \text{ days.} \\
 \phantom{11400} \quad \quad \quad 684000 \\
 \hline
 \phantom{11400} \quad \quad \quad 9300 \\
 \phantom{11400} \quad \quad \quad \hline
 \phantom{11400} \quad \quad \quad 11400 \quad \left. \vphantom{\begin{array}{l} 9300 \\ \hline 11400 \end{array}} \right\} = \frac{3}{8}
 \end{array}$$

Therefore the note must be made payable on the 61st day from the 1st of July, which is the 31st of August.

---

Page 269.

(2)

Whole stock : A's stock :: whole profit : A's profit.

That is, \$4300 : \$3000 :: \$1117 :  $\frac{1117 \times 3000}{4300} = \$779.302+ = \text{A's sh.}$

\$1117 - \$779.302+ = \$337.697 = B's share.

(3)

Whole stock = \$6470 + \$3780 + \$9860 = \$20110.

Whole stock : A's stock :: whole profit : A's profit.

$$\text{That is, } \$20110 : \$6470 :: \$7890 : \frac{7890 \times 6470}{20110} = \$2538.453+ = \text{A's sh.}$$

Again, whole stock : B's stock :: whole profit : B's profit.

$$\text{That is, } \$20110 : \$3780 :: \$7890 : \frac{7890 \times 3780}{20110} = \$1483.053+ = \text{B's sh.}$$

Lastly, whole stock : C's stock :: whole profit : C's profit.

$$\text{That is, } \$20110 : \$9860 :: \$7890 : \frac{7890 \times 9860}{20110} = \$3868.493+ = \text{C's sh.}$$

(4)

Whole stock : B's stock :: whole gain : B's gain.

$$\text{That is, } \$320 : \$120 :: \$80 : \frac{80 \times 120}{320} = \$30 = \text{B's gain.}$$

Again, whole stock : C's stock :: whole gain : C's gain.

$$\text{That is, } \$320 : \$200 :: \$80 : \frac{80 \times 200}{320} = \$50 = \text{C's share.}$$

(5)

Whole stock : B's stock :: whole gain : B's gain.

$$\text{That is, } \$2800 : \$1200 :: \$728 : \frac{728 \times 1200}{2800} = \$312 = \text{B's gain.}$$

Again, whole stock : C's stock :: whole gain : C's gain.

$$\text{That is, } \$2800 : \$1600 :: \$728 : \frac{728 \times 1600}{2800} = \$416 = \text{C's gain.}$$

(6)

Whole stock : B's stock :: whole amount to be divided : B's share.

$$\text{That is, } \$3 : \$2 :: \$100 : \frac{100 \times 2}{3} = \$66.66\frac{2}{3} = \text{B's share.}$$

Again, whole st'k : C's st'k :: whole amo't to be divided : C's sh'e.

$$\text{That is, } \$3 : \$1 :: \$100 : \frac{100 \times 1}{3} = \$33.33\frac{1}{3} = \text{C's share.}$$

(7)

$$£1400 : £500 :: £1100 : \frac{1100 \times 500}{1400} = £392\frac{2}{7} = \text{B's share.}$$

$$£1100 - £392\frac{2}{7} = £707\frac{1}{7} = \text{C's share.}$$

(8)

$$\begin{array}{l} \text{casks. casks. } 180 \times 200 \\ 900 : 200 :: 180 : \frac{\quad}{900} = 40 \text{ casks} = \text{B's loss.} \end{array}$$

$$\begin{array}{l} 180 \times 300 \\ 900 : 300 :: 180 : \frac{\quad}{900} = 60 \text{ casks} = \text{C's loss.} \end{array}$$

$$180 - (40 + 60) = 80 \text{ casks} = \text{D's loss.}$$

(9)

$$\$1800 : \$300 :: \$100 : \frac{100 \times 800}{1800} = \$44.44\frac{4}{9} = \text{B's share.}$$

$$\$1800 : \$600 :: \$100 : \frac{100 \times 600}{1800} = \$33.33\frac{1}{3} = \text{C's share.}$$

$$\$44.44\frac{4}{9} + \$33.33\frac{1}{3} = \$77.77\frac{7}{9}, \text{ and } \$100 - \$77.77\frac{7}{9} =$$

$$\$22.22\frac{2}{9} = \text{D's share.}$$

L

(10)

$$6 : 1 :: 120 : \frac{120 \times 1}{6} = 20.$$

$$6 : 2 :: 120 : \frac{120 \times 2}{6} = 40.$$

$$6 : 3 :: 120 : \frac{120 \times 3}{6} = 60.$$

(11)

$$\text{Whole loss} = \$900 - \$540 = \$360.$$

$$8 : 1 :: \$360 : \frac{360}{8} = \$45 = \text{B's loss.}$$

$$8 : 2 :: \$360 : \frac{360 \times 2}{8} = \$90 = \text{C's loss.}$$

$$\$45 + 90 = \$135, \text{ and } \$360 - 135 = \$225 = \text{D's loss.}$$

(12)

$$\$12 : \$6 :: \$1320 : \frac{1320 \times 6}{12} = \$660 = \text{B's gain.}$$

$$\$12 : \$4 :: \$1320 : \frac{1320 \times 4}{12} = \$440 = \text{C's gain.}$$

$$\$12 : \$2 :: \$1320 : \frac{1320 \times 2}{6} = \$220 = \text{D's gain.}$$

(13)

$$£35 + £29 = £64, \text{ and } £110 - £64 = £46 = \text{D's profit.}$$

$$\text{D's profit} : \text{B's profit} :: \text{D's stock} : \text{B's stock.}$$

$$\text{That is, } £46 : £35 :: £1090 : \frac{1090 \times 35}{46} = £829 \text{ 6s. } 11\frac{1}{3}\text{d.} = \text{B's st.}$$

$$\text{Again, D's profit} : \text{C's profit} :: \text{D's stock} : \text{C's stock.}$$

$$\text{That is, } £46 : £29 :: £1090 : \frac{1090 \times 29}{46} = £687 \text{ 3s. } 5\frac{1}{3}\text{d.} = \text{C's st.}$$

## Page 271.

(2)

$$\left. \begin{array}{l} \$357 \times 5 = \$1785 \text{ for one month} \\ 371 \times 7 = 2597 \text{ for one month} \\ 154 \times 11 = 1694 \text{ for one month} \end{array} \right\} = \$6076 \text{ for one month.}$$

$$\$6076 : \$1785 :: \$347 \cdot 20 : \frac{347 \cdot 20 \times 1785}{6076} = \$102.$$

$$\$6076 : \$2597 :: \$347 \cdot 20 : \frac{347 \cdot 20 \times 2597}{6076} = \$148 \cdot 40.$$

$$\$6076 : \$1694 :: \$347 \cdot 20 : \frac{347 \cdot 20 \times 1694}{6076} = \$96 \cdot 80.$$

(3)

$$\left. \begin{array}{l} 40 \times 6 = 240 \text{ for one month} \\ 30 \times 5 = 150 \text{ for one month} \\ 50 \times 1 = 50 \text{ for one month} \end{array} \right\} = 440 \text{ for one month.}$$

$$440 : 240 :: \$160 : \frac{160 \times 240}{440} = \$87 \cdot 27 \frac{3}{11}; \text{ B's share.}$$

$$440 : 150 :: \$160 : \frac{160 \times 150}{440} = \$54 \cdot 54 \frac{6}{11}; \text{ C's share.}$$

$$440 : 50 :: \$160 : \frac{160 \times 50}{440} = \$18 \cdot 18 \frac{2}{11}; \text{ D's share.}$$

(4)

$$\left. \begin{array}{l} £150 \times 6 = £900 \text{ for one month} \\ 200 \times 3 = 600 \text{ for one month} \\ 125 \times 16 = 2000 \text{ for one month} \end{array} \right\} = £3500 \text{ for one month.}$$

$$£3500 : £900 :: £291 \text{ 13s. 4d.} : \frac{£291 \text{ 13s. 4d.} \times 900}{3500} = £75.$$

$$£3500 : £600 :: £291 \text{ 13s. 4d.} : \frac{£291 \text{ 13s. 4d.} \times 600}{3500} = £50.$$

$$£3500 : £2000 :: £291 \text{ 13s. 4d.} : \frac{£291 \text{ 13s. 4d.} \times 2000}{3500} = £166 \text{ 13s. 4d.}$$



(5)

$$\left. \begin{array}{l} \$4000 \times 12 = \$48000 \text{ for one month} \\ 3000 \times 15 = 45000 \text{ for one month} \\ 5000 \times 8 = 40000 \text{ for one month} \end{array} \right\} = \$133000 \text{ for one month.}$$

$$\$133000 : \$48000 :: \$665 : \frac{665 \times 48000}{133000} = \$240 ; \text{ B's share.}$$

$$\$133000 : \$45000 :: \$665 : \frac{665 \times 45000}{133000} = \$225 ; \text{ C's share.}$$

$$\$133000 : \$40000 :: \$665 : \frac{665 \times 40000}{133000} = \$200 ; \text{ D's share.}$$

(6)

$$\left. \begin{array}{l} 56 \times 12 = 672 \text{ for one day} \\ 64 \times 15 = 960 \text{ for one day} \\ 80 \times 18 = 1440 \text{ for one day} \end{array} \right\} = 3072 \text{ for one day.}$$

$$3072 : 672 :: \$320 : \frac{320 \times 672}{3072} = \$70 = \text{rent to be paid by 1st troop.}$$

$$3072 : 960 :: \$320 : \frac{320 \times 960}{3072} = \$100 = \text{ " " " 2nd "}$$

$$3072 : 1440 :: \$320 : \frac{320 \times 1440}{3072} = \$150 = \text{ " " " 3rd "}$$

(8)

$$\text{Sum of profits} = 240 + 800 + 400 = \$1440.$$

Whole profit : A's profit :: Whole stock for 1 m. : A's st. for 1 m.

$$\text{That is, } 1440 : 240 :: 34560 : \frac{34560 \times 240}{1440} = 5760 = \text{A's stock}$$

for one month. Hence, since A's stock was in for 6 months, it will be  $\$5760 \div 6 = \$960$ .

(Continued on next page.)



(8 Continued.)

Whole profit : B's profit :: Whole stock for 1 m. : B's st. for 1 m.

$$1440 : 800 :: 34560 : \frac{34560 \times 800}{1440} = 19200 = \text{B's stock for one}$$

month. And, since B's stock was in for 12 months,  $19200 \div 12 = \$1600$  will be his stock.

Whole profit : C's profit :: whole stock for 1 m. : C's st. for 1 m.

$$1440 : 400 :: 34560 : \frac{34560 \times 400}{1440} = \$9600 = \text{C's stock for one}$$

month and hence his stock will be  $\$9600 \div 15 = \$640$ .

(9)

A's profit was \$240 for 6 months = \$40 for 1 month.

B's profit was \$800 for 12 months = \$66 $\frac{2}{3}$  for 1 month.C's profit was \$400 for 15 months = \$26 $\frac{2}{3}$  for 1 month.

Sum of profits for 1 month = \$133 $\frac{1}{3}$

Whole profit for 1 m. : A's profit for 1 m. :: whole stock : A's st.

$$133\frac{1}{3} : 40 :: 3200 : \frac{3200 \times 40}{133\frac{1}{3}} = \$960 = \text{A's stock.}$$

$$133\frac{1}{3} : 66\frac{2}{3} :: 3200 : \frac{3200 \times 66\frac{2}{3}}{133\frac{1}{3}} = \$1600 = \text{B's stock.}$$

$$133\frac{1}{3} : 26\frac{2}{3} :: 3200 : \frac{3200 \times 26\frac{2}{3}}{133\frac{1}{3}} = \$640 = \text{C's stock.}$$

Page 275.

(4)

\$0.12 $\frac{1}{2}$  = selling price.

\$0.09 = buying price.

\$0.03 $\frac{1}{2}$  = gain per lb.\$0.03 $\frac{1}{2}$   $\times$  317 = \$11.095.

(5)

\$1.20 = selling price.

\$0.87 $\frac{1}{2}$  = buying price.\$0.32 $\frac{1}{2}$  = gain per bushel.\$0.32 $\frac{1}{2}$   $\times$  2138 = \$694.85.

(6)

$$\begin{aligned} \$0.15 \times 317 \times 13 &= \$618.15 = \text{cost of 13 barrels at } \$0.15 \text{ per lb.} \\ \$735 - 618.15 &= \$116.85 \text{ gain.} \end{aligned}$$

(7)

$$\begin{aligned} \$3.15 \times 22 \times 17 &= \$1178.10 = \text{price of 17 kegs at } \$3.15 \text{ per gal.} \\ \$0.37\frac{1}{2} \times 1178.1 &= \$441.7875 = \text{ad valorem duty.} \\ \$1178.10 + \$441.7875 + \$26.33 &= \$1646.2175 = \text{whole cost.} \\ \$1646.2175 - \$1625 &= \$21.2175 \text{ loss.} \end{aligned}$$

---

 Page 276.

(10)

Here for every \$1 I expend I wish to receive \$1.30, and hence the selling price will be  $\$3.25 \times 1.30 = \$4.22\frac{1}{2}$ .

(11)

Here for every \$1 I expend I wish to receive \$1.05, and hence the selling price will be  $\$1.05 \times 13420 = \$14091$ .

(12)

Here for every \$1 I expend I desire to receive \$1.15, and hence the selling price will be  $\$1.15 \times .11 = \$0.1265 = 12\frac{1}{10}$  cents.

(13)

Here for every \$1 I expend I wish to receive \$1.23, and hence the selling price will be  $\$1.23 \times 15.25 = \$18.75\frac{1}{2}$ .

(14)

Here for every \$1 I expend I am willing to receive \$0.89, and hence the selling price will be  $\$0.89 \times 7890 = \$7022.10$ .

Page 277.

(16)

Here the whole gain is  $\$0.87\frac{1}{2} - \$0.60 = \$0.27\frac{1}{2}$ .

That is,  $\$0.60$  gain  $\$0.27\frac{1}{2}$ , and therefore 1 cent gains  $\frac{27\frac{1}{2}}{60} =$

$$\frac{55}{120} = \frac{11}{24} \text{ of a cent.}$$

And hence, the gain per cent  $= \frac{11}{24} \times 100 = \frac{1100}{24} = 45\frac{5}{6}$  per cent.

(17)

Here the loss on each lb. is 2 cents.

That is, every 13 cents invested gives a loss of 2 cents.

Therefore every cent invested loses  $\frac{1}{13}$  of 2  $= \frac{2}{13}$  cents.

And hence, the loss per cent  $= \frac{2}{13} \times 100 = \frac{200}{13} = 15\frac{5}{13}$  per c.

(18)

Here the gain on each barrel is  $\$1.60$ .

That is, every  $\$6.20$  invested gives a gain of  $\$1.60$ .

Therefore every  $\$1$  invested gains  $\frac{160}{620}$  of 160  $= \frac{8}{31}$  of a \$.

And hence, the gain per cent  $= \frac{8}{31} \times 100 = \frac{800}{31} = 25.8 = 25\frac{1}{2}$  p.c.

(19)

Here the gain on each yard is 35 cents.

That is, every  $\$2.75$  invested gives a gain of 35 cents.

Therefore every  $\$1$  invested gains  $\frac{35}{275}$  of 35  $= \frac{7}{55} = \frac{1}{8}$  of a dollar.

And hence the gain per cent  $= \frac{7}{55} \times 100 = \frac{700}{55} = 12\frac{4}{11}$  p.c.

(20)

Here the gain on every bushel is 9 cents.

That is every 47 cents invested gives a gain of 9 cents.

Therefore every cent invested gains  $\frac{9}{47}$  of 9  $= \frac{81}{47}$  cents.

And hence the gain per cent  $= \frac{81}{47} \times 100 = \frac{8100}{47} = 172\frac{6}{47}$  p.c.

(21)

Here the loss on each lb. is  $1\frac{1}{2}$  cents.

That is every 12 cents invested gives a loss of  $1\frac{1}{2}$  cents.

Therefore every cent invested gives  $\frac{1}{12}$  of  $1\frac{1}{2} = \frac{1}{8}$  of a cent.

And hence, the gain per cent  $= \frac{1}{8} \times 100 = \frac{100}{8} = 12\frac{1}{2}$  p. c.

(22)

Here the whole gain is  $\$127 - \$93 = \$34$ .

That is,  $\$93$  gain  $\$34$ , and therefore  $\$1$  gains  $\frac{34}{93}$  of a dollar.

Hence, gain per cent  $= \frac{\$34}{\$93} \times 100 = \frac{3400}{93} = 36\frac{52}{93}$  per cent.

(23)

Here the loss is  $\$6742.50 - \$6000 = \$742.50$ .

That is,  $\$6742.50$  lose  $\$742.50$ , and therefore  $\$1$  loses  $\frac{742.50}{6742.50}$  of  $742.50 = \frac{299}{899}$  of a dollar.

Hence gain per cent  $= \frac{\$299}{\$899} \times 100 = \frac{29900}{899} = 11\frac{11}{899}$  per cent.

(24)

Here  $\$5700 + \$275 + \$1987.32 = \$7962.32 =$  whole sum expended.

Whole gain  $= \$8750 - \$7962.32 = \$787.68$ .

That is  $\$7962.32$  gain  $\$787.68$ , and therefore  $\$1$  gains  $\frac{787.68}{7962.32}$  of  $787.68 = \frac{2846}{99529}$  of a \$.

Hence gain per cent  $= \frac{\$2846}{\$99529} \times 100 = \frac{284600}{99529} = 9.89$  or nearly 10 per cent.

(25)

$\$4.25 \times 723 = \$3072.75 =$  price of 723 yds. @  $\$4.25$ .

$\$3072.75 \times .07 = \$215.0925 =$  amount for Insurance.

$\$3072.75 \times .22 = \$676.005 =$  amount for ad valorem duty.

Then whole cost  $= \$3072.75 + \$215.0925 + \$23.70 + \$2.70 + \$3.16 + \$676.005 = \$3993.4075$ .

Whole gain  $= \$5270 - \$3993.4075 = \$1276.5925$ .

That is,  $\$3993.4075$  gains  $\$1276.5925$   $\therefore$   $\$1$  gains  $\frac{1276.5925}{3993.4075}$  of a \$.

Hence gain per cent  $= \frac{\$1276.5925}{\$3993.4075} \times 100 = 31.96749$  or nearly 32 per cent.

Page 278.

(27)

Loss on \$1 is 4 cents, or for every \$1 paid I receive \$0.96.  
Hence cost =  $\$24.60 \div 0.96 = \$25.625$ .

(28)

Loss on \$1 is 10 cents, or for every \$1 paid he receives \$0.90.  
Hence cost =  $\$2360 \div .90 = \$2622.22$ .

(29)

Gain on \$1 is 11 cents, or for every \$1 paid he receives \$1.11.  
Hence cost =  $\$7400 \div 1.11 = \$6666.666$ .

(30)

Gain on \$1 is 17 cents, or for every \$1 paid he receives \$1.17.  
\$117 : \$100 :: \$3789.40 :  $\frac{3789.40 \times 100}{117} = \$3238.803$  Ans.

(31)

Loss on \$1 is 13 cents, or for every \$1 paid I receive \$0.87.  
\$87 : \$100 :: \$2740 :  $\frac{2740 \times 100}{87} = \$3149.425$  Ans.

Page 279.

(3)

\$2 gains 50 cents.

Hence \$0.50 : \$0.10 :: \$2.00 :  $\frac{2.00 \times 10}{50} = 40$  cents.

(4)

$$\$2.00 : \$2.80 :: \$2.50 : \frac{2.50 \times 2.80}{2.00} = \$3.50.$$

(5)

8 cents gain 5 cents in 9 months.

$$\text{Hence 9 mo's} : 6 \text{ mo's} :: 5 \text{ cents} : \frac{5 \times 6}{9} = 3\frac{1}{3} = \text{gain for 6 mo's.}$$

$$8 \text{ cts.} : 12 \text{ cts.} :: 3\frac{1}{3} : \frac{3\frac{1}{3} \times 12}{8} = 5 \text{ cts. gain on 12 cts. for 6 mo's.}$$

Therefore  $12 + 5 = 17 =$  his selling price.

(6)

$$\$1.60 : \$1.85 :: \$ .55 : \frac{1.85 \times .55}{1.60} = \$0.6359375 = \text{what L}$$

ought to get in order to sell at the same profit as K.

But L only gets 60 cents, therefore K has the advantage.

$$70 \text{ yds. of cloth at } \$1.85 = \$1.85 \times 70 = \$129.50.$$

$$\$129.50 \div \$ .60 = 215\frac{5}{8}.$$

(7)

$$5 \text{ tons of butter at } \$102 = \$102 \times 5 = \$510$$

$$10\frac{1}{2} \text{ tons of tallow at } \$135 = \$135 \times 10\frac{1}{2} = \$1417.50$$

$$\text{Total value} = \underline{\$1927.50}$$

$$\text{Deduct ready money, } \underline{\$600.30}$$

$$\underline{\$1327.20}$$

$$\$1327.20 \div \$4.20 = 316 \text{ barrels.}$$

## Page 281.

(3)

7 oz. × 22 = 154 carats.	
12½ " × 21 = 262½ "	
17 " × 9 = 153 "	
<hr/>	
36½	36½)569½ "
	2 2 "
	<hr/>
	73)1239(15½ carats.
	73
	<hr/>
	409
	365
	<hr/>
	44

(4)

2 gallons @ 14s. = 28s.
1 " @ 12s. = 12s.
2 " @ 9s. = 18s.
4 " @ 8s. = 32s.
<hr/>
9
<hr/>
9)90s.
<hr/>
10s.

(5)

15 bushels @ \$1.20 = \$18.00	
30 " @ \$1.50 = \$45.00	
60 " @ \$1.10 = \$66.00	
83 " @ \$1.75 = \$145.25	
<hr/>	
188	188)\$274.25(\$1.458
	<hr/>
	188
	<hr/>
	86.2
	75.2
	<hr/>
	11.05
	9.40
	<hr/>
	1.650
	1.504
	<hr/>
	.146

(6)

$$\begin{array}{r}
 12 \text{ lbs. @ } 50 \text{ cents} = 600 \text{ cents.} \\
 16 \text{ " @ } 72 \text{ " } = 1152 \text{ " } \\
 22 \text{ " @ } 65 \text{ " } = 1430 \text{ " } \\
 18 \text{ " @ } 85 \text{ " } = 1530 \text{ " } \\
 100 \text{ " @ } 42 \text{ " } = 4200 \text{ " } \\
 \hline
 168 \qquad \qquad \qquad 168)8912 \text{ cents (} 53\frac{1}{2} \text{ cents.} \\
 \qquad \qquad \qquad \qquad \qquad \qquad 840 \\
 \hline
 \qquad \qquad \qquad \qquad \qquad \qquad 512 \\
 \qquad \qquad \qquad \qquad \qquad \qquad 504 \\
 \hline
 \qquad \qquad \qquad \qquad \qquad \qquad 8 \\
 \qquad \qquad \qquad \qquad \qquad \qquad \hline
 \qquad \qquad \qquad \qquad \qquad \qquad 168 \} = 2\frac{1}{2}.
 \end{array}$$

Page 283.

(11)

$$\begin{array}{c}
 \text{Prices. Differences. Prices.} \\
 125 = \left\{ \begin{array}{l} 160 - 35 \overbrace{\quad\quad\quad}^{15} + 110 \\ 140 - 15 \quad\quad\quad 25 + 100 \end{array} \right\} = 125
 \end{array}$$

$$\begin{array}{c}
 \text{Prices. Differences. Prices.} \\
 125 = \left\{ \begin{array}{l} 160 - 35 \overbrace{\quad\quad\quad}^{15} + 110 \\ 140 - 15 \quad\quad\quad 25 + 100 \end{array} \right\} = 125.
 \end{array}$$

*Ans.* 35 bush. @ \$1.10, 15 @ \$1.60, 15 @ \$1, and 25 @ \$1.40.

35 bush. @ \$1.00, 15 @ \$1.40, 15 @ \$1.10, and 25 @ \$1.60.



(12)

Prices.	Differences.	Prices.	
45 =	$\left. \begin{array}{l} 60 - 15 \\ 50 - 5 \end{array} \right\}$	$\left. \begin{array}{l} 3 + 42 \\ 7 + 38 \\ 15 + 30 \end{array} \right\}$	= 45

Prices.	Differences.	Prices.	
45 =	<del> <math>\left. \begin{array}{l} 60 - 15 \\ 50 - 5 \end{array} \right\}</math> </del>	<del> <math>\left. \begin{array}{l} 3 + 42 \\ 7 + 38 \\ 15 + 30 \end{array} \right\}</math> </del>	= 45.

*Ans.* 15 quarts @ 42 cents, 3 @ 60 cents, 5 @ 38 cents, 5 @ 30 cents, and 7 + 15 + 22 @ 50 cents.!

15 quarts @ 38 cents, 3 @ 50 cents, 5 @ 42 cents, 15 @ 38 cents, and 7 + 15 = 22 @ 60 cents.

(13)

Prices.	Differences.	Prices.	
12½ =	$\left. \begin{array}{l} 18 + 5\frac{1}{2} \\ 17 + 4\frac{1}{2} \\ 16 + 3\frac{1}{2} \\ 15 + 2\frac{1}{2} \\ 14 + 1\frac{1}{2} \end{array} \right\}$	$\left. \begin{array}{l} \frac{1}{2} + 12 \\ 2\frac{1}{2} + 10 \end{array} \right\}$	= 12½.

*Ans.* ½ lb. @ 18 cents, ½ @ 17 cents, ½ @ 16 cents, 2½ @ 15 cents, 2½ @ 14 cents, 5½ + 4½ + 3½ = 13½ @ 12 cents, and 2½ + 1½ = 4 @ 10 cents.

(14)

Prices.	Differences.	Prices.	
10 =	$\left. \begin{array}{l} 13 - 3 \\ 12 - 2 \end{array} \right\}$	$\left. \begin{array}{l} 3 + 7 \\ 5 + 5 \end{array} \right\}$	= 10

*Ans.* 3 lbs. @ 7d., 3 @ 13d., 2 @ 5d., and 5 @ 12d.

Page 284.

(17)

By case I we find that 17 quarts @ 31 cents, 6 @ 16 cents, 6 @ 19 cents, and 6 @ 23 cents will make a mixture worth 25 cents per quart.

Therefore 17 qts. : 87 qts. :: 6 qts. :  $\frac{6 \times 87}{17} = 30\frac{1}{2}$  quarts @

16 cents, and as there are 6 lbs. at each of the other prices, the same statement may be used, and the answer is therefore  $30\frac{1}{2}$  quarts @ each price.

(18)

To produce a mixture worth 75 cents per bushel, we require 45 bushels @ 80 cents, 5 @ 37 cents, and 5 @ 68 cents.

Therefore 45 bush. : 70 bush. :: 5 bush. :  $\frac{5 \times 70}{45} = 7\frac{2}{3}$  bush.

oats @ 37 cents.

45 bush. : 70 bush. :: 5 bush. :  $\frac{5 \times 70}{45} = 7\frac{2}{3}$  bush.

barley @ 68 cents.

(19)

To produce a mixture worth 1s. per lb., we require  $1\frac{1}{2}$  lbs. @ 16d.,  $1\frac{1}{2}$  @ 14d., and 6 @  $10\frac{1}{2}$ d.

Then  $1\frac{1}{2}$  lbs. : 50 lbs. ::  $1\frac{1}{2}$  lbs. : 50 lbs. brass @ 14d.

$1\frac{1}{2}$  lbs. : 50 lbs. :: 6 lbs. : 200 lbs. pewter @  $10\frac{1}{2}$ d.

(20)

By case I we find that 1 oz. of 20 carats fine, 1 of 21 carats fine and 3 of 23 carats fine, will make a mixture 22 carats fine.

Then 1 oz. : 30 oz. :: 1 oz. : 30 oz. of 21 carats fine.

1 oz. : 30 oz. :: 3 oz. : 90 oz. of 23 carats fine.

Page 285.

(22)

To produce a mixture worth \$1.40 per lb., we require 20 lbs. @ \$1.00, 40 @ \$1.20, 40 @ \$1.60, and 20 @ \$1.80. But all of these added together, will make 120 lbs.

$$\begin{array}{cccc} \text{lbs.} & \text{lbs.} & \text{lbs.} & \text{lbs.} \\ \text{Therefore } 120 : 20 :: 168 : \frac{168 \times 20}{126} = 28 \text{ lbs., the required} \\ & & & \text{quantity @ } \$1.00. \end{array}$$

$$120 : 40 :: 168 : \frac{168 \times 40}{126} = 56 \text{ lbs., the required quantity @ } \$1.20.$$

$$120 : 40 :: 168 : \frac{168 \times 40}{120} = 56 \text{ lbs., the required quantity @ } \$1.60.$$

$$120 : 20 :: 168 : \frac{168 \times 20}{120} = 28 \text{ lbs., the required quantity @ } \$1.80.$$

(23)

To produce a mixture worth 4s. 4d. per lb., we require 10 lbs. @ 5s. and 8 @ 3s. 6d. But these added together make 18 lbs.

$$\begin{array}{cccc} \text{lbs.} & \text{lbs.} & \text{lbs.} & \text{lbs.} \\ \text{Therefore } 18 : 10 :: 27 : \frac{27 \times 10}{18} = 15 \text{ lbs., the required quan-} \\ & & & \text{tity of tea @ } 5s. \end{array}$$

$$18 : 8 :: 27 : \frac{27 \times 8}{18} = 12 \text{ lbs., the required quantity of tea @ } 3s. 6d.$$

(24)

To produce a mixture worth \$2.70 per gallon, we require 20 gallons @ \$2.40, 10 @ \$2.60, 10 @ \$2.80, and 30 @ \$2.90. But all of these added together will make 70 gallons. Therefore

$$70 : 20 :: 63 : \frac{63 \times 20}{70} = 18 \text{ gallons, the required quantity of brandy @ } \$2.40.$$

$$70 : 10 :: 63 : \frac{63 \times 10}{70} = 9 \text{ gallons, the required quantity of brandy @ } \$2.60.$$

$$70 : 10 :: 63 : \frac{63 \times 10}{70} = 9 \text{ gallons, the required quantity of brandy @ } \$2.80.$$

$$70 : 30 :: 63 : \frac{63 \times 30}{70} = 27 \text{ gallons, the required quantity of brandy @ } \$2.90.$$

---

Page 289.

(4)

$$1974.80 \times \frac{1}{3} = £740.55 = £740 \text{ 11s.}$$

(5)

$$765.43 \times \frac{2}{3} = £306.172 = £306 \text{ 3s. } 5\frac{7}{8}\text{d.}$$

(6)

$$8172.19 \times \frac{1}{4} = £2043.0475 = £2043 \text{ 0s. } 11\frac{3}{4}\text{d.}$$

(9)

$$£743 \text{ 18s. 11d.} = £743.94583 \text{ and } 743.94583 \div \frac{3}{10} = \$2479.8194.$$

(10)

$$£119 \text{ 9s. } 8\frac{1}{4}\text{d.} = £119.484375 \text{ and } 119.484375 \div \frac{1}{3} = \$318.625.$$

(11)

$$£473 \text{ 17s. } 1\frac{1}{4}\text{d.} = £473.8572916, \text{ and } 473.8572916 \div \frac{1}{30} = \\ \$2030.816964.$$

---

 Page 290.

