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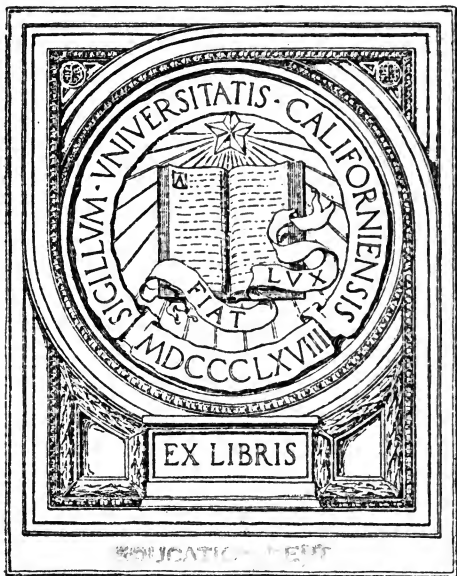


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THE WERNER  
MENTAL  
ARITHMETIC

IN MEMORIAM

John Swett



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THE WERNER

# MENTAL ARITHMETIC

CONTAINING

THE PRINCIPLES OF ARITHMETIC

WITH

NUMEROUS PROBLEMS FOR ORAL ANALYSIS  
AND SOLUTION

BY

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ENGLISH AND AMERICAN LITERATURE."



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## PREFACE.

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THE educational public have become so accustomed to the term mental arithmetic, and the title has become so distinctive, that it would probably be unwise to call the exercises prepared for a book of this kind by their proper name—oral arithmetic. Mental Arithmetic is therefore used as the name of the book, because this title has become most familiar to both teacher and pupil.

The author has tried to make this work not only progressive and practical in its character, but also to adapt it to the wants of those who believe that oral and written arithmetic should be taught in conjunction, the mental or oral arithmetic being made to serve the purpose of developing the principles of the science by a class of problems simpler than are usually found in the written arithmetic, where the help of pen or pencil is an excuse for their presence.

Much of the opposition which once existed against the study of mental arithmetic arose partly because the subject was made too difficult, and partly because there was no visible connection, as ordinarily taught, between the oral and the written process. In order to overcome these objections all ambiguous or mere puzzle problems have been discarded, and

special efforts have been made to develop the principles of the science in harmony with the order and methods found in works on arithmetic where both the oral and the written process are used, but giving a greater number and variety of problems for oral solution than could profitably be given in a book in which both processes are combined.

A. N. R.

DELAWARE COLLEGE, DEL.

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# MENTAL ARITHMETIC.

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## ADDITION.

### I.

1. A boy has 1 right eye and 1 left eye; how many eyes has he?

2. If I have 2 apples in one hand and 1 apple in the other, how many apples have I?

3. Mary has 2 books and her sister has 2; how many have they together?

4. Mary had 3 cents and found 1; how many had she then?

5. A boy had 3 dollars and earned 2 dollars more; how many dollars had he then?

6. James found 2 apples and George found 3; how many did they both find?

7. Tabby caught 3 mice and Tom caught 3; how many did they both catch?

8. A pencil cost 4 cents, and some pens 3 cents; how much did they both cost?

9. If a boy has 5 cents and his sister has 2 cents, how many cents have they together?

10. How many cents are 6 cents and 1 cent?

11. A man earned 4 dollars on Monday and 4 dollars on Tuesday; how much did he earn in the two days?

12. James has 5 cents and Samuel has 3 cents; how many cents have they together?

13. How many are 6 cents and 2 cents?

14. How many are 7 cents and 1 cent?

15. Henry had 8 dollars, and earned 1 dollar more; how many had he then?

16. If George has 7 apples and I give him 2 more, how many will he then have?

17. Sarah baked 4 loaves of bread last week and 5 loaves this week; how many loaves did she bake in the two weeks?

18. A boy paid 6 cents for paper and 3 cents for pens; how much did he pay for both?

19. How many are 2 boys and 7 boys? 3 cents and 6 cents? 4 apples and 5 apples? 1 orange and 8 oranges?

20. Harry had 5 cents and earned 5 cents more; how many had he then?

21. There are 4 boys in one class and 6 in another; how many are there in both classes?

22. A man has 3 horses and 7 cows; how many animals has he?

23. A boy has 8 turkeys and 2 hens; how many fowls has he?

24. If a boy earns 1 dollar and his father earns 9 dollars, how much do they together earn?

25. How many are 9 dollars and 1 dollar? 6 men and 4 men? 7 apples and 3 apples? 8 days and 2 days? 5 cents and 5 cents?

26\*. How many are—

1 and 1?      2 and 3?      2 and 4?      2 and 5?

2 and 1?      1 and 4?      1 and 5?      6 and 1?

3 and 1?      3 and 2?      4 and 2?      4 and 4?

4 and 1?      3 and 3?      4 and 3?      3 and 5?

\* If the learner find difficulty with the abstract numbers, let him at first use counters.

27. How many are—

2 and 6?    4 and 5?    5 and 5?    8 and 2?

7 and 1?    3 and 6?    6 and 4?    7 and 3?

7 and 2?    8 and 1?    1 and 9?    4 and 6?

28. How many are—

7 and 1?    4 and 5?    6 and 2?    4 and 6?

4 and 2?    7 and 2?    2 and 5?    4 and 5?

3 and 3?    5 and 1?    3 and 4?    3 and 7?

## 2.

1. William had 10 cents and found 1 cent; how many cents had he then?

2. There are 10 eggs in one nest and 2 in another; how many eggs in both nests?

3. A boy has 10 hens and 3 ducks; how many fowls has he?

4. There are 10 boys in class and 4 girls; how many pupils in the class?

5. A coat cost 10 dollars and a hat 5 dollars; how much did both cost?

6. I had 11 dollars and earned 1 dollar more; how many dollars had I then?

7. A boy had 11 books and bought 2 more; how many books had he then?

8. If I pay 11 cents for a slate and 3 cents for pens, how much do I pay for both?

9. Mary gave me 11 plums and Henry gave me 4; how many plums have I?

10. Bought a slate for 12 cents and sold it for 1 cent more; how much did I get for it?

11. A farmer sold 12 sheep to one man and 2 to another; how many sheep did he sell?

12. A pupil answered 12 questions correctly and 3 incorrectly; how many did he try to answer?

13. George is 13 years old, his sister is 1 year older; how old is she?

14. James rode 13 miles and walked 2; how far did he travel?

15. Harry jumped 14 feet, but William jumped 1 foot farther; how far did William jump?

16. How many are 2 cents and 10 cents? 3 books and 10 books? 4 men and 10 men? 5 horses and 10 horses?

17. How many are 1 boy and 11 boys? 2 peaches and 11 peaches? 3 hats and 11 hats? 4 pens and 11 pens?

18. How many are 1 pencil and 12 pencils? 3 dollars and 12 dollars? 2 slates and 12 slates?

19. How many are 1 bell and 13 bells? 1 box and 14 boxes? 2 pins and 13 pins?

20. How many are 9 cents and 3 cents? 9 cents and 4 cents? 9 cups and 5 cups? 6 apples and 9 apples?

21. How many are 6 boys and 5 boys? 6 hens and 9 hens? 8 sheep and 6 sheep? 7 men and 7 men?

22. How many are 7 plums and 5 plums? 6 peaches and 7 peaches? 7 miles and 8 miles?

23. How many are 8 boys and 4 boys? 6 men and 8 men? 8 cows and 5 cows? 8 feet and 7 feet?

24. How many are—

7 and 4?    7 and 5?    7 and 6?    10 and 2?

8 and 4?    8 and 5?    8 and 6?    10 and 3?

9 and 4?    9 and 5?    9 and 6?    10 and 4?

25. How many are—

6 and 5?    8 and 3?    4 and 9?    3 and 8?

6 and 6?    8 and 7?    4 and 8?    3 and 10?

6 and 7?    6 and 8?    4 and 7?    3 and 12?

26. How many are—

5 and 6?    2 and 11?    3 and 10?    7 and 8?

5 and 8?    2 and 12?    3 and 11?    4 and 10?

5 and 10?    2 and 13?    3 and 12?    5 and 9?

## 3.

1. A man had 15 dollars and earned 1 dollar more; how much had he then?
2. A coat cost 15 dollars and a hat 5 dollars; how much did both cost?
3. Susan had 15 cents and her brother gave her 3 more; how many had she then?
4. James having 2 dollars earned 15 more; how many dollars had he then?
5. Samuel has 4 pears and John has 15; how many have they together?
6. A farmer having 16 cows bought 3 more; how many had he then?
7. James found 2 eggs in one nest and 16 in another; how many eggs did he find?
8. Mary had 4 chickens, but now she has 16 more; how many has she now?
9. Mary is 17 years old and her brother is 2 years older; how old is he?
10. Samuel had 17 chestnuts in his pocket and found 3 more; how many had he then?
11. If a boy is 18 years old, how old will he be in 2 years from now?
12. How many are 2 men and 15 men? 4 apples and 15 apples? 3 cents and 15 cents?
13. How many are 4 boys and 16 boys? 3 books and 16 books? 2 pens and 16 pens?
14. How many are 1 day and 17 days? 3 days and 17 days? 17 weeks and 2 weeks?
15. How many are 2 minutes and 18 minutes? 18 hours and 1 hour?
16. How many are 10 cents and 10 cents? 8 dollars and 8 dollars? 10 flies and 8 flies?

17. How many are 9 men and 10 men? 7 figs and 9 figs? 6 balls and 12 balls?

18. How many are 8 plates and 9 plates? 7 plums and 9 plums? 8 feet and 7 feet?

19. How many are 9 hens and 5 hens? 10 pigs and 6 pigs? 14 sheep and 5 sheep?

20. How many are—

6 and 11? 7 and 11? 5 and 13? 8 and 8?

5 and 12? 8 and 9? 6 and 13? 9 and 8?

7 and 9? 9 and 7? 7 and 13? 8 and 10?

The sign +, called *plus*, when placed between two numbers indicates that they are to be added. Thus,  $6 + 3$  means 6 and 3.

21. How many are—

$9 + 8?$   $9 + 7?$   $5 + 11?$   $4 + 16?$   $3 + 16?$

$9 + 9?$   $4 + 12?$   $5 + 14?$   $4 + 14?$   $16 + 3?$

$9 + 10?$   $4 + 13?$   $5 + 15?$   $4 + 15?$   $3 + 14?$

#### 4.

1. James has 4 dollars, William has 7, and Harry has 5; how many have they together?

SOLUTION.—Since James has 4 dollars, William 7, and Harry 5, they together have 4 dollars, 7 dollars, and 5 dollars, which is 16 dollars.

2. A farmer has 7 acres of wheat, 5 acres of oats, and 3 acres of barley; how many acres of grain has he?

3. I paid 5 dollars for shoes, 6 dollars for a hat, and 4 dollars for an umbrella; how much did I pay for all?

4. A boy worked 5 days in one week, 6 days the next, and 3 days the next; how many days did he work in the three weeks?

5. I gave 5 cents to one boy, 6 to another, and 8 to another; how many cents did I give to all?

6. I paid 10 dollars for coal, 8 dollars for wood, and 4 dollars for hauling; how much did my fuel cost?

7. George has 4 peaches, James has 12, and Henry 10; how many have they together?



8. A lady paid 6 dollars for a hat, 5 dollars for shoes, and 12 dollars for a dress; how much did she pay for all?

9. A barrel of flour cost 6 dollars, a barrel of sweet potatoes 4 dollars, and a ton of coal 5 dollars; how much did all cost?

10. James has 10 marbles, Henry has 8, and William has 12; how many have they together?

11. Samuel shot 8 birds, William 9, and Joseph 10; how many did they all shoot?

12. If a slate cost 12 cents and some paper 10 cents, how much do both cost?

13. A boy has 5 sisters and 4 brothers; how many children are there in the family?

14. Robert is 16 years old and his sister is 7 years older; how old is the sister?

15. There are 13 girls in a class and 12 boys; how many pupils in the class?

16. If Mary has 24 hens and 6 ducks, how many fowls has she?

17. A farmer has 12 cows, 6 horses, and 10 hogs; how many animals has he?

18. A boy in searching for eggs found 12 in one nest, 10 in another, and 8 in another; how many eggs did he find?

19. Harry has 10 cents, James has 12, and John has 9; how many cents have they together?

20. Lewis found 6 pears under one tree, 8 under another, and 13 under another, how many pears did he find?

21. Lucy has 7 roses, Laura has 10, and Mary has 14; how many roses have they together?

22. John is 10 years old, Annie is 4 years older, and Henry is 8 years older than Annie; how old is each?

23. I gave 5 cents for a pencil, 12 cents for some paper, and 10 cents for a tablet; how much did I pay for all?

24. My copy-book cost me 15 cents, my ink 10 cents, and my pens 6 cents; how much did they all cost?

25. Bought a pound of sugar for 8 cents, a pound of rice for 9 cents, and a pound of coffee for 22 cents; how much did I pay for all?

## 5.

1. There are 16 boys in school, and 15 girls; how many pupils in the school?

2. James walked 15 miles in the forenoon and 12 miles in the afternoon; how far did he walk?

3. Henry can earn 10 cents an hour and Samuel 16 cents an hour; how much can they together earn in an hour?

4. A lady paid 15 cents for soap, 5 cents for pins, and 12 cents for candy; how much did she pay for all?

5. A man sold 10 cords of wood one day, 8 cords the next, and 15 cords the next; how many cords did he sell?

6. How many are 10 horses and 15 horses? 12 boys and 8 boys? 20 cents and 12 cents?

7. How many are 12 horses and 12 horses? 15 cows and 12 cows? 15 sheep and 15 sheep?

8. How many are 14 men and 10 men? 14 boys and 12 boys? 14 cents and 15 cents?

9. How many are 16 bushels and 14 bushels? 16 days and 12 days? 10 weeks and 16 weeks?

10. How many are 18 birds and 8 birds? 10 ducks and 18 ducks? 12 hens and 18 hens?

11. How many are 17 pigs and 8 pigs? 10 robins and 17 robins? 12 plums and 7 plums?

12. How many are 20 hens and 10 hens? 8 pins and 20 pins? 20 cups and 9 cups?

13. How many are 19 dollars and 10 dollars? 8 cents and 19 cents? 9 trees and 19 trees?

14. How many are 21 roses and 7 roses? 6 pinks and 21 pinks? 21 chestnuts and 9 chestnuts?

15. How many are 8 oranges, 10 oranges, and 6 oranges?

16. How many are 3 dollars, 5 dollars, and 12 dollars?

17. How many are 6 boys, 8 boys, and 12 boys?

18. How many are 10 sheep, 12 sheep, and 8 sheep?

19. How many are 16 pigs, 7 pigs, and 6 pigs?

20. How many are 8 doves, 10 doves, and 13 doves?

21. How many are—

$$14 + 10? \quad 16 + 8? \quad 18 + 10? \quad 15 + 7? \quad 17 + 4?$$

$$14 + 12? \quad 16 + 7? \quad 14 + 16? \quad 15 + 10? \quad 17 + 9?$$

$$16 + 5? \quad 21 + 4? \quad 16 + 9? \quad 15 + 8? \quad 16 + 5?$$

22. How many are—

$$14 + 13? \quad 15 + 7? \quad 16 + 6? \quad 19 + 9? \quad 22 + 7?$$

$$13 + 10? \quad 16 + 8? \quad 17 + 7? \quad 19 + 5? \quad 20 + 9?$$

$$10 + 18? \quad 15 + 7? \quad 18 + 8? \quad 19 + 6? \quad 21 + 6?$$

23. How many are—

$$6 + 3 + 4? \quad 8 + 4 + 2? \quad 5 + 6 + 7? \quad 10 + 4 + 6?$$

$$7 + 2 + 8? \quad 9 + 3 + 5? \quad 6 + 7 + 8? \quad 8 + 3 + 10?$$

$$6 + 5 + 3? \quad 6 + 9 + 4? \quad 7 + 8 + 9? \quad 9 + 7 + 10?$$

24. How many are—

$$7 + 6 + 3? \quad 8 + 5 + 6? \quad 10 + 3 + 7? \quad 11 + 3 + 4?$$

$$6 + 8 + 2? \quad 5 + 7 + 10? \quad 9 + 2 + 6? \quad 11 + 6 + 2?$$

$$8 + 9 + 3? \quad 7 + 10 + 9? \quad 8 + 1 + 9? \quad 11 + 5 + 7?$$

25. How many are—

$$12 + 4 + 6? \quad 14 + 6 + 2? \quad 16 + 10 + 4? \quad 18 + 2 + 8?$$

$$12 + 6 + 8? \quad 14 + 4 + 4? \quad 14 + 6 + 8? \quad 4 + 19 + 6?$$

$$12 + 3 + 5? \quad 14 + 8 + 6? \quad 15 + 7 + 3? \quad 8 + 2 + 17?$$

26. Count by 2's from 2 to 50. Thus, 2, 4, 6, 8, 10, etc.

27. Count by 5's from 5 to 50; from 50 to 80.

28. Count by 3's from 3 to 60; from 60 to 99.

29. Count by 4's from 1 to 49; from 50 to 98.

30. Count by 6's from 2 to 50; from 50 to 90.

31. Declare the sums of the following columns:

$$7 \quad 8 \quad 6 \quad 2 \quad 8 \quad 3 \quad 4 \quad 7 \quad 8 \quad 4 \quad 5 \quad 4 \quad 3 \quad 4 \quad 8 \quad 9 \quad 4$$

$$3 \quad 7 \quad 7 \quad 9 \quad 4 \quad 6 \quad 6 \quad 4 \quad 6 \quad 6 \quad 7 \quad 2 \quad 6 \quad 8 \quad 7 \quad 6 \quad 8$$

$$4, \quad 4, \quad 3, \quad 9, \quad 8, \quad 9, \quad 8, \quad 7, \quad 8, \quad 9, \quad 3, \quad 6, \quad 9, \quad 5, \quad 5, \quad 9, \quad 6.$$

4 9 8 9 9 9 3 9 6 6 6 6 7 2 4 4 3  
 4 8 7 3 5 6 7 4 4 7 8 8 8 8 7 5 4  
 3, 9, 8, 6, 5, 4, 7, 6, 6, 2, 7, 8, 6, 3, 8, 4, 8.

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1 8 5 4 6 7 6 8 8 1 4 6 1 3 7 3 8  
 3 6 4 7 2 8 3 8 7 8 6 8 4 6 2 8 6  
 9, 2, 3, 6, 5, 6, 7, 4, 9, 5, 7, 8, 6, 4, 8, 7, 8.

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3 8 2 9 6 7 5 6 8 9 8 7 6 9 9 8 6  
 6 4 6 2 5 4 7 4 7 9 9 5 4 9 9 9 7  
 4, 6, 8, 3, 6, 9, 8, 8, 8, 6, 4, 8, 9, 8, 9, 7, 8.

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7 3 3 8 8 2 5 8 4 8 4 7 7 8 4 9 4  
 3 1 6 7 9 8 6 7 3 3 6 7 5 6 6 8 6  
 4 3 4 4 8 4 7 8 2 6 8 6 7 8 8 7 9  
 4, 9, 7, 9, 6, 6, 3, 5, 6, 4, 3, 3, 8, 6, 7, 8, 6.

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5 4 8 8 4 8 4 9 5 7 4 4 8 7 4 4 8  
 9 2 8 7 8 3 9 6 4 8 8 8 5 8 7 7 4  
 9 6 6 5 5 3 9 9 3 9 6 8 7 4 5 6 8  
 6, 6, 8, 8, 2, 6, 8, 4, 8, 7, 3, 6, 3, 9, 8, 7, 5.

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7 4 8 8 5 7 5 4 6 4 8 6 7 7 5 2 4  
 4 3 4 6 8 4 9 8 8 8 9 9 7 5 7 6 3  
 3 4 8 1 4 7 8 5 6 7 8 7 8 8 9 4 4  
 3 9 8 9 4 4 8 7 5 2 3 2 8 9 1 8 6  
 3, 6, 2, 2, 9, 8, 9, 7, 3, 8, 7, 5, 8, 3, 3, 6, 8.