(13)

$$1006.90 \div 4.867 = £206.88309 = £206 \text{ 17s. } 7\frac{1}{4}\text{d.}$$

(14)

$$916.87 \div 4.867 = £188.38504 = £188 \text{ 7s. } 8\frac{1}{4}\text{d.}$$

(15)

$$2114.81 \div 4.867 = £434.52023 = £334 \text{ 10s. } 4\frac{1}{4}\text{d.}$$

(17)

$$£2043 \text{ 11s. } 3\text{d.} = £2043.5625 \text{ and } 2043.5625 \times 4.867 = \\ \$9946.01868.$$

(18)

$$£777 \text{ 7s. } 7\text{d.} = £777.37916 \text{ and } 777.37916 \times 4.867 = \\ \$3783.50437.$$

(19)

$$£557 \text{ 19s. } 5\frac{1}{4}\text{d.} = £557.972916 \text{ and } 557.972916 \times 4.867 = \\ \$2715.65418.$$

Page 294.

(4)

$$\$16785.25 \times 5.04 = 84597 \text{ francs } 66 \text{ centimes.}$$

(5)

Commercial value of the marc banco =	35	cents.
Add 1 per cent	.35	"
	<hr style="width: 50%; margin: 0 auto;"/>	
	35.35	

$$\text{Then } 35.35 \text{ cents} \times 4000 = \$1414.$$

(6)

$$\$35678 \times 1.0225 = \$36480.755.$$

(7)

The par value of 1 ruble =	75	cents.
Deduct 2 per cent	1.5	"
	<hr style="width: 50%; margin: 0 auto;"/>	
	73.5	

$$\text{Then } 73.5 \text{ cents} \times 2560 = \$1881.60.$$

(8)

Old commercial par of £1 sterling =	\$4.444	= \$4.44444
Add 8 per cent	.35555	
	<hr style="width: 50%; margin: 0 auto;"/>	
	\$4.79999	

$$\text{Then } \$4.79999 \times 800 = \$3839.999 = \$3840.00.$$

Page 295.

(3)

£1 = 420d.

19½d. = 1 franc.

300 francs = 60 ducats.

1 ducat = 360 maravedis.

$x = £1000.$

$$x = \frac{84 \times 300 \times 1 \times 360 \times 1000}{19\frac{1}{2} \times 300} = 1564138 \text{ maravedis by cir. ex.}$$

$$42\frac{1}{2}d. : £1000 :: 272 \text{ maravedis} : \frac{272 \times 1000 \times 20 \times 12}{42\frac{1}{2}} =$$

$$\frac{16 \times 272 \times 1000 \times 8 \times 12}{17} = 1536000 \text{ maravedis by direct exchange.}$$

Difference = 1564138 — 1536000 = 28138 maravedis.

34)28138

8)827 reals 20 maravedis.

103 piastres 3 reals 20 maravedis.

(4)

Old commercial par of £1 sterling = \$4.444

To which add 10 per cent. of itself = .4444

Gives price of £1 sterling = \$4.8884

\$4888.40 ÷ \$4.8884 = £1000 = amount of bill he receives if he remits direct to London.

$$\left. \begin{array}{l} \$1 = 515 \text{ centimes.} \\ 2580 \text{ cen.} = £1 \text{ sterling.} \\ x = \$4888.40 \end{array} \right\} x = \frac{515 \times 4888.40}{2580} = £975.78526.$$

= £975 15s. 8½d.+ = amount of bill he receives if he remits through Paris.

35 cents = 1 marc.

13½ marcs = £1 sterling.

$x = \$4888.40.$

$$x = \frac{4888.40 \times 391072}{.35 \times 13\frac{1}{2} \times 385} = £1015.77142 = £1015 15s. 5d.+ =$$

amount of bill he receives by remitting through Hamburg.

(5)

$$\begin{array}{l}
 18 \text{ cents.} \quad = 1 \text{ franc.} \\
 25 \text{ francs.} \quad = 240 \text{d.} \\
 180 \text{d.} \quad = 3 \text{ milrees.} \\
 5 \text{ milrees.} \quad = 18 \text{ marcs ban.} \\
 1200 \text{ marcs ban.} = x
 \end{array}
 \left. \vphantom{\begin{array}{l} 18 \text{ cents.} \\ 25 \text{ francs.} \\ 180 \text{d.} \\ 5 \text{ milrees.} \\ 1200 \text{ marcs ban.} \end{array}} \right\} x = \frac{18 \times 25 \times 180 \times 1200 \times 5}{240 \times 3 \times 18}$$

= \$375 = circuitous exchange or sum he pays for 1200 marks.

1200 × .35 = \$420 = direct exchange or sum paid for 1200 marks. \$420 — \$375 = \$45 = gain by circuitous exchange.

Page 298.

(3)

$$(3)^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243.$$

(4)

$$(20)^{10} = 20 \times 20 \times 20 \times 20 \times 20 \times 20 \times 20 \times 20 \times 20 \times 20 = 10240000000000.$$

(5)

$$(1.05)^6 = 1.05 \times 1.05 \times 1.05 \times 1.05 \times 1.05 \times 1.05 = 1.340095640625.$$

(6)

$$\left(\frac{3}{8}\right)^7 = \frac{3}{8} \times \frac{3}{8} \times \frac{3}{8} \times \frac{3}{8} \times \frac{3}{8} \times \frac{3}{8} \times \frac{3}{8} = \frac{2187}{78128}.$$

(7)

$$\left(\frac{5}{9}\right)^5 = \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} = \frac{3125}{59049}.$$

(8)

$$11\frac{3}{8} = 57. \quad \left(\frac{57}{8}\right)^3 = \frac{57}{8} \times \frac{57}{8} \times \frac{57}{8} = \frac{185193}{512} = 1481\frac{68}{512}.$$



Page 299.

(9)

$$4^2 \times 4^4 \times 4^5 \times 4^7 = 4^{2+4+5+7} = 4^{18}.$$

(10)

$$13^{11} \div 13^2 = 13^{11-2} = 13^9.$$

(11)

$$(3^3)^5 = 3^{3 \times 5} = 3^{15}.$$

(12)

$$\begin{aligned} \{(7^4 \times 7^3) \div (7^2 \times 7^2)\}^6 &= \{(7^4 + 3) \div (7^2 + 2)\}^6 = \\ \{7^7 \div 7^4\}^6 &= (7^7 - 4)^6 = (7^3)^6 = 7^{3 \times 6} = 7^{18}. \end{aligned}$$

(13)

$$\begin{aligned} \{(5^3 \times 5^4 \times 5^{11} \times 5^9) \div (5^3 \times 5^2 \times 5^7 \times 5^5)\}^3 &= \\ \{(5^3 + 4 + 11 + 9) \div (5^3 + 2 + 7 + 5)\}^3 &= \{5^{27} \div 5^{17}\}^3 = \\ (5^{27-17})^3 &= (5^{10})^3 = 5^{10 \times 3} = 5^{30}. \end{aligned}$$

Page 304.

(4)

$$\begin{array}{r} \overset{\cdot}{1} \overset{\cdot}{9} \overset{\cdot}{5} \overset{\cdot}{3} \overset{\cdot}{6} \overset{\cdot}{4} (442 \\ 16 \\ \hline 84) 353 \\ 336 \\ \hline 882) 1764 \\ 1764 \end{array}$$

(5)

$$\begin{array}{r} \overset{\cdot}{0} \overset{\cdot}{6} \overset{\cdot}{7} \overset{\cdot}{6} (\cdot 26 \\ 4 \\ \hline 46) 276 \\ 276 \end{array}$$

(6)

$$\begin{array}{r} \overset{\cdot}{9} \overset{\cdot}{8} \overset{\cdot}{4} \overset{\cdot}{0} \overset{\cdot}{6} \overset{\cdot}{4} (992 \\ 81 \\ \hline 189) 1740 \\ 1701 \\ \hline 1982) 3964 \\ 3964 \end{array}$$

(7)

$$\begin{array}{r}
 5 \cdot 0000000000 \cdot (2 \cdot 23606 \\
 4 \\
 \hline
 42) 1 \cdot 00 \\
 \cdot 84 \\
 \hline
 443) \cdot 1600 \\
 \cdot 1329 \\
 \hline
 4466) 27100 \\
 26796 \\
 \hline
 447206) 3040000 \\
 2683236 \\
 \hline
 356764
 \end{array}$$

(9)

$$\begin{array}{r}
 60 \cdot 487129 (7 \cdot 777 \\
 49 \\
 \hline
 147) 1148 \\
 1029 \\
 \hline
 1547) 11971 \\
 10829 \\
 \hline
 15547) 114229 \\
 108829 \\
 \hline
 5400
 \end{array}$$

(11)

$$\begin{array}{r}
 \cdot 0000012321 (\cdot 00111 \\
 1 \\
 \hline
 21) 23 \\
 21 \\
 \hline
 221) 221 \\
 221
 \end{array}$$

(8)

$$\begin{array}{r}
 500000000000 (\cdot 707106 \\
 49 \\
 \hline
 1407) 10000 \\
 9849 \\
 \hline
 14141) 15100 \\
 14141 \\
 \hline
 1414206) 9590000 \\
 8485236 \\
 \hline
 1104764
 \end{array}$$

(10)

$$\begin{array}{r}
 79792266297612001 (282475249 \\
 4 \\
 \hline
 48) 397 \\
 384 \\
 \hline
 562) 1392 \\
 1124 \\
 \hline
 5644) 26826 \\
 22576 \\
 \hline
 56487) 425062 \\
 395409 \\
 \hline
 564945) 2965397 \\
 2824725 \\
 \hline
 5649502) 14067261 \\
 11299004 \\
 \hline
 56495044) 276825720 \\
 225980176 \\
 \hline
 564950489) 5084554401 \\
 5084554401
 \end{array}$$

(14)

$$\dot{i} = \frac{1}{9} \text{ and } \sqrt{\frac{1}{9}} = \frac{1}{3}.$$

(16)

$$5\frac{1}{7} = 5.142857142857 \text{ and } \sqrt{5.142857142857} = 2.267786.$$

(17)

$$\frac{217}{333} = .4033457230 \text{ and } \sqrt{.4033457230} = .63509.$$

(18)

$$13\frac{1}{2} = 13.2 \text{ and } \sqrt{13.2} = 3.633.$$

---

 Page 305.

(20)

$$\begin{array}{r} \dot{i}\dot{i}1333311(2626 \\ \underline{4} \\ 46)433 \\ \underline{411} \\ 552)2233 \\ \underline{1434} \\ 5546)46611 \\ \underline{46611} \end{array}$$

(21)

$$\begin{array}{r} \dot{i}\dot{i}\dot{i}\dot{i}33233344(4344 \\ \underline{24} \\ 123)523 \\ \underline{413} \\ 1304)11033 \\ \underline{10024} \\ 13124)100544 \\ \underline{100544} \end{array}$$

(22)

$$\begin{array}{r}
 \begin{array}{c} \cdot \cdot \\ 4234 \cdot 101230 \end{array} (43 \cdot 412 \\
 \begin{array}{c} \cdot \cdot \cdot \cdot \\ 31 \\ \hline 133 \end{array} ) 1134 \\
 \begin{array}{c} 1004 \\ \hline 1414 \end{array} ) 130 \cdot 10 \\
 \begin{array}{c} 122 \cdot 21 \\ \hline 14231 \end{array} ) 2 \cdot 3412 \\
 \begin{array}{c} 1 \cdot 4231 \\ \hline 142322 \end{array} ) \cdot 413130 \\
 \begin{array}{c} \cdot 340144 \\ \hline 22431 \end{array}
 \end{array}$$

(23)

$$\begin{array}{r}
 \begin{array}{c} \cdot \cdot \cdot \cdot \\ 888888 \cdot 8880 \end{array} (888 \cdot 88 \\
 \begin{array}{c} \cdot \cdot \cdot \cdot \\ 71 \\ \hline 178 \end{array} ) 1788 \\
 \begin{array}{c} 1601 \\ \hline 1878 \end{array} ) 18788 \\
 \begin{array}{c} 16801 \\ \hline 18878 \end{array} ) 1887 \cdot 88 \\
 \begin{array}{c} 1688 \cdot 01 \\ \hline 188878 \end{array} ) 188 \cdot 8780 \\
 \begin{array}{c} 168 \cdot 8801 \\ \hline 18 \cdot 8878 \end{array}
 \end{array}$$

(24)

$$\begin{array}{r}
 \begin{array}{c} \cdot \cdot \cdot \cdot \\ 248664e \end{array} t69(54373 \\
 \begin{array}{c} 21 \\ \hline t4 \end{array} ) 386 \\
 \begin{array}{c} 354 \\ \hline t83 \end{array} ) 3264 \\
 \begin{array}{c} 2809 \\ \hline t867 \end{array} ) 657e t \\
 \begin{array}{c} 62e t 1 \\ \hline t8723 \end{array} ) 281969 \\
 \begin{array}{c} 281969 \\ \hline \end{array}
 \end{array}$$

Page 307.

(27)

$$100^2 = 10000$$

$$60^2 = 3600$$

$$\text{Difference} = 6400 \text{ and } \sqrt{6400} = 80.$$

(28)

$$50^2 = 2500$$

$$80^2 = 6400$$

$$\text{Sum} = \overline{8900} \text{ and } \sqrt{8900} = 94.34 \text{ nearly.}$$

(29)

$$24^2 = 576 \div 2 = 288 \text{ and } \sqrt{288} = 16.97.$$

(30)

$$36^2 = 1296$$

$$20^2 = 400$$

$$\text{Difference} = \overline{896} \text{ and } \sqrt{896} = 29.933.$$

(31)

$$40^2 = 1600$$

$$14^2 = 196$$

$$\text{Difference} = \overline{1404} \text{ and } \sqrt{1404} = 37.469.$$

$$40^2 = 1600$$

$$26^2 = 676$$

$$\text{Difference} = \overline{924} \text{ and } \sqrt{924} = 30.397.$$

$$37.469 + 30.397 = 67.866 \text{ and } 67.866 \div 3 = 22.622.$$

(32)

$$1760 \text{ sq. yds.} = 15840 \text{ sq. ft. and } \sqrt{15840} = 125.857.$$

(33)

$$\sqrt{141376} = 376.$$

(34)

$$3^2 = 9$$

$$3^2 = 9$$

$$\text{Sum} = \overline{18} \text{ and } \sqrt{18} = 4.24264.$$

(35)

$16^2 = 256$

$12^2 = 144$

$$\text{Sum} = 400 \text{ and } \sqrt{400} = 20.$$

(36)

$3^2 + 3^2 + 3^2 = 27 \text{ and } \sqrt{27} = 5.196.$

(37)

$(\frac{1}{100})^2 = \frac{1}{10000} \text{ and } (1)^2 = 1.$

$$\text{Then } \frac{1}{100} : 1 :: 450 : \frac{450}{\frac{1}{100}} = 45000.$$

(38)

$$1 \text{ sq. acre} = 160 \text{ sq. perches. } 160 \div 3.1416 = 50.929462 \text{ and } \sqrt{50.929462} = 7.136.$$

Page 311.

(2)

$$62712728317(3973$$

 $27$ 

$3^2 \times 300 = 2700$

$3 \times 9 \times 30 = 810$

$9^2 = 81$

 $3591$  $32319$ 

$39^2 \times 300 = 456300$

$39 \times 7 \times 30 = 8190$

$7^2 = 49$

 $464539$  $3251773$ 

$397^2 \times 300 = 47282700$

$397 \times 3 \times 30 = 35730$

$3^2 = 9$

 $47318439$  $141955317$

(3)

	$\begin{array}{r} 1953125(125 \\ 1 \\ \hline 953 \\ \hline 728 \\ \hline 225125 \\ \hline 225125 \end{array}$
$\begin{array}{r} 1^2 \times 300 = 300 \\ 1 \times 2 \times 30 = 60 \\ 2^2 = 4 \\ \hline 364 \\ \hline 12^2 \times 300 = 43200 \\ 12 \times 5 \times 30 = 1800 \\ 5^2 = 25 \\ \hline 45025 \end{array}$	

(4)

	$\begin{array}{r} 1076890625(1025 \\ 1 \\ \hline 76 \\ \hline 76890 \\ \hline 61208 \\ \hline 15682625 \\ \hline 15682625 \end{array}$
$\begin{array}{r} 1^2 \times 300 = 300 \\ 10^2 \times 300 = 30000 \\ 10 \times 2 \times 30 = 600 \\ 2^2 = 4 \\ \hline 30604 \\ \hline 102^2 \times 300 = 3121200 \\ 102 \times 5 \times 30 = 15300 \\ 5^2 = 25 \\ \hline 3136525 \end{array}$	

(5)

		$\cdot 697864103(\cdot 887$
		512
		<hr/>
$8^2 \times 300 =$	19200	185864
$8 \times 8 \times 30 =$	1920	
$8^2 =$	64	
	<hr/>	
	21184	169472
	<hr/>	
$88^2 \times 300 =$	2323200	16392103
$88 \times 7 \times 30 =$	18480	
$7^2 =$	49	
	<hr/>	
	2341729	16392103

(6)

		$102503 \cdot 232(46 \cdot 8$
		64
		<hr/>
$4^2 \times 300 =$	4800	38503
$4 \times 6 \times 30 =$	720	
$6^2 =$	36	
	<hr/>	
	5556	33336
	<hr/>	
$46^2 \times 300 =$	634800	5167 \cdot 232
$46 \times 8 \times 30 =$	11040	
$8^2 =$	64	
	<hr/>	
	645904	5167 \cdot 232



(7)

		179597·069288(56·42.
		<u>125</u>
$5^2 \times 300 =$	7500	54597
$5 \times 6 \times 30 =$	900	
$6^2 =$	<u>36</u>	
	8436	<u>50616</u>
$56^2 \times 300 =$	940800	3981·069
$56 \times 4 \times 30 =$	6720	
$4^2 =$	<u>16</u>	
	947536	<u>3790·144</u>
$564^2 \times 300 =$	95428800	190·925288
$564 \times 2 \times 30 =$	33840	
$2^2 =$	<u>4</u>	
	95462644	190·925288

(8)

		483·736625(7·85.
		<u>343</u>
$7^2 \times 300 =$	14700	140·736
$7 \times 8 \times 30 =$	1680	
$8^2 =$	<u>64</u>	
	16444	<u>131·552</u>
$78^2 \times 300 =$	1825200	9·184625
$78 \times 5 \times 30 =$	11700	
$5^2 =$	<u>25</u>	
	1836925	9·184625

(9)

$$\begin{array}{r}
 \cdot 636056(\cdot 86. \\
 \underline{512} \\
 124056 \\
 8^2 \times 300 = 19200 \\
 8 \times 6 \times 30 = 1440 \\
 \quad 6^2 = 36 \\
 \underline{\quad\quad} \\
 20676 \\
 124056
 \end{array}$$

Page 312.

(12)

$$\sqrt[2]{19} = \cdot 105263157894+ \text{ and } \sqrt[3]{\cdot 105263157894} = \cdot 4721.$$

(13)

$$\sqrt[3]{17} = \cdot 176470588235+ \text{ and } \sqrt[4]{\cdot 176470588235} = \cdot 5609.$$

(14)

$$\frac{1}{8} \text{ of } 2\frac{1}{2} = \frac{5}{8} = \cdot 833333333+ \text{ and } \sqrt[3]{\cdot 833333333} = \cdot 941.$$

(15)

$$28\frac{1}{4} = 28\cdot 75 \text{ and } \sqrt[3]{28\cdot 75} = 3\cdot 063.$$

(16)

$$32\frac{1}{11} = 32\cdot \dot{7}2 \text{ and } \sqrt[3]{32\cdot \dot{7}2} = 3\cdot 198.$$

Page 313.

(18)

One million = 33233344 senary.

	33233344(244.
	12
	<hr style="width: 10%; margin: 0 auto;"/>
$2^2 = 4 \times 300 =$	2000
$2 \times 30 = 100 \times 4 =$	400
$4^2 =$	24
	<hr style="width: 10%; margin: 0 auto;"/>
	2424
	<hr style="width: 10%; margin: 0 auto;"/>
	14544
	<hr style="width: 10%; margin: 0 auto;"/>
$24^2 = 1104 \times 300 =$	332000
$24 \times 30 = 1200 \times 4 =$	5200
$4^2 =$	24
	<hr style="width: 10%; margin: 0 auto;"/>
	341224
	<hr style="width: 10%; margin: 0 auto;"/>
	2245344

(19)

	6131271·000000(165·32.
	1
	<hr style="width: 10%; margin: 0 auto;"/>
$1^2 \times 300 =$	300
$1 \times 30 \times 6 =$	220
$6^2 =$	44
	<hr style="width: 10%; margin: 0 auto;"/>
	564
	<hr style="width: 10%; margin: 0 auto;"/>
	4270
	<hr style="width: 10%; margin: 0 auto;"/>
$16^2 = 304 \times 300 =$	111400
$16 \times 30 = 520 \times 5 =$	3220
$5^2 =$	31
	<hr style="width: 10%; margin: 0 auto;"/>
	114651
	<hr style="width: 10%; margin: 0 auto;"/>
	600115
	<hr style="width: 10%; margin: 0 auto;"/>
$165^2 = 32571 \times 300 =$	12015300
$165 \times 30 = 5370 \times 3 =$	20350
$3^2 =$	11
	<hr style="width: 10%; margin: 0 auto;"/>
	12035661
	<hr style="width: 10%; margin: 0 auto;"/>
	36131·423
	<hr style="width: 10%; margin: 0 auto;"/>
$1653^2 = 3272071 \times 300 =$	1205625300
$1653 \times 30 = 54010 \times 2 =$	130020
$2^2 =$	4
	<hr style="width: 10%; margin: 0 auto;"/>
	1205755324
	<hr style="width: 10%; margin: 0 auto;"/>
	2413·732650
	<hr style="width: 10%; margin: 0 auto;"/>
	406·422130

(20)

		10221012 · 102000000
		1   112·012 = root.
		—
1 × 1000 =	1000	2221
1 × 1 × 100 =	100	
1 <sup>2</sup> =	1	
	—	
	1101	1101
	—	
11 <sup>2</sup> = 121 × 1000 =	121000	1120012
11 × 100 = 1100 × 2 =	2200	
2 <sup>2</sup> =	11	
	—	
	200211	1101122
	—	
112 <sup>2</sup> = 21021 × 1000 =	21021000	11120 · 102
1120 <sup>2</sup> = 2102100 × 1000 =	2102100000	11120 · 102000
1120 × 100 = 112000 × 1 =	112000	
1 <sup>2</sup> =	1	
	—	
	2102212001	2102 · 212001
	—	
11201 <sup>2</sup> = 211010101 × 1000 =	211010101000	2010 · 112222000
11201 × 100 = 1120100 × 2 =	10010200	
2 <sup>2</sup> =	11	
	—	
	211020111211	1122 · 111000122
		—
		111 · 001221101

(21)

		$\dot{t}\dot{e}\dot{t}\dot{e}\dot{e}\dot{t}\cdot 000000(e7\cdot t2)$
		$92e$
$e^2 = t1 \times 300 =$	26300	$18eeet$
$e \times 30 = 290 \times 7 =$	1730	
$7^2 =$	41	
	2771	167217
$e7^2 = e221 \times 300 =$	2966300	249t3·000
$e7 \times 30 = 2t90 \times t =$	24e60	
$t^2 =$	84	
	298e324	24154·7e4
$e7t^2 = e39544 \times 300 =$	29e441000	84t·408000
$e7t \times 30 = te60 \times 2 =$	19e20	
$2^2 =$	4	
	29e45te24	57t·8e9t48
		28e·70t174

(22)

		$\dot{4}\dot{2}\dot{1}030\cdot 441200000(44\cdot 004)$
		$224$
$4^3 = 31 \times 300 =$	14300	$142030$
$4 \times 30 = 220 \times 4 =$	1430	
$4^2 =$	31	
	21311	141244
$44^2 = 4301 \times 300 =$	2340300	231·441
$440^2 = 430100 \times 300 =$	234030000	231·441000
$4400^2 = 43010000 \times 300 =$	23403000000	231·441000000
$4400 \times 30 = 242000 \times 4 =$	2123000	
$4^2 =$	31	
	23410123031	210·141102224
		21·244342221

Page 314.

(25)

$$3^3 : 6^3 :: 4 \text{ lbs.} : \text{Ans.} = 32 \text{ lbs.}$$

(26)

$$1^3 : \left(\frac{7}{2}\right)^3 :: \$120 : \text{Ans.} = \$5145.$$

(27)

$$\begin{aligned} (70)^3 &: \left(\frac{623}{6}\right)^3 :: 180 \text{ lbs.} : \text{Ans.} \\ 343000 &: \frac{241804367}{125} :: 180 : \text{Ans.} = \\ 180 \times \frac{241804367}{125} \times \frac{1}{343000} &= 1015.1 \text{ lbs.} \end{aligned}$$

(28)

$$973^3 = 921167317$$

$$45^3 = 91125$$

$$62^3 = 238328$$

$$30^3 = 27000$$

$$80^3 = 512000$$

$$20^3 = 8000$$

$$9221167317 - (91125 + 238328 + 27000 + 512000 + 8000) = 920290864 \text{ and } \sqrt[3]{920290864} = 972.69.$$

(29)

8 feet 3 inches = 99 inches, 3 feet = 36 inches, and 2 feet 7 inches = 31 inches.

$$99 \times 36 \times 31 = 110484 \text{ and } \sqrt[3]{110484} = 47.9843.$$

(30)

After the first has wound off her portion, there will remain  $\frac{3}{4}$  of the thread.

Then the whole ball : part remaining :: cube of diameter of whole ball : cube of diameter of part remaining.

That is,  $1 : \frac{3}{4} :: 3^3 : x^3$ , and hence  $x = 3 \times \sqrt[3]{\frac{1}{4}} = 3 \times \sqrt[3]{.75} = .90856 \times 3 = 2.72568 =$  diameter of the ball after the first has wound off her portion.

Similarly after the second has wound off her portion, there will remain  $\frac{1}{2}$  of the ball, and after the third has taken her portion,  $\frac{1}{4}$  of the ball.

Hence  $1 : \frac{1}{2} :: 3^3 : x^3$ , whence  $x = 3 \times \sqrt[3]{\frac{1}{2}} = 3 \times \sqrt[3]{.5} = 3 \times .79370 = 2.38110 =$  diameter after the second has taken her portion.

$1 : \frac{1}{4} :: 3^3 : x^3$ , whence  $x = 3 \times \sqrt[3]{\frac{1}{4}} = 3 \times \sqrt[3]{.25} = 3 \times .62996 = 1.88988 =$  diameter after the third has taken her portion.

Hence 1st takes off 3	— 2.72568 =	.27432 inches.
2nd “ “	2.72568 — 2.38110 =	.34458 “
3rd “ “	2.38110 — 1.88988 =	.49122 “
4th “ “	remaining	1.88988 “

---

Page 315.

(1)

$$\sqrt{19987173376} = 141376, \text{ and } \sqrt{141376} = 376.$$

(2)

$$\sqrt[3]{308915776} = 676, \text{ and } \sqrt{676} = 26.$$

(3)

$$\sqrt[3]{40353607} = 343, \text{ and } \sqrt[3]{343} = 7.$$

(4)

$$\sqrt[3]{387420489} = 729, \sqrt[3]{729} = 9, \text{ and } \sqrt{9} = 3.$$

(5)

$$\sqrt[3]{134217728} = 512, \sqrt[3]{512} = 8, \text{ and } \sqrt[3]{8} = 2.$$

---

 Page 321.

(13)

The mantissa of the logarithm of 8193 (the first four digits) =  $\cdot 913443$ , and the next following mantissa is  $\cdot 913496$ .

Then from  $\cdot 913496$

Subtract ..  $\cdot 913443$

Difference, 53; and  $53 \times 217$  (remaining digits of given number) = 11501, from which we cut off three digits, since we multiplied by a number of three digits, and since the highest digit cut off is not less than 5, we add unity to the part retained, which gives us 12.

Then mantissa of logarithm of first four digits  $\cdot 913443$

Add, 12

Mantissa of logarithm of given number,  $\cdot 913455$

To which attach the characteristic 6 and required logarithm =  $6 \cdot 913455$ .

The mantissa of the logarithm of 7392 (the first four digits) =  $\cdot 868762$ , and the next following mantissa is  $\cdot 868821$ .

Then from  $\cdot 868821$

Subtract ..  $\cdot 868762$

Difference, 59; and  $59 \times 45$  (remaining digits of given number) = 2655, from which we cut off two digits, since we multiplied by a number of two digits, and since the highest digit cut off is not less than 5, we add unity to the part retained, which gives us 27.

Then mantissa of logarithm of first four digits,  $\cdot 868762$

Add, 27

Mantissa of logarithm of given number,  $\cdot 868789$

(Continued on next page.)



(13 continued.)

To which attach the characteristic 1 and required logarithm =  
1.868789.

The mantissa of the logarithm of 8437 (the first four digits)  
= .926188, and the next following mantissa is .926240.

Then from .926240

Subtract.. .926188

Difference, 52; and  $52 \times 42$  (remaining digits of given  
number) = 2184, from which we cut off two digits, since we  
multiplied by a number of two digits, and since the highest digit  
cut off is not less than 5, we add unity to the part retained,  
which becomes 22.

Then mantissa of logarithm of first four digits .926188

Add, 22

Mantissa of logarithm of given number, .926210

To which attach the characteristic  $\bar{1}$  and required logarithm =  
 $\bar{1}.926210$ .

(14)

The mantissa of the logarithm of 2345 = .370143, and the next  
following mantissa is .370338.

Then from .370338

Subtract.. .370143

Difference, 185; and  $185 \times 64 = 11840$ , from which we  
cut off two digits, since we multiplied by a number of two  
digits, which gives us 118.

Then mantissa of logarithm of 2345 = .370143

Add, 118

Mantissa of logarithm of given number = .370261

To which attach the characteristic  $\bar{4}$  and required logarithm =  
 $\bar{4}.370261$ .

(Continued on next page.)

(14 continued.)

The mantissa of the logarithm of 1007 = .003029, and the next following mantissa is .003461.

Then from .003461

Subtract .. .003029

Difference, 432; and  $432 \times 013 = 5616$ , from which we cut off three digits, since we multiplied by a number of three digits, and since the highest digit cut off is not less than 5, we add unity to the part retained, which gives us 6.

Then mantissa of logarithm of 1007 = .003029

Add, 6

Mantissa of logarithm of given number .003035

To which attach the characteristic  $\bar{3}$  and required logarithm =  $\bar{3}.003035$ .