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12 14 11 18 16 27 14 18 16 21 18 16  
 16 11 24 22 20 11 30 17 25 32 26 24  
 10 12 16 25 13 13 42 15 40 45 20 34  
 12, 13, 10, 15, 12, 26, 16, 14, 17, 12, 14, 41.

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## SUBTRACTION.

## 6.

1. John had 3 cents and lost 1 of them; how many cents has he remaining?

SOLUTION.—Since John had 3 cents and lost 1 of them, he has remaining the difference between 3 cents and 1 cent, which is 2 cents.

2. A boy had 4 apples and ate 2; how many has he remaining?

3. If Susan has 5 dollars and spends 3 dollars for a hat, how much money will she have left?

4. 6 birds sat on a tree, but 3 have flown away; how many remain?

5. A boy had 7 pins, but lost 4; how many has he remaining?

6. Henry is 6 years old, but his brother is 2 years younger; how old is the brother?

7. A boy had 7 eggs, but he broke 3; how many remain?

8. Susan is now 8 years old; how old was she 3 years ago?

9. There are 7 pupils in the class, of whom 2 are girls; how many boys in the class?

10. If a boy have 10 cents, and spend 5, how many cents will remain?

11. How many are 8 cents less 3 cents? 6 buttons less 1 button? 9 dollars less 4 dollars?

12. How many are 6 oranges less 2 oranges? 8 dolls less 5 dolls? 7 books less 5 books?

13. How many are 7 boys less 3 boys? 6 pens less 2 pens? 8 peaches less 6 peaches?

14. How many are 8 apples less 4 apples? 10 pears less 6 pears? 7 pencils less 4 pencils?

15. How many are—

4 less 1?      5 less 2?      7 less 2?      10 less 7?

4 less 3?      5 less 4?      9 less 6?      9 less 4?

4 less 2?      5 less 3?      9 less 3?      8 less 5?

16. How many are—

10 less 5?      6 less 3?      7 less 4?      8 less 3?

10 less 8?      6 less 4?      7 less 6?      8 less 4?

10 less 6?      6 less 2?      7 less 2?      8 less 6?

### 7.

1. Mr. A had 20 sheep, but sold 10; how many had he remaining?

2. Bought a slate for 16 cents and sold it for 12 cents; how much did I lose?

3. If a man buy a sheep for 10 dollars and sell it for 15 dollars, how much will he gain?

4. A class has 18 pupils, but 4 are absent; how many are present?

5. James is 16 years of age and Harry is 13; how much older is James than Harry?

6. A boy had 20 quarts of nuts and sold 6 quarts of them; how many quarts remain?

7. Samuel had a flock of 17 hens, but 6 have died; how many remain?

8. A bush had 16 roses, but 10 of them have faded; how many remain?

9. A man planted 18 trees, but 7 have died; how many are living?

10. If a man had 14 bushels of beans and sold 8 bushels, how many bushels remain?

11. If a man buy a colt for 10 dollars and sell it for 16 dollars, how much does he gain?

12. A girl who had 20 cents bought a pound of sugar for 8 cents; how much money had she remaining?

13. Samuel gathered 13 quarts of berries and sold 4 quarts; how many did he keep?

14. A farmer has a flock of 19 turkeys; how many will he have remaining if he sell 14 of them?

15. How many are 16 boys less 4 boys? 15 pens less 8 pens? 17 pencils less 6 pencils?

16. How many are 20 men less 8 men? 14 roses less 11 roses? 20 ducks less 12 ducks?

17. How many are 19 sheep less 15 sheep? 16 oranges less 7 oranges? 18 cents less 9 cents?

18. How many are 19 years less 9 years? 20 days less 11 days? 15 hours less 9 hours?

19. How many are 19 tops less 5 tops? 14 marbles less 8 marbles? 18 toys less 6 toys?

20. How many are—

16 less 4?    14 less 6?    13 less 5?    12 less 7?

18 less 6?    15 less 5?    11 less 7?    13 less 6?

20 less 2?    16 less 8?    12 less 8?    11 less 8?

21. How many are—

15 less 6?    16 less 9?    18 less 5?    19 less 7?

15 less 12?    17 less 8?    18 less 10?    20 less 3?

16 less 6?    17 less 5?    19 less 15?    20 less 9?

NOTE.—The sign for subtraction is a short horizontal line, called *minus*. When placed between two numbers it means that the second is to be subtracted from the first. Thus,  $8-2$  means that 2 is to be taken from 8.

22. How many are—

$11-3?$      $16-4?$      $20-17?$      $19-6?$

$12-6?$      $18-12?$      $15-4?$      $17-14?$

$13-5?$      $16-7?$      $18-11?$      $14-9?$

## 8.

1. Mary had 25 cents and gave 5 cents for a pencil; how much money has she remaining?

2. A farmer bought a cow for 20 dollars and sold her for 30 dollars; how much did he gain?

3. If a man earn 24 dollars a week and pay 6 dollars a week for board, how much does he save?

4. There are 28 pupils in a school, of whom 18 are girls; how many boys are there?

5. A farmer having 25 gallons of vinegar sold 12 gallons; how many gallons has he remaining?

6. Mr. Jones bought a cow for 23 dollars and sold her for 28 dollars; how much did he gain?

7. From a school of 30 pupils 9 were promoted; how many remained?

8. A farmer sold 20 dollars' worth of hay, and received in exchange 12 dollars' worth of coal and the remainder in cash; how much cash did he get?

9. Charles had 29 chickens, but 12 have been sold; how many remain?

10. William is 24 years old and his sister is 8 years younger; how old is she?

11. A lady who earns 40 dollars a month pays 20 dollars a month for board; how much does she save?

12. If I had 36 cents and spent 14 cents for a slate, how much had I remaining?

13. Susan had 45 cents and Mary 32 cents; how much more had Susan than Mary?

14. If a slate cost me 12 cents, how much do I gain by selling it for 23 cents?

15. John is 15 years old; how long before he will be 21 years of age?

16. A boy started to walk to a city 35 miles away; he walked 16 miles the first day; how far did he walk the second day to reach the city?

17. Bought a wagon for 45 dollars and sold it for 28 dollars; how much did I lose?



18. A man had 43 fowls, but after a fox had caught some he had only 36; how many did the fox catch?

19. I am now 48 years old; how old was I 15 years ago?

20. If you are now 14 years old; how long before you will be 40 years of age?

21. How many are 46 dollars less 18 dollars? 27 cents less 12 cents? 43 books less 26 books?

22. How many are 34 apples less 18 apples? 48 pages less 16 pages? 35 years less 16 years?

23. How many are 38 chestnuts less 17 chestnuts? 47 pupils less 18 pupils?

24. How many are 50 miles less 16 miles? 33 feet less 17 feet?

25. How many are 44 days less 32 days? 35 dollars less 22 dollars?

26. How many are—

$$42 - 16? \quad 50 - 18? \quad 48 - 18? \quad 33 - 8?$$

$$34 - 17? \quad 45 - 26? \quad 40 - 19? \quad 47 - 10?$$

$$27 - 6? \quad 39 - 12? \quad 32 - 15? \quad 43 - 13?$$

27. How many are—

$$38 - 14? \quad 43 - 22? \quad 41 - 25? \quad 27 - 17?$$

$$36 - 29? \quad 30 - 18? \quad 36 - 8? \quad 42 - 12?$$

$$48 - 12? \quad 47 - 17? \quad 25 - 13? \quad 38 - 27?$$

28. Count by 2's from 50 to 2; from 100 to 50.

29. Count by 5's from 100 to 60; from 60 to 20.

30. Count by 4's from 100 to 40; from 40 to 0.

31. Count by 6's from 90 to 60; from 60 to 12.

## ADDITION AND SUBTRACTION.

1. Mary had 4 dollars and earned 10 more; she then spent 7 dollars; how much money had she remaining?

2. Susan gathered 10 quarts of berries in the forenoon and

15 quarts in the afternoon; if she sold 16 quarts; how many had she remaining?

3. A man having 16 cents gave 5 cents to one boy and 6 to another; how many cents had he remaining?

4. A farmer bought 12 sheep from one man and 16 from another; he then sold 20 of them; how many had he remaining?

5. Bought a pencil for 5 cents and a slate for 12 cents; how much change did I get by paying with a 25-cent piece?

6. Bought a cow for 30 dollars and a calf for 4 dollars; I sold the two for 38 dollars; how much did I gain?

7. A boy spent 18 cents for oranges and 15 cents for nuts; how much more would he have to spend to make the amount 50 cents?

8. A laborer having 20 dollars earned 15 dollars more, and then bought a suit of clothes for 18 dollars; how much money has he remaining?

9. Henry having 25 apples sold 8 and ate 6; how many has he remaining?

10. A man bought goods for 27 dollars and paid 3 dollars for hauling; how must he sell the goods to gain 6 dollars?

11. George spent 15 cents, then earned 12 cents, and had 17 cents; how much had he at first?

12. Henry wishes to buy a book worth 50 cents: his father gave him 15 cents and his mother 12; how much must he earn to buy the book?

13. Three boys have 48 cents: the first has 12 cents, and the second 19 cents; how much has the third?

14. A boy got 12 peaches from one tree, 15 from another, and 10 from another; he ate 6, gave away 14, and took the others home; how many did he take home?

15. A gentleman bought a watch for 60 dollars and a chain for 12 dollars: he sold the two for 80 dollars; how much did he gain?

16. A merchant had a piece of cloth containing 54 yards : he sold 12 yards to one man, 15 to another, and 10 to another ; how many yards remain in the piece ?

17. A man's wages for the month were 46 dollars : he paid 6 dollars for groceries, 10 dollars for rent, and 12 dollars for meat ; how much had he remaining ?

18. If a boy having 60 cents, spends 24 cents, and then earns 43 cents ; how much will he have ?

19. Samuel is 24 years of age, which is 6 years more than Mary's age and 13 years more than Albert's age ; how old is Mary and how old is Albert ?

20. Two boys gathered some berries : the one gathered 24 quarts and the other gathered 5 quarts less ; how many quarts did both gather ?

21. James exchanged eggs worth 25 cents and butter worth 56 cents for a knife worth 90 cents ; how much cash did he have to pay ?

22. Bought a horse for 120 dollars and a sleigh for 60 dollars ; how much did I gain by selling both for 185 dollars ?

23. A man having a certain number of sheep bought 20, then sold 40, and had 5 remaining ; how many had he at first ?

24. Harry and James began playing with 25 marbles each : at the end of the game James had 32 ; how many had Harry ?

25. Mr. A bought a cart for 30 dollars, some harness for 15 dollars, and a whip for 3 dollars : he sold all for 16 dollars more than the cart cost ; how much did he lose ?

26. Mr. Smith walked 25 miles one day and 20 miles the next : on the third day he returned 32 miles ; how far was he then from the starting-place ?

27. A farmer had 60 sheep in one field and 54 in another : he sold 25 from each field ; how many remained in each ?

28. A man bought a cow for 45 dollars, some sheep for 18 dollars, and pigs for 25 dollars : he exchanged them all for a horse worth 100 dollars ; how much cash did he have to pay ?

Find the value—

- |                         |                         |
|-------------------------|-------------------------|
| 29. Of $4 + 6 - 3$ ;    | 37. Of $20 + 25 - 15$ ; |
| 30. Of $8 + 7 - 6$ ;    | 38. Of $36 + 14 - 12$ ; |
| 31. Of $10 + 12 - 9$ ;  | 39. Of $30 - 6 - 4$ ;   |
| 32. Of $15 + 5 - 8$ ;   | 40. Of $40 - 18 + 6$ ;  |
| 33. Of $18 + 20 - 16$ ; | 41. Of $60 - 24 + 21$ ; |
| 34. Of $25 + 18 - 14$ ; | 42. Of $22 - 14 + 63$ ; |
| 35. Of $20 + 10 - 6$ ;  | 43. Of $70 - 17 + 7$ ;  |
| 36. Of $22 + 18 - 10$ ; | 44. Of $75 - 34 + 22$ . |
45. How many are 6 plus 4 minus 3?  
 46. How many are 20 minus 16 plus 8?  
 47. How many are 32 plus 18 minus 25?  
 48. How many are 45 minus 16 plus 22?  
 49. How many are 60 plus 15 minus 56?  
 50. How many are 36 minus 27 plus 33?

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### MULTIPLICATION.

1. How much will 2 oranges cost at 3 cents each?

REMARK.—Since 1 orange costs 3 cents, two oranges will cost 3 cents and 3 cents, or 2 times 3 cents, which is 6 cents.

SOLUTION.—Since one orange costs 3 cents, 2 oranges will cost 2 times 3 cents, or 6 cents.

2. How much will 2 pencils cost at 4 cents each?  
 3. How many are 2 times 2 boys? 2 times 4 pins?  
 4. How many are 2 times 5 days? 2 times 6 apples?  
 5. How many are 2 times 7 weeks? 2 times 10 cents?  
 6. How many are 2 times 8 sheep? 2 times 9 peaches?  
 7. How many are—

2 times 1?	2 times 4?	2 times 7?	2 times 10?
2 times 2?	2 times 5?	2 times 8?	2 times 11?
2 times 3?	2 times 6?	2 times 9?	2 times 12?

Remark.—2 times 3 is the same as 2 threes.

8. If a lemon cost 3 cents, how much will 3 lemons cost?
  9. At 4 cents each how much will 3 pencils cost?
  10. How much will 3 oranges cost at 5 cents each?
  11. At 6 cents each how much will 3 bottles of ink cost?
  12. How many are 3 times 7 roses? 3 times 8 dollars?
  13. How many are 3 times 9 minutes? 3 times 10 hours?
  14. How many are 3 times 11 days? 3 times 12 eggs?
  15. How many are—
 

3 times 1?	3 times 4?	3 times 7?	3 times 10?
3 times 2?	3 times 5?	3 times 8?	3 times 11?
3 times 3?	3 times 6?	3 times 9?	3 times 12?
  16. How much will 4 apples cost at 2 cents each?
  17. At 4 cents a pint how much will 4 pints of milk cost?
  18. At 6 cents a quart what will 4 quarts of beans cost?
  19. At 10 cents each what will 4 slates cost?
  20. How many are 4 times 3 cents? 4 times 5 cents? 4 times 7 cents?
  21. How many are 4 times 8 sheep? 4 times 9 hens?
  22. How many are 4 times 11 roses? 4 times 12 pinks?
  23. How many are—
 

4 ones?	4 fours?	4 sevens?	4 times 10?
4 twos?	4 fives?	4 eights?	4 times 11?
4 threes?	4 sixes?	4 nines?	4 times 12?
- NOTE.—The sign of multiplication is  $\times$ , which is read *times*. Thus,  $4 \times 3$  is read 4 *times* 3.
24. If 1 hat cost 2 dollars, how much will 5 hats cost?
  25. If a pencil cost 5 cents, how much will 5 pencils cost?
  26. How much will 5 sheep cost at 8 dollars each?
  27. There are 7 days in a week; how many days in 5 weeks?
  28. How many are 5 times 3 apples? 5 times 4 apples?
  29. How many are 5 times 6 pears? 5 times 9 pears?
  30. How many are 5 times 10 hens? 5 times 11 hens? 5 times 12 hours?

31. How many are—

5 ones?    5 times 4?    5 times 7?     $5 \times 10$ ?

5 twos?    5 times 5?    5 times 8?     $5 \times 11$ ?

5 threes?    5 times 6?    5 times 9?     $5 \times 12$ ?

32. There are 3 feet in a yard; how many feet in 6 yards?

33. At 5 cents a yard how much will 6 yards of calico cost?

34. If a boy earns 8 dollars a week, how much does he earn in 6 weeks?

35. How many are 6 times 2 boys?    6 times 4 boys?

36. How many are 6 times 6 books?    6 times 7 books?

37. How many are 6 times 9 feet?    6 times 10 feet?

38. How many are 6 times 11 inches?    6 times 12 inches?

39. How many are—

Six 1's?    6 times 4?    6 times 7?     $6 \times 10$ ?

Six 2's?    6 times 5?    6 times 8?     $6 \times 11$ ?

Six 3's?    6 times 6?    6 times 9?     $6 \times 12$ ?

40. How much will 7 bananas cost at 3 cents each?

41. How much will 7 tablets cost at 10 cents each?

42. There are 7 days in a week; how many days in 7 weeks?

43. How many are 7 times 2 plums?    7 times 8 plums?

44. How many are 7 times 4 cups?    7 times 9 cups?

45. How many are 7 times 5 cents?    7 times 11 cents?

46. How many are 7 times 6 flowers?    7 times 12 flowers?

47. How many are—

7 times 1?    7 times 4?     $7 \times 7$ ?     $7 \times 10$ ?

7 times 2?    7 times 5?     $7 \times 8$ ?     $7 \times 11$ ?

7 times 3?    7 times 6?     $7 \times 9$ ?     $7 \times 12$ ?

48. At 5 cents each how much will 8 pencils cost?

49. A man earns 10 dollars a week; how much does he earn in 8 weeks?

50. How many shoes in 8 pairs?

51. How many are 8 times 3 lemons?    8 times 4 lemons?

52. How many are 8 times 6 boys?    8 times 7 boys?

53. How many are 8 times 9 girls?    8 times 10 girls?

54. How many are 8 times 11 men? 8 times 12 men?
55. How many are—  
 8 times 1?     $8 \times 4?$     8 times 7?     $8 \times 10?$   
 8 times 2?     $8 \times 5?$     8 times 8?     $8 \times 11?$   
 8 times 3?     $8 \times 6?$     8 times 9?     $8 \times 12?$
56. At 2 cents each how much will 9 peaches cost?
57. If a boy walk 3 miles an hour, how far can he walk in 9 hours?
58. What is the cost of 9 pencils at 5 cents each?
59. How many are 9 times 4 acres? 9 times 6 miles? 9 times 7 days?
60. How many are 9 times 8 men? 9 times 10 cents? 9 times 12 eggs?
61. How many are 9 times 9 boys? 9 times 11 dolls?
62. How many are—  
 9 times 1?     $9 \times 4?$      $9 \times 7?$     9 times 10?  
 9 times 2?     $9 \times 5?$      $9 \times 8?$     9 times 11?  
 9 times 3?     $9 \times 6?$      $9 \times 9?$     9 times 12?
63. A chair has 4 legs; how many legs have 10 chairs?
64. At 8 cents each how much will 10 books cost?
65. There are 12 eggs in a dozen; how many eggs in 10 dozen?
66. How many are 10 times 2 cents? 10 times 5 cents? 10 times 3 cents?
67. How many are 10 times 6 loaves? 10 times 7 beans? 10 times 8 birds?
68. How many are 10 times 11 marbles? 10 times 12 marbles?
69. How many are—  
 $10 \times 1?$     10 times 4?    10 times 7?     $10 \times 10?$   
 $10 \times 2?$     10 times 5?    10 times 8?     $10 \times 11?$   
 $10 \times 3?$     10 times 6?    10 times 9?     $10 \times 12?$
70. How many gloves in 11 pairs?
71. How much can a man earn in 11 days at 5 dollars a day?

72. How much will 11 tablets cost at 9 cents each?
73. How many are 11 times 3 books? 11 times 6 books?  
11 times 4 books?
74. How many are 11 times 7 pens? 11 times 9 pens?
75. How many are 11 times 8 roses? 11 times 10 pinks?  
11 times 12 daisies?
76. How many are—
- |                |                |             |              |
|----------------|----------------|-------------|--------------|
| $11 \times 1?$ | $11 \times 4?$ | 11 times 7? | 11 times 10? |
| $11 \times 2?$ | $11 \times 5?$ | 11 times 8? | 11 times 11? |
| $11 \times 3?$ | $11 \times 6?$ | 11 times 9? | 11 times 12? |
77. How much will 12 hats cost at 3 dollars each?
78. How much can a man earn in 12 weeks at the rate of  
10 dollars a week?
79. How many days in 12 weeks?
80. How many are 12 times 2 pens? 12 times 4 pens?  
12 times 5 books? 12 times 6 pages?
81. How many are 12 times 8 pages? 12 times 11 words?  
12 times 9 feet? 12 times 12 inches?
82. How many are—
- |                |                |                |                 |
|----------------|----------------|----------------|-----------------|
| $12 \times 1?$ | $12 \times 4?$ | $12 \times 7?$ | $12 \times 10?$ |
| $12 \times 2?$ | $12 \times 5?$ | $12 \times 8?$ | $12 \times 11?$ |
| $12 \times 3?$ | $12 \times 6?$ | $12 \times 9?$ | $12 \times 12?$ |

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**2.**

1. How much will 3 cows cost at 30 dollars each?
2. What is the cost of 5 bushels of potatoes at 40 cents a bushel?
3. If a train run 25 miles an hour, how far will it run in 6 hours?
4. What is the cost of 5 pounds of coffee at 32 cents a pound?
5. What is the cost of 20 pounds of sugar at 8 cents a pound?



6. At 25 dollars each how much will 8 cows cost?
7. At 50 cents each how much will 4 books cost?
8. Henry is 15 years old, his father is 3 times as old; how old is his father?
9. What is the cost of 33 yards of cloth at 3 dollars a yard?
10. Susan bought 10 yards of gingham at 16 cents a yard; how much did it cost?
11. How much will 15 yards of gingham cost at 16 cents a yard?
12. If a quire of paper cost 22 cents, how much will 3 quires cost? 4 quires? 5 quires?
13. If 6 men can do a piece of work in a day, how long will it take 1 man to do it?
14. If 5 men can do a piece of work in 3 days, how long will it take 1 man?
15. If 10 men can earn 90 dollars in a week, how long will it take 1 man to earn the same amount?
16. If 6 men do a piece of work in 1 day, how long will it take 1 man to do the work?
17. Three men can plow a field in 4 days; how many men will it require to plow the field in 1 day?
18. If a barrel of flour last 8 persons 6 weeks, how many persons will it last 1 week?
19. If 12 men can do a piece of work in 10 days, how many men will it require to do it in 1 day?
20. If 12 men can do a piece of work in 10 days, how long will it take 1 man to do the work?
  
21. What is the cost of 2 oranges at 5 cents each and 4 bananas at 3 cents each?
22. A farmer sold 4 sheep at 5 dollars each, and 6 lambs at 3 dollars each; how much did he get for all?
23. Bought 2 slates at 15 cents apiece, and 3 pencils at 4 cents each; how much did I pay for all?

24. A farmer has 20 bags of wheat, each containing 3 bushels; how much is it worth at 2 dollars a bushel?

25. A man has 6 baskets, each containing 5 quarts of berries; how much are they all worth at 10 cents a quart?

26. A farmer sold 5 cows at 30 dollars each and 3 horses at 120 dollars each; how much did he get for all?

27. A lady bought 2 pounds of rice at 8 cents a pound, 3 pounds of sugar at 7 cents a pound, and 2 quarts of oil at 15 cents a quart; how much did she pay for all?

28. How much must I pay for 2 books at 30 cents each and 3 at 25 cents each?

29. A man and his son worked 12 hours: the father received 15 cents an hour and the son 10 cents an hour; how much did they both receive?

30. A man bought 10 yards of cloth for a suit of clothes at 2 dollars a yard: he paid 6 dollars for making the coat, 2 dollars for making the pantaloons, and 1 dollar for making the vest; how much did the suit cost him?

31. George bought 3 pencils for 10 cents, and sold them at 5 cents each; how much did he gain?

32. A boy bought a dozen bananas for 20 cents, and sold them at 3 cents each; how much did he gain?

33. William earned 90 cents a day; his board cost him 50 cents a day; how much did he save in 12 days?

34. A drover bought 2 cows at 30 dollars each and sold the two for 68 dollars; how much did he gain?

35. If a man earn 16 dollars a week and pay 5 dollars a week for his board, how much can he save in 9 weeks?

36. James drives 6 miles an hour and Henry walks 3 miles an hour in the same direction; how much farther does James travel than Henry in 12 hours?

37. Samuel bought 6 pencils at 4 cents apiece and 5 tablets at 8 cents apiece; how much did he gain by selling the lot for 80 cents?

38. Henry has 10 hens and George has 3 times as many, less 4; how many have they together?

39. William has 15 cents, and Harry has 4 times as many, plus 8 cents; how many has Harry?

40. A farmer bought 2 cows at 30 dollars each and 12 sheep at 5 dollars each: he sold the lot for 150 dollars; how much did he gain?

41. I had 6 cents and found 2 more; how much must I earn to have 15 cents?

42. Henry has 15 cents and David has 20; how much must they earn to have 60 cents together?

43. A and B start at the same point and travel in opposite directions, A at the rate of 3 miles an hour and B at the rate of 5 miles an hour; how far apart are they at the end of 5 hours? At the end of 6 hours? 10 hours?

44. If A and B start at the same point and travel in the same direction, A at the rate of 4 miles an hour and B at the rate of 7 miles an hour, how far apart will they be in 3 hours? In 5 hours? In 8 hours?

45. A farmer sells 5 pounds of butter at 25 cents a pound, and takes in exchange 20 pounds of sugar at 7 cents a pound; how much cash does he have to pay?

46. If a lady exchange 10 dozen of eggs at 15 cents a dozen for 15 pounds of sugar at 8 cents a pound, how much is still due her?

47. A drover bought 40 sheep for 110 dollars: he sold 10 of them at 5 dollars a head, and the remainder at 3 dollars a head; how much did he gain?

48. A lady bought 5 yards of silk at 2 dollars a yard, and 6 yards of velvet at 3 dollars a yard: she gave the merchant 3 ten-dollar bills; how much change did she get?

49. There are 4 quarts in a gallon and 2 pints in a quart; how many pints in 5 gallons?

50. James gathered 6 quarts of nuts, William gathered 3 times as many, less 4 quarts, and Simon gathered as many as the other two; how many did they all gather?

51. How many are 5 times 6, plus 16? 3 times 20, minus 15?

52. How many are 3 times 18, minus 6? 4 times 8, plus 60?

53. How many are  $6 \times 4, + 7?$   $16 \times 5, + 18?$

54. How many are  $7 \times 15, - 12?$   $8 \times 20, - 16?$

55. How many are  $8 \times 5, + 30?$   $8 \times 10, - 23?$

56. How many are  $8 \times 12, + 15 \times 2?$

57. How many are  $10 \times 15, - 6 \times 7?$

58. How many are  $11 \times 6, + 14, - 25?$

59. How many are  $18 \times 5, + 15, + 10, - 16?$

60. How many are  $10 + 5, \times 6, - 25?$

NOTE.— $6 + 4 \times 3 - 16 + 5 \times 8 = 6, + 4 \times 3, - 16, + 5 \times 8 = 6 + 4 \times 3 - 16 + 5 \times 8 = 6 + 12 - 16 + 40 = 42.$

When examples like the foregoing contain the signs  $+$ ,  $-$ , and  $\times$ , the numbers between which the multiplication sign,  $\times$ , is placed should be multiplied before the additions or subtractions are made.

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## DIVISION.

### 1.

1. How many times are 2 cents contained in 6 cents?

SOLUTION.—2 cents are contained 3 times in 6 cents, because 3 times 2 cents are 6 cents.

2. How many times are 3 dollars contained in 6 dollars?

3. How many times are 4 pens contained in 12 pens?

4. How many times are 5 apples contained in 10 apples?

5. How many times are 2 apples contained in 10 apples?

6. How many times are 3 books contained in 12 books?

7. How many times are 4 books contained in 12 books?

8. How many times are 6 pencils contained in 18 pencils?

9. How many apples at 2 cents each can I buy for 8 cents?

SOLUTION.—At 2 cents each I can buy as many apples for 8 cents as 2 cents are contained times in 8 cents, or 4 apples.

10. At 3 cents each how many oranges can I get for 15 cents?

11. At 4 dollars each how many hats can be bought for 20 dollars?

12. At 4 cents each how many bananas can be bought for 12 cents?

13. If I divide 25 cents among 5 boys, how many cents does each boy get?

14. How many yards of silk at 4 dollars a yard can I get for 32 dollars?

15. How many yards of tape at 3 cents a yard can I buy for 21 cents?

16. How many weeks are there in 42 days?

17. When bananas are 5 cents apiece, how many can I buy for 40 cents?

18. Some boys gather 30 quarts of nuts: each has 6 quarts; how many boys are there?

19. A man spent 20 dollars for cloth at 5 dollars a yard; how many yards did he buy?

20. At 3 dollars a barrel how many barrels of apples can be bought for 24 dollars?

21. If a pair of boots cost 8 dollars, how many pairs can be bought for 40 dollars?

22. How many barrels of flour at 7 dollars a barrel can be bought for 49 dollars?

23. How many pounds of rice at 6 cents a pound can be bought for 60 cents?

24. If a man drive at the rate of 6 miles an hour, how long will it take him to drive 42 miles?

25. A boat travels at the rate of 9 miles an hour; how long will it take to go 54 miles?

26. If a boy can earn 10 cents an hour, how long will it take him to earn 90 cents?

27. When coal is worth 6 dollars a ton, how many tons can be bought for 48 dollars?

28. A farmer paid 45 dollars for sheep at 9 dollars apiece; how many did he buy?

29. How many bars of soap at 10 cents a bar can I buy for 80 cents?

30. How many ten-cent pieces are equal to 70 cents?

31. When hay sells at 11 dollars a ton, how many tons can be bought for 55 dollars?

32. At 11 cents a pound how many pounds of cheese can I buy for 88 cents?

33. George has gathered 120 eggs; how many dozen has he gathered?

34. How many slates at 12 cents each can I buy for 96 cents?

35. How many hours at 11 cents an hour must I work to earn 66 cents?

36. At 12 cents a quire how many quires of paper can I buy for 84 cents?

37. At 12 dollars a week how long will it take a man to earn 132 dollars?

38. A farmer traded a horse worth 120 dollars for hogs worth 10 dollars each; how many hogs did he get?

39. A dealer gave coal worth 6 dollars a ton for a load of wheat worth 72 dollars; how many tons of coal did it take?

40. How many men at 9 dollars a week can be hired for 72 dollars?

41. Six roses are how many times 2 roses? 3 roses?

42. 12 cents are how many times 6 cents? 3 cents? 4 cents?

43. 15 cups are how many times 5 cups? 3 cups?
44. 18 dolls are how many times 3 dolls? 9 dolls?
45. 24 men are how many times 3 men? 6 men? 4 men?  
8 men? 12 men?
46. 30 books are how many times 5 books? 10 books? 6  
books?
47. 36 dollars are how many times 3 dollars? 6 dollars?  
9 dollars? 12 dollars? 18 dollars?
48. 48 marbles are how many times 4 marbles? 6 mar-  
bles? 8 marbles? 12 marbles?
49. 60 books are how many times 10 books? 5 books?  
12 books? 6 books? 20 books?
50. 72 cents are how many times 8 cents? 12 cents? 9  
cents? 6 cents? 24 cents?
51. In 16 how many 2's? 8's? 4's?
52. In 40 how many 5's? 8's? 10's? 4's?
53. In 120 how many 10's? 12's? 20's? 40's?
54. In 72 how many 6's? 12's? 8's? 9's?
55. In 60 how many 10's? 6's? 20's? 5's? 12's?

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**2.**

1. How many 3's in 6? In 9? In 18? In 24? In 21?
2. How many 4's in 8? In 20? In 32? In 48? In 20?
3. How many 5's in 10? In 30? In 20? In 40? In 60?
4. How many 6's in 18? In 42? In 54? In 72? In 24?
5. How many times is 7 contained in 21?  
In 28? In 14? In 77? In 35? In 56?  
In 42? In 63? In 70? In 49? In 84?
6. How many times is 8 contained in 24?  
In 40? In 56? In 72? In 88? In 80?  
In 16? In 32? In 48? In 64? In 96?
7. How many times is 9 contained in 54?  
In 18? In 45? In 72? In 99? In 27?  
In 81? In 108? In 36? In 63? In 90?

8. How many 10's in 60?  
 In 20?    In 50?    In 80?    In 110?    In 30?  
 In 100?    In 90?    In 120?    In 40?    In 70?
9. How many 11's in 33?  
 In 77?    In 121?    In 22?    In 66?    In 110?  
 In 44?    In 88?    In 55?    In 99?    In 132?
10. How many 12's in 24?  
 In 36?    In 60?    In 84?    In 108?    In 132?  
 In 48?    In 72?    In 96?    In 120?    In 144?
11. How many 2's in 7?

SOLUTION.—In 7 there are three 2's, and a remainder of 1.

12. In 13 there are how many 2's? 3's? 4's? 5's?  
 13. In 14 there are how many 2's? 4's? 6's? 7's?  
 14. In 15 there are how many times 2? 3? 4? 5? 6?  
 15. 16 is how many times 2? 3? 4? 5? 6? 8?  
 16. 17 is how many times 3? 4? 6? 5? 7? 8?  
 17. In 18 there are how many times 2? 4? 5? 6? 9?  
 18. 19 is how many times 3? 5? 6? 8? 9?  
 19. 20 is how many times 2? 3? 5? 6? 8? 10?  
 20. 25 is how many times 2? 3? 6? 5? 8? 10?  
 21. 30 is how many times 3? 5? 6? 10? 4? 8?  
 22. 35 is how many times 4? 5? 6? 7? 8? 10?  
 23. 40 is how many times 4? 5? 8? 10? 6? 7?  
 24. 50 is how many times 5? 10? 12? 8?  
 25. 60 is how many times 5? 6? 10? 12? 7?  
 26. 70 is how many times 7? 10? 8? 9? 12?  
 27. 80 is how many times 8? 10? 20? 4? 12?  
 28. 90 is how many times 9? 10? 30? 18? 5?  
 29. 100 is how many times 10? 4? 20? 30? 25?  
 30. 100 is how many times 50? 2? 8? 12? 11?

NOTE.—If further exercises are needed, the numbers omitted from 20 to 100 may be used similarly to the foregoing.



## 3.

1. If 2 boys earn 6 dollars, how much does one boy earn?

SOLUTION.—If 2 boys earn 6 dollars, one boy earns as many dollars as 2 is contained times in 6, or 3 dollars.

NOTE.—By some arithmeticians questions like the foregoing are called questions in *partition*. They are more readily solved by fractions, as follows:

If 2 boys earn 6 dollars, one boy earns  $\frac{1}{2}$  of 6 dollars, or 3 dollars.

2. If 5 boys have 30 marbles, how many have they apiece?

3. John shares 8 apples among 4 boys; how many does each receive?

4. If 3 oranges cost 12 cents, how much does 1 orange cost?

5. If 5 cords of wood cost 20 dollars, how much does 1 cord cost?

6. I paid 12 cents for 6 peaches; what was the cost of 1 peach?

7. If 10 cords of wood cost 50 dollars, how much will 1 cord cost?

8. A man paid 40 dollars for 8 sheep; how much did they cost apiece?

9. A man drove 63 miles in 9 hours; how far did he drive in 1 hour?

10. George earned 21 dollars in 7 days; how much did he earn in 1 day?

11. How many oranges at 4 cents each can I get for 6 lemons at 2 cents each?

12. I exchange 12 pencils worth 5 cents apiece for slates at 10 cents apiece; how many slates do I get?

13. Henry exchanged 6 bananas worth 3 cents each for lemons at 2 cents each; how many lemons did he get?

14. How many bananas at 5 cents each can I get for 3 dozen eggs at 10 cents a dozen?

15. I exchange 6 tons of coal at 5 dollars a ton for hay at 10 dollars a load; how many loads of hay do I get?

16. A merchant sold 10 pounds of sugar at 9 cents a pound, and took in exchange 3 pounds of butter; how much a pound was the butter worth?

17. How many pounds of rice at 8 cents a pound can I get for 4 dozen of eggs at 20 cents a dozen?

18. A drover exchanged 3 horses worth 120 dollars each for cows worth 40 dollars each; how many cows did he get?

19. A boy sold 30 quarts of chestnuts to a merchant at 8 cents a quart, and took in exchange coffee at 20 cents a pound; how many pounds of coffee did he get?

20. If James gives 7 quarts of nuts worth 8 cents a quart for 6 pounds of sugar at 9 cents a pound, how much does he lose?

21. A boy exchanged 5 dozen eggs at 18 cents a dozen for 4 dozen buttons at 20 cents a dozen; how much cash ought he to receive?

22. How many are 8 plus 4, divided by 3? 10 plus 8, divided by 3? 12 plus 12, divided by 6?

23. How many are 10 plus 20, divided by 5? 16 plus 12, divided by 7? 15 plus 12, divided by 9?

24. How many are  $18 + 14$ , divided by 8?  $20 + 20$ , divided by 5?  $18 + 30$ , divided by 12?  $25 + 19$ , divided by 11?

25. How many are 18 minus 8, divided by 2? 27 minus 11, divided by 8? 30 minus 6, divided by 6?

26. How many are  $72 - 12$ , divided by 12?  $75 - 25$ , divided by 10?  $49 - 5$ , divided by 11?

NOTE.—The sign of division is  $\div$ ; it is read "divided by." Thus  $16 \div 4$  is read 16 *divided by* 4.

27. How many are  $60 - 20, \div 5$ ?  $40 - 10, \div 6$ ?  $24 - 2, \div 11$ ?  $39 - 3, \div 12$ ?

28. How many are 6 times 5, divided by 3? 7 times 8, divided by 14? 6 times 15, divided by 30?

29. How many are  $7 \times 12$ , divided by 21?  $6 \times 15$ , divided by 9?  $8 \times 12$ , divided by 16?

30. How many are  $10 \times 8, \div 20$ ?  $6 \times 16, \div 12$ ?  $3 \times 24, \div 9$ ?  $6 \times 14, \div 7$ ?  $2 \times 35, \div 14$ ?

31. James had 26 cents and found 10 more; how many tablets at 9 cents each can he buy for his money?

32. John had 15 dollars and Henry had 20; how many sheep can they together buy at 7 dollars apiece?

33. If I earn 27 cents and my father give me 21 more, how many pencils can I buy at 4 cents apiece?

34. Mary had 60 cents, but lost 6; how many pounds of sugar can she buy at 9 cents a pound?

35. A man having 60 dollars paid a debt of 24 dollars; how many yards of cloth at 4 dollars a yard can he buy for the remainder of his money?

36. A man worked 6 weeks at 12 dollars a week, paying 5 dollars a week for his board; how many pairs of boots at 7 dollars a pair can he buy with what he saved?

37. Twice Mary's age + 3 times her age, equals 50 years; how old is she?

38. Four times my age + 2 times my age, - 3 times my age, is 36 years; how old am I?

39. Three times a number, + 5 times the number, - 2 times the number, + 4 times the number, equals 90; what is the number?

40. Five times a number, multiplied by 4, divided by 10, equals 24; what is the number?

41. How many are  $20 + 8 - 16 \div 4$ ?

NOTE.—In problems like this, containing the signs +, —, and  $\times$  or  $\div$ , the indicated multiplication or division should be performed before

the additions or subtractions are made. Thus:  $20 + 8 - 16 \div 4 = 20 + 8 - 4 = 24$ .

Problems like the following:  $30 \div 5 \times 3$ , where the signs of multiplication and division occur in succession, are ambiguous. Thus,  $30 \div 5 \times 3$  may mean  $\frac{30}{5} \times 3 = 18$ , or it may mean  $\frac{30}{5 \times 3} = 2$ .

It is better in such questions to use a comma to convey the meaning, Thus,  $30 \div 5, \times 3 = 18$ , or  $30, \div 5 \times 3 = 2$ . The vinculum also is used for this purpose, also curved lines; as  $\overline{30 \div 5} \times 3 = 18$ , or  $(30 \div 5) \times 3 = 18$ .