(15)

Mantissa of logarithm of 5237..... .719083

Difference from column D = 83; and  $83 \times 6 = 498$

from which we cut off 1 digit and add..... 50

And also attach the characteristic 1, and required logarithm = ..... 1.719133

Mantissa of logarithm of 1294..... .111934

Difference from column D = 335; and  $335 \times 76 =$

25460 from which we cut off two digits and add, 255

And also attach the characteristic 2 and required logarithm = ..... 2.112189

(16)

Mantissa of logarithm of	·0004713	=	·673297
P. P. corresponding to	·00000009	=	83
P. P. " to	·00000008	=	74

Sum, = ·6733874

Therefore required mantissa = ·673387 and required logarithm  
=  $\bar{4}$ ·673387.

Mantissa of logarithm of	9136000	=	·960756
P. P. corresponding to	700	=	33
P. P. " to	10	=	5
P. P. " to	2	=	9

Sum, = ·96078959

Therefore required mantissa = ·960790 and required logarithm  
= 6·960790.

(17)

Mantissa of logarithm of	4·23400	=	·626751
P. P. corresponding to	20	=	20
P. P. " to	9	=	92

Sum, = ·6267802

Therefore required logarithm is 0·626780.

Mantissa of logarithm of	763·1	=	·882581
P. P. corresponding to	·02	=	11
P. P. " to	·009	=	51
P. P. " to	·0008	=	46
P. P. " to	·00007	=	40

Sum, = ·882597600

Therefore required logarithm is 2·882598.

Page 323.

(20)

Given logarithm,  $\cdot 137139$ Next lower in table,  $\cdot 137037 = \log.$  of 1371.Difference  $\quad\quad\quad 102$ , Tabular difference = 316.

Then  $1020000 \div 316$  gives 3227 for digits in 5th, 6th, 7th, and 8th places.

Hence the digits of the natural number are 13713227; and since the characteristic is 4, i. e., one less than the number of digits to the left of the decimal point, the required number is  $13713 \cdot 227$ .

Given logarithm,  $\cdot 718134$ Next lower in table,  $\cdot 718086 = \log.$  of 5225.Difference,  $\quad\quad\quad 48$ , Tabular difference = 83.Then  $48000 \div 83$  gives 578 for digits in 5th, 6th and 7th places.

Hence the digits of the natural number are 5225578, and since the characteristic is 0, i. e., one less than the number of digits to the left of the decimal point, the required number is  $5 \cdot 225578$ .

Given logarithm,  $\cdot 635421$ Next lower in table,  $\cdot 635383 = \log.$  of 4319.Difference,  $\quad\quad\quad 38$ , Tabular difference = 101.

Then  $38000 \div 101$  gives 376 for digits in 5th, 6th, and 7th places.

Hence the digits of the natural number are 4319376, and since the characteristic is  $\bar{4}$ , i. e., one more than the number of ciphers between the decimal point and the first figure to the right, the required number is  $\cdot 0004319376$ .

(21)

Given log.  $\cdot 921686 = \log.$  of 8350.

And since the characteristic is 2, i. e., one less than the number of digits to the left of the decimal point, the required number is 835.

Given logarithm,  $\cdot 922165$

Next lower in table,  $\cdot 922154 = \log.$  of 8359.

Difference =  $\underline{\hspace{2cm}}$  11, Tabular difference = 52.

Then  $11000 \div 52$  gives 211 for digits in 5th, 6th, and 7th places.

Hence the digits of the natural number are 8359211; and since the characteristic is  $\bar{1}$ , i. e., one more than the number of ciphers between the decimal point and first figure to the right, the required number is  $\cdot 8359211$ .

(22)

Given logarithm,  $\cdot 407968$

Next lower in table,  $\cdot 407901 = \log.$  of 2558.

Difference, =  $\underline{\hspace{2cm}}$  67

Highest P.P. not greater than 67 =  $\underline{\hspace{2cm}}$  51 corresponds to 3  
for 5th place.

Highest P.P. not greater than 160 =  $\underline{\hspace{2cm}}$  153 corresponds to 9  
for 6th place.

Highest P.P. not greater than 70 =  $\underline{\hspace{2cm}}$  68 corresponds to  
4 for 7th place.  
2

Therefore digits of required number are 2558394; and since the characteristic is 5, there must be six digits to the left of the decimal point.

Hence required number is 255839 $\cdot$ 4.

(Continued on next page.)

(22 continued.)

Given logarithm,	$\cdot 408386$	
Next lower in table,	$\cdot 408240$	$= \log. \text{ of } 2560.$
Difference, =	<u>146</u>	
Highest P.P. not greater than 146 =	<u>136</u>	corresponds to 8 in 5th place.
	100	
Highest P.P. not greater than 100 =	<u>85</u>	corresponds to 5 in 6th place.
	150	
Highest P.P. not greater than 150 =	<u>136</u>	corresponds to 8 in 7th place.
	140	
Highest P.P. not greater than 140 =	136	corresponds to 8 in 8th place.

Therefore digits of required number are 25608588 ; and since the characteristic is 7, there must be eight digits to the left of the decimal point.

Hence required number is 25608588.

Given logarithm,	$\cdot 416369$	
Next lower in table,	$\cdot 416308$	$= \log. \text{ of } 2608.$
Difference, =	<u>61</u>	
Highest P.P. not greater than 61 =	<u>49</u>	corresponds to 3 in 5th place.
	12	

Therefore digits of required number are 26083 ; and since the characteristic is  $\bar{3}$ , there must be two ciphers between the decimal point and first figure.

Hence required number is  $\cdot 0026083.$

(23)

Given logarithm,	$\cdot 877777$	
Next lower in table,	$\cdot 877774 = \log.$	of 7547.
Difference =	<u>3</u>	
There is no P.P. not greater than 3	0	corresponds to 0 in 5th place.
	<u>30</u>	
Highest P.P. not greater than 30 =	29	corresponds to 5 in 6th place.
	<u>10</u>	
Highest P.P. not greater than 10 =	6	corresponds to 1 in 7th place.
	<u>40</u>	
Highest P.P. not greater than 40 =	35	corresponds to 6 in 8th place.
	<u>50</u>	
Highest P.P. not greater than 50 =	46	corresponds to 8 in 9th place.
	<u>4</u>	

Therefore digits of required number are 754705168 ; and since the characteristic is 4, there must be five digits to the left of the decimal point.

Hence required number is 75470·5168.

Given logarithm,	$\cdot 555555$	
Next lower in table,	$\cdot 555457 = \log.$	of 3593.
Difference, =	<u>98</u>	
Highest P.P. not greater than 98 =	98	corresponds to 8 in 5th place.

Therefore digits of required number are 35938 ; and since the characteristic is 0, there must be one digit to the left of the decimal point.

Hence required number is 3·5938.

Page 324.

(1)

$$10 - 5.63164\dot{2} = 4.368358.$$

$$10 - 0.714000 = 9.286000.$$

(2)

$$10 - \bar{3}.123456 = 12.876544.$$

$$10 - \bar{7}.213149 = 16.786851.$$

(3)

$$10 - 6.124357 = 3.875643 \text{ and } 10 - 2.000837 = 11.999163.$$

---

 Page 325.

(5)

$$\text{Logarithm of } 61 = 1.785330$$

$$\text{" } 22 = 1.342423$$

$$\text{" } 65 = 1.812913$$

$$\text{Sum} = \underline{4.940666} = \text{logarithm of } 87230.$$

(6)

$$\text{Logarithm of } 52 = 1.716003$$

$$\text{" } 734 = 2.865696$$

$$\text{" } 6 = 0.778151$$

$$\text{Sum} = \underline{5.359850}$$

$$\underline{5.359835} = \text{logarithm of } 229000$$

$$\underline{\quad\quad\quad} 15 =$$

7

$$\text{Ans. } \underline{229007}$$



(7)

$$\begin{array}{r}
 \text{Logarithm of } 35.86 = 1.554610 \\
 \text{" } 2.1046 = 0.323169 \\
 \text{" } .8372 = \bar{1}.922829 \\
 \text{" } .00294 = \bar{3}.468347 \\
 \hline
 \text{Sum} = \bar{1}.268955 = \text{logarithm of } .185700 \\
 \bar{1}.268812 \\
 \hline
 143 = \qquad \qquad \qquad 61 \\
 \text{Ans. } \underline{\underline{.185761}}
 \end{array}$$

(8)

$$\begin{array}{r}
 \text{Log. of } .00008764 = \bar{5}.942702 \\
 \text{" } .86359 = \bar{1}.936309 \\
 \hline
 \text{Sum} = \bar{5}.879010 \\
 \bar{5}.878981 = \text{logarithm of } .000075680 \\
 \hline
 29 = \qquad \qquad \qquad 5 \\
 \text{Sum } \underline{\underline{.000075685}}
 \end{array}$$

Page 326.

(11)

$$\begin{array}{r}
 \text{Logarithm of } .6734 = \bar{1}.828273 \\
 \text{" } .0009278 = \bar{4}.967454 \\
 \hline
 \text{Difference} = 2.860819 \\
 2.860817 = \text{logarithm of } 725.8000 \\
 \hline
 2 = \qquad \qquad \qquad 33 \\
 \text{Ans. } \underline{\underline{725.8033}}
 \end{array}$$

(12)

$$\text{Logarithm of } 437.89 = 2.641365$$

$$\text{" } 62.735 = 1.797510$$

$$\text{Difference} = \underline{\quad\quad\quad} .843855 = \text{logarithm of } 6.98$$

(13)

$$\text{Logarithm of } 93.217 = 1.969495$$

$$\text{" } .0007132 = \underline{\quad\quad\quad} 4.853211$$

$$\text{Difference} = 5.116284$$

$$\underline{\quad\quad\quad} 5.116276 = \text{logarithm of } 130700.0$$

$$8 =$$

$$\underline{\quad\quad\quad} 2.4$$

$$\text{Ans. } \underline{\quad\quad\quad} 130702.4$$

(14)

$$\text{Logarithm of } 23 = 1.361728$$

$$\text{" } 189 = 2.276462$$

$$\text{" } 2.748 = \underline{\quad\quad\quad} 0.439017$$

$$\text{Sum} = \underline{\quad\quad\quad} 4.077207$$

$$\text{Logarithm of } 9835267 = 6.992786$$

$$\underline{\quad\quad\quad} 4.077207$$

$$\text{Difference} = 2.915579$$

$$\underline{\quad\quad\quad} 2.915558 = \text{logarithm of } 823.300$$

$$21 =$$

$$\underline{\quad\quad\quad} 39$$

$$\text{Ans. } \underline{\quad\quad\quad} 823.339$$

Page 326.

(17)

$$\text{Logarithm of } 5 = 0.698970.$$

$$\text{Then } 0.698970 \times 5 = 3.494850 = \text{logarithm of } 3125.$$

(18)

Logarithm of 1.073 = .030600.

Then  $.030600 \times 6 = .183600 = \text{logarithm of } 1.5261.$ 

(19)

Logarithm of .0279 =  $\bar{2}.445604.$ Then  $\bar{2}.445604 \times 4 = \bar{7}.782416 = \text{logarithm of } .0000060592.$ 

(20)

Logarithm of 1.111 = .045714.

Then  $.045714 \times 11 = .502854 = \text{logarithm of } 3.1831.$ 


---

 Page 327.

(23)

Logarithm of 913426000 = 8.960673.

8.960673  $\div 7 = 1.2800961 = \text{logarithm of } 19.0588.$ 

(24)

Logarithm of 1.61342 = .207747.

 $.207747 \div 11 = .01888609 = \text{logarithm of } 1.0444.$ 

(25)

Logarithm of .000007139 =  $\bar{6}.853637 = \bar{10} + 4.853637.$  $(\bar{10} + 4.853637) \div 5 = \bar{2}.970727 = \text{logarithm of } .0934817.$ 

(26)

Logarithm of .002147 =  $\bar{3}.331832 = \bar{7} + 4.331832.$  $(\bar{7} + 4.331832) \div 7 = \bar{1}.6188331 = \text{logarithm of } .41575.$

Page 328.

(28)

$$14000 = 7 \times 2 \times 1000 \therefore \log. 14000 = (\log. 7) + (\log. 2) + (\log. 1000).$$

$$\text{Log. } 7 = 0.845098$$

$$\text{Log. } 2 = 0.301030$$

$$\text{Log. } 1000 = 3$$

$$\text{Sum, } \quad = \underline{\quad\quad\quad} = \log. 14000$$

$$4.9 = 7^2 \div 10 \therefore \log. 4.9 = (\log. 7) \times 2 - (\log. 10).$$

$$\text{Log. } 7 = 0.845098 \times 2 = 1.690196$$

$$\text{Log. } 10 = \quad \quad \quad 1$$

$$\text{Difference} = \underline{\quad\quad\quad} = \log. 4.9.$$

$$.00196 = 49 \times 4 \div 100000 = 7^2 \times 2^2 \div 100000$$

$$\therefore \log. .00196 = (\log. 7) \times 2 + (\log. 2) \times 2 - (\log. 100000).$$

$$\text{Log. } 7 = 0.845098 \times 2 = 1.690196$$

$$\text{Log. } 2 = 0.301030 \times 2 = 0.602060$$

$$\text{Sum} = \underline{\quad\quad\quad} = 2.292256$$

$$\text{Log. of } 100000 = 5 \text{ and } 2.292256 - 5 = \bar{3}.292256 = \log. \text{ of } .00196.$$

$$\text{Since } 5 = 10 \div 2, \text{ the logarithm of } 5 = \log. 10 - \log. 2 = 1 - 0.301030 = 0.698970.$$

$$1750 = 5^2 \times 7 \times 10 \therefore \log. 1750 = (\log. 5) \times 2 + (\log. 7) + (\log. 10).$$

$$\text{Log. } 5 = 0.698970 \times 2 = 1.397940$$

$$\text{Log. } 7 = \quad \quad \quad .845098$$

$$\text{Log. } 10 = \quad \quad \quad 1$$

$$\text{Sum, } = \underline{\quad\quad\quad} = \log. \text{ of } 1750.$$

$$1428.571428 = \frac{1}{7} \times 10000 \therefore \log. 1428.571428 = (\log. \frac{1}{7}) + \log. 10000.$$

(Continued on next page.)

(28 continued.)

$$\text{Log. } \frac{1}{7} = (\text{log. } 1) - (\text{log. } 7) = 0 - 0.845098 = \bar{1}.154902$$

$$\text{Log. } 10000 = 4$$

$$\therefore \text{log. of } 1428.571428 = \text{sum} = 3.154902$$

$$\cdot 00000112 = 2^4 \times 7 \div 100000000 \therefore \text{log. } \cdot 00000112 =$$

$$(\text{log. } 2) \times 4 + (\text{log. } 7) - (\text{log. } 100000000).$$

$$\text{Log. } 2 = 0.301030 \times 4 = 1.204120$$

$$\text{Log. } 7 = 0.845098$$

$$\text{Sum} = 2.049218 = \text{and log. } 100000000 = 8$$

$$2.049218 - 8 = \bar{6}.049218 = \text{log. } \cdot 00000112$$

$$3.0625 = \frac{49}{16} \therefore \text{log. } 3.0625 = (\text{log. } 49) - (\text{log. } 16) =$$

$$(\text{log. } 7) \times 2 - (\text{log. } 4) \times 4.$$

$$\text{Log. } 7 = 0.845098 \times 2 = 1.690196$$

$$\text{Log. } 2 = 0.301030 \times 4 = 1.204120$$

$$\text{Difference} = 0.486076 = \text{log. of } 3.0625.$$

(29)

$$49\frac{1}{2} = \frac{99}{2} = 3^2 \times 11 \times \frac{1}{2} \therefore \text{log. } 49\frac{1}{2} = (\text{log. } 3) \times 2 + (\text{log. } 11) + (\text{log. } \frac{1}{2}).$$

$$\text{Log. } 3 = 0.477121 \times 2 = 0.954242$$

$$\text{Log. } 11 = 1.041393$$

$$\text{Log. } \frac{1}{2} = \bar{1}.698970$$

$$\text{Sum} = 1.694605 = \text{log. of } 49\frac{1}{2}.$$

$$363 = 11^2 \times 3 \therefore \text{log. } 363 = (\text{log. } 11) \times 2 + (\text{log. } 3).$$

$$\text{Log. } 11 = 1.041393 \times 2 = 2.082786$$

$$\text{Log. } 3 = 0.477121$$

$$\text{Sum} = 2.559906 = \text{log. of } 363.$$

Log.  $\cdot 5$  or  $\frac{1}{2} = \bar{1}.698970$ , and by altering the characteristic we get  $0.698970$  for log. of  $5$ .

(Continued on next page.)

(29 continued.)

$$4\cdot\overset{\cdot\cdot}{09} = 4\frac{1}{11} = \frac{45}{11} = 3^2 \times 5 \div 11 \therefore \log. 4\cdot\overset{\cdot\cdot}{09} = (\log. 3) \times 2 + (\log. 5) - (\log. 11).$$

$$\text{Log. 3} = \cdot 477121 \times 2 = 0\cdot 954242$$

$$\text{Log. 5} = \cdot 698970$$

$$\hline 1\cdot 653212$$

$$\text{Log. 11} = 1\cdot 041393 \text{ and } 1\cdot 653212 - 1\cdot 041393 = 0\cdot 611819 = \text{log. of } 4\cdot\overset{\cdot\cdot}{09}.$$

$$2\cdot\overset{\cdot}{4} = 2\frac{4}{9} = \frac{2^2}{9} = 11 \times 2 \div 9 \therefore \log. 2\cdot\overset{\cdot}{4} = (\log. 11) + (\log. 2) - (\log. 3) \times 2.$$

$$\text{Log. 2} = (\log. 10) - (\log. 5) = 1 - 0\cdot 698970 = 0\cdot 301030.$$

$$\text{Log. 11} = 1\cdot 041393$$

$$\text{Log. 2} = 0\cdot 301030$$

$$\hline 1\cdot 342423$$

$$\text{Log. 3} = 0\cdot 477121 \times 2 = 0\cdot 954242 \text{ and } 1\cdot 342423 - 0\cdot 954242 = 0\cdot 388181 = \text{log. of } 2\cdot\overset{\cdot}{4}.$$

$$392\cdot\overset{\cdot\cdot}{72} = 392\frac{8}{11} = \frac{4320}{11} = 2^4 \times 3^3 \times 10 \div 11 \therefore \log. 392\cdot\overset{\cdot\cdot}{72} = (\log. 2) \times 4 + (\log. 3) \times 3 + (\log. 10) - (\log. 11).$$

$$\text{Log. 2} = 0\cdot 301030 \times 4 = 1\cdot 204120$$

$$\text{Log. 3} = 0\cdot 477121 \times 3 = 1\cdot 431363$$

$$\text{Log. 10} = 1$$

$$\hline \text{Sum} = 3\cdot 635483$$

$$\text{Log. 11} = 1\cdot 041393 \text{ and } 3\cdot 635483 - 1\cdot 041393 = 2\cdot 594090 = \text{log. of } 392\cdot\overset{\cdot\cdot}{72}.$$

$$293333\frac{1}{3} = \frac{880000}{3} = 2^3 \times 11 \times 10000 \div 3 \therefore \log. 293333\frac{1}{3} = (\log. 2) \times 3 + (\log. 11) + (\log. 10000) - (\log. 3).$$

$$\text{Log. 2} = 0\cdot 301030 \times 3 = 0\cdot 903090$$

$$\text{Log. 11} = 1\cdot 041393$$

$$\text{Log. 10000} = 4$$

$$\hline \text{Sum} = 5\cdot 944483$$

(Continued on next page.)

Log. 3 = 0.477121 and  $5.944483 - 0.477121 = 5.467362 =$   
log. of 293333 $\frac{1}{2}$ .

$19.965 = 11^3 \times 5 \times 3 \div 1000 \therefore \log. 19.965 = (\log. 11) \times 3$   
 $+ (\log. 5) + (\log. 3) - (\log. 1000).$

$$\text{Log. } 11 = 1.041393 \times 3 = 3.124179$$

$$\text{Log. } 5 = 0.698970$$

$$\text{Log. } 3 = 0.477121$$

$$\text{Sum} = \underline{\underline{4.300270}}$$

Log. 1000 = 3 and  $4.300270 - 3 = 1.300270 = \log. \text{ of } 19.965.$

---

Page 336.

(6)

Here we have given the first term 4, the number of terms 17,  
and the sum of the series 884, to find  $l$ , the last term.

$$\text{Then } l = \frac{2s}{n} - a = \frac{884 \times 2}{17} - 4 = 104 - 4 = 100.$$

(7)

Here we have given the first term 21, the last term 497 and  
the number of terms 41, to find the common difference.

$$\text{Then } d = \frac{l - a}{n - 1} = \frac{497 - 21}{41 - 1} = \frac{476}{40} = \frac{119}{10} = 11\frac{9}{10}.$$

(8)

Here we have given  $a$ ,  $l$ , and  $d$ , to find  $n$ , and since  $a = 12$ ,  
 $l = 96$ , and  $d = 6$ , we have

$$n = \frac{l - a}{d} + 1 = \frac{96 - 12}{6} + 1 = \frac{84}{6} + 1 = 14 + 1 = 15.$$

(9)

Here we have given  $l$ ,  $d$ , and  $s$ , to find  $n$ , and since  $l = 14$ ,  $d = 1$ , and  $s = 105$ , we have

$$n = \frac{2l + d}{2d} + \sqrt{\left(\frac{2l + d}{2d}\right)^2 - \frac{2s}{d}} = \frac{2 \times 14 + 1}{2 \times 1} + \sqrt{\left(\frac{2 \times 14 + 1}{2 \times 1}\right)^2 - \frac{2 \times 105}{1}} = 14\frac{1}{2} + \sqrt{\left(\frac{29}{2}\right)^2 - 210} = 14\frac{1}{2} + \sqrt{\frac{841}{4} - 210} = 14\frac{1}{2} + \sqrt{\frac{841 - 840}{4}} = 14\frac{1}{2} + \sqrt{\frac{1}{4}} = 14\frac{1}{2} + \frac{1}{2} = 15.$$

(10)

Here we have given  $a$ ,  $d$ , and  $s$ , to find  $l$ , and since  $a = \frac{2}{3}$ ,  $d = \frac{2}{3}$ , and  $s = 1180$ , we have

$$l = -\frac{1}{2}d + \sqrt{2ds + \left(a - \frac{1}{2}d\right)^2} = -\frac{1}{2} \text{ of } \frac{2}{3} + \sqrt{2 \times \frac{2}{3} \times 1180 + \left(\frac{2}{3} - \frac{1}{2} \times \frac{2}{3}\right)^2} = -\frac{1}{3} + \sqrt{\frac{4720}{3} + \left(\frac{1}{3}\right)^2} = -\frac{1}{3} + \sqrt{\frac{1720}{3} + \frac{1}{9}} = -\frac{1}{3} + \sqrt{\frac{14161}{9}} = -\frac{1}{3} + \frac{119}{3} = \frac{118}{3} = 39\frac{2}{3}.$$

(11)

Here we have given  $a$ ,  $l$ , and  $s$ , to find  $d$ , and since  $a = 8$ ,  $l = 170$ , and  $s = 4895$ , we have

$$d = \frac{(l + a)(l - a)}{2s - l - a} = \frac{(170 + 8)(170 - 8)}{2 \times 4895 - 170 - 8} = \frac{178 \times 162}{9790 - 178} = \frac{28836}{9612} = 3.$$

(12)

Here we have given  $a$ ,  $l$ , and  $d$ , to find  $n$ , and since  $a = 5$ ,  $l = 27\frac{1}{2}$ , and  $d = 2\frac{1}{4}$ , we have

$$n = \frac{l - a}{d} + 1 = \frac{27\frac{1}{2} - 5}{2\frac{1}{4}} + 1 = \frac{22\frac{1}{2}}{2\frac{1}{4}} + 1 = \frac{45}{\frac{9}{4}} + 1 = 10 + 1 = 11$$



(13)

Here we have given  $a$ ,  $l$ , and  $n$ , to find  $s$ , and since  $a = 2$ ,  $l = 478$ , and  $n = 86$ , we have

$$s = (a + l)\frac{n}{2} = (2 + 478)\frac{86}{2} = 480 \times 43 = 20640.$$

(14)

Here we have given  $a$ ,  $l$ , and  $d$ , to find  $s$ , and since  $a = 2$ ,  $l = 998$ , and  $d = 6$ , we have

$$s = \frac{(l+a)(l-a)}{2d} + \frac{l+a}{2} = \frac{(998+2)(998-2)}{2 \times 6} + \frac{998+2}{2} = \frac{1000 \times 996}{12} + \frac{1000}{2} = 83000 + 500 = 83500.$$

(15)

Here we have given  $a$ ,  $n$ , and  $d$ , to find  $l$ , and since  $a = 5$ ,  $n = 11$ , and  $d = 2\frac{1}{2}$ , we have

$$l = a + (n - 1)d = 5 + (11 - 1)2\frac{1}{2} = 5 + 10 \times 2\frac{1}{2} = 5 + 4\frac{5}{2} = 5\frac{5}{2} = 27\frac{1}{2}.$$

(16)

Here we have given  $l$ ,  $d$ , and  $n$ , to find  $s$ , and since  $l = 199$ ,  $d = 11$ , and  $n = 19$ , we have

$$s = \{2l - (n - 1)d\}\frac{n}{2} = \{2 \times 199 - (19 - 1)11\}\frac{19}{2} = \{398 - 18 \times 11\}\frac{19}{2} = 200 \times \frac{19}{2} = 1900.$$

(17)

Here we have given  $s$ ,  $a$ , and  $l$ , to find  $n$ , and since  $s = 39840$ ,  $a = 2$ , and  $l = 478$ , we have

$$n = \frac{2s}{l + a} = \frac{2 \times 39840}{478 + 2} = \frac{79680}{480} = 166.$$

(18)

Here we have given  $s$ ,  $l$ , and  $a$ , to find  $d$ , and since  $s = 83500$ ,  $l = 998$ , and  $a = 2$ , we have

$$d = \frac{(l + a)(l - a)}{2s - l - a} = \frac{(998 + 2)(998 - 2)}{2 \times 83500 - 998 - 2} = \frac{1000 \times 996}{167000 - 1000} = \frac{996000}{166000} = 6.$$

(19)

Here we have given  $s$ ,  $a$ , and  $d$ , to find  $n$ , and since  $s = 260$ ,  $a = 2$ , and  $d = 2$ , we have

$$n = \frac{d - 2a}{2d} + \sqrt{\frac{2s}{d} + \left(\frac{2a - d}{2d}\right)^2} = \frac{2 - 2 \times 2}{2 \times 2} + \sqrt{\frac{2 \times 260}{2} + \left(\frac{2 \times 2 - 2}{2 \times 2}\right)^2} = -\frac{1}{2} + \sqrt{260 + \left(-\frac{1}{2}\right)^2} = -\frac{1}{2} + \sqrt{260\frac{1}{4}} = -\frac{1}{2} + 16.13226 = 15.63226 \text{ days} = 15 \text{ days, } 15 \text{ hours, } 10 \text{ minutes, } 27.264 \text{ seconds.}$$

(20)

Here we have given  $s$ ,  $a$ , and  $d$ , to find  $l$ , and since  $s = 83500$ ,  $a = 2$ , and  $d = 6$ , we have

$$l = -\frac{1}{2}d + \sqrt{2ds + \left(a - \frac{1}{2}d\right)^2} = -\frac{1}{2} \times 6 + \sqrt{2 \times 6 \times 83500 + \left(2 - \frac{1}{2} \times 6\right)^2} = -3 + \sqrt{1002000 + (2 - 3)^2} = -3 + \sqrt{1002001} = -3 + 1001 = 998.$$

(21)

Here we have given  $s$ ,  $n$ , and  $l$ , to find  $a$ , and since  $s = \$1125$ ,  $n = 18$ , and  $l = 120$ , we have

$$a = \frac{2s}{n} - l = \frac{2 \times 1125}{18} - 120 = 125 - 120 = 5.$$

(22)

Here we have given  $a$ ,  $l$ , and  $n$ , to find  $d$ , and since  $a = 5$ ,  $l = 27\frac{1}{2}$ , and  $n = 11$ , we have

$$d = \frac{l - a}{n - 1} = \frac{27\frac{1}{2} - 5}{11 - 1} = \frac{22\frac{1}{2}}{10} = 2\frac{1}{4}.$$

(23)

Here we have  $a$ ,  $d$ , and  $n$ , given to find  $s$ , and since to deposit one stone he must walk 5 yards, and the distance travelled for each succeeding stone is 5 yards, therefore  $a = 5$ ,  $d = 5$ , and  $n = 220$ .

$$\begin{aligned} \text{Then } s &= \{2a + (n - 1)d\} \frac{n}{2} = \{2 \times 5 + (220 - 1)5\} \frac{220}{2} \\ &= \{10 + 219 \times 5\} 110 = \\ &1105 \times 110 = 121550 \text{ yards} = 69\frac{1}{8} \text{ miles.} \end{aligned}$$

(24)

Here we have  $s$ ,  $n$ , and  $l$ , given to find  $a$ , and since  $s = 39840$ ,  $n = 166$ , and  $l = 478$ , we have

$$a = \frac{2s}{n} - l = \frac{2 \times 39840}{166} - 478 = 480 - 478 = 2.$$

(25)

Here we have  $n$ ,  $a$ , and  $d$ , given to find  $s$ , and since  $n = 12$ ,  $a = 4$ , and  $d = 2$ , we have

$$\begin{aligned} s &= \{2a + (n - 1)d\} \frac{n}{2} = \{2 \times 4 + (12 - 1)2\} \frac{12}{2} = \{8 + 11 \times 2\} 6 = \\ &30 \times 6 = 180. \end{aligned}$$

(26)

Here we have given  $a$ ,  $l$ , and  $n$ , to find  $s$ , and  $a = 1$ ,  $l = 24$ , and  $n = 24$ .

$$\text{Then } s = (a + l) \frac{n}{2} = (1 + 24) \frac{24}{2} = 25 \times 12 = 300.$$

Page 342.