Find the value of the following:

- |   |                                   |
|---|-----------------------------------|
| 42. $4 + 8 - 3 + 6$ .   | 50. $24 \times 3 - 4 \times 12$ . |
| 43. $28 - 4 + 16 - 5$ .   | 51. $40 - 10 \times 2 + 32$ .     |
| 44. $25 + 7 - 14 - 8$ .   | 52. $16 \div 4 + 6 - 2$ .         |
| 45. $30 - 16 + 2 - 10$ .  | 53. $28 \div 4 - 6 + 5$ .         |
| 46. $24 + 16 - 18 + 3$ .  | 54. $14 + 6 \div 2 - 4$ .         |
| 47. $16 + 8 \times 2$ .   | 55. $27 + 3 - 16 \div 2$ .        |
| 48. $20 + 10 \times 3 - 14$ .   | 56. $3 \times 4 + 6 \times 9$ .   |
| 49. $18 \times 2 - 6 + 8$ .   | 57. $18 \div 3 + 6 - 5$ .         |
| 58. $63 \div 7 + 6 \times 4 - 27 \div 9$ .  |                                   |
| 59. $48 \div 6 + 3 \times 5 - 30 \div 3$ .  |                                   |
| 60. $48 \times 2 - 10 + 5 - 16 \div 4$ .  |                                   |
| 61. $120 \div 5 + 5 \times 6 - 18 \div 3 + 3 \times 7$ .  |                                   |
| 62. $9, \times 8, \div 6, \times 3, - 16$ .   |                                   |
| 63. $45, \div 5, \times 8, + 3, \div 15, + 8$ .   |                                   |
| 64. $20, \times 4, + 10, \div 6, + 15, \div 5, + 6$ .   |                                   |
| 65. $24, - 4, + 16, \div 3, + 6, \div 9$ .  |                                   |
| 66. $(7 + 17) \div 6 + (20 + 16) \div 9$ .  |                                   |
| 67. $\overline{48 + 6} \div 6 - \overline{18 + 30} \div 8$ .  |                                   |
| 68. $\overline{4 + 7} \times 8 - 44 \div 11 + 16 \times 3 - 18 \div 6$ .                              |                                   |
| 69. $(7 + 3) \times 4 + (16 \times 3) \div 8 - (27 \div 3) \times 4$ .                                |                                   |
| 70. $(16 \times 4 - 18 \times 2) \div (14 \times 2 - 3 \times 7)$ .                                   |                                   |
| 71. $16, + 4, - 2, \times 3, \div 6, \times 8, - 2, + 11, \div 9$ .                                   |                                   |
| 72. $8, \times 10, + 4, \div 7, \times 6, + 8, \div 20, \times 10, \div 4, + 26, - 4, + 18, \div 5$ . |                                   |

## UNITED STATES MONEY.

United States Money is the legal currency of the United States.

Business transactions are usually conducted in dollars and cents.

The following is the table :

10 mills (M.)	equal	1 cent,	ct.
10 cents	"	1 dime,	d.
10 dimes	"	1 dollar,	\$.
10 dollars	"	1 eagle,	E.

Dollars and cents are written with a point (.) placed between ; thus, \$3.24 is read 3 dollars and 24 cents.

1. How many mills in 2 cents? In 5 cents? In 4 cents? In 8 cents?

2. How many cents in 20 mills? In 60 mills? In 70 mills?

3. How many cents in 3 dimes? In 6 dimes? In 8 dimes?

4. How many dimes in 40 cents? In 50 cents? In 90 cents?

5. How many dimes in \$2? In \$8? In \$6?

6. How many cents in \$3? In \$5? In \$7?

7. How many cents in \$2.25? In \$6.50? In \$8.43?

8. How many dollars in 70 dimes? In 80 dimes?

9. How many dollars in 624 cents? In 729 cents? In 942 cents? In 465 cents?

10. How many dollars in 3 eagles? In 7 eagles?

11. If I buy a book for 90 cents and a slate for 20 cents, how much do I pay for both?

12. If some sugar cost me 80 cents and some rice 55 cents, how much do both cost?

13. If a goose cost 90 cents and a pair of chickens 75 cents, how much do both cost?

14. A turkey cost \$1.25 and some hens \$1.20; how much did both cost?

15. Bought a pair of boots for \$7.50 and a hat for \$3.25; what was the cost of both?

16. I bought a ton of coal for \$5.25 and some lumber for \$10.50; how much did I pay for both?

17. If a horse cost \$150 and a cow \$37.50, how much do both cost?

18. Bought a hen for 45 cents, a pair of ducks for 90 cents, and 2 turkeys for \$2.75; what was the cost of all?

19. If I buy a book for 60 cents and sell it for 85 cents, how much do I gain?

20. Albert receives \$2.50 a day and Henry \$2.25; how much more does Albert receive in a day than Henry?

21. A merchant bought cloth at \$1.70 a yard and sold it at \$2.25 a yard; how much did he gain a yard?

22. A dealer bought chairs at 75 cents apiece and sold them at 95 cents apiece; how much did he gain on them?

23. Bought books at \$1.25 apiece and sold them at \$1.60 apiece; what was the gain on each?

24. A horse cost \$122.50 and a cow \$34; how much was gained if both were sold for \$160?

25. Bought a coat for \$18, a hat for \$5.50 and a pair of shoes for \$4.25: if I paid for them with \$30, how much change did I get?

26. Henry had \$40.25: he paid \$16.50 for board and \$14.25 for books; how much had he remaining?

27. How much will 3 hens cost at 40 cents each?

28. If a boy can earn 60 cents a day, how much can he earn in 5 days? How much in 8 days?

29. A drover sold sheep at \$4 each; how much did he receive for 20 sheep?

30. How much are 25 sheep worth at \$4.50 each?
  31. What is the cost of 12 books at \$1.25 each?
  32. Bought 12 hens at 30 cents each and 4 ducks at 35 cents each; how much did they all cost?
  33. A lady, having \$5, bought 4 chickens at 40 cents each and a turkey for \$1.50; how much money had she remaining?
  34. If I buy 20 books at \$1.10 each and sell them at \$1.25 each, how much do I gain?
  35. What is the cost of 7 pounds of coffee at 21 cents a pound and 4 pounds of sugar at 9 cents a pound?
  36. A man bought 3 pounds of butter at 30 cents a pound, a bag of flour for 90 cents, and 5 pounds of coffee at 25 cents a pound: he paid for all with a 5-dollar bill; how much change did he get?
  37. If 5 pounds of sugar cost 35 cents, how much does a pound cost?
  38. I paid \$1.20 for 3 hens; how much was that apiece?
  39. If 40 sheep cost \$160, what is the cost of 1 sheep?
  40. I paid \$6 a dozen for books and sold them at 75 cents apiece; how much did I gain on each?
  41. If chairs that cost \$15 a dozen are sold at \$1.50 each, what is the gain?
  42. Bought 30 sheep for \$120 and sold them at \$4.75 apiece; what was the gain on each and on all?
  43. Samuel bought 25 hens for 6 dollars and sold them at a gain of 8 cents apiece; how much did he get for them?
  44. A farmer bought 12 acres of land for 1500 dollars and sold it for \$1800; how much did it cost him an acre, and how much did he gain per acre?
  45. If pencils cost 72 cents a dozen, how much is that apiece?
-

## FRACTIONS.

If anything, as an apple, is divided into *two* equal parts, one of these parts is called a *half*; if into *three* equal parts, each part is called a *third*; if into *four* equal parts, each part is called a *fourth*, and so on. These equal parts of a unit, one-half ( $\frac{1}{2}$ ), one-third ( $\frac{1}{3}$ ), one-fourth ( $\frac{1}{4}$ ), etc., are called *fractions*.

## 1.

1. How many halves in 1 orange? In 2 oranges? In 5 oranges?

2. What is one-half of 8 books?

*Analysis.*—One half of 8 books is 4 books, because 2 times 4 books are 8 books.

3. What is 1 half of 6 boys? Of 4 cents? Of 8 dollars?

4. What is 1 half of 10 roses? Of 12 hens? Of 14 toys?

5. What is 1 half of 20 men? Of 16 ducks? Of 30 pens?

6. What is 1 half of 6? Of 22? Of 24? Of 40?

7. What is 1 half of 18? Of 32? Of 50? Of 60?

8. If a pound of rice cost 8 cents, how much will 1 half pound cost?

9. George has 18 marbles, and Henry has 1 half as many; how many has Henry?

10. If a dozen eggs cost 20 cents, how much will 1 half dozen cost?

11. How many thirds in an apple? How many in 2 apples? In 5 apples?

12. What is  $\frac{1}{3}$  of 6 cents? Of 12 cents? Of 15 cents?

13. What is  $\frac{1}{3}$  of 9 men? Of 27 men? Of 36 men?

14. What is  $\frac{1}{3}$  of 21? Of 24? Of 30? Of 33?

15. What is  $\frac{1}{3}$  of 12? Of 36? Of 48? Of 60?



16. A book cost 60 cents and a slate  $\frac{1}{3}$  as much ; how much did the slate cost ?

17. Mr. Smith is 36 years old and his son is  $\frac{1}{3}$  as old ; how old is the son ?

18. James has 27 cents and John has  $\frac{1}{3}$  as many ; how many has John ?

19. William earned 54 dollars in a month and his brother  $\frac{1}{3}$  as much ; how much did the brother earn ?

20. How many are  $\frac{2}{3}$  of 6 apples ?

SOLUTION.— $\frac{1}{3}$  of 6 apples is 2 apples, and  $\frac{2}{3}$  of 6 apples are 2 times 2 apples, or 4 apples.

21. How many are  $\frac{2}{3}$  of 9 men ? Of 12 men ? Of 18 men ?

22. How many are  $\frac{2}{3}$  of 15 dollars ? Of 24 dollars ? Of 30 dollars ?

23. How many are  $\frac{2}{3}$  of 6 ? Of 15 ? Of 21 ?

24. How many are  $\frac{2}{3}$  of 12 ? Of 60 ? Of 45 ? Of 48 ?

25. Harry earned 30 dollars a month and Amos  $\frac{2}{3}$  as much ; how much did Amos earn ?

26. Bought 24 pencils and sold  $\frac{2}{3}$  of them ; how many did I sell ?

27. A man earned 45 dollars and spent  $\frac{2}{3}$  of it ; how much did he spend ?

28. If I can earn 48 dollars in a month, how much can I earn in  $\frac{2}{3}$  of a month ?

29. One book cost 66 cents and another  $\frac{2}{3}$  as much ; how much did the second book cost ?

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30. How many fourths in 1 apple ? In 2 apples ? In 3 apples ? In 6 apples ?

31. What is  $\frac{1}{4}$  of 4 cents ? Of 8 cents ? Of 20 cents ?

32. What is 1 fourth of 12? Of 16? Of 24? Of 48?  
33. What is 1 fourth of 32? Of 20? Of 36? Of 60?  
34. A cow cost 24 dollars and a sheep 1 fourth as much;  
how much did the sheep cost?  
35. If a man earn 32 dollars and spend 1 fourth of it, how  
much does he spend?  
36. A farmer had 40 acres of land, 1 fourth of which he  
planted in corn; how many acres did he plant in corn?  
37. How much is 2 fourths of 16 dollars? Of 12 cents?  
Of 20 men?

NOTE.—Fractions are generally written as figures alone; thus 2  
fourths is  $\frac{2}{4}$ , 3 fifths is  $\frac{3}{5}$ , 5 sevenths is  $\frac{5}{7}$ , and so on.

38. How much is  $\frac{2}{4}$  of 8? Of 24? Of 32? Of 44?  
39. A man having 28 bushels of corn sold  $\frac{2}{4}$  of it; how  
much did he sell?  
40. Harry having 40 cents spent  $\frac{2}{4}$  of it; how much did  
he spend?  
41. How much is  $\frac{3}{4}$  of 20 cents? Of 48 apples? Of 36  
men?  
42. How much is  $\frac{3}{4}$  of 12? Of 16? Of 40? Of 28?  
Of 32?  
43. How much is  $\frac{3}{4}$  of 48? Of 60? Of 80? Of 36?  
Of 72?  
44. George earns 48 dollars a month and Henry earns  $\frac{3}{4}$  as  
much; how much does Henry earn?  
45. A man had \$60 and gave  $\frac{3}{4}$  of it for a cow; how much  
did he pay for the cow?  
46. Henry is 20 years old and his brother is  $\frac{3}{4}$  as old; how  
old is his brother?  
47. If a man pay  $\frac{3}{4}$  of \$1.20 for a book, what does the  
book cost him?  
48. James had \$36, William had  $\frac{3}{4}$  as much, and Andrew  
 $\frac{2}{3}$  as much; how much had William and Andrew each?
-

1. If an apple is divided into 5 equal parts, what is 1 of these parts called? 2 parts? 3 parts?

2. How many fifths in a pie? In 3 pies? In 5 pies?

3. What is 1 fifth of 10 cents? Of 20 cents? Of 35 cents?

4. What are  $\frac{2}{5}$  of 10? Of 20? Of 30? Of 40?

5. What are  $\frac{3}{5}$  of 15? Of 30? Of 50? Of 45?

6. What are  $\frac{4}{5}$  of 20? Of 40? Of 55? Of 75?

7. John earned 25 cents and spent  $\frac{2}{5}$  of it; how much did he spend?

8. A knife cost 1 dollar and a book  $\frac{2}{5}$  as much; what was the cost of the book?

9. James had \$45 and earned  $\frac{3}{5}$  as much more; how much had he then?

10. A pair of boots cost \$10 and a pair of shoes  $\frac{4}{5}$  as much; how much did the shoes cost?

11. A boy had 75 cents, but spent  $\frac{4}{5}$  of it; how much did he spend?

12. If anything is divided into 6 equal parts, what is 1 of these parts called? 3 parts? 5 parts?

13. How many sixths are there in an orange? In 2 oranges? In 5 oranges? In 10 oranges?

14. How many are  $\frac{1}{6}$  of 12 boys? Of 30 cents? Of 42 apples?

15. What are  $\frac{2}{6}$  of 18? Of 36? Of 48? Of 60?

16. What are  $\frac{3}{6}$  of 24? Of 42? Of 54? Of 30?

17. What are  $\frac{4}{6}$  of 12? Of 30? Of 48? Of 72?

18. What are  $\frac{5}{6}$  of 24? Of 66? Of 42? Of 54?

19. Mr. Morgan is 48 years old and his son is  $\frac{2}{3}$  as old; how old is the son?

20. If one man earn \$60 and another earn  $\frac{5}{6}$  as much, how much will the second earn?

21. A boy, having 48 cents, spent  $\frac{4}{6}$  of it; how much did he spend?

22. If Mr. A has 36 acres of grass and  $\frac{3}{8}$  as many acres of corn, how many acres of corn has he?

23. John had 42 marbles and won  $\frac{5}{6}$  as many more; how many had he then?

24. A cow cost \$60 and a colt  $\frac{3}{8}$  as much; how much did they together cost?

25. If an orange is divided into 7 equal parts, what is 1 of these parts called? 2 parts? 5 parts?

26. How many sevenths are there in a melon? In 2 melons? In 3 melons? In 5 melons?

27. What is  $\frac{1}{7}$  of 21 cents? Of 35 dollars? Of 28 cents? Of 56 boys?

28. What are  $\frac{2}{7}$  of 14? Of 70? Of 49? Of 35?

29. What are  $\frac{3}{7}$  of 21? Of 35? Of 56? Of 63?

30. What are  $\frac{4}{7}$  of 14? Of 28? Of 42? Of 56?

31. What are  $\frac{5}{7}$  of 70? Of 84? Of 21? Of 35?

32. What are  $\frac{6}{7}$  of 49? Of 63? Of 77? Of 28?

33. A cow was bought for \$42 and sold for  $\frac{6}{7}$  of the cost; at what price was she sold?

34. If I buy a watch for \$70 and sell it at  $\frac{5}{7}$  of the cost, how much do I lose?

35. Mr. A paid \$84 for a carriage and  $\frac{4}{7}$  as much for a sleigh; how much did both cost?

36. If a horse cost \$140 and a sleigh  $\frac{3}{7}$  as much, how much is the loss if both are sold for \$190?

37. If a man earns \$77 and pays  $\frac{2}{7}$  of it for board, how much has he remaining?

38.  $\frac{3}{7}$  of \$56 is \$10 less than the cost of a cow; how much did the cow cost?

39.  $\frac{5}{7}$  of \$70 is \$30 less than the cost of a sleigh; how much did the sleigh cost?

40. A man had \$84; he spent  $\frac{4}{7}$  of it and gave  $\frac{2}{7}$  of the remainder to his sister; how much did he spend, and how much did he give to his sister?

1. If anything is divided into 8 equal parts, what is one of these parts called? 3 parts? 5 parts? 7 parts?
2. How many eighths in a pie? In 2 pies? In 4 pies?
3. What is  $\frac{1}{8}$  of 16 roses? Of 32 pinks? Of 40 flowers?
4. What are  $\frac{3}{8}$  of 16? Of 32? Of 48? Of 64?
5. What are  $\frac{3}{8}$  of 8? Of 24? Of 56? Of 72?
6. What are  $\frac{5}{8}$  of 24? Of 40? Of 56? Of 80?
7. What are  $\frac{7}{8}$  of 32? Of 48? Of 64? Of 96?
8. If a carriage cost \$80 and a set of harness  $\frac{5}{8}$  as much, how much does the harness cost?
9. A young lady wrote 72 letters one day and  $\frac{7}{8}$  as many the next; how many did she write the second day?
10. If James has 96 cents and George has  $\frac{5}{8}$  as many, how many have they together?
11. Samuel has 64 cents and William has  $\frac{3}{8}$  as many; how many has Samuel more than William?
12. If anything is divided into 9 equal parts, what is one of these parts called? 3 parts? 7 parts?
13. How many ninths of an apple in 1 apple? In 2 apples? In 5 apples?
14. How much is  $\frac{1}{9}$  of 36 men? Of 45 pupils? Of 63 horses? Of 81 questions?
15. What are  $\frac{2}{9}$  of 18? Of 36? Of 54? Of 72?
16. What are  $\frac{4}{9}$  of 27? Of 45? Of 9? Of 63?
17. What are  $\frac{5}{9}$  of 72? Of 81? Of 90? Of 99?
18. What are  $\frac{7}{9}$  of 18? Of 27? Of 45? Of 108?
19. What are  $\frac{8}{9}$  of 36? Of 63? Of 90? Of 81?
20. A cow cost 45 dollars and a colt  $\frac{7}{9}$  as much; how much did the colt cost?
21. William had 36 marbles and Henry gave him  $\frac{4}{9}$  as many more; how many had he then?
22. Alfred had 90 marbles and gave  $\frac{5}{9}$  of them away; how many had he remaining?

23. James had 63 cents; he earned  $\frac{5}{9}$  as much more, and then spent 42 cents; how much money had he remaining?

24. Harry had  $\frac{2}{3}$  of \$36 and his father had 5 times as much; how many dollars had the father?

25. When anything is divided in 10 equal parts, what is 1 part called? 4 parts? 6 parts?

26. What is  $\frac{1}{10}$  of 40 cents? Of 60 cents? Of 40 dollars? Of 100 peaches?

27. How many are  $\frac{3}{10}$  of 30? Of 50? Of 70? Of 90?

28. How many are  $\frac{7}{10}$  of 40? Of 80? Of 120? Of 60?

29. How many are  $\frac{9}{10}$  of 20? Of 100? Of 70? Of 110?

30. I had 70 cents, but I gave  $\frac{3}{10}$  of it for a slate; how much money have I remaining?

31. A drover had 120 sheep; he sold  $\frac{3}{10}$  of them to one man and  $\frac{7}{10}$  to another; how many did he sell to each?

32. How much will an arithmetic cost if a geography cost \$1.20 and an arithmetic  $\frac{7}{10}$  as much?

33. John, having 80 cents, earned  $\frac{5}{10}$  as much more, and then spent  $\frac{3}{10}$  of all his money; how much did he spend?

34.  $\frac{2}{3}$  of 24 are how many times 4?

35.  $\frac{3}{4}$  of 40 are how many times 6?

36.  $\frac{5}{6}$  of 42 are how many times 5?

37.  $\frac{4}{7}$  of 63 are how many times 6?

38.  $\frac{5}{7}$  of 63 are how many times 5?

39.  $\frac{3}{8}$  of 72 are how many times 3?

40.  $\frac{5}{8}$  of 80 are how many times 25?

41.  $\frac{5}{9}$  of 81 are how many times 15?

42.  $\frac{7}{9}$  of 72 are how many times 4?

43.  $\frac{7}{10}$  of 60 are how many times 3?

44.  $\frac{7}{9}$  of 90 are how many times  $\frac{1}{5}$  of 50?

45.  $\frac{9}{10}$  of 80 are how many times  $\frac{1}{3}$  of 18?

46.  $\frac{7}{10}$  of 90 are how many times  $\frac{1}{5}$  of 35?

47.  $\frac{5}{8}$  of 96 are how many times  $\frac{4}{5}$  of 25?

48.  $\frac{8}{9}$  of 54 are how many times  $\frac{2}{5}$  of 30?

49.  $\frac{6}{7}$  of 84 are how many times  $\frac{3}{4}$  of 24?  
 50.  $\frac{5}{9}$  of 63 are how many times  $\frac{1}{7}$  of 49?

## 2.

## REDUCTION OF FRACTIONS.

1. How many halves in an apple? How many thirds?  
 How many fourths? How many fifths?  
 2. How many halves in 3 oranges?

SOLUTION.—In 1 orange there are 2 halves, and in 3 oranges there are 3 times 2 halves, or 6 halves.

3. How many halves in 4? In 6? In 5? In 8?  
 4. How many thirds in 3? In 7? In 4? In 10?  
 5. How many fourths in 2? 3? 5? 4? 6?  
 6. How many fifths in 3? 5? 6? 7? 9?  
 7. How many sixths in 4? 5? 8? 10? 4?  
 8. How many sevenths in 5? 3? 9? 7? 11?  
 9. How many eighths in 4? 6? 8? 10? 12?  
 10. How many ninths in 3? 5? 7? 9? 11?  
 11. How many tenths in 4? 5? 8? 10? 12?  
 12. How many thirds in  $5\frac{1}{3}$ ?

SOLUTION.—In 1 there are 3 thirds; in 5 there are 5 times 3 thirds, or 15 thirds; 15 thirds and 1 third are 16 thirds. Therefore in  $5\frac{1}{3}$  there are 16 thirds.

13. How many fourths in 3? In 5? In  $2\frac{3}{4}$ ?  
 14. How many fifths in 2? In 6? In  $3\frac{2}{5}$ ? In  $4\frac{1}{5}$ ?  
 15. How many sixths in 3? In  $2\frac{1}{6}$ ? In  $3\frac{5}{6}$ ?  
 16. How many sevenths in 4? In  $3\frac{2}{7}$ ? In  $5\frac{4}{7}$ ?  
 17. How many eighths in 3? In  $4\frac{1}{8}$ ? In  $5\frac{3}{8}$ ?  
 18. How many ninths in 4? In  $3\frac{1}{9}$ ? In  $7\frac{2}{9}$ ?  
 19. How many tenths in 5? In  $6\frac{1}{10}$ ? In  $8\frac{3}{10}$ ?  
 20. Reduce  $4\frac{3}{5}$  to an improper fraction.

NOTE.—An *improper* fraction is one whose denominator is less than its numerator.

SOLUTION.—In 1 there are 5 fifths; in 4 there are 4 times 5 fifths, or 20 fifths; 20 fifths plus 3 fifths are 23 fifths.

21. Reduce to improper fractions  $2\frac{1}{3}$ ;  $3\frac{1}{2}$ ;  $4\frac{2}{3}$ ;  $4\frac{1}{4}$ .

22. Reduce to improper fractions  $3\frac{1}{5}$ ;  $5\frac{1}{6}$ ;  $6\frac{1}{4}$ ;  $8\frac{1}{3}$ .

23. Reduce to improper fractions  $4\frac{1}{5}$ ;  $5\frac{3}{7}$ ;  $6\frac{5}{6}$ ;  $7\frac{2}{5}$ .

24. Reduce to improper fractions  $3\frac{2}{5}$ ;  $4\frac{2}{9}$ ;  $6\frac{5}{7}$ ;  $7\frac{1}{4}$ .

25. Reduce to improper fractions  $6\frac{1}{5}$ ;  $7\frac{3}{10}$ ;  $5\frac{1}{4}$ ;  $8\frac{2}{7}$ .

26. If  $2\frac{1}{3}$  yards of cloth cost 14 dollars, how much will a yard cost?

SOLUTION.— $2\frac{1}{3}$  yards are equal to  $\frac{7}{3}$  yards. If  $\frac{7}{3}$  yards cost 14 dollars,  $\frac{1}{3}$  of a yard will cost  $\frac{1}{7}$  of 14 dollars, or 2 dollars; and  $\frac{2}{3}$ , or a yard, will cost 3 times 2 dollars, which are 6 dollars.

27. If  $6\frac{1}{2}$  pounds of sugar cost 52 cents, how much does 1 pound cost?

28. How much will a bushel of beans cost if  $2\frac{1}{4}$  bushels cost \$8.10?

29. I paid 55 cents for  $3\frac{2}{3}$  dozen of eggs; how much was that for 1 dozen?

30. If  $5\frac{1}{2}$  tons of coal cost 33 dollars, how much will 1 ton cost?

31. I paid 34 cents for  $2\frac{1}{8}$  yards of gingham; what was the price per yard?

32. A man can earn 40 cents in  $2\frac{2}{3}$  hours; how much can he earn in 10 hours?

33. A train of cars runs 60 miles in  $2\frac{1}{2}$  hours; how far does it go in 8 hours?

34. If I pay 44 cents for  $2\frac{3}{4}$  pounds of meat, how much ought I to pay for 10 pounds?

35. George earns 100 dollars in  $3\frac{1}{3}$  months; how much can he earn in 12 months?

36. There are 132 minutes in  $2\frac{1}{5}$  hours; how many minutes in 6 hours?



37. In  $3\frac{1}{4}$  days there are 78 hours; how many hours in 2 days?

38. If  $2\frac{3}{8}$  pounds of cheese cost 38 cents, what are 5 pounds worth?

39. What is the cost of 3 pounds of butter if  $2\frac{1}{4}$  pounds cost 63 cents?

40. A boy can walk 16 miles in  $5\frac{1}{3}$  hours; how far can he walk in 12 hours?

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### 3.

1. How many ones in  $\frac{6}{3}$ ?

SOLUTION.—Since 1 equals  $\frac{3}{3}$ , in  $\frac{6}{3}$  there are as many ones as  $\frac{3}{3}$  is contained times in  $\frac{6}{3}$ , or 2.

2. How many ones in  $\frac{4}{2}$ ? In  $\frac{12}{3}$ ? In  $\frac{15}{3}$ ? In  $\frac{10}{2}$ ?

3. How many ones in  $\frac{8}{4}$ ? In  $\frac{12}{4}$ ? In  $\frac{20}{4}$ ? In  $\frac{24}{4}$ ?

4. How many ones in  $\frac{15}{5}$ ? In  $\frac{20}{5}$ ? In  $\frac{30}{5}$ ? In  $\frac{18}{3}$ ?

5. How many ones in  $\frac{40}{5}$ ?  $\frac{40}{8}$ ?  $\frac{40}{10}$ ?  $\frac{40}{20}$ ?

6. Reduce  $\frac{12}{5}$  to a mixed number.

NOTE.—A *mixed number* consists of a whole number and a fraction.

SOLUTION.—Since 1 equals  $\frac{5}{5}$ , in  $\frac{12}{5}$  there are as many ones as  $\frac{5}{5}$  is contained times in  $\frac{12}{5}$ , or  $2\frac{2}{5}$ .

7. Reduce to mixed numbers  $\frac{15}{4}$ ;  $\frac{7}{2}$ ;  $\frac{12}{5}$ ;  $\frac{10}{3}$ .

8. Reduce to mixed numbers  $\frac{13}{3}$ ;  $\frac{14}{3}$ ;  $\frac{14}{4}$ ;  $\frac{14}{5}$ .

9. Reduce to mixed numbers  $\frac{15}{2}$ ;  $\frac{15}{4}$ ;  $\frac{16}{3}$ ;  $\frac{16}{5}$ .

10. Reduce to mixed numbers  $\frac{10}{4}$ ;  $\frac{17}{3}$ ;  $\frac{25}{4}$ ;  $\frac{25}{2}$ .

11. Reduce to mixed numbers  $\frac{14}{8}$ ;  $\frac{21}{6}$ ;  $\frac{25}{8}$ ;  $\frac{30}{4}$ .

12. Reduce to mixed numbers  $\frac{20}{3}$ ;  $\frac{30}{7}$ ;  $\frac{40}{6}$ ;  $\frac{45}{8}$ .

13. How much will 5 pairs of shoes cost at  $3\frac{3}{4}$  dollars a pair?

SOLUTION.—If 1 pair of shoes cost  $3\frac{3}{4}$  dollars, 5 pairs will cost 5 times  $3\frac{3}{4}$  dollars. 5 times 3 dollars are 15 dollars; 5 times  $\frac{3}{4}$  of a dollar are  $1\frac{1}{4}$  dollars, or  $3\frac{3}{4}$  dollars; 15 dollars plus  $3\frac{3}{4}$  dollars are  $18\frac{3}{4}$  dollars. Therefore 5 pairs of shoes at  $3\frac{3}{4}$  dollars a pair will cost  $18\frac{3}{4}$  dollars.

14. How much will 9 barrels of apples cost at  $2\frac{1}{4}$  dollars a barrel?

15. What is the cost of 6 pairs of shoes at  $3\frac{1}{4}$  dollars a pair?

16. If 4 dozen eggs cost 50 cents, how much does 1 dozen cost?

17. If a boy can walk  $16\frac{2}{3}$  miles in 5 hours, how far can he walk in 1 hour?

18. What is the cost of 6 tons of coal at  $5\frac{1}{5}$  dollars a ton?

19. I paid  $1\frac{1}{10}$  dollars for 5 pounds of butter; how much is that a pound?

20. If 3 hats cost  $6\frac{3}{4}$  dollars, how much will 5 hats cost?

21. How much can a man earn in 6 days at the rate of  $2\frac{1}{4}$  dollars a day?

22. How much will 16 bushels of potatoes cost at the rate of  $\frac{3}{5}$  of a dollar a bushel?

23. If 4 pairs of shoes cost  $16\frac{4}{5}$  dollars, how much is that a pair?

24. If a boy can earn  $6\frac{1}{4}$  dollars in 5 days, how much can he earn in 3 days?

25. How far can a man walk in 10 hours, if he can walk 5 miles in 2 hours?

26. At the rate of  $5\frac{1}{4}$  dollars a ton, how much will 6 tons of coal cost?

27. How much will 6 pounds of butter cost at  $12\frac{1}{2}$  cents a pound?

28. What is the cost of 8 pounds of rice at  $6\frac{1}{4}$  cents a pound?

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## 4.

## FRACTIONS TO HIGHER TERMS.

1. How many sixths in  $\frac{1}{3}$ ?

SOLUTION.—In 1 there are  $\frac{6}{6}$ ; hence in  $\frac{1}{3}$  there are  $\frac{1}{3}$  of  $\frac{6}{6}$ , or  $\frac{2}{6}$ .

2. How many fourths in  $\frac{1}{2}$ ?

3. How many sixths in  $\frac{1}{2}$ ?  $\frac{1}{3}$ ?  $\frac{2}{3}$ ?

4. How many eighths in  $\frac{1}{2}$ ?  $\frac{1}{4}$ ?  $\frac{3}{4}$ ?

5. How many tenths in  $\frac{1}{2}$ ?  $\frac{1}{5}$ ?  $\frac{2}{5}$ ?  $\frac{4}{5}$ ?

6. How many twelfths in  $\frac{1}{2}$ ?  $\frac{1}{3}$ ?  $\frac{1}{4}$ ?  $\frac{2}{3}$ ?  $\frac{3}{4}$ ?

7. How many fifteenths in  $\frac{1}{3}$ ?  $\frac{2}{3}$ ?  $\frac{1}{5}$ ?  $\frac{3}{5}$ ?

8. How many sixteenths in  $\frac{1}{2}$ ?  $\frac{1}{4}$ ?  $\frac{3}{4}$ ?  $\frac{3}{8}$ ?

9. How many eighteenthths in  $\frac{1}{2}$ ?  $\frac{2}{3}$ ?  $\frac{5}{6}$ ?  $\frac{4}{9}$ ?

10. How many twentieths in  $\frac{3}{4}$ ?  $\frac{2}{5}$ ?  $\frac{3}{5}$ ?  $\frac{7}{10}$ ?

11. How many twenty-fourths in  $\frac{5}{6}$ ?  $\frac{7}{12}$ ?  $\frac{5}{12}$ ?  $\frac{3}{8}$ ?

12. Reduce  $\frac{3}{4}$  to twelfths.

ANALYSIS.— $\frac{1}{4}$  equals  $\frac{3}{12}$ ; hence  $\frac{3}{4}$  equals 3 times  $\frac{3}{12}$ , or  $\frac{9}{12}$ .

13. Reduce  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{5}{6}$  to twelfths.

14. Reduce  $\frac{2}{5}$ ,  $\frac{3}{5}$ ,  $\frac{2}{3}$  to fifteenths.

15. Reduce  $\frac{3}{4}$ ,  $\frac{3}{8}$ ,  $\frac{5}{8}$  to sixteenths.

16. Reduce  $\frac{2}{5}$ ,  $\frac{3}{10}$ ,  $\frac{7}{10}$  to twentieths.

17. Reduce  $\frac{2}{5}$ ,  $\frac{5}{8}$ ,  $\frac{3}{10}$  to thirtieths.

18. Reduce  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$  to twenty-fourths.

19. Reduce  $\frac{2}{5}$  to fifteenths.

Since  $\frac{2}{5} = \frac{6}{15}$ , by what number do we multiply both numerator and denominator of  $\frac{2}{5}$  to obtain  $\frac{6}{15}$ ?

NOTE.—To reduce a fraction to higher terms, multiply both numerator and denominator of the fraction by that number which will produce the required denominator.

20. By what must both numerator and denominator of  $\frac{2}{3}$  be multiplied to reduce it to 6ths? To 12ths? To 15ths?

21. By what must both numerator and denominator of  $\frac{3}{4}$  be multiplied to reduce it to 8ths? To 12ths? To 20ths?

22. Reduce  $\frac{1}{2}$  to sixths; to eighths; to tenths.

23. Reduce  $\frac{2}{3}$  to 10ths; to 20ths; to 30ths.

24. Reduce  $\frac{3}{4}$  to 12ths; to 20ths; to 36ths.

25. Reduce  $\frac{1}{3}$  and  $\frac{1}{2}$  to 12ths.

26. Reduce  $\frac{2}{5}$ ,  $\frac{3}{4}$ , and  $\frac{5}{8}$  to 40ths.

27. Reduce  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$  to 24ths.

NOTE.—When fractions have the same denominator they are said to have a *common denominator*.

28. Reduce  $\frac{1}{2}$  and  $\frac{2}{5}$  to a common denominator.

ANALYSIS.—A common denominator of halves and fifths is tenths;  $\frac{1}{2}$  equals  $\frac{5}{10}$ , and  $\frac{2}{5}$  equals  $\frac{4}{10}$ .

29. Reduce  $\frac{1}{3}$  and  $\frac{1}{4}$  to a common denominator.

30. Reduce  $\frac{2}{3}$  and  $\frac{1}{2}$  to a common denominator.

31. Reduce  $\frac{2}{3}$  and  $\frac{2}{5}$  to a common denominator.

32. Reduce  $\frac{1}{2}$  and  $\frac{1}{3}$  to a common denominator.

33. Reduce  $\frac{2}{5}$  and  $\frac{3}{4}$  to a common denominator.

34. Reduce  $\frac{3}{4}$  and  $\frac{1}{6}$  to a common denominator.

35. Reduce  $\frac{3}{5}$  and  $\frac{5}{6}$  to a common denominator.

36. Reduce  $\frac{2}{3}$  and  $\frac{3}{10}$  to a common denominator.

37. Reduce  $\frac{1}{5}$  and  $\frac{2}{7}$  to a common denominator.

38. Reduce  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and  $\frac{1}{4}$  to a common denominator.

39. Reduce  $\frac{1}{3}$ ,  $\frac{1}{5}$ , and  $\frac{1}{4}$  to a common denominator.

40. Reduce  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and  $\frac{1}{5}$  to a common denominator.

41. Reduce  $\frac{1}{4}$ ,  $\frac{1}{5}$ , and  $\frac{1}{10}$  to a common denominator.

42. Reduce  $\frac{1}{3}$ ,  $\frac{3}{4}$ , and  $\frac{3}{10}$  to a common denominator.

43. Reduce  $\frac{1}{2}$ ,  $\frac{2}{3}$ , and  $\frac{3}{5}$  to a common denominator.

44. Reduce  $\frac{1}{5}$ ,  $\frac{3}{4}$ , and  $\frac{1}{3}$  to a common denominator.

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## 5.

### FRACTIONS TO LOWER TERMS.

1. How many fourths in  $\frac{9}{12}$ ?

ANALYSIS.—Since  $\frac{1}{4}$  equals  $\frac{3}{12}$ , there are as many 4ths in  $\frac{9}{12}$  as  $\frac{3}{12}$  is contained times in  $\frac{9}{12}$ , or  $\frac{3}{4}$ .

2. How many halves in  $\frac{2}{4}$ ;  $\frac{4}{4}$ ;  $\frac{18}{8}$ ;  $\frac{9}{6}$ ;  $\frac{12}{4}$ ?
3. How many thirds in  $\frac{4}{6}$ ;  $\frac{8}{6}$ ;  $\frac{6}{9}$ ;  $\frac{8}{12}$ ;  $\frac{20}{15}$ ?
4. How many fourths in  $\frac{4}{8}$ ;  $\frac{6}{8}$ ;  $\frac{6}{12}$ ;  $\frac{8}{12}$ ;  $\frac{16}{12}$ ?
5. How many fifths in  $\frac{4}{10}$ ;  $\frac{6}{10}$ ;  $\frac{8}{10}$ ;  $\frac{9}{15}$ ;  $\frac{12}{15}$ ?
6. How many sixths in  $\frac{4}{12}$ ;  $\frac{6}{12}$ ;  $\frac{8}{12}$ ;  $\frac{9}{18}$ ;  $\frac{21}{18}$ ?
7. How many sevenths in  $\frac{4}{14}$ ;  $\frac{8}{14}$ ;  $\frac{12}{14}$ ;  $\frac{6}{21}$ ;  $\frac{12}{21}$ ?
8. How many eighths in  $\frac{2}{16}$ ;  $\frac{6}{16}$ ;  $\frac{10}{16}$ ;  $\frac{20}{16}$ ;  $\frac{9}{24}$ ?
9. How many ninths in  $\frac{4}{18}$ ;  $\frac{8}{18}$ ;  $\frac{12}{18}$ ;  $\frac{16}{18}$ ;  $\frac{15}{27}$ ?
10. How many tenths in  $\frac{4}{20}$ ;  $\frac{6}{20}$ ;  $\frac{8}{20}$ ;  $\frac{12}{20}$ ;  $\frac{15}{20}$ ?

Since  $\frac{8}{12}$  equals  $\frac{2}{3}$ , by what do we divide both numerator and denominator of  $\frac{8}{12}$  to produce  $\frac{2}{3}$ ?

NOTE.—To reduce a fraction to lower terms, divide both numerator and denominator by a number that will divide each.

11. By what may we divide both numerator and denominator of  $\frac{4}{6}$ ?  $\frac{8}{12}$ ?  $\frac{10}{4}$ ?

12. Reduce  $\frac{8}{6}$  to thirds;  $\frac{10}{15}$  to 5ths.

13. Reduce  $\frac{6}{9}$  to 3ds;  $\frac{9}{12}$  to 4ths.

14. Reduce  $\frac{8}{12}$  to 6ths;  $\frac{10}{8}$  to 4ths.

15. Reduce  $\frac{10}{18}$  to 9ths;  $\frac{15}{18}$  to 6ths.

16. Reduce  $\frac{8}{16}$  to 4ths;  $\frac{6}{20}$  to 5ths.

17. Reduce  $\frac{12}{21}$  to 7ths;  $\frac{14}{21}$  to 3ds.

18. Reduce  $\frac{15}{20}$  to 4ths;  $\frac{18}{20}$  to 10ths;  $\frac{8}{20}$  to 5ths.

NOTE.—When a fraction cannot be reduced to one having a less denominator, it is said to be in its lowest terms.