(5)

Here  $n = 11$ ,  $a = £1024$ , and  $r = 1\frac{1}{2}$ .Then  $l = ar^{n-1} = 1024 \times (\frac{3}{2})^{10} = 1024 \times \frac{59049}{1024} = £59049$ .

$$s = \frac{rl - a}{r - 1} = \frac{\frac{3}{2} \times 59049 - 1024}{\frac{3}{2} - 1} = \frac{177147 - 1024}{\frac{1}{2}} = \frac{176099}{\frac{1}{2}} = £176099 = \text{whole fortune.}$$

(6)

Here  $a = 7$ ,  $l = 1240029$  and  $s = 1860040$ .

$$\text{Then } r = \frac{s - a}{s - l} = \frac{1860040 - 7}{1860040 - 1240029} = \frac{1860033}{620011} = 3.$$

(7)

Here  $n = 12$ ,  $a = £1$ , and  $l = £2048$ .

$$\text{Then } r = \left(\frac{l}{a}\right)^{\frac{1}{n-1}} = \left(\frac{2048}{1}\right)^{\frac{1}{11}} = \sqrt[11]{2048} = 2.$$

$$s = \frac{rl - a}{r - 1} = \frac{2 \times 2048 - 1}{2 - 1} = 4096 - 1 = £4095.$$

(8)

Here  $r = \frac{3}{2}$ ,  $n = 8$ , and  $l = 106\frac{403}{12}$ .

$$\text{Then } s = \frac{l(r^n - 1)}{(r - 1)r^{n-1}} = \frac{106\frac{403}{12} \times [(\frac{3}{2})^8 - 1]}{(\frac{3}{2} - 1)(\frac{3}{2})^7} = \frac{54675 \times 6305}{\frac{1}{2} \times 2187} = \frac{25 \times 6305}{512} = 307\frac{41}{12}.$$

(9)

Here  $a = 1$ ,  $n = 7$ , and  $r = 3$ .

$$\text{Then } s = \frac{a(r^n - 1)}{r - 1} = \frac{1 \times (3^7 - 1)}{3 - 1} = \frac{2186}{2} = 1093.$$

(10)

Here  $a = 1$ ,  $l = 10077696$ , and  $n = 10$ .

$$\begin{aligned} \text{Then } s &= \frac{l^{\frac{n}{n-1}} - a^{\frac{n}{n-1}}}{l^{\frac{1}{n-1}} - a^{\frac{1}{n-1}}} = \frac{(10077696)^{\frac{10}{10-1}} - 1^{\frac{10}{10-1}}}{(10077696)^{\frac{1}{10-1}} - 1^{\frac{1}{10-1}}} = \\ &= \frac{\sqrt[9]{(10077696)^{10}} - 1}{\sqrt[9]{10077696} - 1} = \frac{\sqrt[3]{(216)^{10}} - 1}{\sqrt[3]{216} - 1} = \frac{6^{10} - 1}{6 - 1} = \frac{60466176 - 1}{5} \\ &= \frac{60466175}{5} = 12093235. \end{aligned}$$

(11)

Here  $a = 6$ ,  $l = 3072$ , and  $s = 6138$ .

$$\text{Then } r = \frac{s - a}{s - l} = \frac{6138 - 6}{6138 - 3072} = \frac{6132}{3066} = 2.$$

(12)

Here  $r = 2$ ,  $n = 11$ , and  $s = 20470$ .

$$\begin{aligned} \text{Then } l &= \frac{(r-1)sr^{n-1}}{r^n - 1} = \frac{(2-1) \times 20470 \times 2^{10}}{2^{11} - 1} = \frac{20470 \times 1024}{2047} \\ &= 10240. \end{aligned}$$

(13)

Here  $a = 1s.$ ,  $n = 12$ , and  $r = 2$ .

$$\text{Then } s = \frac{a(r^n - 1)}{r - 1} = \frac{1 \times (2^{12} - 1)}{2 - 1} = \frac{4095}{1} = 4095s. \\ = \text{£}204 \text{ } 15s.$$

(14)

Here  $a = 1$  farthing,  $r = 2$ , and  $n = 32$ .

$$\text{Then } s = \frac{a(r^n - 1)}{r - 1} = \frac{1 \times (2^{32} - 1)}{2 - 1} = 4294967295 \text{ far.} = \\ \text{£}4473924 \text{ } 5s. \text{ } 3\frac{1}{4}d.$$

(15)

Here  $a = 4$ ,  $l = 78732$ , and  $n = 10$ .

$$\text{Then } r = \left(\frac{l}{a}\right)^{\frac{1}{n-1}} = \left(\frac{78732}{4}\right)^{\frac{1}{10-1}} = \sqrt[9]{19683} = 3.$$

(16)

Here  $a = 5$ ,  $r = 2$ , and  $n = 7$ .

$$\text{Then } l = ar^{n-1} = 5 \times 2^{7-1} = 5 \times 2^6 = 5 \times 64 = 320.$$

(17)

Here  $a = 5$ ,  $l = 327680$ , and  $r = 4$ .

$$\text{Then } s = \frac{rl - a}{r - 1} = \frac{(327680 \times 4) - 5}{4 - 1} = \frac{1310715}{3} = 436905.$$

(18)

Here  $a = 1$ ,  $r = 2$ , and  $n = 64$ .

$$\text{Then } s = \frac{a(r^n - 1)}{r - 1} = \frac{1 \times (2^{64} - 1)}{2 - 1} = 18446744073709551615 \text{ gr.}$$

$$18446744073709551615 \div (7680 \times 64) = 37529996894754 \text{ bush.}$$

$$\$1.50 \times 37529996894754 = \$56294995342131.$$

(19)

Here  $r = 3$ ,  $n = 10$ , and  $s = 295240$ .

$$\text{Then } l = \frac{(r-1)sr^{n-1}}{r^n - 1} = \frac{(3-1) \times 295240 \times 3^9}{3^{10} - 1} = \frac{2 \times 295240 \times 19683}{59048} = 196830.$$

(20)

Here  $a = 1$ ,  $l = 2048$ , and  $n = 12$ .

$$\text{Then } s = \frac{l^{\frac{n}{n-1}} - a^{\frac{n}{n-1}}}{l^{\frac{1}{n-1}} - a^{\frac{1}{n-1}}} = \frac{2048^{1\frac{1}{12}-1} - 1^{1\frac{1}{12}-1}}{2048^{1\frac{1}{12}-1} - 1^{1\frac{1}{12}-1}} =$$

$$\frac{\sqrt[11]{(2048)^{12}-1}}{\sqrt[11]{2048}-1} = \frac{2^{12}-1}{2-1} = 2^{12}-1 = 4095.$$

(21)

Here  $a = 5$ ,  $r = 4$ , and  $n = 9$ .

$$\text{Then } l = ar^{n-1} = 5 \times 4^{9-1} = 5 \times 4^8 = 5 \times 65536 = 327680.$$

Page 344.

(24)

Here  $a = \frac{2}{7}$ , and  $r = \frac{3}{8}$ .

$$\text{Then } s = \frac{a}{1-r} = \frac{\frac{2}{7}}{1-\frac{3}{8}} = \frac{\frac{2}{7}}{\frac{5}{8}} = \frac{2}{7} \cdot \frac{8}{5} = \frac{16}{35}.$$

(25)

Here  $a = 4$ , and  $r = \frac{1}{2}$ .

$$\text{Then } s = \frac{a}{1-r} = \frac{4}{1-\frac{1}{2}} = \frac{4}{\frac{1}{2}} = 4 \cdot 2 = 8.$$

(26)

Here  $a = \frac{79}{100}$ , and  $r = \frac{1}{100}$ .

$$\text{Then } s = \frac{a}{1-r} = \frac{\frac{79}{100}}{1-\frac{1}{100}} = \frac{\frac{79}{100}}{\frac{99}{100}} = \frac{79}{99} = 7\frac{2}{9}.$$

(27)

Here  $a = \frac{1234}{10000}$ , and  $r = \frac{1}{10000}$ .

$$\text{Then } s = \frac{a}{1-r} = \frac{\frac{1234}{10000}}{1-\frac{1}{10000}} = \frac{\frac{1234}{10000}}{\frac{9999}{10000}} = \frac{1234}{9999}.$$



Page 345.

(3)

Since there are 9 means and 2 extremes the number of terms is 11.

$$\text{Then } d = \frac{l-a}{n-1} = \frac{92-2}{11-1} = \frac{90}{10} = 9.$$

1st term = 2; 2nd = 2 + 9 = 11; 3rd = 11 + 9 = 20; 4th = 20 + 9 = 29; 5th = 29 + 9 = 38; 6th = 38 + 9 = 47; and so on.

And series is 2, 11, 20, 29, 38, 47, 56, 65, 74, 83, 92.

(4)

Since there are 4 means and two extremes the number of terms is 6.

$$\text{Then } d = \frac{l-a}{n-1} = \frac{50-7}{6-1} = \frac{43}{5} = 8\frac{3}{5}.$$

1st term = 7; 2nd = 7 + 8 = 15 $\frac{3}{5}$ ; 3rd = 15 $\frac{3}{5}$  + 8 $\frac{3}{5}$  = 24 $\frac{1}{5}$ ; 4th = 24 $\frac{1}{5}$  + 8 $\frac{3}{5}$  = 32 $\frac{4}{5}$ ; 5th = 32 $\frac{4}{5}$  + 8 $\frac{3}{5}$  = 41 $\frac{2}{5}$ ; and 6th = 41 $\frac{2}{5}$  + 8 $\frac{3}{5}$  = 50.

And series is 7, 15 $\frac{3}{5}$ , 24 $\frac{1}{5}$ , 32 $\frac{4}{5}$ , 41 $\frac{2}{5}$ , 50.

(5)

Since there are 8 means and two extremes the number of terms is 10.

$$\text{Then } r = \left(\frac{l}{a}\right)^{\frac{1}{n-1}} = \left(\frac{4096}{4096}\right)^{\frac{1}{10-1}} = \left(\frac{1}{1}\right)^{\frac{1}{9}} = \frac{1}{9}.$$

1st term = 4096; 2nd = 4096 ×  $\frac{1}{9}$  = 2048; 3rd = 2048 ×  $\frac{1}{9}$  = 1024; 4th = 1024 ×  $\frac{1}{9}$  = 512; 5th = 512 ×  $\frac{1}{9}$  = 256, and so on.

And the means are 2048, 1024, 512, 256, 128, 64, 32, and 16.

(6)

Since there are 7 means and two extremes the number of terms is 9.

$$\text{Then } r = \left(\frac{l}{a}\right)^{\frac{1}{n-1}} = \left(\frac{23514624}{14}\right)^{\frac{1}{8-1}} = (1679616)^{\frac{1}{7}} = 6.$$

1st term = 14; 2nd =  $14 \times 6 = 84$ ; 3rd =  $84 \times 6 = 504$ ; 4th =  $504 \times 6 = 3024$ ; 5th =  $3024 \times 6 = 18144$ , and so on.

And the means are 84, 504, 3024, 18144, 108864, 653184, and 3919104.

Page 347.

(3)

Assume 4 to be the number of men.

Then  $2 \times 4 = 8 =$  number of women.

And  $8 \times 3 = 24 =$  number of children.

6d.  $\times 4 = 24$ d. = amount received by the men.

4d.  $\times 8 = 32$ d. = " " " women.

2d.  $\times 24 = 48$ d. = " " " children.

Sum, = 104d., but it should, by question, = 78d.

$$\text{Then } 104 : 78 :: 4 : \frac{78 \times 4}{104} = 3 = \text{number of men.}$$

$3 \times 2 = 6 =$  number of women, and  $6 \times 3 = 18 =$  number of children.

(4)

Assume £8 to be the price of the harness.

Then  $\text{£}8 \times 2 = 16 =$  price of horse.

And  $\text{£}8 + \text{£}16 = \text{£}24 \times 2 = 48 =$  " chaise.

Sum, = £72, but it should by question = £60.

$$\text{Then } \text{£}72 : \text{£}60 :: \text{£}8 : \frac{8 \times 60}{72} = \text{£}6 \text{ } 13 \text{ } 4 = \text{price of harness.}$$

$\text{£}6 \text{ } 13 \text{ } 4 \times 2 = 13 \text{ } 6 \text{ } 8 =$  " horse.

$\text{£}6 \text{ } 13 \text{ } 4 + \text{£}13 \text{ } 6 \text{ } 8 = \text{£}20 \times 2 = 40 \text{ } 0 \text{ } 0 =$  " chaise.

(5)

Assume 20 as C's age.

Then  $20 \times 3 = 60 =$  B's age.And  $60 \times 2 = 120 =$  A's age.

Sum = 200, but by question it should = 140.

$$20 \times 140$$

Then  $200 : 140 :: 20 : \frac{20 \times 140}{200} = 14 =$  C's age. $14 \times 3 = 42 =$  B's age, and  $42 \times 2 = 84 =$  A's age.

(6)

Assume 100.

One fourth of 100 = 25 and remainder =  $100 - 25 = 75$ .One fifth of 75 = 15 and remainder =  $75 - 15 = 60$ , but it should be by the question = 72.

$$100 \times 72$$

Then  $60 : 72 :: 100 : \frac{100 \times 72}{60} = 120$ .

(7)\*

A can do the work in 7 days  $\therefore$  he will do  $\frac{1}{7}$  of it in 1 day.B " " 5 "  $\therefore$  "  $\frac{1}{5}$  " "C " " 6 "  $\therefore$  "  $\frac{1}{6}$  " "Then all working together will do  $\frac{1}{7} + \frac{1}{5} + \frac{1}{6} = \frac{107}{210}$  in 1 day.Therefore to do the whole work it will take them  $\frac{1}{\frac{107}{210}} = \frac{210}{107} =$  $1\frac{103}{107}$  days.

(8)\*

A and B working together can do it in 10 days  $\therefore$  they will do  $\frac{1}{10}$  of it in 1 day.A can do it in 15 days  $\therefore$  he will do  $\frac{1}{15}$  of it in 1 day.Therefore  $\frac{1}{10} - \frac{1}{15} = \frac{1}{30} =$  amount done by B in 1 day.Then if he does  $\frac{1}{30}$  in 1 day, it will take him 30 days to do the whole.

---

\* \* The mode of working these questions by position is so simple that they cannot trouble any one; it has therefore been thought advisable to work them by simple analysis.

(9)\*

The first pipe empties the whole of it in 1 hour.

The second pipe empties  $\frac{1}{2}$  of it in 1 hour.

The third pipe empties  $\frac{1}{3}$  of it in 1 hour.

Then all these pipes running together will empty  $1 + \frac{1}{2} + \frac{1}{3} = \frac{11}{6}$  in 1 hour.

Therefore to empty the cistern it will take  $1 \div \frac{11}{6} = \frac{6}{11}$  hours.

(10)

Assume 84

One third of 84 = 28

One sixth of 84 = 14

One seventh of 84 = 12

Sum = 54, but by question it should = 27.

$$\text{Then } 54 : 27 :: 84 : \frac{84 \times 27}{54} = 42.$$

(11)\*

All 5 mills working together will grind  $7 + 5 + 4 + 3 + 1 = 20$  bushels in 1 hour.

Therefore to grind 500 bushels it will take them  $500 \div 20 = 25$  hours.

(12)\*

One pipe fills  $\frac{1}{2}$  of the cistern in 1 hour, and the other empties  $\frac{1}{8}$  of it in 1 hour.

Then  $\frac{1}{2} - \frac{1}{8} = \frac{3}{8} =$  part of the cistern filled in 1 hour when both are left open.

And if  $\frac{1}{36}$  of it is filled in 1 hour, the whole will be filled in

$$\frac{1}{\frac{1}{36}} = 36 \text{ hours.}$$

\* See note on page 227.

Page 352.

(6)

Assume 60 for father's age, then 15 = son's.

$$\begin{array}{r}
 5 \qquad \qquad \qquad 5 \\
 \hline
 5)55 \qquad \qquad \qquad 10 \\
 \hline
 11 \\
 10 \\
 \hline
 -1
 \end{array}$$

Assume 100 for father's age, then 25 = son's.

$$\begin{array}{r}
 5 \qquad \qquad \qquad 5 \\
 \hline
 5)95 \qquad \qquad \qquad 20 \\
 \hline
 19 \\
 20 \\
 \hline
 +1
 \end{array}$$

Errors. Assumed numbers.

$$\begin{array}{r}
 -1 \times 100 = 100 \\
 +1 \times 60 = 60 \\
 \hline
 \hline
 \end{array}$$

Sum of errors = 2 Sum of products = 160

Therefore result required =  $160 \div 2 = 80 =$  father's age, and  
 $\frac{1}{4}$  of 80 = 20 = son's age.

(7)

$  \begin{array}{r}  \text{Assume } 80 \\  34 \\  \hline  46 \\  3 \\  \hline  138 \\  80 \\  \hline  58 \\  \frac{1}{4} \text{ of } 80 = 20 \\  \hline  + 38  \end{array}  $	$  \begin{array}{r}  \text{Assume } 44 \\  34 \\  \hline  10 \\  3 \\  \hline  30 \\  44 \\  \hline  -14 \\  \frac{1}{4} \text{ of } 44 = 11 \\  \hline  -25  \end{array}  $
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

(Continued on next page.)

(7 continued.)

Errors. Assumed numbers.

$$- 25 \quad \times \quad 80 \quad = \quad 2000$$

$$+ 38 \quad \times \quad 44 \quad = \quad 1672$$

$$\text{Sum of errors} = \underline{63} \qquad \qquad \qquad \underline{3672}$$

$$\text{Therefore result required} = 3672 \div 63 = 58\frac{2}{3}.$$

(9)

Assume 18 and 7

$$\text{One half of 18} = \underline{9} \quad 2 \times 7 = \underline{14}$$

14

- 5

Assume 22 and 3

$$\text{One half of 22} = \underline{11} \quad 2 \times 3 = \underline{6}$$

6

+ 5

Errors. Assumed numbers.

$$- 5 \quad \times \quad 22 \quad = \quad 110$$

$$+ 5 \quad \times \quad 18 \quad = \quad \underline{90}$$

$$\text{Sum of errors} = 10 \quad \text{Sum of products} = 200$$

Then  $200 \div 10 = 20 =$  one number, and  $25 - 20 = 5$   
 $=$  other number.

(10)

A.	B.	A.	B.
Suppose 8	6	Suppose 6	6
22½	9	22½	9
<hr/>	12	<hr/>	12
180	15	135	15
132	18	81	18
<hr/>	21	<hr/>	21
8)48	24	6)54	—
<hr/>	27	<hr/>	81
+ 6	—	+ 9	
6	132	8	
<hr/>		<hr/>	
36		72	
72			
<hr/>			
3)36			
<hr/>			
12			

$$9 - 6 = 3 = \text{difference of errors.}$$

(12)

Assume 30.

$$\begin{aligned} \frac{1}{2} \text{ of } 30 &= 15; \quad \frac{1}{3} \text{ of } 30 = 10; \\ \frac{1}{4} \text{ of } 30 &= 7\frac{1}{2}; \\ \frac{1}{5} \text{ of } 30 &= 6; \quad \text{and } \frac{1}{6} \text{ of } 30 = 5; \\ 15 \times 7\frac{1}{2} \times 6 \times 5 &= 3375; \\ 3375 - 6998\frac{2}{3} &= -3623\cdot4 = \text{error.} \end{aligned}$$

Assume 60.

$$\begin{aligned} \frac{1}{2} \text{ of } 60 &= 30; \quad \frac{1}{3} \text{ of } 60 = 20; \\ \frac{1}{4} \text{ of } 60 &= 15; \quad \text{and } \frac{1}{5} \text{ of } 60 = 12; \\ 30 \times 20 \times 15 \times 12 &= 54000. \\ 54000 - 6998\frac{2}{3} &= +47001\cdot6 = \text{error.} \\ 30^4 &= 810000, \quad \text{and } 60^4 = 12960000 \\ -3623\cdot4 \times 12960000 &= 46959264000 \\ +47001\cdot6 \times 810000 &= 38071296000 \end{aligned}$$

$$\text{Sum} = 50625 \qquad \text{Sum} = 85030560000$$

$$85030560000 \div 50625 = 1679616$$

4th root = square root of square root.

$$\sqrt{1679616} = 1296, \quad \text{and } \sqrt{1296} = 36 = \text{required number.}$$

NOTE.—For reason why we multiply by the 4th powers of the assumed numbers and then take the 4th root of the quotient, see Arith. page 352,

Let  $x$  = the number required.

example 11.

It may, however, perhaps be clearer from the following illustration :

$$\begin{aligned} \text{Then } \frac{x}{2} \times \frac{x}{4} \times \frac{x}{5} \times \frac{x}{6} &= \frac{x^4}{240} = 6998\frac{2}{3} \\ \therefore x^4 &= 1679616 \\ \therefore x &= \sqrt[4]{1679616} = 36. \end{aligned}$$

(13)

Suppose A had 9s. at first.

Then  $9 + 1 = 10$ ;  $10 \div 2 = 5$ ;  $5 + 1 = 6 =$  what B had at first.

$6 + 1 = 7$ , but should  $= 9 - 1 = 8$ .

$$\text{Error} = 7 - 8 = -1.$$

Suppose A had 11s. at first.

Then  $11 + 1 = 12$ ;  $12 \div 2 = 6$ ;  $6 + 1 = 7 =$  what B had at first.

$7 + 1 = 8$ , but should  $= 11 - 1 = 10$ .

$$\text{Error} = 8 - 10 = -2.$$

(Continued on next page.)

(13 continued.)

Errors.

$$- 2 \times 9 = 18$$

$$- 1 \times 11 = 11$$

$$\text{Diff.} = 1 \quad \text{diff.} = 7$$

 $7 \div 1 = 7 =$  shillings A had at first. $7 + 1 = 8$ ;  $8 \div 2 = 4$ ;  $4 + 1 = 5 =$  shillings B had at first.

(14)

Assume 24 and 6.

$$\frac{2^4}{2} + \frac{2^4}{3} + \frac{2^4}{6} = 24.$$

$$\frac{6}{2} + \frac{3}{4} \text{ of } 6 + \frac{6}{4} = 9.$$

$$24 - 9 = + 15 = \text{error.}$$

Assume 20 and 10.

$$\frac{2^0}{2} + \frac{2^0}{3} + \frac{2^0}{6} = 20.$$

$$\frac{1^0}{2} + \frac{3}{4} \text{ of } 10 + \frac{1^0}{4} = 15.$$

$$20 - 15 = + 5 = \text{error.}$$

Errors.

$$+ 15 \times 20 = 300$$

$$+ 5 \times 24 = 120$$

$$\text{Diff.} = 10 \quad \text{diff.} = 180$$

$$180 \div 10 = 18 = \text{one number.}$$

$$30 - 18 = 12 = \text{other number.}$$

(15)

Suppose 1st horse to be worth £20.

$$20 + 50 = 70$$
;  $70 \div 2 = \text{£}35 =$  value of 2nd horse.

$$35 + 50 = 85$$
, but it should equal 60, i. e.  $(20 \times 3)$ .

$$\text{Then } 60 - 85 = - 25 = \text{error.}$$

Suppose 1st horse to be worth £60.

$$\text{£}60 + \text{£}50 = \text{£}110$$
;  $\text{£}110 \div 2 = \text{£}55 =$  worth of 2nd horse.

$$55 + 50 = 105$$
, but it should equal 180, i. e.  $(60 \times 3)$ .

$$180 - 105 = + 75 = \text{error.}$$

Errors.

$$75 \times 20 = 1500$$

$$25 \times 60 = 1500$$

$$\text{Sum} = 100$$

$$\text{Sum} = 3000$$

$$3000 \div 100 = \text{£}30 =$$
 value of 1st horse.

$$\text{£}30 + \text{£}50 = \text{£}80$$
;  $\text{£}80 \div 2 = \text{£}40 =$  value of 2nd horse.



(16)

Suppose there were 11 beggars.

$$11 \times 4 = 44; 44 + 6 = 50 = \text{number of pence he had.}$$

$$11 \times 6 = 66; 66 - 12 = 54 = \text{ " " "}$$

$$54 - 50 = + 4 = \text{error.}$$

Suppose there were 12 beggars.

$$12 \times 4 = 48; 48 + 6 = 54 = \text{pence he had.}$$

$$12 \times 6 = 72; 72 \div 12 = 60 = \text{pence he had.}$$

$$60 - 54 = + 6 = \text{error.}$$

Errors.

$$+ 6 \times 11 = 66$$

$$+ 4 \times 12 = 48$$

$$\text{Diff.} = 2 \quad \text{diff.} = 18, \text{ and } 18 \div 2 = 9 = \text{number of beggars.}$$

Page 357.

(7)

Here  $P = \$713.29$ ,  $r = .045$ , and  $t = 14$ .

$$\text{Then } A = P(1+r)^t, \text{ or } \log. A = \log. P + \log. (1+r) \times t \\ = 2.853267 + .019116 \times 14 = 3.120891 = \log. \text{ of } Ans.$$

Hence amount = \$1320.96.

(8)

Here  $n = 7$ ,  $r = .015$ .

$$\text{Then } t = \frac{\log. n. \quad 845098}{\log. (1+r) \quad .006466} = \frac{845098}{.006466} = 130.698 \text{ payments, and}$$

$$130.698 \div 4 = 32.674 \text{ years} = 32 \text{ years 8 months 2 days.}$$

(9)

Here  $A = \$1111.11$ ,  $P = 111.11$ , and  $r = .08$ .

$$\text{Then } t = \frac{\log. A - \log. P \quad 3.045757 - 2.045753 \quad 1.000004}{\log. (1+r) \quad .033424 \quad .033424} = \frac{1.000004}{.033424} \\ = 29.918 \text{ years} = 29 \text{ years 11 months.}$$

(10)

Here  $A = \$3333.33$ ,  $P = \$222.22$ , and  $t = 120$ .

$$\text{Then } r = \sqrt[t]{\frac{A}{P}} - 1; \text{ or } \log. (1 + r) = \frac{\log. A - \log. P}{t} =$$

$$\frac{3.522878 - 2.346784}{120} = \frac{1.176095}{120} = .0098007. \text{ Hence } 1 + r$$

$$= 1.0228, r = .0228, \text{ and rate per cent.} = 2\frac{7}{5}.$$

(11)

Here  $n = 2$  and  $r = .07$ .

$$\text{Then } t = \frac{\log. n}{\log. (1 + r)} = \frac{0.301030}{0.029384} = 10.2446 \text{ years} = 10 \text{ yrs.}$$

2 months 28 days.

(12)

Here  $A = \$100$ ,  $r = .0225$ , and  $t = 28$ .

$$\text{Then } P = \frac{A}{(1 + r)^t}, \text{ or } \log. P = \log. A - \log. (1 + r) \times t.$$

$$\text{Log. } P = 2 - 0.009664 \times 28 = 2 - 0.270592 = 1.729408.$$

Hence  $P = \$53.63$ .

(13)

Here  $P = \$2468.13$ ,  $r = .0375$ , and  $t = 26$ .

$$\text{Then } A = P (1 + r)^t, \text{ or } \log. A = \log. P + \log. (1 + r) \times t.$$

$$\text{Log. } A = 3.392368 + 0.015988 \times 26 = 3.392368 + 0.415688$$

$$= 3.808056.$$

Hence  $A = \$6427.705$ .

(14)

Here  $A = \$7137.40$ ,  $r = .0425$ , and  $t = 22$ .

$$\text{Then } P = \frac{A}{(1 + r)^t}, \text{ or } \log. P = \log. A - \log. (1 + r) \times t.$$

$$\text{Log. } P = 3.853540 - 0.018076 \times 22 = 3.853540 - 0.397672$$

$$= 3.455868.$$

Hence  $P = \$2856.723$ .

(15)

Here  $n = 19$ , and  $r = .0525$ .

$$\text{Then } t = \frac{\log. n}{\log. (1 + r)} = \frac{1.278754}{0.022222} = 57.5445 \text{ payments} =$$

$$28.7225 \text{ years} = 28 \text{ years } 9 \text{ months } 8 \text{ days.}$$

Page 360.

(3)

Here  $r = .03$ ,  $a = 500$ ,  $A = 8365$ .

$$\text{Formula IV. } t = \frac{\sqrt{\left\{ \frac{8rA}{a} + (2-r)^2 \right\}} - (2-r)}{2r}$$

$$= \frac{\sqrt{\left\{ \frac{8 \times .03 \times 8365 + (2 - .03)^2 \right\}}{500} \right\}}{2 \times .03} - (2 - .03)$$

$$= \frac{\sqrt{\left\{ \frac{2007.6}{500} + 3.8809 \right\}} - 1.97}{.06}$$

$$= \frac{\sqrt{(4.0152 + 3.8809)} - 1.97}{.06} = \frac{\sqrt{7.8961} - 1.97}{.06}$$

$$= \frac{2.81 - 1.97}{.06} = \frac{.84}{.06} = \frac{84}{6} = 14 \text{ payments} = 7 \text{ years.}$$

(4)

Here  $a = 112.50$ ,  $r = .015$ ,  $t = 44$ .

$$\text{Formula I. } A = at \left( 1 + \frac{(t-1)r}{2} \right)$$

$$= 112.50 \times 44 \left( 1 + \frac{(44-1) \times .015}{2} \right) = 4950 \times 1.3225$$

$$= \$6546.375.$$

(5)

Here  $a = 300$ ,  $A = 1680$ , and  $t = 5$ .

$$\begin{aligned} \text{Formula III. } r &= \frac{2(A - at)}{at(t-1)} = \frac{2(1680 - 300 \times 5)}{300 \times 5(5-1)} \\ &= \frac{2(1680 - 1500)}{300 \times 5 \times 4} = \frac{2 \times 180}{6000} = \frac{360}{6000} = .06. \end{aligned}$$

$$\therefore \text{Rate per cent} = .06 \times 100 = 6.$$

(6)

Here  $A = 2080$ ,  $r = .04$ , and  $t = 16$ .

$$\begin{aligned} \text{Formula II. } a &= \frac{2A}{t\{2 + (t-1)r\}} = \frac{2 \times 2080}{16\{2 + (16-1) \cdot 04\}} \\ &= \frac{4160}{16 \times (2 + 15 \times .04)} = \frac{4160}{16 \times 2.6} = \frac{4160}{41.6} = \frac{41600}{416} \end{aligned}$$

$= \$100 = 1$  payment or rent for half a year, hence yearly  
rent  $= \$100 \times 2 = \$200$ .

---

Page 366.

(5)

Here  $r = .04$ , and  $v = \$3000$ .Then  $a = vr = 3000 \times .04 = \$120$ .

(6)

Here  $a = 563$ , and  $v = 11260$ 

$$\text{Then } r = \frac{a}{v} = \frac{563}{11260} = \frac{1}{20} = .05, \text{ and hence rate}$$

per cent.  $= 5$ .

(7)

Here  $a = 75$ ,  $r = .05$ , and  $s = 14$ .

$$\begin{aligned} \text{Then } v &= \frac{a}{r(1+r)^s} = \frac{75}{.05 \times (1.05)^{14}} \\ \log. v &= \log. 75 - \log. (1.05) \times 14 \\ &= 1.875061 - (0.021189 \times 14 + \log. .05) \\ &= 1.875061 - (0.296646 + 2.698970) \\ &= 2.879445. \end{aligned}$$

$\therefore v =$  nat. number corresponding to the logarithm 2.879445, which is \$757.608.