19. Reduce  $\frac{10}{12}$  and  $\frac{8}{6}$  to their lowest terms.

20. Reduce  $\frac{9}{12}$  and  $\frac{8}{24}$  to their lowest terms.

21. Reduce  $\frac{6}{16}$  and  $\frac{10}{15}$  to their lowest terms.

22. Reduce  $\frac{8}{20}$  and  $\frac{10}{24}$  to their lowest terms.

23. Reduce  $\frac{14}{12}$  and  $\frac{8}{12}$  to their lowest terms.

24. Reduce  $\frac{30}{36}$  and  $\frac{30}{40}$  to their lowest terms.

25. Reduce  $\frac{12}{18}$  and  $\frac{18}{24}$  to their lowest terms.

26. Reduce  $\frac{28}{40}$  and  $\frac{35}{60}$  to their lowest terms.

27. Reduce  $\frac{16}{20}$  and  $\frac{9}{21}$  to their lowest terms.

28. Reduce  $\frac{16}{6}$  and  $\frac{45}{55}$  to their lowest terms.

## 6.

## COMPOUND FRACTIONS.

A *compound fraction* is a fraction of a fraction ; as,  $\frac{1}{2}$  of  $\frac{1}{3}$  ;  $\frac{2}{3}$  of  $\frac{5}{8}$ .

1. What is  $\frac{1}{2}$  of  $\frac{1}{3}$  ?

ANALYSIS.—Since  $\frac{1}{3}$  equals  $\frac{2}{6}$ ,  $\frac{1}{2}$  of  $\frac{1}{3}$  is  $\frac{1}{2}$  of  $\frac{2}{6}$ , or  $\frac{1}{6}$ .

2. What is  $\frac{1}{2}$  of  $\frac{1}{4}$  ?  $\frac{1}{2}$  of  $\frac{1}{5}$  ?

3. What is  $\frac{1}{3}$  of  $\frac{1}{4}$  ?  $\frac{1}{3}$  of  $\frac{1}{6}$  ?  $\frac{1}{5}$  of  $\frac{1}{4}$  ?

4. What is  $\frac{1}{3}$  of  $\frac{1}{5}$  ?  $\frac{1}{2}$  of  $\frac{1}{2}$  ?  $\frac{1}{3}$  of  $\frac{1}{3}$  ?

5. What is  $\frac{1}{3}$  of  $\frac{1}{6}$  ?  $\frac{1}{4}$  of  $\frac{1}{3}$  ?  $\frac{1}{4}$  of  $\frac{1}{6}$  ?

6. Susan had  $\frac{1}{2}$  a dollar and gave  $\frac{1}{2}$  of it away ; how much did she give away ?

7. If I had  $\frac{1}{4}$  of a dollar and spent  $\frac{1}{5}$  of it, how much did I spend ?

8. A man sells  $\frac{1}{2}$  of  $\frac{1}{3}$  of his corn ; how much does he sell ?

9. How much is  $\frac{1}{2}$  of  $\frac{1}{4}$  of an inch ?

10. A man earned  $\frac{1}{2}$  of a dollar and his son  $\frac{1}{5}$  as much ; how much did the son earn ?

11. How much is  $\frac{2}{3}$  of  $\frac{2}{5}$  ?

ANALYSIS.— $\frac{1}{3}$  of  $\frac{1}{5}$  is  $\frac{1}{15}$  ;  $\frac{1}{3}$  of  $\frac{2}{5}$  is 2 times as much, or  $\frac{2}{15}$  ; and  $\frac{2}{3}$  of  $\frac{2}{5}$  is 2 times  $\frac{2}{15}$ , or  $\frac{4}{15}$ .

12. What is  $\frac{2}{3}$  of  $\frac{1}{4}$  ?

16. What is  $\frac{1}{2}$  of  $\frac{2}{5}$  ?

13. What is  $\frac{3}{4}$  of  $\frac{2}{5}$  ?

17. What is  $\frac{2}{5}$  of  $\frac{3}{4}$  ?

14. What is  $\frac{2}{3}$  of  $\frac{3}{5}$  ?

18. What is  $\frac{2}{3}$  of  $\frac{2}{6}$  ?

15. What is  $\frac{3}{4}$  of  $\frac{3}{5}$  ?

19. What is  $\frac{3}{5}$  of  $\frac{3}{5}$  ?

20. A boy had  $\frac{3}{4}$  of a dollar and spent  $\frac{2}{3}$  of it ; how much did he spend ?

21. If a boy has  $\frac{1}{2}$  of a pie and gives away  $\frac{2}{3}$  of it, how much does he give away ?

22. If Amos has  $\frac{2}{5}$  of a dollar and spends  $\frac{3}{4}$  of it, how much does he spend ?

23. If I give away  $\frac{2}{3}$  of  $\frac{3}{4}$  of my money, how much do I give away?

24. A boy had 40 cents: he spent  $\frac{2}{3}$  of  $\frac{9}{10}$  of it; how much did he spend?

25. A horse cost 120 dollars, and a cow cost  $\frac{2}{5}$  of  $\frac{3}{4}$  as much; how much did the cow cost?

26. A gentleman who owned  $\frac{3}{4}$  of a farm sold  $\frac{2}{3}$  of his share; how much of the farm did he sell?

27. George had  $\frac{3}{4}$  of a bushel of chestnuts: he shared them equally among 6 of his playmates; what part of a bushel did each get?

28. William had  $\frac{2}{5}$  of a dollar, and shared it with 3 brothers; what part of a dollar did each get?

#### ADDITION OF FRACTIONS.

1. What is the sum of  $\frac{1}{3}$  of a pie and  $\frac{2}{3}$  of a pie?
2. What is the sum of  $\frac{3}{4}$  of a dollar and  $\frac{2}{4}$  of a dollar?
3. What is the sum of  $\frac{2}{5}$  of a dollar and  $\frac{4}{5}$  of a dollar?
4. What is the sum of  $\frac{2}{6}$  of an orange and  $\frac{3}{6}$  of an orange?
5. How much is  $\frac{1}{8}$  of a peck,  $\frac{3}{8}$  of a peck, and  $\frac{5}{8}$  of a peck?
6. What is the sum of  $\frac{1}{3}$ ,  $\frac{2}{3}$ , and  $\frac{4}{3}$ ?
7. What is the sum of  $\frac{2}{7}$ ,  $\frac{3}{7}$ , and  $\frac{5}{7}$ ?
8. What is the sum of  $\frac{1}{9}$ ,  $\frac{2}{9}$ , and  $\frac{5}{9}$ ?
9. What is the sum of  $\frac{3}{10}$ ,  $\frac{1}{10}$ , and  $\frac{7}{10}$ ?
10. How many 4ths in  $\frac{1}{2}$  and  $\frac{1}{4}$ ?
11. How many 6ths in  $\frac{1}{2}$  and  $\frac{2}{3}$ ?
12. How many 8ths in  $\frac{1}{2}$  and  $\frac{3}{4}$ ?
13. How many 10ths in  $\frac{1}{2}$  and  $\frac{3}{5}$ ?
14. How many 12ths in  $\frac{1}{3}$ ,  $\frac{1}{4}$ , and  $\frac{1}{6}$ ?
15. How many 15ths in  $\frac{2}{3}$  and  $\frac{3}{5}$ ?
16. How many 20ths in  $\frac{1}{4}$ ,  $\frac{2}{5}$ , and  $\frac{3}{10}$ ?

17. What is the sum of  $\frac{1}{3}$  and  $\frac{3}{5}$ ?

SOLUTION.— $\frac{2}{3}$  equals  $\frac{10}{15}$ , and  $\frac{3}{5}$  equals  $\frac{9}{15}$ ;  $\frac{10}{15}$  plus  $\frac{9}{15}$  are  $\frac{19}{15}$ , or  $1\frac{4}{15}$ .

What is the sum—

18. Of  $\frac{1}{2}$  and  $\frac{1}{3}$ ?

29. Of  $\frac{5}{6}$  and  $\frac{4}{5}$ ?

19. Of  $\frac{1}{2}$  and  $\frac{1}{4}$ ?

30. Of  $\frac{3}{4}$  and  $\frac{3}{8}$ ?

20. Of  $\frac{1}{3}$  and  $\frac{1}{5}$ ?

31. Of  $\frac{7}{8}$  and  $\frac{2}{3}$ ?

21. Of  $\frac{1}{3}$  and  $\frac{1}{6}$ ?

32. Of  $\frac{2}{7}$  and  $\frac{1}{2}$ ?

22. Of  $\frac{1}{3}$  and  $\frac{1}{4}$ ?

33. Of  $\frac{3}{7}$  and  $\frac{4}{5}$ ?

23. Of  $\frac{2}{3}$  and  $\frac{1}{2}$ ?

34. Of  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and  $\frac{1}{4}$ ?

24. Of  $\frac{2}{3}$  and  $\frac{3}{4}$ ?

35. Of  $\frac{1}{6}$ ,  $\frac{1}{4}$ , and  $\frac{1}{5}$ ?

25. Of  $\frac{2}{3}$  and  $\frac{2}{5}$ ?

36. Of  $\frac{1}{3}$ ,  $\frac{1}{4}$ , and  $\frac{1}{8}$ ?

26. Of  $\frac{3}{4}$  and  $\frac{2}{5}$ ?

37. Of  $\frac{2}{3}$ ,  $\frac{1}{4}$ , and  $\frac{3}{5}$ ?

27. Of  $\frac{3}{4}$  and  $\frac{1}{6}$ ?

38. Of  $\frac{2}{3}$ ,  $\frac{2}{5}$ , and  $\frac{1}{2}$ ?

28. Of  $\frac{3}{5}$  and  $\frac{1}{6}$ ?

39. Of  $\frac{2}{7}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$ ?

40. What is the sum of  $2\frac{2}{3}$  and  $1\frac{1}{4}$ ?

SOLUTION 1.— $2\frac{2}{3}$  equals  $\frac{8}{3}$ ;  $1\frac{1}{4}$  equals  $\frac{5}{4}$ ;  $\frac{8}{3}$  equals  $\frac{32}{12}$ , and  $\frac{5}{4}$  equals  $\frac{15}{12}$ ;  $\frac{32}{12}$  plus  $\frac{15}{12}$  equals  $\frac{47}{12}$ , or  $3\frac{11}{12}$ .

SOLUTION 2.—2 plus 1 are 3;  $\frac{2}{3}$  equals  $\frac{8}{12}$ , and  $\frac{1}{4}$  equals  $\frac{3}{12}$ ;  $\frac{8}{12}$  plus  $\frac{3}{12}$  are  $\frac{11}{12}$ ; hence  $2\frac{2}{3}$  plus  $1\frac{1}{4}$  equals  $3\frac{11}{12}$ .

NOTE.—In solution 2 the whole numbers and the fractions are added separately.

What is the sum—

41. Of  $2\frac{1}{3}$  and  $3\frac{1}{4}$ ?

46. Of  $6\frac{1}{5}$  and  $5\frac{1}{6}$ ?

42. Of  $1\frac{2}{3}$  and  $3\frac{1}{2}$ ?

47. Of  $4\frac{1}{6}$  and  $2\frac{1}{7}$ ?

43. Of  $3\frac{1}{4}$  and  $2\frac{3}{5}$ ?

48. Of  $8\frac{2}{3}$  and  $3\frac{5}{6}$ ?

44. Of  $2\frac{1}{4}$  and  $3\frac{1}{6}$ ?

49. Of  $10\frac{1}{4}$  and  $6\frac{1}{5}$ ?

45. Of  $6\frac{1}{4}$  and  $2\frac{2}{3}$ ?

50. Of  $6\frac{1}{2}$  and  $10\frac{5}{6}$ ?

51. I paid  $\frac{1}{4}$  of a dollar for a hen and  $\frac{2}{5}$  of a dollar for a duck; how much did I pay for both?

52. If a book cost  $\frac{3}{5}$  of a dollar and a slate  $\frac{1}{4}$  of a dollar, how much do both cost?

53. If I pay  $\frac{1}{2}$  of a dollar for a dinner and  $\frac{3}{4}$  of a dollar for car-fare, how much do I pay for both?



54. George gave  $\frac{2}{5}$  of his money for oranges and  $\frac{1}{3}$  for candy; how much of his money did he spend?

55. If a book cost  $\frac{3}{4}$  of a dollar, some paper  $\frac{1}{5}$  of a dollar, and some pencils  $\frac{3}{10}$  of a dollar, how much do all cost?

56. Henry, having  $\frac{4}{5}$  of a dollar, earned  $\frac{3}{4}$  of a dollar; how much had he then?

57. If  $\frac{1}{2}$  of a number increased by  $\frac{1}{4}$  of the same number equals 36, what is the number?

58. My money increased by  $\frac{3}{8}$  of my money is 64 cents; how much money have I?

59.  $\frac{3}{4}$  of John's marbles increased by  $\frac{2}{3}$  of his marbles equals 39; how many marbles has he?

60. Mary's number of pinks increased by  $\frac{2}{3}$  of her number equals 45; how many pinks has she?

61. Albert, having  $\frac{3}{4}$  of a certain sum of money, found  $\frac{3}{5}$  of the same sum, and then had 81 cents; what was the sum?

62.  $\frac{5}{6}$  of a certain number increased by  $\frac{2}{5}$  of the number is 74; what is the number?

63. George paid  $\frac{1}{5}$  of a dollar for a slate,  $\frac{3}{4}$  of a dollar for a book, and  $\frac{3}{10}$  of a dollar for paper; how much did he pay for all?

64. If a man pays  $\$3\frac{1}{4}$  for a pair of shoes and  $\$1\frac{1}{2}$  for a pair of gloves, how much does he pay for both?

65. If a man walk  $3\frac{1}{4}$  miles the first hour and  $3\frac{1}{5}$  miles the second, how far does he walk in the two hours?

66. Bought a hat for  $\$3\frac{1}{5}$ , a pair of shoes for  $\$5\frac{1}{2}$ , and an umbrella for  $\$2\frac{3}{4}$ ; how much did I pay for all?

67. Bought coal for  $\$5\frac{3}{5}$  and wood for  $\$3\frac{1}{4}$ ; how much did I pay for both?

68. I paid  $\frac{3}{5}$  of a dollar for ribbon,  $\frac{3}{4}$  of a dollar for muslin, and  $\$2\frac{1}{2}$  for gloves; how much did I pay for all?

69. A boy walked  $12\frac{1}{10}$  miles in the forenoon and  $15\frac{1}{4}$  miles in the afternoon; how far did he walk during the day?

70. James has  $\$5\frac{1}{2}$ , George has  $\$6\frac{3}{4}$ , and Henry  $\$3\frac{2}{5}$ ; how much money have they together?

## SUBTRACTION OF FRACTIONS.

1. What is the difference between  $\frac{3}{4}$  of a dollar and  $\frac{1}{4}$  of a dollar?

2. What is the difference between  $\frac{5}{6}$  of an apple and  $\frac{2}{6}$  of an apple?

3. What is the difference between  $\frac{7}{8}$  of an acre and  $\frac{5}{8}$  of an acre?

4. What is the difference between  $\frac{7}{10}$  of a cent and  $\frac{3}{10}$  of a cent?

5. What is the difference between  $\frac{5}{12}$  of a dozen and  $\frac{1}{12}$  of a dozen?

What is the difference—

6. Between  $\frac{7}{13}$  and  $\frac{3}{13}$ ?

9. Between  $\frac{9}{14}$  and  $\frac{7}{14}$ ?

7. Between  $\frac{7}{11}$  and  $\frac{5}{11}$ ?

10. Between  $\frac{8}{15}$  and  $\frac{6}{15}$ ?

8. Between  $\frac{1}{6}$  and  $\frac{7}{6}$ ?

11. Between  $\frac{1}{20}$  and  $\frac{1}{20}$ ?

12. How much is  $\frac{2}{3} - \frac{2}{3}$ ?

SOLUTION.— $\frac{2}{3}$  equals  $\frac{10}{15}$ , and  $\frac{2}{3}$  equals  $\frac{10}{15}$ ;  $\frac{10}{15}$  less  $\frac{10}{15}$  is  $\frac{0}{15}$ ; hence  $\frac{2}{3} - \frac{2}{3}$  is  $\frac{0}{15}$ .

What is the value—

13. Of  $\frac{1}{2} - \frac{1}{4}$ ?

21. Of  $\frac{3}{4} - \frac{1}{3}$ ?

14. Of  $\frac{2}{3} - \frac{1}{2}$ ?

22. Of  $\frac{1}{7} - \frac{1}{8}$ ?

15. Of  $\frac{3}{4} - \frac{2}{3}$ ?

23. Of  $\frac{2}{7} - \frac{1}{6}$ ?

16. Of  $\frac{2}{3} - \frac{3}{5}$ ?

24. Of  $\frac{1}{2} - \frac{1}{9}$ ?

17. Of  $\frac{5}{6} - \frac{3}{4}$ ?

25. Of  $\frac{1}{4} - \frac{2}{9}$ ?

18. Of  $\frac{5}{6} - \frac{2}{3}$ ?

26. Of  $\frac{5}{6} - \frac{3}{7}$ ?

19. Of  $\frac{5}{6} - \frac{4}{5}$ ?

27. Of  $\frac{7}{8} - \frac{3}{5}$ ?

20. Of  $\frac{1}{6} - \frac{1}{7}$ ?

28. Of  $\frac{3}{5} - \frac{1}{4}$ ?

29. What is the difference between  $2\frac{1}{3}$  and  $1\frac{3}{4}$ ?

SOLUTION.— $2\frac{2}{3}$  equals  $\frac{8}{3}$ ;  $1\frac{3}{4}$  equals  $\frac{7}{4}$ ;  $\frac{8}{3}$  equals  $\frac{32}{12}$ , and  $\frac{7}{4}$  equals  $\frac{21}{12}$ ;  $\frac{32}{12} - \frac{21}{12}$  equals  $\frac{11}{12}$ ; hence the difference between  $2\frac{2}{3}$  and  $1\frac{3}{4}$  is  $\frac{11}{12}$ .

What is the difference—

30. Between  $2\frac{1}{2}$  and  $1\frac{2}{3}$ ?

34. Between  $4\frac{1}{5}$  and  $3\frac{2}{3}$ ?

31. Between  $3\frac{1}{4}$  and  $2\frac{1}{5}$ ?

35. Between  $7\frac{1}{2}$  and  $6\frac{1}{4}$ ?

32. Between  $4\frac{1}{3}$  and  $3\frac{1}{4}$ ?

36. Between  $3\frac{2}{3}$  and  $2\frac{3}{4}$ ?

33. Between  $6\frac{1}{4}$  and  $3\frac{1}{2}$ ?

37. Between  $4\frac{1}{5}$  and  $3\frac{1}{10}$ ?

38. If a boy has  $\frac{3}{4}$  of a dollar and gives away  $\frac{2}{5}$  of a dollar, how much money has he remaining?

39. The difference between  $\frac{2}{3}$  of my money and  $\frac{3}{5}$  of it is 6 dollars; how much money have I?

40. Henry had  $\$5\frac{1}{2}$  and spent  $\$3\frac{1}{4}$ ; how much money had he remaining?

41. George had  $\$5$  and spent  $\$2\frac{1}{5}$ ; how much had he remaining?

42. If I buy sheep at  $\$3\frac{1}{4}$  apiece and sell them at  $\$4\frac{4}{5}$  apiece, how much do I make?

43. Bought oranges at  $2\frac{1}{4}$  cents each and sold them at the rate of  $3\frac{1}{3}$  cents; how much do I make on each?

44. James earned  $\$6\frac{1}{2}$  a week and William  $\$5\frac{1}{4}$  dollars a week; how much does James earn more than William?