(8)

Here  $a = \$90$ ,  $r = .04$ ,  $t = 12$ ,  $s = 7$ , and  $\therefore s + t = 19$ .

$$\begin{aligned} \text{Formula VII. } v &= \frac{a}{r} \left\{ \frac{1}{(1+r)^t} - \frac{1}{(1+r)^{s+t}} \right\} \\ &= \frac{90}{.04} \left\{ \frac{1}{(1.04)^{12}} - \frac{1}{(1.04)^{19}} \right\} = \frac{9000}{4} \left\{ \frac{1}{1.60101} - \frac{1}{2.10682} \right\} \\ &= 2250 \times (.624605 - .474649) = 2250 \times .149956 \\ &= \$337.3988. \end{aligned}$$

(9)

Here  $a = 1500$ , and  $r = .05$ .

$$\begin{aligned} \text{Formula VIII. } v &= \frac{a}{r} = \frac{1500}{.05} = \frac{150000}{5} = \$30000 \\ &= 20 \times 1500 \text{ or } 20 \text{ years' purchase.} \end{aligned}$$

(10)

Here  $a = 22$ ,  $v = 308.64366$ , and  $r = .04$ .

$$\begin{aligned} \text{Then Formula VI. } t &= \frac{\log. a - \log. (a - vr)}{\log. (1+r)} \\ &= \frac{\log. 22 - \log. (22 - 308.6436 \times .04)}{\log. (1.04)} \\ &= \frac{1.342423 - \log. (9.65425)}{0.017033} = \frac{1.342423 - 0.984707}{0.017033} \\ &= \frac{0.357716}{0.017033} = \frac{357716}{1117033} = 21 +. \end{aligned}$$

(11)  
Here  $a = 154$ ,  $t = 19$ , and  $r = .05$ .

$$\begin{aligned} \text{Formula IV. } v &= \frac{a}{r} \left\{ 1 - \frac{1}{(1+r)^t} \right\} \\ &= \frac{154}{.05} \times \left\{ 1 - \frac{1}{(1.05)^{19}} \right\} = \frac{15400}{5} \times \left\{ 1 - \frac{1}{2.5269} \right\} \\ &= 3080 \times (1 - .39574) = 3080 \times .60426 = \$1861.12 +. \end{aligned}$$

(12)  
Here  $A = 600$ ,  $t = 40$ , and  $r = .0375$ .

$$\begin{aligned} \text{Formula II. } a &= \frac{Ar}{(1+r)^t - 1} = \frac{600 \times .0375}{(1.0375)^{40} - 1} \\ &= \frac{22.5}{4.36034 - 1} = \frac{22.5}{3.36034} = \frac{2250000}{336034} \\ &= £6.6957 = £6 \text{ 13s. } 10\frac{1}{2}\text{d} +. \end{aligned}$$

(13)  
Here  $a = 8$ ,  $A = 187.315625$  and  $r = .03$ .

$$\begin{aligned} \text{Formula III. } t &= \frac{\log (Ar + a) - \log a}{\log (1+r)} \\ &= \frac{\log (187.315625 \times .03 + 8) - \log 8}{\log 1.03} \\ &= \frac{\log (5.61946875 + 8) - \log 8}{\log 1.03} \\ &= \frac{\log 13.61946875 - \log 8}{\log 1.03} = \frac{1.134160 - 0.903090}{0.012837} \\ &= \frac{0.231070}{0.012837} = \frac{231070}{12837} = 18. \end{aligned}$$

(14)  
Here  $A = 74$ ,  $r = .04$  and  $t = 30$

$$\begin{aligned} \text{Formula I. } A &= a \left\{ \frac{(1+r)^t - 1}{r} \right\} = \frac{74 \times \{(1.04)^{30} - 1\}}{.04} \\ &= \frac{74}{.04} \times (3.24332 - 1) = \frac{7400}{4} \times 2.24332 = \$4150.142 \end{aligned}$$

By Table, page 362. Amount of \$1 for 30 years, at 4 per cent.  
= \$56.08494

$$\text{Then } \$56.08494 \times 74 = \$4150.28.$$

Page 367.

## EXAMINATION PAPERS.

## FIRST SERIES.

(2)

$$\$7580 \times .19 = \$1440.20, \text{ and } \$7580 - \$1440.20 = \$6139.80.$$

D is to have one third as much as A, B, and C together, therefore he will have one-fourth of the whole.  $\frac{1}{4}$  of  $\$6139.80 = \$1534.95 = \text{D's share.}$

$\$6139.80 - \$1534.95 = \$4604.85 = \text{amount to be divided among A, B, and C.}$

B is to have  $\$90.90$  more than C.

A is to have  $\$111.11 + \$90.90 = 202.01$  " " "

$$\underline{\hspace{1.5cm}} \\ \$292.91$$

$\$4604.85 - \$292.91 = \$4311.94 = \text{three times C's share.}$

$$\$4311.94 \div 3 = \$1437.31\frac{1}{3} = \text{C's share.}$$

$$\$1437.31\frac{1}{3} + \$90.90 = \$1528.21\frac{1}{3} = \text{B's share.}$$

$$\$1528.21\frac{1}{3} + \$111.11 = \$1639.32\frac{1}{3} = \text{A's share.}$$

(3)

A and B working together can do the work in 96 hours, therefore in one hour they will do  $\frac{1}{96}$  of it.

A by himself can do the work in 192 hours; therefore in 1 hour he can do  $\frac{1}{192}$  of it.  $\frac{1}{96} - \frac{1}{192} = \frac{1}{192} = \text{part B can do in one hour.}$  Therefore he will require as many hours to finish it as  $\frac{1}{192}$  is contained times in the whole, i. e.  $1 \div \frac{1}{192} = 192$  hours. Then  $192 \div 14 = 13\frac{7}{7}$  days.

(4)

$$£179 \text{ 14s. } 8\frac{1}{2}\text{d.} = \$718.94\frac{7}{8} = \$718.94583.$$

$$\$718.94583 \div .00000048 = \$71894583333\frac{3}{8} \div 48 = \$1497803819.4444.$$

(5)

$$77 \mid 44..18..30..77..56..27$$

$$30 \mid 4..18..30 \qquad 8..27$$

$$36 \mid 2..8 \qquad 4..9$$

$$77 \times 30 \times 36 = 83160 = \text{l. c. m.}$$



(6)

Here  $n = 20$ , and  $r = .0525$ .

$$\text{Then } t = \frac{n-1}{r} = \frac{20-1}{.0525} = \frac{19}{.0525} = 361.9028 \text{ years} =$$

361 years 10 months 25 days.

(7)

7342163 octenary = 710e57 duodenary, and 61351 nonary = 1e454 duodenary.

$$710e57 \div 1e454 = 40.38 \text{ duodenary.}$$

(8)

$$783\frac{1}{2} = 3\frac{1}{2} + 10 \times 8 + 10 \times 10 \times 7.$$

lbs.	oz.	dwt.	grs.	×	$3\frac{1}{2}$	=	lbs.	oz.	dwt.	grs.
43	3	17	11				151	7	11	$2\frac{1}{2}$
			10							

433	2	14	14	×	8	=	3465	9	16	16
			10							

4332	3	5	20	×	7	=	30325	11	0	20
							33943	4	8	$14\frac{1}{2}$

(9)

Here  $a = 1$ , and  $r = \frac{1}{2}$ .

$$\text{Then } S = \frac{a}{1-r} = \frac{1}{1-\frac{1}{2}} = \frac{1}{\frac{1}{2}} = 2.$$

(10)

$$\frac{1}{2} \text{ of } \frac{2}{3} \text{ of } 192 \div \frac{2\frac{1}{2}}{3} = 64 \div \frac{\frac{5}{2}}{3} = 64 \div \frac{\frac{5}{6}}{\frac{3}{2}} = 64 \div \frac{\frac{5}{6}}{\frac{3}{2}}$$

$\frac{2\frac{1}{2}}{3}$	$\frac{\frac{5}{2}}{3}$	$\frac{\frac{5}{6}}{\frac{3}{2}}$	$\frac{\frac{5}{6}}{\frac{3}{2}}$
$\frac{4\frac{1}{2}}{2}$	$\frac{\frac{9}{2}}{2}$	$\frac{\frac{5}{2}}{3}$	$\frac{\frac{5}{6}}{\frac{3}{2}}$
$\frac{3}{2}$	$\frac{3}{2}$	$\frac{5}{6}$	$\frac{5}{6}$

$$= 64 \times \frac{8}{10} = 129\frac{1}{2}.$$



(11)

Logarithm of 129140163 = 8.111061.

 $8.111061 \div 17 = .477121 = \text{logarithm of } 3.$ 

(12)

Suppose 48	Suppose 36
18	18
<hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/>
66	54
84	63
<hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/>
- 18	- 9

Errors. Assumed numbers.

$$- 18 \times 36 = 648$$

$$- 9 \times 48 = 432$$

Difference of errors = 9

9)216 = sum of products.

---

  
24

## SECOND SERIES.

(13)

B is to have \$69.18 more than C.

A is to have \$69.18 + \$93.40 = \$162.58 " " "

---

  
\$231.76 $\$897.43 - \$231.76 = \$665.67 = \text{Amount to be divided equally amongst A, B, and C.}$  $\$665.67 \div 3 = \$221.89 = \text{C's share.}$  $\$221.89 + \$69.18 = \$291.07 = \text{B's "}$  $\$291.07 + \$93.40 = \$384.47 = \text{A's "}$ 

(14)

7 lbs. wheat	= 9 lbs. rye	7 = 9	
5 " rye	= 8 " oats	5 = 8	
13 " oats	= 21 " buckwheat	13 = 21	7
27 " buckwheat	= 20 " barley	27 = 20	4
24 " barley	= 26 " peas	3 24 = 26	2
11 " peas	= 35 " potatoes	11 = 35	
x " potatoes	= 16 " wheat	x = 16	

$$4 \times 2 \times 35 \times 16 = 4480$$

$$\text{Ans. } \frac{4480}{3 \times 11} = \frac{4480}{33} = 135\frac{20}{33}$$

(15)

$\frac{3}{8}$  of  $4\frac{1}{2}$  of  $7\frac{1}{2}$  of  $\frac{9}{19\frac{1}{2}}$  of  $\frac{5}{9}$  of 3 oz. 4 drs. 2 scr. 5 grs. =  $\frac{3}{8}$  of  $\frac{9}{2}$  of

$\frac{3^9}{8}$  of  $\frac{1^8}{3^9}$  of  $\frac{5}{9}$  of 1725 grs. = 10350 grs.

$\frac{6}{11}$  of  $\cdot 63$  of  $2\frac{3}{4}$  of  $\frac{3}{13}$  of  $6\frac{1}{2}$  times 7 lbs. 3 oz. =  $\frac{6}{11}$  of  $\frac{7}{11}$  of  $\frac{121}{42}$   
of  $\frac{3}{13}$  of  $\frac{1}{2}$  of 41760 grs. = 62640 grs.

$$10350 \div 62640 = \cdot 165229.$$

(16)

Dissimilar.                      Similar.                      Similar and Coterminous.

$$623\cdot 4279\dot{3} = 623\cdot 42793\dot{7}93 = 623\cdot 42793\dot{7}9379\dot{3}$$

$$93\cdot 42671\dot{9}2 = 93\cdot 42671\dot{9}2 = 93\cdot 426719\dot{2}929\dot{2}$$

$$\text{Difference} = 530\cdot 00121864500$$

(17)

$$\$1.00 - \$0.046 = \$0.954, \text{ and } \$7493 \div 0.954 = \$7854.29.$$

(18)

36 : 20 weeks  
6 : 5 days  
9 : 11 hours  
11 : 24 cellars  
20 : 22 feet long  
16 : 22 feet wide  
5 : 4 feet deep

$$\left. \begin{array}{l} 36 : 20 \text{ weeks} \\ 6 : 5 \text{ days} \\ 9 : 11 \text{ hours} \\ 11 : 24 \text{ cellars} \\ 20 : 22 \text{ feet long} \\ 16 : 22 \text{ feet wide} \\ 5 : 4 \text{ feet deep} \end{array} \right\} \begin{array}{l} \\ \\ \\ \therefore 18 \text{ men:} \\ \\ \\ \end{array} \frac{\begin{array}{r} 6 \qquad \qquad \qquad 2 \quad 11 \\ 18 \times 20 \times 5 \times 11 \times 24 \times 22 \times 22 \times 4 \\ \hline 36 \times 6 \times 9 \times 11 \times 20 \times 16 \times 5 \\ \begin{array}{r} 3 \qquad \qquad \qquad 4 \\ 8 \qquad \qquad \qquad 2 \end{array} \end{array}}$$

$$= \frac{11 \times 22}{9} = 26\frac{2}{3}.$$

(19)

$\frac{1}{4}$  of  $\frac{2}{3}$  of  $\frac{4}{7} = \frac{2}{35}$ ; and if  $\frac{6}{35}$  of a certain number =  $\frac{7}{35}$ ,  $\frac{1}{35} = \frac{1}{35}$ ,  
and  $\frac{2}{35} = \frac{1}{35} \times 35 = 12$ .

$$\left( \left\{ \left[ \left[ (12 \times 12\frac{1}{2}) + 31 \right] \times 3 \right] - 33 \right\} \times 300 \right] \div 17 \left. \right\} \times 9 \right) = 81000.$$

(20)

$$\begin{array}{r|l} 1176 & 480.. 768.. 348.. 1176 \\ 32 & 20.. 32.. 29 \\ 145 & 5 \qquad \qquad 29 \end{array}$$

$$1176 \times 32 \times 145 = 5456640.$$

(21)

	838)171347(204	
	<u>1676</u>	
	3747	
	<u>3352</u>	
17598)46090(2	395)838(2	
35196	<u>790</u>	
	<u>48)395(8</u>	
10894)17598(1	384	
10894	<u>11)48(4</u>	
	44	
6704)10894	<u>4)11(2</u>	
6704	8	
4190)6704(1	<u>3)4(1</u>	
4190	3	
2514)4190(1	<u>1)3</u>	
2514	3	
1676)2514(1	<u>3</u>	
1676		
838)1676(2		
1676		

As no number greater than unity will divide all of them without a remainder, they have no G. C. M.

(22)

$\$12000 \times 4 = \$48000$	
$\$12000 + \$8000 = \$20000 \times 2 = \$40000$	
	<u><math>\\$88000 =</math> product of A's stock and time.</u>
$\$25000 \times 3 = \$75000$	
$\$25000 - \$10000 = \$15000 \times 3 = \$45000$	
	<u><math>\\$120000 =</math> product of B's stock and time.</u>
	$\$35000 \times 2 = \$70000$

(Continued on next page.)

(22 continued.)

$$\frac{2}{7} \text{ of } \$35000 = \$10000. \quad \$35000 - \$10000 = \$25000 \times 4 = \underline{\$100000}$$

= product of C's stock and time.

$$\$88000 + \$120000 + \$170000 = \$378000 = \text{sum of the products of stocks and times.}$$

$$\text{Then } \$378000 : \$88000 :: \$15000 : \frac{15000 \times 88000}{378000} = \$3492.06$$

= A's share.

$$\$378000 : \$170000 :: \$15000 : \frac{15000 \times 170000}{378000} = \$6746.03$$

= C's share.

$$\$15000 - (\$3492.06 + \$6746.03) = \$4761.91 = \text{B's share.}$$

(23)

A's gain in 5 months = \$125 ∴ his gain for 9 months  
 =  $1\frac{1}{2} \times \$125$ ..... = \$225

B's gain in 6 months = \$125 ∴ his gain for 9 months  
 =  $1\frac{1}{2} \times \$125$ .. : ..... = \$187½

C' gain in 9 months ..... = \$125

Sum = \$537½

$$\text{Then } \$537\frac{1}{2} : \$225 :: \$400 : \frac{400 \times 225}{537\frac{1}{2}} = \$167\frac{1}{3} = \text{A's stock.}$$

$$\$537\frac{1}{2} : \$187\frac{1}{2} :: \$400 : \frac{400 \times 187\frac{1}{2}}{537\frac{1}{2}} = \$139\frac{2}{3} = \text{B's stock.}$$

$$\$537\frac{1}{2} : \$125 :: \$400 : \frac{400 \times 125}{537\frac{1}{2}} = \$93\frac{1}{3} = \text{C's stock.}$$

(24)

$$\frac{1}{6} + \frac{1}{8} + \frac{1}{10} + \frac{1}{12} = \frac{57}{120} = \frac{19}{40} = \text{part of the cistern filled in one hour when the four pipes are left open.}$$

$$\frac{1}{6} + \frac{1}{8} + \frac{1}{4} + \frac{1}{3} = \frac{111}{120} = \frac{37}{40} = \text{part of the cistern emptied in one hour when the four are left open.}$$

$$\frac{37}{40} - \frac{19}{40} = \frac{18}{40} = \frac{9}{20} = \text{part of the cistern which remains filled after the eight pipes have been left open for one hour. And if } \frac{19}{40} \text{ of the cistern are emptied in one hour, it will take } 1 \div \frac{19}{40} = 2\frac{2}{19} \text{ hours to empty the whole of it.}$$

THIRD SERIES.

(26)

As often as the first receives 4 the second receives 3, therefore as often as the first receives 6 the second receives  $4\frac{1}{2}$ . Then  $6 + 4\frac{1}{2} + 7 = 17\frac{1}{2}$ .

loaves.

$$17\frac{1}{2}:6 :: 2310:\frac{2310 \times 6}{17\frac{1}{2}} = 792 \text{ loaves} = \text{number the first receives.}$$

$$17\frac{1}{2}:4\frac{1}{2} :: 2310:\frac{2310 \times 4\frac{1}{2}}{17\frac{1}{2}} = 594 \text{ " } = \text{ " second "}$$

$$17\frac{1}{2}:7 :: 2310:\frac{2310 \times 7}{17\frac{1}{2}} = 924 \text{ " } = \text{ " third "}$$

(27)

To produce a mixture worth 8 cents a pound, we require 4 lbs. @ 12 cents, 4 @ 4 cents, 1 @ 5 cents, and 3 @ 9 cents. or 3 lbs. @ 12 cents, 1 @ 4 cents, 4 @ 5 cents, and 4 @ 9 cents, lbs.lbs. lbs. lbs.lbs. lbs.

Then 4:72::4:72 lbs. @ 4 cts. or 3:72::1:24 lbs. @ 4 cts.  
 4:72::1:18 lbs. @ 5 cts. 3:72::4:96 lbs. @ 5 cts.  
 4:72::3:54 lbs. @ 9 cts. 3:72::4:96 lbs. @ 9 cts.

(28)

Here  $A = \$4444.44$ ,  $r = .0444$ , and  $t = 4.3\frac{1}{3}$ .

$$\text{Then } P = \frac{A}{1+rt} = \frac{\$4444.44}{1+.0444 \times 4.3\frac{1}{3}} = \frac{\$4444.44}{1.19289\frac{1}{3}} = \$3725.764.$$

(29)

$$\$1.00 - \$0.0225 = \$0.9775. \quad \$23470 \div 0.9775 = \$24010.23.$$

(30)

Here  $A = \$7493.47$ ,  $r = .07$ , and  $t = 8$ .

$$\text{Then } P = \frac{A}{1+rt} = \frac{7493.47}{1+.07 \times 8} = \frac{7493.47}{1.56} = \$4803.5064.$$

(31)

\$17460 ÷ 1.03125 = \$16930.909 = sum to be invested.

16930.909 ÷ 2.95 = 5739.29 yds. cloth.

16930.900 × .02½ = \$423.27272 = ad valorem duty.

\$17460 + \$1347.90 + \$479.40 + \$169.83 + \$423.27272 =  
\$19880.40272 = whole cost.

\$25000 - \$19880.40272 = \$5119.59728 = whole gain.

Then \$19880.40272 : \$100 :: \$5119.59728 :  $\frac{5119.59728 \times 100}{19880.40272} =$

27.75 = 27½ per cent.

(32)

V.	=	III.	=	VIII.	=	XII.
134234		21122021		12701		3281
5		3		8		12
—		—		—		—
8		7		10		38
5		3		8		12
—		—		—		—
44		22		87		464
5		3		8		12
—		—		—		—
222		68		696		5569 den.
5		3		8		
—		—		—		
1113		206		5569 den.		
5		3				
—		—				
5569 den.		618				
		3				
		—				
		1856				
		3				
		—				
		5569 den.				

(33)

¾ of 4½ of  $\frac{9\frac{3}{4}}{28}$  of  $\frac{1}{16}$  of  $\frac{1}{3}$  of £43 18s. 11½d. £43 18s. 11½d. =  
\$175.79½.

(Continued on next page.)

(33 continued.)

$$\frac{7}{8} \text{ of } \frac{2}{3} \text{ of } \frac{3^2}{13} \text{ of } \frac{1}{15} \text{ of } \frac{1}{7} \text{ of } \$175 \cdot 79\frac{1}{8} = \frac{3}{7} \text{ of } \frac{9}{2} \text{ of } \frac{15}{1} \text{ of } \frac{1}{15} \text{ of } \frac{7}{9} \text{ of } \$175 \cdot 79\frac{1}{8} = \frac{7}{8} \text{ of } \$175 \cdot 79\frac{1}{8} = \$263 \cdot 6875.$$

$$3\frac{3}{8} \text{ of } \frac{1}{17\frac{1}{2}} \text{ of } \cdot 56 \text{ of } 1 \cdot 75 \text{ of } 6\frac{1}{2} \text{ times } \$97 \cdot 18 =$$

$$\frac{3^2}{9} \text{ of } \frac{1}{25} \text{ of } \frac{56}{100} \text{ of } \frac{175}{100} \text{ of } 6\frac{1}{2} \text{ times } \$97 \cdot 18; 6\frac{1}{2} \text{ times } \$97 \cdot 18 = \$631 \cdot 67.$$

$$\frac{85}{9} \text{ of } \frac{2}{85} \text{ of } \frac{55}{100} \text{ of } \frac{175}{100} \text{ of } \$631 \cdot 67 = \frac{49}{9 \times 25} \text{ of } \$631 \cdot 67$$

$$= \frac{49}{225} \text{ of } \$631 \cdot 67.$$

$$\frac{19}{25} \text{ of } \$631 \cdot 67 = \$137 \cdot 5636.$$

$$\text{Then } \$263 \cdot 6875 - \$137 \cdot 5636 = \$126 \cdot 1239 = \text{difference.}$$

(34)

$$7 = 1 \div 13 \therefore \log. \frac{1}{13} = \log. 1 - \log. 13 = 0 - 1 \cdot 113943 = \overline{2} \cdot 886057.$$

$$19 \cdot 5 = 3 \times 13 \times 5 \div 10 \therefore \log. 19 \cdot 5 = \log. 3 + \log. 13 + \log. 5 - \log. 10.$$

$$\log. 3 = 0 \cdot 477121$$

$$\log. 13 = 1 \cdot 113943$$

$$\log. 5 = \log. 10 - \log. 2 = 1 - 0 \cdot 301030 \therefore \log. 5 = 0 \cdot 698970$$

$$\text{Sum} = 2 \cdot 290043$$

$$\text{From which take } \log. 10 = 1$$

$$\text{Rem.} = 1 \cdot 290034$$

$$= \log. 19 \cdot 5.$$

$$1125 = 5^3 \times 3^2 \therefore \log. 1125 = (\log. 5) + 3 + (\log. 3) \times 2.$$

$$\log. 5 = 0 \cdot 698970 \times 3 = 2 \cdot 096910$$

$$\log. 3 = 0 \cdot 477121 \times 2 = 0 \cdot 954242$$

$$\text{Sum} = 3 \cdot 051152 = \log. \text{ of } 1125.$$

(Continued on next page.)



(34 continued.)

$$28 \cdot 16 = 28\frac{1}{6} = \frac{16^2}{6} = 13^2 \div 6 \therefore \log. 28 \cdot 16 = (\log. 13) \times 2 - (\log. 2 + \log. 3).$$

$$\log. 13 = 1 \cdot 113943 \times 2 = 2 \cdot 227886$$

$$(\log. 2 + \log. 3) = (0 \cdot 301030 + 0 \cdot 477121) = 0 \cdot 778151$$

$$\text{Diff.} = \underline{\underline{1 \cdot 449735}}$$

$$= \log. 28 \cdot 16.$$

$$65000 = 13 \times 5 \times 1000 \therefore \log. 65000 = \log. 13 + \log. 5 + \log. 1000.$$

$$\log. 13 = 1 \cdot 113943$$

$$\log. 5 = 0 \cdot 698970$$

$$\log. 1000 = 3$$

$$\text{Sum} = \underline{\underline{4 \cdot 812913}} = \log. \text{ of } 65000.$$

$$\log. \cdot 0005 = \log. 5 \text{ with characteristic changed to } -4 = \bar{4} \cdot 698970.$$

$$152 \cdot 1 = 3^2 + 13^2 \div 10 \therefore \log. 152 \cdot 1 = (\log. 3) \times 2 + (\log. 13) \times 2 - \log. 10.$$

$$\log. 3 = 0 \cdot 477121 \times 2 = 0 \cdot 954242$$

$$\log. 13 = 1 \cdot 113943 \times 2 = 2 \cdot 227886$$

$$\text{Sum} = \underline{\underline{3 \cdot 182128}}$$

$$\text{From which take } \log. 10 = 1$$

$$\text{Diff.} = \underline{\underline{2 \cdot 182128}} = \log. 152 \cdot 1.$$

$$8 \cdot 112 = 2^4 \times 13^2 \times 3 \div 1000 \therefore \log. 8 \cdot 112 = (\log. 2) \times 4 + (\log. 13) \times 2 + \log. 3 - \log. 1000.$$

$$\log. 2 = 0 \cdot 301030 \times 4 = 1 \cdot 204120$$

$$\log. 13 = 0 \cdot 113943 \times 2 = 2 \cdot 227886$$

$$\log. 3 = \quad \quad \quad 0 \cdot 477211$$

$$\text{Sum} = \underline{\underline{3 \cdot 909217}}$$

$$\text{From which take } \log. 1000 = 3$$

$$\text{Diff.} = \underline{\underline{0 \cdot 909217}} = \log. 8 \cdot 112.$$



(35)

		XII.
$t^2 \times 300 = 21000$		871tet·72 (1t8·22
$t \times 8 \times 30 = 1800$		6e4
$8^2 = 54$		179tet
	22854	159768
$t 8^2 \times 300 = 2454000$		20352720
$t 8 \times t \times 30 = 22800$		
$t^2 = 84$		
	2476884	1e1372e4
$t 8 t^2 \times 300 = 249961000$		517428000
$t 8 t \times 2 \times 30 = 54500$		
$2^2 = 4$		
	2499e5504	4977t t t 08
		3e8301e4

(36)

$\frac{1}{6} + \frac{1}{12} + \frac{1}{7} + 5$  years =  $\frac{1}{2}$  of life time + 5 years = age at birth of son.  
 $\frac{2}{3} - (\frac{1}{6} + 5) = \frac{1}{3}$  of his life time — 5 years = time he lived after birth of son.

$\frac{1}{2}$  of father's life time — 5 years — 4 years = age of son =  $\frac{1}{2}$  father's age.

$\frac{1}{3}$  of father's life time — 9 years =  $\frac{1}{2}$  father's age.

∴ 9 years is the difference between  $\frac{1}{3}$  and  $\frac{1}{2}$  of father's age.

∴ 9 years is equal to  $\frac{3}{8}$  of father's age.

If 9 years is  $\frac{3}{8}$  of his age,  $\frac{1}{8}$  will be the  $\frac{1}{3}$  of 9 which is 3 years.

If  $\frac{1}{8}$  is 3 years,  $\frac{2}{8}$  or the whole age will be  $3 \times 28 = 84$  years.

*Or by Position.*

Assume 42 for father's age at death, the son's age = 21.

$\frac{1}{6} + \frac{1}{12} + \frac{1}{7} + 5 = \frac{1}{2} + 5$ ;  $\frac{1}{2}$  of 42 =  $16\frac{1}{2}$  and  $16\frac{1}{2} + 5 = 21\frac{1}{2}$  = age of father when son was born.

∴ he lived after birth of his son  $42 - 21\frac{1}{2} = 20\frac{1}{2}$  years.

(Continued on next page.)

(36 continued.)

By the question he lived  $21 + 4 = 25$  years.

The error  $25 - 20\frac{1}{2} = -4\frac{1}{2}$ .

Assume 98 for father's age, then son's age =  $\frac{1}{2}$  of 98 = 49.

$\frac{1}{6} + \frac{1}{12} + \frac{1}{7} + 5 = \frac{11}{8} + 5$ ;  $\frac{11}{8}$  of 98 =  $38\frac{1}{2}$ , and  $38\frac{1}{2} + 5 = 43\frac{1}{2}$   
= age of father at birth of son.

$\therefore$  he lived after birth of his son  $98 - 43\frac{1}{2} = 54\frac{1}{2}$  years.

But by the question he lived  $49 + 4$  years = 53 years.

Then  $53 - 54\frac{1}{2} = +1\frac{1}{2}$  = error.

Errors.

$$-4\frac{1}{2} \times 98 = 392$$

$$+1\frac{1}{2} \times 42 = 63$$

$$\begin{array}{r} \hline \text{Sum} = 6 \qquad \qquad \qquad 504 \end{array}$$

$$504 \div 6 = 84 = \text{father's age.}$$

(37)

m.	fur.	per.	yds.	ft.	in.	÷	fur.	per.	yds.
63	3	7	3	2	7		7	23	3 $\frac{1}{2}$
8							40		
<hr/>									
507							303		
40							5 $\frac{1}{2}$		
<hr/>									
20287							1518 $\frac{1}{2}$		
5 $\frac{1}{2}$							151 $\frac{1}{2}$		
<hr/>									
101438							1670 $\frac{1}{2}$		
10143 $\frac{1}{2}$							3		
<hr/>									
111581 $\frac{1}{2}$							5010 $\frac{1}{2}$		
3							12		
<hr/>									
334746 $\frac{1}{2}$							60129		
12									
<hr/>									
4016965									

(Continued on next page.)

(37 continued.)

60129)4016965(66·80578 times  
360774

409225

360774

484510

481032

347800

300645

471550

420903

506470

481032

(38)

6·3 ÷ ·000000274

274)6300000000(22992700·72992700

548

820

548

2720

2466

2540

2466

740

548

1920

1918

2000

1918

820

548

2720

2466

2540

2466

740

548

1920

1918

200 remainder.

(39)

$$\frac{7}{8} \text{ yds.} : 6\frac{3}{11} \text{ yds.} :: \$1\frac{1}{7} : \frac{8}{7} \times \frac{69}{11} \times 1\frac{1}{7} = 1\frac{176}{105} = \$5.482.$$

(40)

$$I = Prt = \$4237.71 \times .065 \times 1.67 = \$460.0034205.$$

(41)

$$t = \frac{A - P}{Pr} = \frac{\$1000 - \$674.30}{\$674.30 \times .085} = \frac{325.70}{57.3155} = 5.68258 \text{ years} =$$

5 years 8 months 5.7288 days.

(42)

By Table, page 260, the amount of \$1 for 14 payments at 4 per cent is \$1.73168.

Then \$1.73168  $\times$  813.71 = \$1409.0853328 = Amount.

Subtract 813.71

Difference = 595.3753328 = Interest.

(43)

\$300	$\times$	0	=	0	
700	$\times$	4	=	2800	
750	$\times$	7	=	5250	
850	$\times$	9	=	7650	
400	$\times$	13	=	5200	
1300	$\times$	19	=	24700	
<hr/>					
4300	)			45600	( 10 months 18 $\frac{2}{3}$ days.
				4300	
				<hr/>	
				2600	
				30	
				<hr/>	
				78000	= days.
				4300	
				<hr/>	
				35000	
				34400	
				<hr/>	
				49600	

(44)

23 per cent of \$4200 =  $\frac{23}{100}$  of 4200 = \$966.00, and \$4200 — \$966.00 = \$3234.00. E has half as much as A, B, C, and D together; therefore E has *one-third* of \$3234.00, which is \$1078.00.

Deducting E's share, \$1078, from \$3234, the whole sum to be divided, there remains \$2156 to be divided among A, B, C, and D. Now D gets a certain amount; C gets \$42.11 more than D; B gets \$61.34 (42.11 + 19.23) more than D; and A gets \$78.44 (61.34 + 17.10) more than D. Together they get, then, *four times* D's share, together with \$42.11 + \$61.34 + \$8.44, or, in other words, four times D's share, together with \$181.89.

That is, four times D's share, together with \$181.89 is equal to \$2156.

Hence \$2156.00 — \$181.89 = \$1974.11 = four times D's share.

Then \$1974.11 ÷ 4 = \$493.5275 = D's share.

$$\text{Add } 42.11$$

$$\text{Sum } \$535.6375 = \text{C's share.}$$

$$\text{Add } 19.23$$

$$\text{Sum } \$554.8675 = \text{B's share.}$$

$$\text{Add } 17.10$$

$$\text{Sum } \$571.9675 = \text{A's share.}$$

(45)

$$P = \frac{A}{1+rt} = \frac{\$3786.80}{1+1.76^*} = \frac{3786.80}{2.76} = \frac{378680}{276} = \$1372.02898 +$$

(46)

$$\frac{\{ (3\frac{3}{4} - 2\frac{7}{10}) \times .46 \div \frac{2}{3} \text{ of } .142857 \} \div 8\frac{1}{2} \text{ times } (\frac{1}{2} + \frac{1}{3} + \frac{1}{5} - \frac{337}{10})}{}$$

$$\{ (.73 \times .12345 \div \frac{77}{100}) + \frac{2}{7} + 9\frac{2}{5} + 17\frac{1}{11} \} \div 27.4922077$$

$$\frac{\{ (3\frac{3}{8} - 2\frac{4}{10}) \times \frac{15}{99} \div \frac{2}{3} \text{ of } \frac{1}{7} \} \div \frac{1}{2} \times (\frac{35}{10} + \frac{10}{10} + \frac{1}{10} - \frac{337}{10})}{}$$

$$\{ (\frac{55}{10} \times \frac{12345}{99000} \div \frac{77}{100}) + \frac{2}{7} + 9\frac{2}{5} + 17\frac{1}{11} \} \div 27.4922077$$

(Continued on next page.)

$$* rt = .16 \times 11 = 1.76.$$

(46 continued.)

$$\begin{aligned}
 &= \frac{(51 \times \frac{16}{99} \times \frac{5}{2} \times 7) \times \frac{2}{17} \times \frac{2310}{1610}}{\left\{ \left( \frac{11}{18} \times \frac{679}{8800} \times \frac{759}{679} \right) + 27 \frac{151}{388} \right\} \div 27 \cdot 4922077} \\
 &= \frac{\frac{391}{66} \times \frac{2}{17} \times \frac{2310}{1610}}{\left( \frac{1}{10} + 27 \frac{151}{388} \right) \div 27 \cdot 4922077} = \frac{1}{27 \frac{779}{70} \div 27 \cdot 4922077} \\
 &= \frac{1}{27 \cdot 4922077 \div 27 \cdot 4922077} = \frac{1}{1} = 1
 \end{aligned}$$

(47)

312312302 quaternary = 224690 decimal scale.

2312132 quaternary = 11678 decimal scale.

Sum = 236368

4234 quinary = 569 decimal, and  $569 \times 23011 = 13093259$ . $236368 \times 13093259 = 3094827443312$ . $555 + 444 + 333 + 222 + 111$  senary = 2553 senary = 645 decimal. $3094827443312 - 645 = 3094827442667$ .

6542 septenary = 2333 decimal.

 $3094827442667 \div 2333 = 1326544124 \frac{1375}{333}$  den.

x.	VIII.
1326544124	= 11704272374
x.	VIII.
1375	= 2537
x.	VIII.
2333	= 4435
x.	VIII.
$\therefore 1326544124 \frac{1375}{333} = 11704272374 \frac{4435}{333}$ .	

(48)

$$\cdot 1 = \frac{1}{10} \text{ and } \left( \frac{1}{10} \right)^2 = \frac{1}{100} = \cdot 01$$

$$\cdot 1 = \frac{1}{9} \text{ and } \left( \frac{1}{9} \right)^2 = \frac{1}{81} = \cdot 012345679.$$

## FIFTH SERIES.

(50)

Assume 27 | 2..9..16..27..48 and 81; strike out 2, 9 and 16,  
16 3 since they are con-  
tained as factors in  
the others.

$$\text{The l. c. m.} = 27 \times 16 \times 3 = 1296.$$

(51)

$$t = \frac{\log. n}{\log. (1+r)} = \frac{\log. 7}{\log. (1.06)} = \frac{0.845098}{0.025306} = 33.395 \text{ years.}$$

(52)

20 miles = 1267200 inches; and 14 ft. 10 in. = 178 inches.  
 $1267200 \div 178 = 7119 \frac{9}{8}$  times.

(53)

$1749600 = 2^5 \times 3^7 \times 5^2$ ; increasing each index by unity and multiplying, we have  $6 \times 8 \times 3 = 144$ .

(54)

$$\begin{aligned} \frac{2}{3} \text{ of } \frac{96}{\frac{5}{6}} \div \frac{\frac{1}{2} \text{ of } 7}{\frac{3\frac{1}{2}}{2}} &= \frac{2}{3} \times \frac{\frac{96}{1}}{\frac{5}{6}} \div \frac{\frac{7}{2}}{\frac{3\frac{1}{2}}{2}} = \frac{2}{3} \times \frac{576}{5} \div \frac{7}{1\frac{3}{2}} \\ &= \frac{2}{3} \times \frac{576}{5} \div \frac{7}{\frac{3}{2}} = \frac{2}{3} \times \frac{576}{5} \times \frac{3}{7} = 35\frac{2}{7}. \end{aligned}$$

(55)

A can do the whole work in 12 days, therefore he can do  $\frac{1}{12}$  in 1 day. A and B together can do the work in 5 days, therefore they can do  $\frac{1}{5}$  in 1 day. Therefore B can do  $\frac{1}{5} - \frac{1}{12} = \frac{7}{60}$  in 1 day, and he will require as many times 1 day to do the whole work as  $\frac{7}{60}$  is contained times in 1, i. e.  $1 \div \frac{7}{60} = \frac{60}{7} = 8\frac{4}{7}$  days.

(56)

$$P = \frac{A}{(1+r)^t}; \log. P = \log. A - \log. (1+r) \times t = \log. 8899.77$$

$$- \log. (1.06) \times 22 = 3.949378 - 0.025306 \times 22$$

$$= 3.949378 - 0.556732 = 3.392646, \text{ and } \log. 3.392646$$

$$= \$2469.71.$$

By Table, page 260, amount of \$1 at 6 per cent. for 22 payments = 3.60354.

$$\text{Then } \$8899.77 \div 3.60354 = \$2469.73 \text{ nearly.}$$

(57)

Let the 1st number be 2. Then  $2 \times 2 = 4$

$$1\frac{1}{2} \times 3 = 4$$

$$10 - (2 + 1\frac{1}{2}) = 10 - 3\frac{1}{2} = 6\frac{1}{2} + 4 = 26\frac{1}{2}, \text{ but it should equal 4.}$$

$$\text{Therefore } 26\frac{1}{2} - 4 = +22\frac{1}{2} = \text{error.}$$

Let  $1\frac{1}{2}$  be the 1st number; then  $1\frac{1}{2} \times 2 = 3$

$$1 \times 3 = 3$$

$$10 - (1\frac{1}{2} + 1) = 10 - 2\frac{1}{2} = 7\frac{1}{2} \times 4 = 30, \text{ but it should } = 3.$$

$$\text{Therefore } 30 - 3 = +27 = \text{error.}$$

Errors.

$$+ 27 \times 2 = 54$$

$$+ 22\frac{1}{2} \times 1\frac{1}{2} = 44$$

$$\text{Diff.} = 4\frac{1}{3} \quad \text{diff.} = 20, \text{ and } 20 \div 4\frac{1}{3} = 4\frac{8}{13} = \text{1st number.}$$

$$4\frac{8}{13} \times 2 = 9\frac{3}{13} = \text{1st product.}$$

$$\text{Second number} = 9\frac{3}{13} \div 3 = 3\frac{1}{13} \times 3 = 9\frac{3}{13} = \text{2nd product.}$$

$$10 - 7\frac{9}{13} = 2\frac{4}{13} \times 4 = 9\frac{3}{13} = \text{3rd product.}$$

(58)

Suppose A has 40; then B has  $110 - 40 = 70$ , and C has  $130 - 70 = 60$ .

A and C together have  $40 + 60 = 100$ , but it should be 120.

$$\text{Therefore } 100 - 120 = -20 = \text{error.}$$

Suppose A has 80; then B has  $110 - 80 = 30$ , and C has  $130 - 30 = 100$ .

A and C together have  $80 + 100 = 180$ , but they should have 120.

$$\text{Therefore } 180 - 120 = +60 = \text{error.}$$

(Continued on next page.)



(58 continued.)

Errors.

$$+ 60 \times 40 = 2400$$

$$- 20 \times 80 = 1600$$

$$\text{Sum} = 80 \qquad \text{Sum} = 4000$$

4000  $\div$  80 = 50 = number A has.

Then B has 110 - 50 = 60, and C has 130 - 60 = 70.

$$50 + 60 + 70$$

$\frac{\quad}{3} = 60 = \text{each man's share when equally divided.}$

(59)

Formula I, p. 333.  $l = a + (n - 1)d = 7 + (47 - 1) \times 4$   
 $= 7 + 46 \times 4 = 7 + 184 = 191.$

Formula VI, p. 333.  $s = \frac{\{2a + (n - 1)d\}n}{2}$   
 $= \{2 \times 7 + (93 - 1) \times 4\} \frac{93}{2}$   
 $= (14 + 368) \times \frac{93}{2} = \frac{382 \times 93}{2} = 17763.$

(60)

$t = \frac{\log. n}{\log. (1 + r)} = \frac{\log. 21}{\log. (1.07)} = \frac{1.322219}{0.029384} = 44.997 \text{ years.}$

## SIXTH SERIES.

(61)

B gets \$196.87 more than C, and A gets \$387 + \$196.87 = \$583.87 more than C, therefore together they get *three* times C's share, together with \$196.87 + \$583.87, i. e. three times C's share, together with \$780.74; but together they get \$3700.

Therefore \$3700 = three times C's share, together with \$780.74, or \$3700 - \$780.74 = \$2919.26 = three times C's share.

Hence \$2919.26  $\div$  3 = \$973.08 $\frac{2}{3}$  = C's share.

$$\text{Add} \quad 196.87$$

$$\text{Sum} = \$1169.95\frac{2}{3} = \text{B's share.}$$

$$\text{Add} \quad 387.00$$

$$\text{Sum} = \$1556.95\frac{2}{3} = \text{C's share.}$$

(62)

$$5716 = 2^2 \times 1429$$

$$1 \quad \dots \quad 2 \quad \dots \quad 4$$

$$1 \quad \dots \quad 1429$$

---


$$1 \quad \dots \quad 2 \quad \dots \quad 4 \quad \dots \quad 1429 \quad \dots \quad 2858 \quad \dots \quad 5716$$

(63)

$$\left\{ (17\frac{7}{2} - 10\frac{5}{8}) - (.4 + \frac{1}{2} + .9 - \frac{1}{2}) \right\} \div (.8378 \div \frac{1}{2} \text{ of } 31)$$

$$.6322632 \times \frac{1}{2} \text{ of } 9\frac{1}{4} \div (\frac{1}{2} \text{ of } 4\frac{1}{2} \text{ of } \frac{1}{11} \text{ of } 85\frac{1}{37} \div 101)$$

$$6\frac{3}{8} - 1 \div (\frac{8378}{9999} \times \frac{3}{2})$$

---


$$\frac{\frac{8322}{9999} \times \frac{1}{2} \times \frac{37}{4} \div (\frac{1}{2} \times \frac{37}{9} \times \frac{1}{11} \times \frac{3161}{37} \times \frac{1}{101})}{5\frac{3}{8} \times \frac{8378}{9999} \times \frac{3}{2}}$$

---


$$\frac{\frac{8322}{9999} \times \frac{1}{2} \times \frac{37}{4} \times \frac{5}{4} \times \frac{37}{37} \times \frac{11}{3161} \times \frac{101}{101}}{2^8 \times \frac{37}{37} \times \frac{3}{2}}$$

---


$$\frac{\frac{3161}{101} \times \frac{37}{4} \times \frac{5}{4} \times \frac{1}{37} \times \frac{37}{3161} \times \frac{101}{101}}{\frac{14 \times 37}{5} \quad \frac{14 \times 37}{5}}$$

$$= \frac{\frac{5}{5}}{\frac{1}{4} \times \frac{5}{4} \times \frac{37}{4}} = \frac{5}{5 \times 37} = \frac{56}{25} = 2\frac{6}{25}$$

(64)

Each child gets 1 child's share,  $\therefore$  17 children get 17 shares.

Each woman gets *three* times a child's share,  $\therefore$  4 women get 12 shares.

Each man gets *six* times a child's share,  $\therefore$  3 men get 18 shares.

And together they get 47 times a child's share.

Therefore  $\$7200 \div 47 = \$153 \cdot 19\frac{7}{7} =$  a child's share.

$$\$153 \cdot 19\frac{7}{7} \times 3 = \$459 \cdot 57\frac{2}{7}$$

$$\$153 \cdot 19\frac{7}{7} \times 6 = \$919 \cdot 14\frac{2}{7}$$

(65)

$254000 = 2^3 \times 5^2 \times 127$ . Adding unity to each index and multiplying the results, we get  $4 \times 3 \times 2 = 24$ .

(66)

$$\frac{2}{3} \text{ of } 4\frac{1}{2} \text{ of } \frac{9\frac{3}{4}}{1\frac{1}{4}} \text{ of } \frac{1}{6} \text{ of } \text{£}3 \text{ 16s. 1}\frac{1}{2}\text{d.} = \frac{2}{3} \times \frac{9}{2} \times \frac{65 \times 14}{7 \times 11} \times \frac{1}{6}$$

$$\times \$15 \cdot 39\frac{1}{2} = 6 \text{ times } \$15 \cdot 39\frac{1}{2} = \$92 \cdot 35.$$

$$\frac{3}{11} \text{ of } 4\frac{3}{8} \text{ of } \frac{19\frac{1}{2}}{3\frac{1}{4}} \text{ of } \frac{25}{117} \text{ of } \frac{11}{23} \text{ of } \cdot 85 \text{ of } \frac{1}{42\frac{1}{2}} \text{ of } \$1783$$

$$\frac{12}{19}$$

$$= \frac{3}{11} \times \frac{23}{8} \times \frac{39}{12} \times \frac{25}{117} \times \frac{11}{23} \times \frac{85}{100} \times \frac{2}{85} \text{ of } \$1783.$$

$$= \frac{3}{11} \times \frac{23}{8} \times \frac{78}{19} \times \frac{25}{117} \times \frac{11}{23} \times \frac{85}{100} \times \frac{2}{85} \times \frac{1783}{1}$$

$$= \$17 \cdot 83 \times 4 = \$71 \cdot 32. \quad \$92 \cdot 35 - \$71 \cdot 32 = \$21 \cdot 03.$$

(67)

7 : 13 = 7 ÷ 13 = .538	}	Therefore 9 : 16 is the greatest, and 10 : 19 is the least.
9 : 16 = 9 ÷ 16 = .562		
8 : 15 = 8 ÷ 15 = .533		
10 : 19 = 10 ÷ 19 = .526		

$$\text{Compound ratio} = \frac{3}{13} \times \frac{7}{16} \times \frac{8}{15} \times \frac{5}{19} = \frac{21}{247} = 21 : 247.$$

(68)

$$67 \cdot 432 = 67 \frac{432}{1000} = \frac{66758}{990} \text{ and } 7 \cdot 9036 = 7 \frac{9036}{1000} = \frac{78957}{990}$$

$$\frac{66758}{990} \div \frac{78957}{990} = \frac{66758}{990} \times \frac{990}{78957} = \frac{7410138}{868527} = 8.5318452.$$

(69)

9 per. 9 yds. 7 ft. 120 in. = 365628 inches

$\frac{1}{2}$  of  $\frac{3}{8}$  of  $\frac{2}{7}$  of 35 acres 2 roods =  $\frac{3}{35}$  of 35 acres 2 roods =  $\frac{3}{35}$  of 222678720 inches

$$\frac{365628}{\frac{3}{35} \text{ of } 222678720} = \frac{2559396}{133607232} = 0.019156118.$$

(70)

Dissimilar.

Similar.

17.0342

17.03424242

27.06357

27.06357575

98.123456

98.123456456

829.6423

829.642342342

986.1234298

986.1234298429

9.876342

9.876342876342

813.9864234567

813.9864234567

Similar and Coterminous.

17.034242424242424242

27.063575757575757575

98.123456456456456456

829.642342342342342342

986.123429842984298429

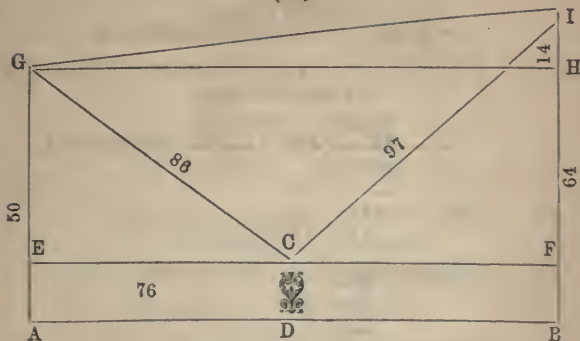
9.876342876342876342

813.986423456745674567

-4 carried

2781.849813156689829957

(71)



$$EG = \sqrt{86^2 - 76^2} = \sqrt{1620} = 40.249 \text{ feet}$$

Height of Statue  $CD = AG - EG = 50 - 40.249 = 9.751 \text{ ft.} = BF$

$$FI = BI - BF = 64 - 9.751 = 54.249 \text{ feet}$$

$$CF = \sqrt{CI^2 - FI^2} = \sqrt{97^2 - 54.249^2} = \sqrt{6466.045999} = 80.411 \text{ feet}$$

$$GH = EF = EC + CF = 76 + 80.411 = 156.411 \text{ feet and}$$

$$HI = 64 - 50 = 14 \text{ feet}$$

$$GI = \sqrt{GH^2 + HI^2} = \sqrt{156.411^2 + 14^2} = \sqrt{24660.400921} \\ = 157.036 \text{ feet.}$$

(72)

The mixture = spirits + water =  $\frac{1}{2}$  of mixture + 25 gal. +  $\frac{1}{3}$  of mixture - 5 gal. =  $\frac{1}{2} + \frac{1}{3} + 20 \text{ gal.} = \frac{5}{6} + 20 \text{ gal.}$  Then 20 gal. =  $\frac{1}{6}$  of the mixture, and therefore the mixture contained  $6 \times 20 = 120 \text{ gal.}$

$$\begin{array}{l} \text{Then } \frac{1}{2} \text{ of } 120 = 60 + 25 = 85 \text{ gal.} = \text{spirits } \} \\ \quad \frac{1}{3} \text{ of } 120 = 40 - 5 = 35 \text{ gal.} = \text{water } \} \end{array}$$

## SEVENTH SERIES.

(73)

$$\begin{array}{r}
 \begin{array}{r}
 \cdot \cdot \cdot \cdot \\
 401241 \cdot 3424 \quad (422 \cdot 32 \\
 31 \\
 \hline
 132 \quad ) \quad 412 \\
 \quad \quad 314 \\
 \hline
 1342 \quad ) \quad 4341 \\
 \quad \quad 3234 \\
 \hline
 13443 \quad ) \quad 110234 \\
 \quad \quad 101434 \\
 \hline
 140012) \quad 330024 \\
 \quad \quad 330024.
 \end{array}
 \end{array}$$

(74)

Suppose father's age = 60, the son's age now =  $60 \div 5 = 12$ ,  
 and son's age four years ago =  $12 - 4 = 8$ . But the son's  
 age four years ago should, by the question, have been  $60 \div$   
 $7 = 8\frac{1}{7}$ .

Therefore  $8 - 8\frac{1}{7} = -\frac{1}{7} = \text{error}$ .

Suppose father's age = 35; then son's age now =  $35 \div 5 = 7$ ,  
 and age four years ago =  $7 - 4 = 3$ .

But son's age four years ago should, by question, have been  $35$   
 $\div 7 = 5$ .

Therefore  $3 - 5 = -2 = \text{error}$ .

Errors.

$$-2 \times 60 = 120$$

$$-\frac{1}{7} \times 35 = 20$$

$$\text{diff. } 1\frac{1}{7} \quad \text{diff.} = 100$$

$$100 \div 1\frac{1}{7} = 70 = \text{father's and son's age} = 70 \div 5 = 14.$$

(75)

$$\cdot 72347 \div \cdot 0032 = \frac{72275}{99900} \div \frac{32}{9900} =$$

$$\frac{72275}{99900} \times \frac{11}{32} = \frac{795025}{3552} = 223 \cdot 82460585.$$

(76)

Logarithm of  $97294764 \cdot 372$  is  $7 \cdot 988089$ 

$$7 \cdot 988089 \div 11 = 0 \cdot 726189$$

Log.  $0 \cdot 726189 = 5 \cdot 32341 = 11$ th root of  $97294764 \cdot 372$ .

(77)

Assume  $43\frac{1}{2}$  for the greater number

$$7\frac{1}{2} : 3\frac{1}{2} :: 43\frac{1}{2} : \frac{43\frac{1}{2} \times 3\frac{1}{2}}{7\frac{1}{2}} = 21 \text{ the less}$$

$$43\frac{1}{2} - 21 = 22\frac{1}{2} \text{ but it should} = 30$$

$$\text{Therefore error} = 22\frac{1}{2} - 30 = -7\frac{1}{2}.$$

Assume  $72\frac{1}{2}$  for the greater number

$$7\frac{1}{2} : 3\frac{1}{2} :: 72\frac{1}{2} : \frac{72\frac{1}{2} \times 3\frac{1}{2}}{7\frac{1}{2}} = 35 = \text{the less}$$

$$72\frac{1}{2} - 35 = 37\frac{1}{2} \text{ but it should} = 30$$

$$\text{Therefore error} = 37\frac{1}{2} - 30 = +7\frac{1}{2}.$$

Errors.

$$+7\frac{1}{2} \times 43\frac{1}{2} = 326\frac{1}{2}$$

$$-7\frac{1}{2} \times 72\frac{1}{2} = 543\frac{1}{2}$$

$$\text{Sum} = 15 \quad \text{Sum} = 870$$

$$870 \div 15 = 58 \text{ greater}$$

$$7\frac{1}{2} : 3\frac{1}{2} :: 58 : \frac{58 \times 3\frac{1}{2}}{7\frac{1}{2}} = 28 \text{ less.}$$

(78)

Assume 35	35,	16,	18,	28,	62,	83,	20
Assume 16	16	18	4	62	9	8	
Assume 9		9		31	9		

31

$$l. c. m. = 35 \times 16 \times 9 \times 31 = 156240.$$

(79)

Here  $a = 1, d = 6, n = 101,$

$$s = \left\{ 2a + (n - 1)d \right\} \frac{n}{2} = \left\{ 2 \times 1 + (101 - 1) \times 6 \right\} \frac{101}{2}$$

$$= (2 + 600) \frac{101}{2} = \frac{602 \times 101}{2} = 30401.$$

(80)

$$\frac{19}{7} \times \frac{11}{56} \times \frac{35}{121} \times \frac{11\frac{7}{8}}{29} \times \frac{8}{4\frac{3}{4}} \times \frac{4\frac{1}{2}}{3} = \frac{11\frac{7}{8} \times 4 \times 5}{7 \times 7 \times 11 \times 3} = \frac{228\frac{7}{8}}{1617} = 228\frac{7}{8} : 1617.$$

(82)

$$\frac{\left( \left\{ (9\frac{1}{6} + 4\frac{1}{2} + 3\frac{1}{7} - 16\frac{3}{5}) \times .54 \right\} \div 1\frac{7}{8} \right) \times 35 \text{ times } .14285\dot{7}}{\left\{ .97 \times .24378 \times (1\frac{1}{4} \times 4\frac{16}{57}) \right\} \times (4\frac{3}{11} - 2\frac{1}{7})}$$

$$= \frac{\left( \left\{ (16\frac{5}{20} - 16\frac{4}{20}) \times \frac{5}{8} \right\} \div 1\frac{7}{8} \right) \times 35 \times \frac{1}{7}}{\frac{88}{90} \times \frac{24378}{99900} \times \frac{15}{14} \times \frac{1850}{461} \times (4\frac{2}{87} - 2\frac{1}{87})}$$

$$= \frac{\frac{12\frac{1}{20}}{45} \times \frac{6}{1850} \times \frac{7}{14} \times \frac{35}{44} \times \frac{1}{7}}{\frac{44}{45} \times \frac{151}{1850} \times \frac{15}{44} \times \frac{1850}{461} \times \frac{381}{187}} = \frac{\frac{1}{2}}{\frac{381}{187}} = \frac{187}{381}$$

(83)

Suppose the *hour* hand moves over 4 minutes, then since the minute hand moves 12 times as fast, it will have travelled over 48 minutes. But in order to overtake the hour hand, the minute hand must traverse the entire circle, 60 minutes, plus the 4 minutes we have supposed the hour hand to have moved forward, *i. e.* 64 minutes. Then 48 should equal 64, for we should find the same number by each process;  $48 - 64 = -16$  error.

Suppose hour hand moves over 6 minutes, the minute hand moves over  $6 \times 12 = 72$  minutes. But minute hand moves over  $60 + 6 = 66$  minutes.

Then  $72 - 66 = +6$  error.

(Continued on next page.)



(83 continued.)

Errors.

$$- 16 \times 6 = 96$$

$$+ 6 \times 4 = 24$$

$$\text{Sum } 22 \quad \text{Sum } 120$$

$120 \div 22 = 5\frac{5}{11}$  min. = minutes passed over by the hour hand,  
hence space passed over by the minute hand =  $5\frac{5}{11} \times 12$   
=  $65\frac{5}{11}$  min. = 1 hour  $5\frac{5}{11}$  min. = time.

(84)

$$\text{Log. } 5 = \text{log. } 10 - \text{log. } 2 = 1 - 0.301030 = 0.698970$$

$$3850000 = 5 \times 7 \times 11 \times 10000.$$

$$\therefore \text{Log. } 3850000 = \text{log. } 5 + \text{log. } 7 + \text{log. } 11 + \text{log } 10000$$

$$= 0.698970 + 0.845098 + 1.041393 + 4 = 6.585461.$$

$$3181.8\dot{1} = 31.8\dot{1} \times 100 = 31\frac{8}{11} \times 100 = \frac{349}{11} \times 100.$$

$$\therefore \text{Log. } 3181.8\dot{1} = \text{log. } 5 + \text{log. } 7 + \text{log. } 1000 - \text{log. } 11$$

$$= 0.698970 + 0.845098 + 3 - 1.041393 = 3.502675$$

$$\cdot 0000154 = 2 \times 7 \times 11 \div 10000000.$$

$$\therefore \text{Log. } \cdot 0000154 = \text{log. } 2 + \text{log. } 7 + \text{log. } 11 - \text{log. } 10000000$$

$$= 0.301030 + 0.845098 + 1.041393 - 7 = \bar{5}.187521.$$

$$\text{Log. } \frac{1}{77} = \text{log. } 1 - (\text{log. } 7 + \text{log. } 11) = 0 - (0.845098$$

$$+ 1.041393, = 0 - 1.886491 = \bar{2}.113509.$$

$$1.571428 = 1\frac{4}{7} = \frac{11}{7}.$$

$$\text{Log. } 1.571428 = \text{log. } 11 - \text{log. } 7 = 1.041393 - 0.845098$$

$$= 0.196295$$

$$93.17 = 9317 \div 100 = 11^3 \times 7 \div 100.$$

$$\therefore \text{Log. } 9317 = 3 \text{ times log. } 11 + \text{log. } 7 - \text{log. } 100 = 1.041393$$

$$\times 3 + 0.845098 - 2 = 1.969277.$$

## EIGHTH SERIES.

(85)

$$\text{Simple Interest} = Prt = \$700 \times .045 \times 3 = \$94.50.$$

$$\text{Amount Compound Interest} = P(1+r)^t = \$700 \times (1.045)^3$$

$$= \$700 \times 1.14116 = \$798.814 - \$700 = \$98.814 = \text{Comp.}$$

Int.

$$\$98.814 - \$94.50 = \$4.314.$$

(86)

X's gain =  $\frac{1}{12}$ , and Z's =  $\frac{1}{2}$ ;  $\therefore$  Y's gain =  $1 - (\frac{1}{12} + \frac{1}{2})$   
 $= 1 - \frac{7}{12} = \frac{5}{12}$ .

X's gain is  $\frac{1}{12}$  for 3 months, therefore for 1 month it is  $\frac{1}{36}$ .

Y's gain is  $\frac{5}{12}$  for 9 months, " " "  $\frac{5}{108}$ .

Z's gain is  $\frac{1}{2}$  for 4 months, " " "  $\frac{1}{8}$ .

$\frac{1}{36} : \frac{1}{36} :: \$3024 : \$3024 \times \frac{1}{36} \times \frac{8}{1} = \$672 =$  X's stock.

$\frac{1}{8} : \frac{1}{108} :: \$3024 : \$3024 \times \frac{1}{108} \times \frac{8}{1} = \$1120 =$  Y's stock.

(87)

$\frac{3}{8} \times \sqrt{17} \div (1\frac{1}{2})^3 = \frac{3}{8} \times \sqrt{17} \div (\frac{3}{2})^3 = \frac{3}{8} \times \frac{4}{3} \times \frac{8}{27} = \frac{4}{27}$ .

(88)

$4^2 = 16 \times 300$	=	4800	80677568161 (4321 cube rt.)
$4 \times 3 = 12 \times 30$	=	360	64
$3^2 =$	=	9	<u>16677</u>
		5169	<u>15507</u>
$43^2 = 1849 \times 300$	=	554700	1170568
$43 \times 2 = 86 \times 30$	=	2580	
$2^2 =$	=	4	
		557284	<u>1114568</u>
$432^2 = 186624 \times 300$	=	55987200	56000161
$432 \times 1 = 432 \times 30$	=	12960	
$1^2 =$	=	1	
		56000161	<u>56000161</u>

(89)

$$7 = \left\{ 8 - 1 \begin{array}{l} \nearrow 3 + 4 \\ \searrow 1 + 6 \end{array} \right\} = 7$$

4 lbs. at 8d. }  
 1 lb. at 4d. } Make a mixture of 6 lbs. at 7d.  
 1 lb. at 6d. }

$$6 : 112 :: 4 : \frac{112 \times 4}{6} = 74\frac{2}{3} \text{ at 8d.}$$

(Continued on next page.)

(89 continued.)

$$6 : 112 :: 1 : \frac{112 \times 1}{6} = 18\frac{2}{3} \text{ at 4d.}$$

$$6 : 112 :: 1 : \frac{112 \times 1}{6} = 18\frac{2}{3} \text{ at 6d.}$$

(90)

Assume 40 as the sum of the three numbers.