45. A is  $6\frac{2}{3}$  years old and B is  $8\frac{1}{5}$  years old; how much older is B than A?

46. Mr. Smith had 60 sheep: he sold  $\frac{2}{3}$  of them; how many remained?

47. Mr. Martin is 40 years old and his son is  $\frac{1}{2}$  of  $\frac{3}{4}$  as old; how old is his son?

48. Harry has 12 cents, and his number is  $\frac{2}{5}$  of  $\frac{2}{3}$  of Philip's number; how many has Philip?

What is the value—

49. Of  $\frac{1}{3} + \frac{1}{4} - \frac{1}{2}$ ?

53. Of  $\frac{2}{3} + \frac{2}{5} - \frac{1}{2}$ ?

50. Of  $\frac{1}{2} + \frac{1}{3} - \frac{1}{4}$ ?

54. Of  $\frac{3}{4} + \frac{3}{10} - \frac{4}{5}$ ?

51. Of  $\frac{1}{2} + \frac{1}{4} - \frac{1}{3}$ ?

55. Of  $\frac{3}{5} + \frac{2}{3} - \frac{5}{12}$ ?

52. Of  $\frac{2}{3} + \frac{1}{2} - \frac{3}{4}$ ?

56. Of  $2\frac{1}{2} + 3\frac{1}{4} - 4\frac{1}{3}$ ?

57. A man sold  $\frac{1}{2}$  of his sheep to one farmer,  $\frac{1}{5}$  to another, and had 6 remaining; how many had he at first?

58. If I pay  $\frac{3}{4}$  of a dollar for one book and  $\frac{2}{5}$  of a dollar for another, and pay for both with a two-dollar bill, how much change do I get?

59. A hat cost  $\$4\frac{1}{2}$  and a pair of shoes  $\$3\frac{1}{4}$ ; how much change do I get in paying for them with 10 dollars?

60. A merchant had 100 bushels of wheat in a bin: he sold to one man  $24\frac{3}{4}$  bushels and to another man  $13\frac{3}{8}$  bushels; how many bushels remain?

## MULTIPLICATION OF FRACTIONS.

### 1.

#### FRACTIONS MULTIPLIED BY INTEGERS.

1. How much will 6 books cost at  $\frac{3}{4}$  of a dollar each?

SOLUTION.—Since 1 book costs  $\frac{3}{4}$  of a dollar, 6 books will cost 6 times  $\frac{3}{4}$  of a dollar, or  $\frac{18}{4}$  dollars, equal to  $4\frac{1}{2}$  dollars.

2. At  $\frac{2}{5}$  of a dollar each, how much will 10 hens cost?

3. George can earn  $\frac{3}{5}$  of a dollar in a day; how much can he earn in 8 days?

4. William eats  $\frac{1}{3}$  of a dozen oranges in a day; how many will he eat in 5 days?

5. If 1 dollar buy  $\frac{7}{8}$  of a yard of cloth, how many yards will \$10 buy?

6. How much will 12 bananas cost at the rate of  $\frac{2}{5}$  of a dime each?

7. How many are 6 times  $\frac{3}{7}$ ?

SOLUTION.—6 times  $\frac{3}{7}$  are  $\frac{18}{7}$ , or  $2\frac{4}{7}$ .

How many are—

8. 3 times  $\frac{2}{3}$ ?

12. 2 times  $\frac{5}{7}$ ?

9. 5 times  $\frac{4}{7}$ ?

13. 3 times  $\frac{5}{8}$ ?

10. 4 times  $\frac{5}{8}$ ?

14. 5 times  $\frac{3}{7}$ ?

11. 4 times  $\frac{3}{8}$ ?

15. 6 times  $\frac{6}{10}$ ?

16. 4 times  $\frac{5}{9}$ ?                      18. 8 times  $\frac{3}{11}$ ?  
 17. 6 times  $\frac{5}{7}$ ?                      19. 10 times  $\frac{2}{7}$ ?  
 20. How many are 3 times  $\frac{5}{6}$ ?

SOLUTION.—3 times  $\frac{1}{6}$  equals  $\frac{3}{6}$ , or  $\frac{1}{2}$ , and 3 times  $\frac{5}{6}$  equals 5 times  $\frac{1}{2}$ , or  $\frac{5}{2}$ .

NOTE.—Since 3 times  $\frac{5}{6}$  equals  $\frac{15}{6}$ , or  $\frac{5}{2}$ , a fraction may be multiplied either by multiplying its numerator or by dividing its denominator.

How many are—

21. 3 times  $\frac{4}{9}$ ?                      27. 7 times  $\frac{3}{14}$ ?  
 22. 5 times  $\frac{7}{10}$ ?                      28. 8 times  $\frac{9}{16}$ ?  
 23. 4 times  $\frac{5}{8}$ ?                      29. 9 times  $\frac{5}{27}$ ?  
 24. 5 times  $\frac{12}{10}$ ?                      30. 7 times  $\frac{6}{21}$ ?  
 25. 6 times  $\frac{3}{2}$ ?                      31. 4 times  $2\frac{1}{8}$ ?  
 26. 6 times  $\frac{5}{8}$ ?                      32. 3 times  $6\frac{5}{9}$ ?  
 33. How much will 16 books cost at  $\frac{3}{5}$  of a dollar each?  
 34. What is the cost of 12 bushels of oats at  $\frac{2}{5}$  of a dollar a bushel?  
 35. If a cow eat  $\frac{3}{8}$  of a bushel of bran in a day, how much will she eat in 4 days?  
 36. George earns  $\frac{9}{10}$  of a dollar in one day; how much will he earn in 12 days?  
 37. At  $\frac{7}{8}$  of a dollar a pair, how much will 12 chickens cost?  
 38. What is the cost of 4 tons of coal at  $\$5\frac{1}{5}$  a ton?  
 39. I hired 8 men to work at  $\$2\frac{3}{4}$  a day; how much did I have to pay daily to all?  
 40. What is the cost of 8 pounds of sugar at  $\frac{4}{5}$  of a dime a pound?  
 41. How far can a boy walk in 10 hours, if he can walk  $3\frac{1}{5}$  miles an hour?  
 42. How much will 5 yards of silk cost at  $\$2\frac{1}{2}$  a yard?  
 43. What is the cost of 3 yards of cloth at  $\$2\frac{3}{4}$  a yard?  
 44. 5 times  $5\frac{3}{5}$  years is twice my age; how old am I?

45. 6 times  $\$5\frac{1}{8}$  is 4 dollars less than a cow cost; how much did she cost?

46. 5 times  $3\frac{1}{10}$  dollars is 3 dollars more than the cost of my coat; how much did it cost?

47. 3 times  $5\frac{1}{8}$  miles is  $\frac{1}{2}$  the distance from my home to the city; how far is it to the city?

## 2.

### INTEGERS MULTIPLIED BY FRACTIONS.

1. How much will  $\frac{1}{4}$  of a pound of nuts cost at 16 cents a pound?

SOLUTION.—If 1 pound of nuts cost 16 cents,  $\frac{1}{4}$  of a pound will cost  $\frac{1}{4}$  of 16 cents, or 4 cents.

2. What is the cost of  $\frac{1}{3}$  of a dozen oranges at 30 cents a dozen?

3. A boy had 90 cents, and spent  $\frac{1}{5}$  of it; how much did he spend?

4. If my wages are 60 dollars a month, how much are they for  $\frac{1}{10}$  of a month?

5. If 5 boys earn 40 dollars, how much does each earn?

6. A cow cost  $\$35$  and a sheep  $\frac{1}{7}$  as much; how much did the sheep cost?

7. How much will  $\frac{3}{4}$  of a bushel of potatoes cost at 60 cents a bushel?

SOLUTION.—If a bushel of potatoes cost 60 cents,  $\frac{1}{4}$  of a bushel will cost  $\frac{1}{4}$  of 60 cents, or 15 cents; and  $\frac{3}{4}$  of a bushel will cost 3 times 15 cents, or 45 cents.

8. How many eggs in  $\frac{2}{3}$  of a dozen?

9. Mr. Ellis is 40 years old and his son is  $\frac{2}{5}$  as old; how old is his son?

10. A boy had 60 cents, but spent  $\frac{2}{3}$  of it; how much has he remaining?

11. What is the cost of  $\frac{3}{4}$  of an acre of land at 72 dollars an acre?

12. If a horse cost 120 dollars and a cow  $\frac{3}{10}$  as much, how much does the cow cost?

13. If 3 calves cost  $\frac{2}{5}$  of 30 dollars, how much does 1 calf cost?

14.  $\frac{3}{7}$  of 21 dollars is twice the cost of a pair of shoes; how much did the shoes cost?

15. A horse cost \$150 and a wagon  $\frac{3}{5}$  as much; how much did the wagon cost?

16.  $\frac{3}{9}$  of 36 are how many times 3?

17.  $\frac{6}{7}$  of 49 are how many times  $\frac{1}{7}$  of 49?

18.  $\frac{6}{11}$  of 88 are how many times  $\frac{2}{5}$  of 40?

19.  $\frac{5}{9}$  of 54 are how many times  $\frac{3}{5}$  of 30?

20.  $\frac{5}{8}$  of 96 are how many times  $\frac{2}{5}$  of 50?

21. What is  $\frac{1}{5}$  of 8?

ANALYSIS.—Since  $\frac{1}{5}$  of 1 is  $\frac{1}{5}$ ,  $\frac{1}{5}$  of 8 is 8 times  $\frac{1}{5}$ , or  $\frac{8}{5}$ .

22. What is  $\frac{1}{3}$  of 4?  $\frac{1}{3}$  of 5?

23. What is  $\frac{1}{2}$  of 5?  $\frac{1}{4}$  of 5?

24. What is  $\frac{1}{4}$  of 6?  $\frac{1}{4}$  of 7?

25. What is  $\frac{1}{5}$  of 6?  $\frac{1}{5}$  of 8?

26. What is  $\frac{1}{6}$  of 8?  $\frac{1}{6}$  of 10?

27. What is  $\frac{2}{3}$  of 5?

ANALYSIS.—Since  $\frac{1}{5}$  of 5 is  $\frac{5}{5}$ ,  $\frac{2}{3}$  of 5 is 2 times  $\frac{5}{3}$ , or  $\frac{10}{3}$ .

28. What is  $\frac{2}{3}$  of 4?  $\frac{2}{3}$  of 7?

29. What is  $\frac{3}{4}$  of 5?  $\frac{3}{4}$  of 9?

30. What is  $\frac{3}{5}$  of 6?  $\frac{2}{3}$  of 10?

31. What is  $\frac{2}{3}$  of 11?  $\frac{3}{5}$  of 16?

32. What is  $\frac{3}{8}$  of 18?  $\frac{5}{6}$  of 20?

33. What is  $\frac{5}{7}$  of 10?  $\frac{5}{9}$  of 12?

34. What is  $\frac{2}{5}$  of \$8?  $\frac{5}{7}$  of 15 bushels?

35. When apples are worth \$3 a barrel, how much will  $3\frac{1}{2}$  barrels cost?

36. When wheat is worth 80 cents a bushel, what is the cost of  $2\frac{3}{4}$  bushels?

37. When coal is \$5 a ton, how much will  $4\frac{1}{4}$  tons cost?

38. If eggs are worth 30 cents a dozen, how much will  $3\frac{3}{4}$  dozen cost?

39. When cheese is worth 18 cents a pound, what is the cost of  $2\frac{3}{8}$  pounds?

40. If land is worth \$50 an acre, how much will  $5\frac{1}{4}$  acres cost?

41. What is the price of 1 dozen and 5 eggs at 18 cents a dozen?

42. If a horse travel 8 miles an hour, how far will he travel in  $5\frac{2}{3}$  hours?

43. What is the cost of  $6\frac{3}{4}$  bushels of potatoes at 50 cents a bushel?

44. If a family use a barrel of flour in 9 weeks, how long will  $2\frac{3}{4}$  barrels last them?

45. What is the cost of  $6\frac{1}{4}$  pounds of coffee at 30 cents a pound?

46. When flour is worth \$6 a barrel, how much is  $\frac{1}{8}$  of a barrel worth?

47. When hay is worth \$16 a ton, how much is  $\frac{2}{5}$  of a ton worth?

48. If 8 bushels of corn cost \$4, how much will 3 bushels cost?

49. What is the cost of  $\frac{7}{8}$  of a yard of linen worth 60 cents a yard?

50. If I pay 20 cents a dozen for oranges, how much is that apiece?

51. How much will 3 dozen and 5 eggs cost at 18 cents a dozen?

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## 3.

## FRACTIONS MULTIPLIED BY FRACTIONS.

1. What is  $\frac{2}{3}$  of  $\frac{2}{5}$ ?

SOLUTION.— $\frac{1}{3}$  of  $\frac{1}{5}$  is  $\frac{1}{15}$ ;  $\frac{1}{3}$  of  $\frac{2}{5}$  is 2 times  $\frac{1}{15}$ , or  $\frac{2}{15}$ ; and  $\frac{2}{3}$  of  $\frac{2}{5}$  is 2 times  $\frac{2}{15}$ , or  $\frac{4}{15}$ .

2. What is  $\frac{2}{3}$  of  $\frac{1}{3}$ ?

6. What is  $\frac{3}{4}$  of  $\frac{5}{6}$ ?

3. What is  $\frac{2}{5}$  of  $\frac{2}{3}$ ?

7. What is  $\frac{5}{6}$  of  $\frac{7}{10}$ ?

4. What is  $\frac{3}{4}$  of  $\frac{3}{5}$ ?

8. What is  $\frac{2}{3}$  of  $\frac{5}{4}$ ?

5. What is  $\frac{1}{2}$  of  $\frac{5}{6}$ ?

9. What is  $\frac{3}{5}$  of  $\frac{7}{9}$ ?

10. What is  $\frac{2}{3}$  of  $6\frac{1}{4}$ ?

SUGGESTION.— $6\frac{1}{4}$  is  $\frac{25}{4}$ , hence  $\frac{2}{3}$  of  $6\frac{1}{4}$  is  $\frac{2}{3}$  of  $\frac{25}{4}$ .

11. What is  $\frac{3}{4}$  of  $4\frac{1}{3}$ ?

12. What is  $\frac{3}{5}$  of  $4\frac{1}{6}$ ?  $\frac{5}{6}$  of  $2\frac{1}{4}$ ?

13. How much will  $\frac{1}{4}$  of a bushel of wheat cost at  $\frac{4}{5}$  of a dollar a bushel?

14. A boy, having  $\frac{1}{3}$  of a pie, gave away  $\frac{1}{2}$  of it; what part of a pie did he give away?

15. If a yard of cloth is worth  $\frac{3}{4}$  of a dollar, how much is  $\frac{3}{8}$  of a yard worth?

16. What is the cost of  $\frac{3}{4}$  of a pound of butter at  $\frac{2}{5}$  of a dollar a pound?

17. If I have  $\frac{3}{5}$  of a dollar and give away  $\frac{2}{3}$  of it, what part of a dollar do I have remaining?

18. How much can a boy earn in  $2\frac{1}{2}$  days at  $\frac{3}{4}$  of a dollar a day?

19. At  $\$5\frac{1}{4}$  a ton, how much will  $\frac{3}{4}$  of a ton of coal cost?

20. If a man earn  $\$3\frac{1}{2}$  a day, how much does he earn in  $\frac{3}{4}$  of a day?

21. How much will  $2\frac{3}{4}$  dozen of eggs cost at  $12\frac{1}{2}$  cents a dozen?

22. What is the cost of  $3\frac{1}{4}$  pounds of steak at 18 cents a pound?

23. When cloth is worth  $\$3\frac{1}{2}$  a yard, what is the cost of  $2\frac{1}{4}$  yards?

24. A man had  $\$7\frac{1}{2}$  and spent  $\frac{3}{5}$  of it for a hat; what did the hat cost?

25. How much will  $10\frac{1}{2}$  pounds of sugar cost at  $6\frac{1}{2}$  cents a pound?

26. When pork sells at  $12\frac{1}{2}$  cents a pound, what is the cost of  $5\frac{1}{2}$  pounds?

27. When eggs are worth 15 cents a dozen, how much do 3 dozen and 3 eggs cost?

28. When meat is selling at 2 pounds for 25 cents, how much are  $6\frac{1}{4}$  pounds worth?

What is the product—

29. Of  $\frac{2}{3}$  by  $\frac{3}{5}$ ?

32. Of  $\frac{1}{4}$  of 6 by  $\frac{3}{5}$ ?

30. Of  $\frac{6}{7}$  by  $\frac{2}{3}$ ?

33. Of  $\frac{2}{3}$  of 5 by  $\frac{1}{2}$  of 7?

31. Of  $\frac{2}{3}$  of  $\frac{1}{2}$  by  $\frac{3}{4}$ ?

34. Of  $\frac{3}{5}$  of 4 by  $\frac{2}{3}$  of 8?

## DIVISION OF FRACTIONS.

### 1.

#### FRACTIONS DIVIDED BY INTEGERS.

1. If 3 boys earn  $\frac{6}{10}$  of a dollar, how much does 1 boy earn?

2. If 4 hens cost  $\frac{8}{10}$  of a dollar, how much does one hen cost?

3. If 2 ducks cost  $\frac{4}{5}$  of a dollar, how much does 1 cost?

4. If 4 slates cost  $\frac{3}{5}$  of a dollar, how much will one slate cost?

SOLUTION.—If 4 slates cost  $\frac{3}{5}$  of a dollar, 1 slate will cost  $\frac{1}{4}$  of  $\frac{3}{5}$  of a dollar, or  $\frac{3}{20}$  of a dollar.

5. If 5 dozen eggs cost  $\frac{4}{5}$  of a dollar, how much does 1 dozen cost?

6. When 6 yards of calico are worth  $\frac{3}{10}$  of a dollar, what is 1 yard worth?

7. If 6 men can do  $\frac{3}{4}$  of a piece of work, how much can one man do?

8. Divide  $\frac{8}{9}$  into 5 equal parts.

9. When 4 pounds of butter are worth  $\$1\frac{1}{2}$ , how much does one pound cost?

10. If 5 men earn  $\$8\frac{1}{4}$ , how much does 1 man earn?

11. A boy, having 6 quarts of cherries, shared them with 7 other boys; what part of a quart did each receive?

12. Henry, having 6 oranges, divided them among 4 of his companions; how many did each companion receive?

13. If a boy walk  $13\frac{1}{2}$  miles in 4 hours, how far does he walk in 1 hour?

14. If 5 yards of cloth cost  $12\frac{1}{2}$  dollars, how much will 1 yard cost?

15. James, having gathered 12 quarts of berries, gave  $\frac{1}{3}$  of them to his mother and sold the remainder for  $\frac{1}{2}$  of a dollar; how much per quart did he get for them?

16. If 6 men in a certain time earn  $13\frac{1}{2}$  dollars, how much does 1 man earn?

17. How many times is 2 contained in  $\frac{3}{4}$ ? In  $\frac{2}{3}$ ?

18. How often is 5 contained in  $\frac{3}{2}$ ? In  $\frac{5}{6}$ ?

19. Divide  $\frac{7}{12}$  by 4;  $\frac{4}{5}$  by 10;  $\frac{7}{8}$  by 5.

20. Divide  $\frac{3}{4}$  by 6;  $\frac{15}{6}$  by 5;  $\frac{1}{2}$  by 8.

21. Divide  $6\frac{1}{2}$  by 3;  $3\frac{1}{3}$  by 4;  $5\frac{1}{6}$  by 5.

22. Divide  $2\frac{2}{3}$  by 7;  $6\frac{1}{4}$  by 3;  $14\frac{2}{5}$  by 6.

## 2.

### INTEGERS DIVIDED BY FRACTIONS.

1. At  $\frac{3}{4}$  of a dollar a bushel, how much corn can be bought for \$6?

SOLUTION.—If 1 bushel of corn cost  $\frac{3}{4}$  of a dollar, for \$6, or  $\$2\frac{2}{3}$ , as many bushels can be bought as  $\frac{3}{4}$  is contained times in  $2\frac{2}{3}$ , or 8 bushels.

2. How many books at  $\frac{2}{5}$  of a dollar each can I buy for \$4.

3. How many hens at  $\frac{3}{5}$  of a dollar each can I get for \$6?

4. If I earn  $\frac{3}{4}$  of a dollar a day, how long will it take to earn \$9?

5. How many strips of carpet  $\frac{3}{4}$  of a yard wide will it require to cover a floor 6 yards wide?

6. How many baskets of peaches at  $\frac{4}{5}$  of a dollar a basket can be bought for \$8?

7. If it require  $\frac{5}{8}$  of a yard of linen to make an apron, how many aprons can be made from 5 yards?

8. How many hens at  $\frac{1}{4}$  of a dollar each can be bought for \$10?

9. How long will it take a man to earn \$15, if he earn  $\$2\frac{1}{2}$  a day?

10. If it require  $\frac{3}{8}$  of a yard of ribbon to make a badge, how many badges can be made from 12 yards of ribbon?