Since  $1\text{st} + 2\text{nd} + 3\text{rd} = 40$ ,

$$\text{And } 1\text{st} + \frac{1}{2}(2\text{nd} + 3\text{rd}) = 34 \therefore \frac{1}{2}(2\text{nd} + 3\text{rd}) = 6 \dots \therefore 2\text{nd} + 3\text{rd} = 12$$

$$\text{And } 2\text{nd} + \frac{1}{3}(1\text{st} + 3\text{rd}) = 34 \therefore \frac{2}{3}(1\text{st} + 3\text{rd}) = 6 \dots \therefore 1\text{st} + 3\text{rd} = 9$$

$$\text{And } 3\text{rd} + \frac{1}{4}(1\text{st} + 2\text{nd}) = 34 \therefore \frac{3}{4}(1\text{st} + 2\text{nd}) = 6 \dots \therefore 1\text{st} + 2\text{nd} = 8$$

$$\begin{array}{r} \text{Adding, } 2 \times (1\text{st} + 2\text{nd} + 3\text{rd}) = 29 \\ \therefore 1\text{st} + 2\text{nd} + 3\text{rd} = 14\frac{1}{2}. \end{array}$$

But the sum should equal 40.

$$\text{Hence } 14\frac{1}{2} - 40 = -25\frac{1}{2}.$$

Assume 48 as the sum of the three numbers.

Since  $1\text{st} + 2\text{nd} + 3\text{rd} = 48$ .

$$\text{And } 1\text{st} + \frac{1}{2}(2\text{nd} + 3\text{rd}) = 34 \therefore \frac{1}{2}(2\text{nd} + 3\text{rd}) = 14 \dots \therefore 2\text{nd} + 3\text{rd} = 28$$

$$\text{And } 2\text{nd} + \frac{1}{3}(1\text{st} + 3\text{rd}) = 34 \therefore \frac{2}{3}(1\text{st} + 3\text{rd}) = 14 \dots \therefore 1\text{st} + 3\text{rd} = 21$$

$$\text{And } 3\text{rd} + \frac{1}{4}(1\text{st} + 2\text{nd}) = 34 \therefore \frac{3}{4}(1\text{st} + 2\text{nd}) = 14 \dots \therefore 1\text{st} + 2\text{nd} = 18\frac{2}{3}$$

$$\begin{array}{r} \text{Adding, } 2 \times (1\text{st} + 2\text{nd} + 3\text{rd}) = 67\frac{2}{3} \\ \therefore 1\text{st} + 2\text{nd} + 3\text{rd} = 33\frac{1}{3}. \end{array}$$

But the sum should equal 48.

$$\text{Hence } 33\frac{1}{3} - 48 = -14\frac{2}{3} = \text{error.}$$

Errors.

$$-25\frac{1}{2} \times 48 = 1224$$

$$-14\frac{2}{3} \times 40 = 566\frac{2}{3}$$

$$\text{Diff.} = 1\frac{1}{3} \qquad \text{Diff.} = 657\frac{1}{3}$$

$$657\frac{1}{3} \div 11\frac{1}{3} = 58 = \text{the sum of the three numbers.}$$

(Continued on next page.)

(90 nontinued.)

$$1\text{st} + \frac{1}{2}(2\text{nd} + 3\text{rd}) = 34 \therefore \frac{1}{2}(2\text{nd} + 3\text{rd}) = 58 - 34 = 24$$

$$\therefore 2\text{nd} + 3\text{rd} = 48.$$

$$2\text{nd} + \frac{1}{3}(1\text{st} + 3\text{rd}) = 34 \therefore \frac{2}{3}(1\text{st} + 3\text{rd}) = 58 - 34 = 24$$

$$\therefore 1\text{st} + 3\text{rd} = 36.$$

$$1\text{st} + 2\text{nd} + 3\text{rd} = 58, \text{ and } 2\text{nd} + 3\text{rd} = 48 \therefore 1\text{st} = 10.$$

$$1\text{st} + 2\text{nd} + 3\text{rd} = 58, \text{ and } 1\text{st} + 3\text{rd} = 36 \therefore 2\text{nd} = 22.$$

$$2\text{nd} + 3\text{rd} = 48, \text{ and } 2\text{nd} = 22 \therefore 3\text{rd} = 26.$$

(91)

4 means + 2 extremes = 6 terms.

$$\text{Formula IX, p. 333. } d = \frac{l - a}{n - 1} = \frac{40 - 1}{6 - 1} = \frac{39}{5} = 7\frac{4}{5}.$$

$$1, 8\frac{4}{5}, 16\frac{8}{5}, 24\frac{2}{5}, 32\frac{2}{5}, 40.$$

(92)

 $s = 1860040, l = 1240029, \text{ and } r = 3.$ 

$$\text{Formula XI, p. 340. } a = rl - (r - 1)s = 1240029 \times 3$$

$$- 2 \times 1860040 = 3720087 - 3720080 = 7.$$

(93)

6 apples + 7 pears cost 33 pence  $\therefore$  2 apples +  $2\frac{1}{2}$  pears cost 11 pence.10 apples + 8 pears cost 44 pence  $\therefore$  2 apples +  $1\frac{3}{4}$  pears cost  $8\frac{1}{2}$  pence.Subtract, and  $2\frac{1}{2} - 1\frac{3}{4}$  pears cost 11d. —  $8\frac{1}{2}$ d.That is,  $\frac{1}{4}$  of a pear costs  $2\frac{1}{2}$ d.If  $\frac{1}{4}$  cost  $\frac{1}{2}$ d.,  $\frac{1}{8}$  will cost  $\frac{1}{4}$  of  $\frac{1}{2}$ d., which is  $\frac{1}{8}$ d.If  $\frac{1}{8}$  cost  $\frac{1}{8}$ d.,  $\frac{1}{2}$  will cost  $\frac{1}{2}$ d. = 3d.6 apples + 7 pears cost 33 pence, and 7 pears cost 21d.  $\therefore$  6 apples cost 12d. and 1 apple costs 2d.

(94)

$$\frac{1}{2} \times \frac{3}{4} \times \frac{5}{6} \times \frac{57}{6} \times \frac{3}{4} \times \frac{1}{3} \times \frac{1}{2}$$

$$= \frac{1}{2} \times \frac{3}{4} \times \frac{5}{3} \times \frac{57}{12} \times \frac{2}{3} \times \frac{4}{5} \times \frac{3}{4} = \frac{19}{48}.$$

(95)

$\$10 = \frac{1}{2}$  of 2nd rem. —  $\$20 \therefore \frac{1}{2}$  of 2nd rem. =  $\$30 \therefore$  2nd rem. =  $\$40$ .

$\$40 = \frac{1}{5}$  of 1st rem. —  $\$30 \therefore \frac{1}{5}$  of 1st rem. =  $\$70 \therefore$  1st rem. =  $\$87.50$ .

$\$87.50 = \frac{1}{2}$  of original sum —  $\$50 \therefore \frac{1}{2}$  of original sum =  $\$137.50 \therefore$  original sum =  $\$137.50 \times 2 = \$275$ .

(96)

$a = 60, n = 17,$  and  $d = 4$ .

$$\begin{aligned} \text{Formula VI, p. 333. } s &= \left\{ 2a + (n-1)d \right\} \frac{n}{2} \\ &= \left\{ 2 \times 60 + (17-1) \times 4 \right\} \frac{17}{2} = (120 + 64) \times \frac{17}{2} \\ &= \frac{184 \times 17}{2} = \$1564 = \text{sum received for 17 years.} \end{aligned}$$

Formula I, p. 333.  $l = a + (n-1)d = 60 + (17-1) \times 4 = 60 + 64 = \$124 = \text{wages for 17th year.}$

---

NINTH SERIES.

(98)

$\text{£}749 \text{ } 16\text{s. } 5\frac{1}{2}\text{d.} = \text{£}749.823958; \text{£}1 \text{ Sterling} = \$4.867$

$\text{£}749.823958 \times 4.867 = \$3649.3932$ .

(99)

$$\begin{array}{r} 2 \ ) 177408 \\ \hline 2 \ ) 88704 \\ \hline 2 \ ) 44352 \\ \hline 2 \ ) 22176 \\ \hline 2 \ ) 11088 \\ \hline 2 \ ) 5544 \\ \hline 2 \ ) 2772 \\ \hline \end{array} \qquad \begin{array}{r} 2 \ ) 1386 \\ \hline 3 \ ) 693 \\ \hline 3 \ ) 231 \\ \hline 7 \ ) 77 \\ \hline 11 \end{array}$$

$$2^3 \times 3^2 \times 7 \times 11.$$

(100)

$$\text{Formula III, page 354, } r = \sqrt{\frac{t/A}{P}} - 1 \therefore r + 1 = \sqrt{\frac{t/A}{P}}$$

$$\text{Log. } (r + 1) = (\text{log. } A - \text{log. } P) \div t$$

$$\begin{aligned} \text{That is, log. } (r + 1) &= (\text{log. } 11111 \cdot 11 - \text{log. } 704) \div 11 \\ &= (4 \cdot 045757 - 2 \cdot 847573) \div 11 \\ &= 1 \cdot 198184 \div 11 = 0 \cdot 108925 \end{aligned}$$

Therefore  $r + 1 =$  natural number corresponding to the logarithm  $0 \cdot 108925$  which is  $1 \cdot 285$ .

Since  $r + 1 = 1 \cdot 285$ ,  $r = \cdot 285 =$  rate per unit and rate per cent.  $= \cdot 285 \times 100 = 28\frac{1}{2}$ .

(101)

If 9 be  $\frac{1}{13}$ ,  $\frac{1}{3}$  or the whole will equal  $9 \times 13 = 117$ .

(102)

3 gal. + 4 gal. + 7 gal. = 14 gal.

Hence 14 gal. : 292 gal. :: 3 gal. :  $\frac{292 \times 3}{14} = 62\frac{1}{2}$  of 1st kind.

14 gal. : 292 gal. :: 4 gal. :  $\frac{292 \times 4}{14} = 83\frac{2}{7}$  gal. of 2d "

14 gal. : 292 gal. :: 7 gal. :  $\frac{292 \times 7}{14} = 146$  gal. of 3d

(103)

$$\pounds \frac{1}{2} + \pounds \frac{1}{3} + \pounds \frac{1}{4} + \pounds \frac{1}{5} = \pounds 1\frac{7}{60}$$

$$\text{Then } \pounds 1\frac{7}{60} : \pounds 500 :: \pounds \frac{1}{2} : \pounds 500 \times \frac{1}{2} \times \frac{60}{77} = \frac{\pounds 15000}{77}$$

$$= \pounds 194 \text{ 16s. } 1\frac{1}{7}\text{d.}$$

$$\pounds 1\frac{7}{60} : \pounds 500 :: \pounds \frac{1}{3} : \pounds 500 \times \frac{1}{3} \times \frac{60}{77} = \frac{\pounds 10000}{77}$$

$$= \pounds 129 \text{ 17s. } 4\frac{2}{7}\text{d.}$$

$$\pounds 1\frac{7}{60} : \pounds 500 :: \pounds \frac{1}{4} : \pounds 500 \times \frac{1}{4} \times \frac{60}{77} = \frac{\pounds 7500}{77}$$

$$= \pounds 97 \text{ 8s. } 0\frac{4}{7}\text{d.}$$

$$\pounds 1\frac{7}{60} : \pounds 500 :: \pounds \frac{1}{5} : \pounds 500 \times \frac{1}{5} \times \frac{60}{77} = \frac{\pounds 6000}{77}$$

$$= \pounds 97 \text{ 18s. } 5\frac{2}{7}\text{d.}$$

(104)

By Table, page 363, present value of annuity of \$1 at 6 per cent. for 23 payments = \$12·30338.

Hence present value of \$100 = \$12·30338 × 100 = \$1230·338·

By Formula V, page 361,  $v = \frac{a}{r} \left\{ 1 - \frac{1}{(1+r)^t} \right\}$

$$= \frac{100}{.06} \times \left( 1 - \frac{1}{(1.06)^{23}} \right) = \frac{10000}{6} \times (1 - 0.25583)$$

$$= \frac{10000}{6} \times 0.74417 = \frac{7441.7}{6} = \$1240.28.$$

(105)

Since each loses 1 hour per day for 24 days, the whole hours lost = 24 × 25.

Also, 5 men working 1 hour per day for 12 days make up 5 × 12 × 1 = 60 hours.

Hence they will each have to work as many hours per day as 60 hours is contained times in 24 × 25 hours *i. e.*  $\frac{24 \times 25}{60} = 10$  hours.

(106)

$$a = 5, s = 161 \text{ and } d = 6$$

Then Formula II, p. 333.  $l = -\frac{1}{2}d + \sqrt{2d6 \div (a - \frac{1}{2}d)^2} = -\frac{1}{2} \text{ of } 6 + \sqrt{2 \times 6 \times 161 + (5 - \frac{1}{2} \text{ of } 6)^2} = -3 + \sqrt{1932 + 4} = -3 + \sqrt{1936} = -3 + 44 = 41 \text{ years.}$

(107)

$$6^3 : 10^3 :: 1 \text{ day} : \frac{10^3 \times 1}{6^3} = \frac{1000}{216} = 4.629 \text{ days.}$$

$$\begin{aligned} * \text{ Log. } \frac{1}{(1.06)^{23}} &= \log. 1 - \log. 1.06 \times 23 = 0 - 0.025306 \times 23 \\ &= 0 - 0.592038 = \bar{1}.407962 \end{aligned}$$

$$\therefore \frac{1}{(1.06)^{23}} = \text{natural number corresponding to the logarithm}$$

$\bar{1}.407962$ , which is 0.25583.

(108)

For 12 months he was to receive £8 and a suit of clothes ; for 7 months he received £2 13s. 4d. and the suit of clothes ;  
 $\therefore$  for 5 months he would have received the difference between £8 and £2 13s. 4d., which is £5 6s. 8d.

Hence for 1 month he would have received £5 6s. 8d.  $\div$  5, which is £1 1s. 4d., and hence his wages for the year would have been, in money alone, £1 1s. 4d.  $\times$  12 *i. e.* £12 16s.

Therefore the suit of clothes was valued at £12 16s. — £8 = £4 16s.

## TENTH SERIES.

(109)

$\frac{1}{2} + \frac{1}{3} + \frac{1}{4} = 1\frac{1}{12}$  ; if  $1\frac{1}{2}$  of a number = 48,  $\frac{1}{12}$  will =  $48 \div 12 = 3\frac{2}{3}$   
 If  $3\frac{2}{3} = \frac{1}{12}$ ,  $1\frac{1}{2}$ , or the whole number =  $3\frac{2}{3} \times 12 = 44\frac{1}{3}$ .

(110)

$$6^3 : 8^3 :: 600 : \frac{600 \times 8^3}{6^3} = \frac{600 \times 512}{216} = 1422 \cdot 2 \text{ lbs.}$$

(See Art. 33, sec. X.)

(111)

Part of ball remaining after 1st has taken off her share =  $\frac{3}{4}$

Then whole ball : remainder :: cube of diameter of whole : cube of diameter of remainder

$$1 : \frac{3}{4} :: 5^3 : x^3 \text{ hence } x = \sqrt[3]{\frac{3}{4}} \times 125 = \sqrt[3]{\frac{3 \cdot 125}{4}} = \sqrt[3]{93 \cdot 75} = 4 \cdot 542$$

$\therefore$  Part taken off by 1st = 5 in. — 4.542 in. = 0.458 in.

After 2nd had taken off her portion  $\frac{1}{2}$  of the ball remained.

$$1 : \frac{1}{2} :: 5^3 : x^3, \text{ hence } x = \sqrt[3]{\frac{1}{2}} \times 125 = \sqrt[3]{\frac{1 \cdot 125}{2}} = \sqrt[3]{62 \cdot 5} = 3 \cdot 968 \text{ in.}$$

$\therefore$  Part taken off by 2nd = 4.542 — 3.968 = 0.574 in.

After 3rd had taken off her share there remained  $\frac{1}{4}$  of the ball.

$$1 : \frac{1}{4} :: 5^3 : x^3, \text{ hence } x = \sqrt[3]{\frac{1}{4}} \times 125 = \sqrt[3]{\frac{1 \cdot 125}{4}} = \sqrt[3]{31 \cdot 25} = 3 \cdot 149 \text{ in.}$$

$\therefore$  Part taken off by 3rd = 3.968 — 3.149 = 0.819 inches

Remainder = 3.149 = part taken off by 4th.



(112)

$$71213 \cdot 43 \div 12 \cdot 342 = 71213430 \div 12342$$

$$12342)71213430(5570 \cdot 238552$$

62831

72724

62831

87833

87525

3070.0

2468.4

500.50

371.36

118.130

111.067

7.0520

6.2831

.65780

.62831

.028480

.024684

.003685

IX.

$$5570 \cdot 238552(71 \cdot 118 = \text{sq. rt.}$$

54

151) 170

151

1521) 18.23

15.21

15221) 3.0285

1.5221

152228) 1 406452

1.360051

.036411

NOTE.—Unless the quotient is carried out to *six places* of decimals, i. e., twice as many as are required in the root, the last figure in the root will be 7 or 6.

(113)

$$\text{1st } \left\{ \begin{array}{l} \$60 \times 48 = \$2880 \text{ for 1 month} \\ \$800 \times 43 = 34400 \text{ for 1 month} \\ \$1500 \times 4 = 6000 \text{ for 1 month} \\ \text{Sum} = \underline{\$43280} \end{array} \right\} = \$43280 \text{ for 1 month.}$$

$$\text{2nd } \left\{ \begin{array}{l} \$600 \times 48 = \$28800 \text{ for 1 month} \\ \$1800 \times 42 = 75600 \text{ for 1 month} \\ \text{Sum} = \underline{\$104400} \end{array} \right\} = \$104400 \text{ for 1 month.}$$

(Continued on next page.)

(113 continued.)

$$\begin{array}{l}
 \text{3rd} \left\{ \begin{array}{l}
 \$400 \times 48 = \$19200 \\
 \$500 \times 42 = 21000 \\
 \$500 \times 36 = 18000 \\
 \$500 \times 30 = 15000 \\
 \$500 \times 24 = 12000 \\
 \$500 \times 18 = 9000 \\
 \$500 \times 12 = 6000 \\
 \$500 \times 6 = 3000 \\
 \hline
 \text{Sum} = \$103200
 \end{array} \right\} = \$103200 \text{ for 1 month.}
 \end{array}$$

$$\begin{array}{l}
 \text{4th} \left\{ \begin{array}{l}
 \$900 \times 40 = \$36000 \\
 \$900 \times 34 = 30600 \\
 \$900 \times 28 = 25200 \\
 \$900 \times 22 = 19800 \\
 \$900 \times 16 = 14400 \\
 \$900 \times 10 = 9000 \\
 \$900 \times 4 = 3600 \\
 \hline
 \text{Sum} = \$138600
 \end{array} \right\} = \$138600 \text{ for 1 month.}
 \end{array}$$

\$43280

104400

103200

138600

4 years at \$1.25 per day

= \$1.25 \times 4 \times 365 = \$1825 = share of 5th.

\$389480 for one month.

\$20000 - \$1825 = \$18175 = sum to be divided among the four.

\$389480 : \$18175 :: \$43280 : \$2019.651 = share of 1st.

\$389480 : \$18175 :: \$104400 : \$4871.803 = " 2nd.

\$389480 : \$18175 :: \$103200 : \$4815.805 = " 3rd.

\$389480 : \$18175 :: \$138600 : \$6467.739 = " 4th.

(114)

$$\begin{array}{l}
 \text{Simple Interest, formula IX, p. 248. } t = \frac{n-1}{r} = \frac{16-1}{.05} = \frac{15}{.05} \\
 = \frac{1500}{5} = 300 \text{ years.}
 \end{array}$$

$$\begin{array}{l}
 \text{Compound Interest, formula V, p. 354. } t = \frac{\log. n}{\log. (1+r)} \\
 = \frac{\log. 16}{\log. 1.05} = \frac{1.204120}{0.021189} = \frac{1204120}{21189} = 56.827 \text{ years.}
 \end{array}$$

(115)

For every \$1 the first gave, the second gave \$3 and the third \$6.  $\$1 + \$3 + \$6 = \$10$ .

Hence the 1st gave \$1, the second \$3, and the third \$6 as often as \$10 is contained times in \$9202, which is  $920\frac{1}{5}$  times.

$$\$1 \times 920\frac{1}{5} = \$920 \cdot 20 = \text{payment of 1st person.}$$

$$\$3 \times 920\frac{1}{5} = \$2760 \cdot 60 = \quad \quad \quad \text{2nd "}$$

$$\$6 \times 920\frac{1}{5} = \$5521 \cdot 20 = \quad \quad \quad \text{3rd "}$$

(116)

$25 + 22 = 47 =$  whole number of men.

$165 \div 47 = 3\frac{2}{7} =$  acres cleared by each man.

$3\frac{2}{7} \times 22 = 77\frac{1}{7}$  acres = acres cleared by company of 22 men.

$165$  acres —  $77\frac{1}{7}$  acres =  $87\frac{2}{7}$  acres = acres cleared by company of 25 men.

1st company contains 3 more men than 2nd company and receives \$86 more.

Therefore \$86 pays 3 men. Hence each man gets  $\$86 \div 3 = \$28 \cdot 66\frac{2}{3}$ .

Each man clears  $3\frac{2}{7}$  acres, and receives  $\$28 \cdot 66\frac{2}{3}$  for it; therefore cost of 1 acre =  $\$28 \cdot 66\frac{2}{3} \div 3\frac{2}{7} = \$8\frac{2}{3}$ .

(117)

$15^2 = 225$ ;  $346 - 225 = 121 =$  square of the less.

Hence less =  $\sqrt{121} = 11$ .

(118)

Formula V, page 248,  $A=P(1+rt) = \$1200 \times 1.95 = \$2340.00$ .

(119)

$$\begin{array}{l|l} 24 : 496 & \\ 9 : 11 & \\ 7 : 4 & \\ 465 : 537\frac{1}{2} & \\ 3\frac{2}{3} : 5\frac{2}{3} & \\ 2\frac{1}{3} : 3\frac{1}{3} & \end{array} \quad \therefore 5\frac{1}{2} : x$$

(Continued on next page.)

(119 continued.)

$$\frac{31}{62} \times \frac{11}{1} \times \frac{4}{1} \times \frac{3}{2} \times \frac{27}{675} \times \frac{2}{5} \times \frac{7}{2} \times \frac{11}{2} \times \frac{1}{24} \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{7} \times \frac{1}{465}$$

$$\times \frac{3}{11} \times \frac{3}{7} = 11 \times 4 \times 3 = 132 \text{ days.}$$

(120)

$\begin{aligned} A + B + C &= \frac{47}{60} \\ B + C + D &= \frac{37}{60} \\ A + C + D &= \frac{42}{60} \\ A + B + D &= \frac{45}{60} \\ \hline 3A + 3B + 3C + 3D &= \frac{171}{60} \\ \therefore A + B + C + D &= \frac{57}{60} \end{aligned}$	$\begin{aligned} A + B + C + D &= \frac{57}{60} \\ A + B + C &= \frac{47}{60} \\ \hline \therefore D &= \frac{10}{60} = \frac{1}{6} \\ A + B + C + D &= \frac{57}{60} \\ B + C + D &= \frac{37}{60} \\ \hline \therefore A &= \frac{20}{60} = \frac{1}{3} \\ A + B + C + D &= \frac{57}{60} \\ A + C + D &= \frac{42}{60} \\ \hline \therefore B &= \frac{15}{60} = \frac{1}{4} \\ A + B + C + D &= \frac{57}{60} \\ A + B + D &= \frac{45}{60} \\ \hline \therefore C &= \frac{12}{60} = \frac{1}{5} \end{aligned}$
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

- $\frac{57}{60} : \frac{60}{60} :: \frac{1}{6} : \frac{1}{6} \times \frac{60}{60} \times \frac{60}{60} = \frac{10}{60} = D$ 's true share which is therefore =  $\frac{1}{6}$  of \$6213 = \$1090.
- $\frac{57}{60} : \frac{60}{60} :: \frac{1}{3} : \frac{1}{3} \times \frac{60}{60} \times \frac{60}{60} = \frac{20}{60} = A$ 's true share which is therefore =  $\frac{2}{3}$  of \$6213 = \$2180.
- $\frac{57}{60} : \frac{60}{60} :: \frac{1}{4} : \frac{1}{4} \times \frac{60}{60} \times \frac{60}{60} = \frac{15}{60} = B$ 's true share which is therefore =  $\frac{1}{4}$  of \$6213 = \$1635.
- $\frac{57}{60} : \frac{60}{60} :: \frac{1}{5} : \frac{1}{5} \times \frac{60}{60} \times \frac{60}{60} = \frac{12}{60} = C$ 's true share which is therefore =  $\frac{1}{5}$  of \$6213 = \$1308.

ELEVENTH SERIES.

(121)

$$\begin{aligned} \cdot 7 = \frac{7}{9}; \quad \cdot 83 = \frac{83}{99}; \quad \cdot 727 = \frac{727}{999}; \quad \cdot 91325 = \frac{91325}{99999} = \frac{91325}{99999} = \frac{156667}{199999} \\ 8 \cdot 671347 = 8 \frac{671347}{99999} = 8 \frac{671347}{99999} = 8 \frac{11188}{16666} \end{aligned}$$

(122)

713 unden. = 816 den.; 291 unden. = 342 den.; 3t1 unden.  
= 474 den.

291  
Then 713 — unden. = 861  $\frac{291}{713}$  den. = 861  $\frac{57}{9}$  den.  
3t1

12123 quat. = 411 den.; 11223 quat. = 363 den.; 100000 quat.  
= 1024 den.

Then 12123  $\frac{11223}{100000} = 411 \frac{363}{1024}$  den.

(123)

3  $\frac{3}{8}$  of 2  $\frac{1}{2}$  of 7  $\frac{1}{10}$  of £1 =  $\frac{27}{8}$  of  $\frac{1}{6}$  of  $\frac{151}{20}$  of £1  
= £  $\frac{27 \times 151}{8 \times 6 \times 20} = \dots = \text{£}56 \ 1 \ 2 \frac{1}{10}$   
9  $\frac{7}{8}$  of 3  $\frac{5}{9}$  of 1s. — 6  $\frac{5}{8}$  of 3  $\frac{5}{9}$  of 1s. =  $\frac{130}{8}$  s. .... = 16 8  
8  $\frac{1}{4}$  of 4  $\frac{1}{8}$  of 1d. =  $\frac{13}{4}$  of 3  $\frac{3}{8}$  of 1d. =  $\frac{1089}{32}$  d. ... = 0 2 10  $\frac{1}{8}$   
Sum = £58 0 8  $\frac{1}{10}$

$\frac{1}{2}$  of  $\frac{5}{4}$  of  $\frac{3}{8}$  of 3  $\frac{1}{2}$  d. =  $\frac{1}{2} \times \frac{5}{4} \times \frac{3}{8} \times \frac{7}{2} = \frac{55}{16}$  d.

£58 0s. 8  $\frac{1}{10}$  d. =  $22 \frac{2501}{160}$  d.

$22 \frac{2501}{160} \div \frac{55}{16} = 22 \frac{2501}{160} \times \frac{16}{55} = \frac{202521}{5} \times \frac{1}{5} = \frac{210321}{25}$   
= 32414.56.

(124)

$$\begin{array}{l} 24 : 90 \\ 2\frac{1}{2} : 4 \\ 12\frac{1}{2} : 9 \\ 4\frac{7}{8} : 4\frac{1}{2} \\ 3\frac{1}{2} : 2\frac{1}{2} \end{array} \left| \begin{array}{l} \\ \\ \\ \\ \end{array} \right. :: 139\frac{1}{2} : x$$

(Continued on next page.)

(124 continued.)

9

18      7                  3                    43

$$\frac{90}{1} \times \frac{21}{5} \times \frac{29}{3} \times \frac{9}{2} \times \frac{5}{2} \times \frac{559}{4} \times \frac{1}{24} \times \frac{2}{5} \times \frac{2}{25} \times \frac{8}{80}$$

$$\times \frac{5}{16} = \frac{9 \times 7 \times 29 \times 43}{2 \times 4 \times 5 \times 4} = \frac{78561}{161} = 491\frac{1}{160}$$

8  
4

(125)

\$182 is  $\frac{91}{100}$  of buying price  $\therefore \$182 \div 91 = \$2 = \frac{1}{100}$  of buying price  $\therefore$  buying price  $= \$2 \times 100 = \$200$ .  
 To realize a profit of 7 per cent., he must receive \$1.07 for every \$1 the goods cost; but they cost him \$200, therefore he must sell for  $\$1.07 \times 200 = \$214$ .

(126)

Simple Interest  $t = \frac{n-1}{r} = \frac{11\frac{1}{2}-1}{.06} = \frac{10.5}{.06} = \frac{1050}{6}$   
 $= 175$  years.

Compound Interest  $t = \frac{\log. n}{\log. (1+r)} = \frac{\log. 11\frac{1}{2}}{\log. 1.06} = \frac{1.060698}{0.025306}$   
 $= \frac{1060698}{25306} = 41.914$  years.

(127)

An acre contains 4 roods  $= 160$  sq. perches.  
 $\therefore 160 \div 15\frac{1}{2} = 10\frac{2}{31}$  perches = length.

(128)

35 yards = 32 metres  $\therefore 1$  yd.  $= \frac{32}{35}$  of a metre.  
 $69\frac{1}{2}$  miles  $= 69\frac{1}{2} \times \frac{1760}{1}$  yards  $= 69\frac{1}{2} \times \frac{1760}{1} \times \frac{32}{35}$  metres

$$= \frac{217}{22} \times \frac{1760}{1} \times \frac{32}{35} = 217 \times 16 \times 32 = 111104$$
 metres.

8  
7

(129)

7 means + 2 extremes = 9 terms.

$$\text{Formula XIII, p. 340. } r = \left(\frac{l}{a}\right)^{\frac{1}{n-1}} = \left(\frac{19683}{3}\right)^{\frac{1}{8}} = (6561)^{\frac{1}{8}} = 3$$

Hence means are 9, 27, 81, 243, 729, 2187, and 6561.

(130)

$$\text{Formula XXI, p. 344. } s = \frac{a}{1-r} = \frac{7}{1-\frac{1}{3}} = \frac{7}{\frac{2}{3}} = \frac{21}{2} = 10\frac{1}{2}.$$

(131)

Part remaining after 1st has received his share =  $\frac{3}{4}$ .

$$1 : \frac{3}{4} :: 60^2 : x^2; \text{ whence } x = \sqrt{3600 \times \frac{3}{4}} = \sqrt{900 \times 3} \\ = 30\sqrt{3} = 1.732 \times 30 = 51.96 \text{ inches.}$$

Hence 1st ground off  $60 - 51.96 = 8.04$  inches.Part remaining after 2nd had taken off his share =  $\frac{1}{2}$ .

$$1 : \frac{1}{2} :: 60^2 : x^2; \text{ whence } x = \sqrt{3600 \times \frac{1}{2}} = 30\sqrt{2} \\ = 1.4142 \times 30 = 42.426.$$

Hence 2nd ground off  $51.96 - 42.426 = 9.534$  inches.Part remaining after the 3rd had taken off his share =  $\frac{1}{4}$ .

$$1 : \frac{1}{4} :: 6^2 : x^2; \text{ whence } x = \sqrt{3600 \times \frac{1}{4}} = \sqrt{900} = 30 \text{ inches.}$$

Hence 3rd ground off  $42.426 - 30$  inches = 12.426 inches,  
and the 4th ground off remaining 30 inches.

(132)

$$1 \text{ guinea} = 21\text{s.}$$

$$1 \text{ half-guinea} = 10\frac{1}{2}\text{s.}$$

$$1 \text{ crown} = 5\text{s.}$$

$$1 \text{ half-crown} = 2\frac{1}{2}\text{s.}$$

$$1 \text{ shilling} = 1\text{s.}$$

$$\text{Sixpence} = \frac{1}{2}\text{s.}$$

$$100 \text{ guineas} = 2100 \text{ shillings.}$$

$$2100 \div 40\frac{1}{2} = 51 \text{ times and re-} \\ \text{mainder, } 69 \text{ half-shillings.}$$

$$69 \text{ half-shil.} = \frac{69}{2}\text{s.} = \text{£}\frac{69}{40} = 1\frac{29}{40}.$$

$$\text{Sum} = 40\frac{1}{2}\text{s.}$$

TWELFTH SERIES.

(133)

$$\frac{3}{11} \text{ of } \frac{2}{9} \text{ of } \frac{4}{17} = \frac{8}{561}; \frac{2\frac{1}{2}}{4\frac{1}{4}} \text{ of } \frac{2}{5} = \frac{10}{17} \text{ of } \frac{2}{5} = \frac{4}{17}$$

$$\frac{8}{561} : \frac{4}{17} :: \$12\frac{4}{33} : \$12\frac{4}{33} \times \frac{4}{17} \times \frac{561}{8} = \frac{\$200}{\cancel{33}} \times \frac{4}{17} \times \frac{\cancel{561}}{8} = \$200.$$

(134)

By Formula III, page 354,  $r = \sqrt[t]{\frac{A}{P}} - 1 \therefore r + 1 = \sqrt[t]{\frac{A}{P}}$

$$\begin{aligned} \therefore \text{Log. } (1 + r) &= (\text{log. } A - \text{log. } P) \div t \\ &= (\text{log. } 1679 \cdot 40 - \text{log. } 700 \cdot 90) \div 5 \\ &= (3 \cdot 225154 - 2 \cdot 845656) \div 5 \\ &= 0 \cdot 379498 \div 5 = 0 \cdot 075894. \end{aligned}$$

$\therefore 1 + r =$  nat. num. corresponding to the logarithm  $0 \cdot 074894$  which is  $1 \cdot 19$ ,  $\therefore r = \cdot 19 =$  rate per unit, and hence rate per cent.  $= 19$ .

(135)

Having paid 10 per cent. he had 90 per cent. remaining.

$$\frac{90}{100} \text{ or } \frac{9}{10} \text{ of his salary} = \$1250, \therefore \frac{1}{10} = \frac{1250}{9} = \$138\frac{2}{9}$$

$$\text{If } \$138\frac{2}{9} = \frac{1}{10}, \text{ the whole} = \$138\frac{2}{9} \times 10 = \$1388 \cdot 888.$$

(136)

21 children receive 21 times a child's share

21 women " 42 " "

21 men " 63 " "

Together they receive 126 " "

$$£3 \text{ } 13\text{s. } 6\text{d.} \div 126 = 7\text{d.} = \text{a child's share.}$$

$$7\text{d.} \times 2 = 1\text{s. } 2\text{d.} = \text{a woman's share.}$$

$$7\text{d.} + 1\text{s. } 2\text{d.} = 1\text{s. } 9\text{d.} = \text{a man's share.}$$



(137)

A gets 1 time A's share.

B " 1 " A's "

C " 2 " A's "

D " 4 " A's "

Together they get 8 times A's share.

$\$200 \div 8 = \$25 =$  A's share ;  $\$25 =$  B's share.

$\$25 + \$25 = \$50 =$  C's share ;  $\$25 + \$25 + \$50 = \$100$   
 $=$  D's share.

(138)

$$\sqrt{\frac{2}{3}} = \frac{1}{3} \sqrt{18} = \frac{1}{3} \text{ of } 2.62074 = .87358$$

$$\sqrt{\frac{3}{5}} = \frac{1}{5} \sqrt{6} = \frac{1}{5} \text{ of } 2.44948 = .81649$$

$$\text{Difference} = .05709$$

(139)

$\frac{327}{92807}$  when each term is divided by 121, becomes  $\frac{27}{767}$ .

$$17\frac{5}{12} + 1\frac{1}{5} + 144\frac{1}{11} = 161 + \frac{5}{12} + \frac{1}{5} + \frac{1}{11} = 161 + \frac{175}{120} + \frac{11}{110}$$

$$+ \frac{220}{110} = 161 + \frac{507}{110} = 161 + 1\frac{87}{110} = 162\frac{87}{110} = 162\frac{29}{40}$$

$$2\frac{1}{3} - \frac{1}{2} = 2\frac{2}{6} - \frac{3}{6} = 1\frac{4}{6} - \frac{1}{6} = 1\frac{3}{6} = 1\frac{1}{2}$$

5

$$\begin{array}{ccccccc} 3 & 6 & 4 & 15 & 21 & 54 & \\ - \text{ of } - & \text{ of } - & \text{ of } - & \text{ of } - & \text{ of } - & = & - \\ 4 & 7 & 15 & 11 & 23 & 253 & \end{array}$$

$$6347 \div 2\frac{1}{4} = \frac{6347}{1} \div \frac{1}{4} = \frac{6347}{1} \times \frac{4}{1} = 25388$$

(140)

	884736 (96 = cube root.)
	729
	-----
$9^2 = 81 \times 300$	$= 24300$
$9 \times 6 = 54 \times 50$	$= 1620$
$6^2 =$	$36$
	-----
	25956
	-----
	155736

$$95951\frac{1}{6}\frac{5}{6} = 95951.2576$$

(Continued on next page.)

(140 continued.)

95951.2576 (309.76 = square root.

<p>9</p> <p>609 ) <u>5951</u></p> <p style="padding-left: 2em;">5481</p> <hr style="width: 100%;"/> <p>618.7) <u>470.25</u></p> <p style="padding-left: 2em;">433.09</p> <hr style="width: 100%;"/> <p>619.46) <u>37.1676</u></p> <p style="padding-left: 2em;">37.1676</p> <hr style="width: 100%;"/>	<p>309.76 (17.6=17<math>\frac{2}{3}</math>=fourth root.</p> <p>1</p> <hr style="width: 100%;"/> <p>29   209</p> <p style="padding-left: 1em;">189</p> <hr style="width: 100%;"/> <p>34.6   2076</p> <p style="padding-left: 1em;">2076</p> <hr style="width: 100%;"/>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

(141)

<p>250</p> <p>300</p> <p>400</p> <p>500</p> <hr style="width: 100%;"/>	<p>1450:250:: \$520: <math>\frac{\\$520 \times 250}{1450} = \\$89\frac{1}{2}</math> = contrib. on 1st village.</p> <p>1450:300:: \$520: <math>\frac{\\$520 \times 300}{1450} = \\$107\frac{1}{2}</math> = " 2d "</p> <p>1450:400:: \$520: <math>\frac{\\$520 \times 400}{1450} = \\$143\frac{1}{2}</math> = " 3d "</p> <p>1450:500:: \$520: <math>\frac{\\$520 \times 500}{1450} = \\$179\frac{1}{2}</math> = " 4th "</p>
------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

(142)

By Table on p. 362, the amount of \$1 for 34 payments at 3 per cent. = \$57.73018.

$$\$57.73018 \times 260 = \$15009.84.$$

By Formula I, page 361,  $A = \frac{a \{ (1+r)^t - 1 \}}{2}$

$$= \frac{a}{r} \{ (1+r)^t - 1 \} = \frac{260}{.03} \{ (1.03)^{34} - 1 \}$$

$$= \frac{26000}{3} \times (2.731855 - 1) = \frac{26000 \times 1.731855}{3} = \$15009.41.$$

(143)

$$\text{By Formula IX, p. 333, } d = \frac{l-a}{n-1} = \frac{79-2}{6-1} = \frac{77}{5} = 15\frac{2}{5}.$$

Hence the series is 2,  $17\frac{2}{5}$ ,  $32\frac{4}{5}$ ,  $48\frac{1}{5}$ ,  $63\frac{3}{5}$ , and 79.

$$\text{Formula I, p. 333. } l = a + (n-1)d = 3 + (9-1) \times 4 \\ = 3 + 8 \times 4 = 3 + 32 = 35.$$

$$\text{Formula VI, p. 333. } s = \left\{ 2a + (n-1)d \right\} \frac{n}{2} \\ = \left\{ 2 \times 3 + (207-1) \times 4 \right\} \frac{207}{2} = (6 + 206 \times 4) \frac{207}{2} \\ = (6 + 824) \times \frac{207}{2} = \frac{830 \times 207}{2} = 85905.$$

(144)

B travels 4 miles per day faster than A, and will therefore gain the circumference of the island in  $\frac{7^3}{4} = 18\frac{1}{4}$  days.

C travels 10 miles per day faster than A, and will therefore gain the whole circumference of the island in  $\frac{7^3}{10} = 7\frac{1}{10}$  days.

Now B cannot be with A except at the end of  $18\frac{1}{4}$  days, or twice  $18\frac{1}{4}$  days, or three times  $18\frac{1}{4}$  days, or some other multiple of  $18\frac{1}{4}$  days.

Similarly C cannot be with A except at the end of  $7\frac{1}{10}$  days, or of some other multiple of  $7\frac{1}{10}$  days.

Therefore C and B will both be with A for the first time after the lapse of a number of days expressed by the least common multiple of  $18\frac{1}{4}$  and  $7\frac{1}{10}$ .

The greatest common factor of  $18\frac{1}{4}$  and  $7\frac{1}{10}$  is  $3\frac{1}{20}$ .

$$\text{Hence the l. c. m. of } 7\frac{1}{10} \text{ and } 18\frac{1}{4} \text{ is } \frac{7\frac{1}{10} \times 18\frac{1}{4}}{3\frac{1}{20}} = 36\frac{1}{2} = \text{number}$$

of days when A, B, and C will first be together.

## ARITHMETICAL RECREATIONS.

1. The third of 6 = 2, and the fourth of 20 = 5.

Then if 2 becomes 3, what should 5 become? Evidently  $7\frac{1}{2}$ . *Ans.*

or

$$\left. \begin{array}{l} 6 : 20 \\ \frac{1}{3} : \frac{1}{4} \end{array} \right\} :: 3 : x = \frac{3 \times 20 \times \frac{1}{4}}{6 \times \frac{1}{3}} = 7\frac{1}{2}.$$

2. The half of 5 =  $2\frac{1}{2}$ ; then if 7 becomes  $2\frac{1}{2}$ , what will 11 become?

$$\frac{2\frac{1}{2} \times 11}{7} = \frac{5\frac{5}{2}}{14}. \text{ Lastly, what part of 9 is } \frac{5\frac{5}{2}}{14}?$$

$$\frac{\frac{5\frac{5}{2}}{14}}{\frac{9}{1}} = \frac{5\frac{5}{2}}{126}. \text{ Ans.}$$

or

$$\left. \begin{array}{l} 9 : 5 \\ 7 : 11 \end{array} \right\} :: \frac{1}{2} : x = \frac{\frac{1}{2} \times 5 \times 11}{9 \times 7} = \frac{5\frac{5}{2}}{63} = \frac{5\frac{5}{2}}{126}. \text{ Ans.}$$

3.  $99\frac{2}{3}$ .

4.  $\frac{1}{3}$  of 2d. =  $\frac{2}{3}$ d. Then  $\frac{2}{3}$ d. is what part of 3d.? *Ans.*  $\frac{2}{9}$ .

5.  $1\frac{1}{2}$ d. for a herring and a half is at the rate of 1d. per herring; hence 11 herrings will cost 11d.

6. 12 apples = 21 pears = 7 cents.

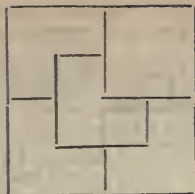
If 12 apples cost 7 cents, what will 100 apples cost?

$$12 : 100 :: 7 : \frac{100 \times 7}{12} = 58\frac{1}{3} \text{ cents.}$$

7. If 5 is  $\frac{2}{3}$  of a certain number,  $\frac{1}{3}$  will be  $\frac{1}{3}$  of 5, which is  $\frac{5}{3}$ . If  $\frac{5}{3}$  is  $\frac{1}{7}$  of a certain number, the whole number will be  $\frac{5}{3} \times 7 = \frac{35}{3} = 11\frac{2}{3}$ . *Ans.*

8. The hurdles are arranged so as to form a rectangular enclosure having 49 hurdles on each side and one on each end. Two additional hurdles will give two hurdles to each end, and will thus double the size of the enclosure.

9. The mode of dividing the plot may be learned from the following figure:—



10.  $33\frac{3}{4}$ .

11. XIII; rub out the lower half, and there remains the expression VIII = 8.

12. 1st Step: Fill the 3-gallon cask and empty it into the 5-gallon cask.

2nd Step: Again fill the 3-gallon cask out of the 8-gallon cask.

3rd Step: Fill up the 5-gallon cask out of the 3-gallon cask. This will leave one gallon in the latter.

4th Step: Empty the 5-gallon cask into the 8-gallon cask.

5th Step: Pour the one gallon out of the 3-gallon cask into the 5-gallon cask.

6th Step: Fill the 3-gallon cask out of the 8-gallon cask and empty it into the 5-gallon cask.

The following diagrams show this more clearly :

1st Step.



2nd Step.



3rd Step.



4th Step.



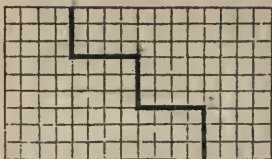
5th Step.



6th Step.



13. The heavy line in the accompanying figure shows how the board is to be cut.



14.

8	1	6
3	5	7
4	9	2

15. Weigh out 7 lbs. as often as possible and there will remain 2 lbs.; add two four pounds and one seven pounds to this, and the sum will be 17 lbs., the share of one.

Weigh 7 lbs. as often as possible out of the remaining 34 lbs. and there will remain 6 lbs., to which add 7 lbs. and 4 lbs., and the sum will be 17 lbs., the share of the second. The remaining 17 lbs. will be the share of the third.

16. The hurdles are, in the first case, placed 12 on a side and one on each end, and then they inclose a space represented by 12 squares whose area is, by the question, 40 square yards. If two hurdles be taken away there will remain 24, and if these be placed in the form of a square, each side containing 6 hurdles, they will enclose a space represented by 36 squares of the same size as the former. Hence they now inclose three times as much space as before, *i. e.* three times 40 square yards, or 120 square yards.

17. He takes the goose to the remote bank and leaves it there, returning, he next carries over the fox, which he leaves, but takes the goose back with him. He now leaves the goose on the first bank, and carries over the oats which he allows to remain on the remote bank with the fox and returns for the goose.

18. The following diagrams exhibit the solution of this problem :

I.	II.	III.	IV.	V.	VI.																																																						
<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border: 1px solid black; padding: 2px;">3</td><td style="border: 1px solid black; padding: 2px;">3</td><td style="border: 1px solid black; padding: 2px;">3</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">3</td><td style="border: 1px solid black; padding: 2px;">P</td><td style="border: 1px solid black; padding: 2px;">3</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">3</td><td style="border: 1px solid black; padding: 2px;">3</td><td style="border: 1px solid black; padding: 2px;">3</td></tr> </table>	3	3	3	3	P	3	3	3	3	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border: 1px solid black; padding: 2px;">4</td><td style="border: 1px solid black; padding: 2px;">1</td><td style="border: 1px solid black; padding: 2px;">4</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">1</td><td style="border: 1px solid black; padding: 2px;">P</td><td style="border: 1px solid black; padding: 2px;">1</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">4</td><td style="border: 1px solid black; padding: 2px;">1</td><td style="border: 1px solid black; padding: 2px;">4</td></tr> </table>	4	1	4	1	P	1	4	1	4	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border: 1px solid black; padding: 2px;">2</td><td style="border: 1px solid black; padding: 2px;">5</td><td style="border: 1px solid black; padding: 2px;">2</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">5</td><td style="border: 1px solid black; padding: 2px;">P</td><td style="border: 1px solid black; padding: 2px;">5</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">2</td><td style="border: 1px solid black; padding: 2px;">5</td><td style="border: 1px solid black; padding: 2px;">2</td></tr> </table>	2	5	2	5	P	5	2	5	2	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border: 1px solid black; padding: 2px;">1</td><td style="border: 1px solid black; padding: 2px;">7</td><td style="border: 1px solid black; padding: 2px;">1</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">7</td><td style="border: 1px solid black; padding: 2px;">P</td><td style="border: 1px solid black; padding: 2px;">7</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">1</td><td style="border: 1px solid black; padding: 2px;">7</td><td style="border: 1px solid black; padding: 2px;">1</td></tr> </table>	1	7	1	7	P	7	1	7	1	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border: 1px solid black; padding: 2px;">0</td><td style="border: 1px solid black; padding: 2px;">9</td><td style="border: 1px solid black; padding: 2px;">0</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">9</td><td style="border: 1px solid black; padding: 2px;">P</td><td style="border: 1px solid black; padding: 2px;">9</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">0</td><td style="border: 1px solid black; padding: 2px;">9</td><td style="border: 1px solid black; padding: 2px;">0</td></tr> </table>	0	9	0	9	P	9	0	9	0	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border: 1px solid black; padding: 2px;">5</td><td style="border: 1px solid black; padding: 2px;">0</td><td style="border: 1px solid black; padding: 2px;">4</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">0</td><td style="border: 1px solid black; padding: 2px;">P</td><td style="border: 1px solid black; padding: 2px;">0</td></tr> <tr><td style="border: 1px solid black; padding: 2px;">4</td><td style="border: 1px solid black; padding: 2px;">0</td><td style="border: 1px solid black; padding: 2px;">5</td></tr> </table>	5	0	4	0	P	0	4	0	5
3	3	3																																																									
3	P	3																																																									
3	3	3																																																									
4	1	4																																																									
1	P	1																																																									
4	1	4																																																									
2	5	2																																																									
5	P	5																																																									
2	5	2																																																									
1	7	1																																																									
7	P	7																																																									
1	7	1																																																									
0	9	0																																																									
9	P	9																																																									
0	9	0																																																									
5	0	4																																																									
0	P	0																																																									
4	0	5																																																									
24	20	28	32	36	18																																																						

19. Represent the three husbands by A, B, and C, and their wives respectively by the letters *a*, *b*, and *c*.

I. A and *a* go over, *a* remains while A takes back the boat.

II. *b* and *c* go over and remain while *a* takes back the boat.

III. B and C go over, B remains while C and *c* take back the boat.

IV. A and C go over and remain while *b* takes back the boat.

V. *a* and *b* go over and remain while C takes back the boat.

VI. C. and *c* go over.

20.

17	24	1	8	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9

**RULE FOR FILLING MAGIC SQUARES OF ODD NUMBER OF CELLS.**

Begin in centre cell of top horizontal row by placing 1 in it; ascend diagonally to the right, and where this carries us beyond the square, transport the next number to the cell at the remote end of the vertical or horizontal band to which it belongs. When in ascending we come to a cell already filled we place the number in the cell next below the cell last filled. The following is a square of 7 cells in a side filled after this method :



30	39	48	1	10	19	28
38	47	7	9	18	27	29
46	6	8	17	26	35	37
5	14	16	25	34	36	45
13	15	24	33	42	44	4
21	23	32	41	43	3	12
22	31	40	49	2	11	20

21. Half-a-dozen dozen =  $6 \times 12 = 72$ .

Six dozen dozen =  $6 \times 12 \times 12 = 864$ .

$864 - 72 = 792$ . *Ans.*

22. The following shows the mode of performing this.

It will be observed that the two side-counters are merely moved one counter higher when the other two are taken away.

0  
0  
0  
0  
0  
0  
0  
0

23. This problem admits of the following two solutions :

1ST SOLUTION.

Persons.	Full bottles.	Hf.-full bottles.	Empty bottles.
1st	2	3	2
2nd	2	3	2
3rd	3	1	3
.	<hr/>	<hr/>	<hr/>
	7	7	7

Each person has  $3\frac{1}{2}$  bottles of wine and 7 bottles.

2ND SOLUTION.

1st	3	1	3
2nd	3	1	3
3rd	1	5	1
	<hr/>	<hr/>	<hr/>
	7	7	7

Each person, as before, has 7 bottles and  $3\frac{1}{2}$  bottles of wine.



24. There were in all 8 hottles of wine, of which each drank  $\frac{1}{4}$ , which is  $2\frac{3}{4}$ . The third person, therefore, drank  $\frac{1}{4}$  of a bottle belonging to him who had but 3 hottles, and  $\frac{7}{8}$  of a bottle belonging to him who owned the 5 hottles. Hence the latter should have *seven* times as much of the money as the former, or, in other words, the latter gets 7 shillings and the former 1 shilling.
25. This problem is merely to find some number between 5 and 100 which is exactly divisible by 2 and by 3, but which divided by 5 leaves a remainder 3.

The only numbers between 50 and 100 that are divisible by both 2 and 3 are 54, 60, 66, 72, 78, 84, 90, and 96, and by inspection the only one of these which gives a remainder 3 when divided by 5 is 78; therefore the basket contained 78 eggs.

26. *Ans.* 1 lh., 3 lbs., 9 lbs., and 27 lbs.

For 1 lh. = 1 lh.; 2 lbs. = 3 lbs. — 1 lh., i. e. 3 lbs in one scale and 1 lh. in the other; 3 lbs. = 3 lbs.; 4 lbs. = 3 lbs. + 1 lb.; 5 lbs. = 9 lbs. — (3 lbs. + 1 lh.); 6 lbs. = 9 lbs. — 3 lbs.; 7 lbs. = 9 lbs. + 1 lh. — 3 lbs.; 8 lbs. = 9 lbs. — 1 lh.; 9 lbs. = 9 lbs.; 10 lbs. = 9 + 1 lb.; 11 lbs. = 9 lbs. + 3 lbs. — 1 lb.; 13 lbs. = 9 lbs. + 3 lbs. + 1 lh.; 14 lbs. = 27 lbs. — (9 lbs. + 3 lbs. + 1 lb.); 15 lbs. = 27 lbs. — (9 lbs. + 3 lbs.); 16 lbs. = 27 lbs. + 1 lh. — (9 lbs. + 3 lbs.); 17 lbs. = 27 lbs. — (9 lbs. + 1 lh.); 18 lbs. = 27 lbs. — 9 lbs.; &c., &c.

27. In order to fill seven out of the eight points, it is merely requisite to remember that the second counter must be carried to the point from which the first *started*, the third to the point from which the second started, &c.

Thus if the first counter is carried from 1 to 4 and there deposited, the second must be taken from 6 to 1 and there deposited; the third from 3 to 6; the fourth from 8 to 3; the fifth from 5 to 8; the sixth from 2 to 5; and the seventh either from 7 to 2 or from 2 to 7.

28. The mouth fills the reservoir in 6 hours, therefore it fills  $\frac{1}{6}$  in 1 hour; the right eye fills it in 48 hours, therefore it fills

$\frac{1}{8}$  in 1 hour; the left eye fills it in 72 hours, therefore it fills  $\frac{1}{72}$  in 1 hour; the foot fills it in 96 hours, therefore it fills  $\frac{1}{96}$  in 1 hour. Hence together they fill  $\frac{1}{6} + \frac{1}{8} + \frac{1}{72} + \frac{1}{96} = \frac{61}{288}$  in 1 hour, and to fill the reservoir they require  $1 \div \frac{61}{288} = \frac{288}{61} = 4$  hours 43 min.  $16\frac{44}{61}$  sec.

29. The person who thinks of the numbers must proceed as follows: He must multiply the 1st by 2 and add 5 to the product; he must next multiply this sum by 5 and add the second number to the product; he must next multiply this result by 10 and add the third number to the product; lastly, he must subtract 250 and name the remainder.

The three digits of the remainder will be the three numbers thought of, and will be in the order in which they were thought of.

The reason is obvious: let  $a = 1$ st,  $b = 2$ nd, and  $c = 3$ rd number thought of.

$$a \times 2 + 5 = 2a + 5.$$

$$(2a + 5) \times 5 + b = 10a + b + 25.$$

$$(10a + b + 25) \times 10 + c = 100a + 10b + c + 250.$$

$$(100a + 10b + c + 250) - 250 = 100a + 10b + c = a \text{ in hundreds' place, } b \text{ in tens' place, and } c \text{ in units' place.}$$

30. Since each man possesses 63 square rods of land more than his son, we must form three pairs of numbers, such that the difference of their squares shall be 63.

The difference of the squares of two numbers is equal to their sum multiplied by their difference, and hence 63 must be divided into two factors in three distinct ways, thus:

$$63 = 63 \times 1 = 21 \times 3 = 9 \times 7.$$

If sum = 63 and difference = 1, the numbers are 32 and 31.

If sum = 21 and difference = 3, the numbers are 12 and 9.

If sum = 9 and difference = 7, the numbers are 8 and 1.

Hence the squares of Jones, Brown, and Smith, are respectively 32 rods, 12 rods, and 8 rods on the side, and the son's squares are respectively 31, 9, and 1 yards on the side.

Jones' piece was 23 rods longer on each side than Tom's, and since the difference between 32 and 9 is 23, we may conclude that Jones' square was 32 rods to the side, and Tom's 9 rods on a side.

Brown's piece was 11 rods longer on a side than Harry's, and since if the above numbers 12 and 1 have 11 for their difference, we may conclude that Brown's piece was 12 rods on a side, and Harry's piece 1 rod.

Hence Tom was Brown's son, Harry was Smith's son, and Ned was Jones' son.

31. The mode of arranging the crew may be remembered by attention to the vowels in the following line :

*Populeam virgam mater regina ferebat.*

The vowels refer to the crew as follows,  $a = 1$ ,  $e = 2$ ,  $i = 3$ ,  $o = 4$ , and  $u = 5$ .

We begin with 4 whites because the first vowel is  $o$ , next  $u = 5$  blacks, next  $e = 2$  whites, next  $a = 1$  black, next  $i = 3$  whites, next  $a = 1$  black, next  $e = 2$  whites, next  $e = 2$  blacks, &c., as follows,  $o$  standing for a white and  $+$  for a black.

oooo+++++oo+oo+o++++o+++++

32. You select the multiplier or the multiplicand, such that the sum of its digits shall be exactly divisible by nine. Hence upon the principle of the proof by casting out the nines, the product has the sum of its digits exactly divisible by nine. By subtracting the sum of the digits of the remainder from the next higher multiple of 9 you determine the digit crossed out.

Thus suppose you select 117, and he takes for multiplicand 21613. Then  $21613 \times 117 = 2528721$ . Now suppose he crosses out the 7; upon reading you the remaining digits 252821, you find that their sum = 20, which taken from 27 the next higher multiple of 9 leaves 7 the digit he crossed out.

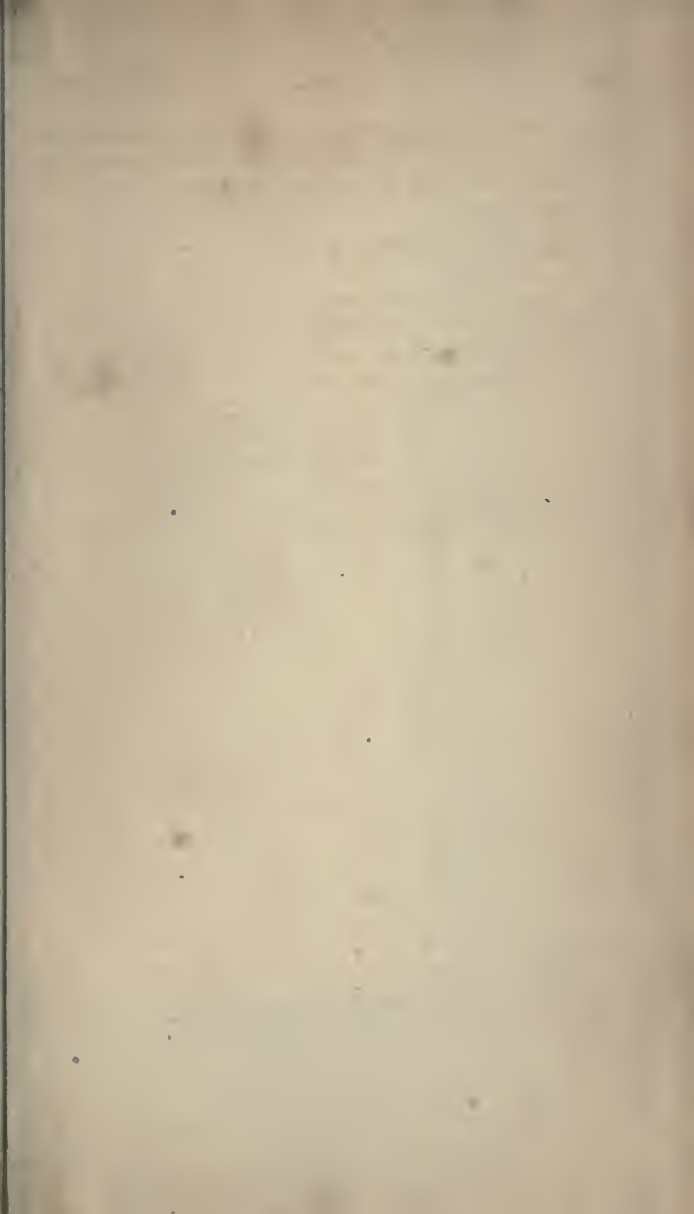
If he crosses out a 0 or a 9, you cannot determine which, but in all other cases you can tell the exact figure.

33. You write the second, fourth, sixth, &c. lines in such a manner as to make the sum of the first pair, the sum of the second pair, &c. an exact number of 9's. Then having settled the number of pairs, you get the answer by multiplying by that number a row of 9's containing as many digits as there are to be figures in the line.

Thus suppose you agree to write 5 lines each, and that each line is to contain 5 digits, or not more than 5 digits. Then  $99999 \times 5 = 499995$  will be the answer. This is shown as follows:

Suppose he writes	41113	}	=	99999	}	
You write	58886	}	=	99999		
Suppose he writes	61451	}	=	99999		
You write	38548	}	=	99999		
Suppose he writes	6500	}	=	99999		
You write	93499	}	=	99999		
Suppose he writes	1	}	=	99999		
You write	99998	}	=	99999		
Suppose he writes	99999	}	=	99999		
You write	00000	}	=	99999		
<hr style="width: 10%; margin: 0 auto;"/>						
Sum = 499995						

THE END.





1861  
SMR