11. At  $\$1\frac{1}{4}$  each how many turkeys can be bought for \$10?

12. James can earn  $\$1\frac{3}{4}$  a day; how long will it take him to earn \$14?

13. How many tons of coal at  $\$5\frac{1}{4}$  a ton can be bought for \$21?

14. If a boy spend  $\$1\frac{1}{2}$  a week, in how many weeks will he spend \$12?

15. How many pounds of sugar at  $6\frac{1}{4}$  cents a pound can be bought for 50 cents?

16. How often is  $\frac{1}{3}$  contained in 2? In 4? In 5?

17. How often is  $\frac{3}{4}$  contained in 3? In 9? In 12?

18. Divide 4 by  $\frac{4}{5}$ ; 6 by  $\frac{3}{7}$ ; 8 by  $\frac{2}{3}$ .

19. Divide 4 by  $\frac{2}{7}$ ; 5 by  $\frac{3}{4}$ ; 6 by  $\frac{5}{8}$ .

20. Divide 5 by  $\frac{3}{8}$ ; 8 by  $\frac{2}{5}$ ; 10 by  $\frac{5}{7}$ .

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## 3.

## FRACTIONS DIVIDED BY FRACTIONS.

1. If a duck cost  $\frac{2}{3}$  of a dollar, how many ducks can I buy for  $\$1\frac{2}{3}$ ?

SOLUTION.—If 1 duck cost  $\frac{2}{3}$  of a dollar, for  $\$1\frac{2}{3}$ , or  $\frac{5}{3}$  dollars, I can buy as many ducks as  $\frac{2}{3}$  is contained times in  $\frac{5}{3}$ , or 4 ducks.

2. How many dozen oranges at  $\frac{1}{5}$  of a dollar a dozen can I buy for  $\frac{1}{2}$  of a dollar?

3. How many melons at  $\frac{1}{4}$  of a dollar each can I buy for  $\$2\frac{1}{4}$ ?

4. How many bananas at  $\frac{2}{5}$  of a dime each can I get for 6 dimes?

5. When paper is  $\frac{1}{5}$  of a dollar a quire, how many quires can I buy for  $\$3$ ?

6. At  $\$1\frac{1}{5}$  a yard how many yards of silk can I buy for  $\frac{1}{2}$  of a dollar?

7. If 2 oranges cost a dime, how many can I get for  $1\frac{1}{2}$  dimes?

8. At  $\frac{6}{10}$  of a dollar a yard how many yards of cashmere can I get for  $\$4\frac{2}{5}$ ?

9. If 3 turkeys cost  $\$2\frac{1}{4}$ , how many can be bought for  $\$7\frac{1}{2}$ ?

10. Harry gave  $12\frac{1}{2}$  quarts of chestnuts worth 10 cents a quart for muslin at  $12\frac{1}{2}$  cents a yard; how many yards did he get?

11. How many bushels of potatoes at  $\frac{3}{8}$  of a dollar a bushel can be bought for  $\$4\frac{1}{2}$ ?

12. At  $\frac{2}{5}$  of a dollar a pound how many pounds of coffee can be bought for  $\frac{3}{4}$  of a dollar?

13. How many times is  $\frac{2}{4}$  contained in  $\frac{4}{5}$ ?

SOLUTION 1.— $\frac{3}{4}$  equals  $\frac{15}{20}$ , and  $\frac{4}{5}$  equals  $\frac{16}{20}$ ;  $\frac{15}{20}$  is contained in  $\frac{16}{20}$  as often as 15 is contained in 16, or  $1\frac{1}{15}$  times.

SOLUTION 2.—Since 1 is contained in  $\frac{4}{3} \frac{4}{3}$  times,  $\frac{1}{4}$  is contained in  $\frac{4}{3}$  4 times  $\frac{4}{3}$  times, or  $\frac{16}{9}$  times, and  $\frac{3}{4}$  is contained in  $\frac{4}{3} \frac{1}{3}$  of  $\frac{16}{9}$  times, or  $1\frac{2}{3}$  times, equal to  $1\frac{2}{3}$  times.

14. How often is  $\frac{2}{3}$  contained in  $\frac{3}{4}$ ? In  $\frac{5}{6}$ ?

15. How often is  $\frac{2}{5}$  contained in  $\frac{2}{3}$ ? In  $\frac{3}{4}$ ?

16. How often is  $\frac{5}{6}$  contained in  $\frac{3}{4}$ ? In  $\frac{4}{5}$ ?

17. How often is  $\frac{7}{8}$  contained in  $\frac{5}{6}$ ? In  $\frac{9}{10}$ ?

18. How often is  $\frac{3}{5}$  contained in  $1\frac{1}{2}$ ? In  $2\frac{1}{4}$ ?

Divide—

19.  $\frac{3}{4}$  by  $\frac{5}{8}$ ;  $\frac{9}{10}$  by  $\frac{2}{5}$ .

20.  $\frac{3}{5}$  by  $\frac{2}{3}$ ;  $\frac{5}{8}$  by  $\frac{3}{4}$ .

21.  $2\frac{1}{4}$  by  $\frac{3}{5}$ ;  $3\frac{1}{3}$  by  $\frac{5}{6}$ .

22.  $6\frac{1}{4}$  by  $2\frac{1}{2}$ ;  $4\frac{1}{5}$  by  $3\frac{1}{2}$ .

23.  $4\frac{2}{7}$  by  $3\frac{1}{9}$ ;  $9\frac{1}{2}$  by  $3\frac{1}{4}$ .

24.  $\frac{1}{2}$  of  $\frac{1}{4}$  by  $\frac{1}{3}$ ;  $\frac{2}{3}$  of  $2\frac{2}{5}$  by  $\frac{5}{8}$ .

25.  $\frac{1}{3}$  of  $3\frac{3}{4}$  by  $\frac{5}{6}$ ;  $\frac{2}{3}$  of  $\frac{5}{6}$  by  $\frac{3}{4}$  of  $\frac{3}{5}$ .

26. At  $\$3\frac{1}{5}$  apiece how many sheep can be bought for  $\$19\frac{1}{5}$ ?

27. If 3 baskets of peaches are worth  $\$2$ , how many baskets are worth  $\$2\frac{2}{3}$ ?

28. A farmer divided his land,  $85\frac{1}{2}$  acres, among his 3 sons; how much did each get?

29. If a boy can run  $\frac{1}{8}$  of a mile in a minute, how long will it take him to run  $\frac{2}{3}$  of a mile?

30. If I buy  $2\frac{1}{2}$  bushels of potatoes for  $\$1$ , how much will  $6\frac{1}{4}$  bushels cost?

31. If a turkey cost  $\$1\frac{2}{5}$ , how many turkeys at the same rate can be bought for  $\$8\frac{2}{5}$ ?

32. If a man can do a piece of work in  $8\frac{1}{2}$  days, how many men will be required to do the work in  $2\frac{5}{8}$  days?

33. How many quarts of berries at  $\frac{1}{12}$  of a dollar a quart can be bought for  $3\frac{1}{2}$  bushels of wheat worth  $\frac{4}{5}$  of a dollar a bushel?

34. A woman exchanged  $6\frac{1}{2}$  dozen of eggs at  $\frac{1}{5}$  of a dollar

a dozen for coffee at  $\frac{2}{5}$  of a dollar a pound ; how much coffee did she get ?

35. A farmer sold  $22\frac{1}{2}$  pounds of butter at  $\frac{3}{10}$  of a dollar a pound, and took in exchange cloth at  $\frac{3}{4}$  of a dollar a yard ; how much cloth did he get ?

### COMPLEX FRACTIONS.

A *Complex Fraction* is an indicated division, in which either the numerator or the denominator or both are fractions.

1. What is the value of  $\frac{\frac{5}{6}}{3\frac{1}{5}}$  ?

SOLUTION.—The fraction  $\frac{\frac{5}{6}}{3\frac{1}{5}}$  is equivalent to  $\frac{5}{6}$  divided by  $3\frac{1}{5}$ , or  $\frac{16}{5}$ .

Since  $\frac{5}{6}$  equals  $\frac{25}{30}$  and  $3\frac{1}{5}$  equals  $\frac{16}{5}$ ,  $\frac{5}{6}$  divided by  $3\frac{1}{5}$  is equal to 16 divided by 96, or  $\frac{1}{6}$ .

What is the value—

2. Of  $\frac{\frac{1}{2}}{\frac{1}{3}}$  ?

6. Of  $\frac{2\frac{1}{2}}{4\frac{1}{5}}$  ?

3. Of  $\frac{\frac{5}{6}}{\frac{2}{3}}$  ?

7. Of  $\frac{5\frac{1}{2}}{\frac{1}{3}}$  ?

4. Of  $\frac{\frac{3}{4}}{\frac{3}{5}}$  ?

8. Of  $\frac{6\frac{1}{2}}{3\frac{1}{3}}$  ?

5. Of  $\frac{6\frac{1}{2}}{\frac{1}{4}}$  ?

9. Of  $\frac{\frac{1}{2} \times 6\frac{1}{2}}{3\frac{1}{5}}$  ?

10. A man's wages are  $\$2\frac{3}{4}$  a day ; how long does it take him to earn  $\$13\frac{3}{4}$  ?

11. If  $4\frac{1}{2}$  pounds of meat cost  $49\frac{1}{2}$  cents, how much does it cost per pound ?

12. If  $\frac{1}{2}$  of  $\frac{3}{4}$  of a ton of coal cost  $\$1\frac{4}{5}$ , how much will a ton cost ?

## RELATION OF NUMBERS.

## 1.

## RELATION OF INTEGERS TO INTEGERS.

1. If 2 apples cost 3 cents, how much will 10 apples cost?

SOLUTION.—If 2 apples cost 3 cents, 10 apples, or 5 times 2 apples, will cost 5 times 3 cents, or 15 cents.

2. If 2 bananas cost 5 cents, how much will 6 bananas cost?

3. If 3 pencils cost 10 cents, how much will 12 pencils cost?

4. If 5 boys earn \$3, how much will 20 boys earn in the same time?

5. What is the relation of 30 to 5?

ANS.—30 is 6 times 5.

What is the relation—

6. Of 6 to 3? Of 6 to 2? Of 12 to 4?

7. Of 10 to 5? Of 20 to 5? Of 20 to 4?

8. Of 15 to 3? Of 15 to 5? Of 16 to 4?

9. Of 30 to 6? Of 40 to 8? Of 36 to 6?

10. Of 50 to 25? Of 60 to 12? Of 12 to 6?

11. If \$20 buy three sheep, how many may be bought for \$60?

12. If 20 cents buy a dozen of eggs, how many eggs will 30 cents buy?

13. If a man can walk 10 miles in 3 hours, how far can he walk in 9 hours?

14. If 10 cents buy 4 oranges, how many oranges will 5 cents buy?

15. If 5 horses cost \$750, how much will 10 horses cost?

16. What is the cost of 3 cows if 9 cows cost \$360?

17. A merchant sold shoes at the rate of 2 pairs for \$7; how many pairs can I get at the same rate for \$21?

18. If \$15 buy 12 turkeys, how many will \$5 buy?



## 2.

## RELATION OF FRACTIONS TO INTEGERS.

1. What part of 6 is  $\frac{3}{4}$ ?

SOLUTION.—1 is  $\frac{1}{6}$  of 6, and  $\frac{3}{4}$  is  $\frac{3}{4}$  of  $\frac{1}{6}$  of 6, or  $\frac{3}{24}$  of 6.

2. What part of 5 is  $\frac{2}{3}$ ?  $\frac{1}{4}$ ?  $\frac{5}{6}$ ?

3. What part of 4 is  $\frac{2}{3}$ ?  $\frac{3}{5}$ ?  $\frac{3}{8}$ ?

4. What part of 6 is  $\frac{3}{4}$ ?  $\frac{4}{5}$ ?  $\frac{5}{7}$ ?

5. What part of 8 is  $1\frac{1}{2}$ ?  $3\frac{1}{4}$ ?  $5\frac{1}{6}$ ?

6. What is the relation of  $\frac{2}{3}$  to 20?

7. What is the relation of  $\frac{5}{6}$  to 12?

8. What is the relation of  $\frac{3}{5}$  to 16?

9. What is the relation of  $3\frac{1}{2}$  to 14?

10. What is the relation of  $2\frac{2}{3}$  to 6?

## 3.

## RELATION OF INTEGERS TO FRACTIONS.

1. What is the relation of 4 to  $\frac{4}{5}$ ?

SOLUTION.—4, which is  $\frac{20}{5}$ , is 5 times  $\frac{4}{5}$ .

What is the relation—

2. Of 6 to  $\frac{2}{5}$ ?

6. Of 12 to  $\frac{6}{7}$ ?

10. Of  $3\frac{3}{5}$  to  $\frac{5}{6}$ ?

3. Of 8 to  $\frac{4}{5}$ ?

7. Of 12 to  $\frac{4}{5}$ ?

11. Of  $6\frac{1}{4}$  to  $\frac{5}{12}$ ?

4. Of 12 to  $\frac{3}{7}$ ?

8. Of 12 to  $\frac{4}{7}$ ?

12. Of 30 to  $3\frac{3}{4}$ ?

5. Of 9 to  $\frac{3}{5}$ ?

9. Of 10 to  $\frac{5}{9}$ ?

13. Of 16 to  $3\frac{1}{5}$ ?

## 4.

## RELATION OF FRACTIONS TO FRACTIONS.

1. What part of  $\frac{5}{6}$  is  $\frac{3}{4}$ ?

SOLUTION.—Since  $\frac{1}{6}$  is  $\frac{1}{5}$  of  $\frac{5}{6}$ ,  $\frac{6}{6}$ , or 1, is 6 times  $\frac{1}{6}$  of  $\frac{5}{6}$ , or  $\frac{6}{6}$  of  $\frac{5}{6}$ ; and since 1 is  $\frac{6}{5}$  of  $\frac{5}{6}$ ,  $\frac{3}{4}$  is  $\frac{3}{4}$  of  $\frac{6}{5}$  of  $\frac{5}{6}$ , or  $\frac{18}{20}$  of  $\frac{5}{6}$ .

What part—

- |  |  |  |
|--|--|--|
| 2. Of $\frac{1}{2}$ is $\frac{1}{3}$ ? | 6. Of $\frac{4}{5}$ is $\frac{3}{4}$ ? | 10. Of $\frac{3}{4}$ is $2\frac{1}{2}$ ?   |
| 3. Of $\frac{2}{3}$ is $\frac{3}{4}$ ? | 7. Of $\frac{5}{8}$ is $\frac{2}{9}$ ? | 11. Of $6\frac{1}{4}$ is $\frac{4}{5}$ ?   |
| 4. Of $\frac{3}{4}$ is $\frac{2}{5}$ ? | 8. Of $\frac{3}{5}$ is $\frac{2}{3}$ ? | 12. Of $8\frac{1}{3}$ is $\frac{3}{4}$ ?   |
| 5. Of $\frac{5}{6}$ is $\frac{4}{5}$ ? | 9. Of $\frac{2}{3}$ is $\frac{3}{5}$ ? | 13. Of $12\frac{1}{2}$ is $6\frac{1}{4}$ ? |
14. What is the relation of  $3\frac{1}{3}$  to  $16\frac{2}{3}$ ?
15. What is the relation of  $31\frac{1}{4}$  to  $6\frac{1}{4}$ ?

## ANALYSIS, OR COMPARISON OF NUMBERS.

### 1.

#### INTEGERS COMPARED WITH INTEGERS.

1. If 5 boys earn \$12, how much will 3 boys earn?

ANALYSIS.—Since 5 boys earn \$12, one boy earns  $\frac{1}{5}$  of \$12, or  $\frac{1}{5} \times 12$  dollars; and 3 boys earn 3 times  $\frac{1}{5} \times 12$  dollars, or  $\frac{3}{5} \times 12$  dollars, equal to  $7\frac{1}{5}$  dollars.

2. If 5 barrels of flour cost \$30, how much will 4 barrels cost?

3. If a horse travel 36 miles in 6 hours, how far does he travel in 2 hours, at the same rate?

4. If 5 yards of ribbon cost 55 cents, how much will 12 yards cost?

5. If 3 dozen eggs cost 60 cents, how much will 5 dozen cost?

6. When 6 yards of muslin cost 48 cents, how much do 10 yards cost?

7. If 10 quarts of milk are worth 60 cents, how much are 3 quarts worth?

8. George can earn 80 dollars in 5 weeks; how much can he earn in 3 weeks?

9. If 5 weeks' board cost \$20, how much do 8 weeks' board cost?

10. If 5 tons of coal are worth \$26, how much are 3 tons worth?

11. If 4 quarts of oil cost 60 cents, how many quarts can I buy for 75 cents?

12. What is the cost of 8 dozen of eggs, if 5 dozen cost 70 cents?

13. If a coach travels 40 miles in 8 hours, how far does it travel in 10 hours?

14. How much will 15 cows cost if 5 cost \$75?

15. If 20 brooms cost \$5, how many brooms can be bought for \$12?

16. If I exchange 10 yards of silk at 90 cents a yard for butter, how much butter do I get if 4 pounds of butter are worth \$1.20?

17. At the rate of 10 cents a dozen how many apples can I get for 25 cents?

18. A farmer sells 15 hens worth 40 cents each, and takes in exchange coffee worth 30 cents a pound; how many pounds of coffee does he get?

19. If 4 men can do a piece of work in 6 days, how long will it take 12 men to do the same work?

ANALYSIS.—If 4 men can do a piece of work in 6 days, it will take 1 man 4 times 6 days, or 24 days, to do the work, and 12 men will do it in  $\frac{1}{3}$  of 24 days, or 8 days.

20. How long will it take 1 man to do a piece of work if 6 men do the same work in 3 days?

21. If 6 men do a piece of work in 4 days, how many men will be required to do the same work in 1 day?

22. If 8 men can dig a cellar in 5 days, how long will it take 4 men to dig it? 5 men? 10 men?

23. If 5 men can build a wall in 12 days, how many men will it take to build it in 1 day? In 6 days? In 10 days?

24. A laborer agrees to work 4 months for 60 dollars; if he work 6 months, how much does he receive?

25. If 3 men do the carpenter work on a house in 20 days, how long would it have taken 5 men to do it?

26. If 4 men can build a stone wall in 15 days, how many men could have built it in 12 days? In 5 days? In 6 days?

## 2.

### COMPARISON OF FRACTIONS WITH INTEGERS.

1. If  $\frac{7}{12}$  of a dozen eggs cost 14 cents, how much will 4 dozen cost?

ANALYSIS.—If  $\frac{7}{12}$  of a dozen of eggs cost 14 cents,  $\frac{1}{12}$  of a dozen will cost  $\frac{1}{7}$  of 14 cents, or 2 cents;  $\frac{1}{12}$ , or 1 dozen, will cost 12 times 2 cents, or 24 cents; and 4 dozen will cost 4 times 24 cents, or 96 cents.

2. If  $\frac{3}{5}$  of the price of a book is 30 cents, what is the full price?

3. How old am I if  $\frac{2}{3}$  of my age is 24 years?

4. If \$30 is  $\frac{3}{4}$  of what a man paid for a cow, how much did she cost?

5. When  $2\frac{1}{2}$  pounds of butter cost 90 cents, what is the cost of 6 pounds?

6. Mr. A paid \$150 for a horse, and a cow cost  $\frac{2}{5}$  as much; how much did the cow cost?

7. What is the cost of 10 sheep if  $\frac{3}{4}$  of 8 dollars is the cost of 1 sheep?

8. I bought some grain for \$120, which is  $\frac{5}{6}$  of what I sold it for; how much did I gain?

9. George earned \$15, which is  $\frac{3}{4}$  of what he already had; how much had he at first?

10. Henry lost 12 marbles, which is  $\frac{2}{7}$  of his number at first; how many has he remaining?

11. George ate 8 plums, which is  $\frac{2}{5}$  of the number he has remaining; how many had he at first?

12. 9 is  $\frac{1}{5}$  of what number?

13. 8 is  $\frac{2}{3}$  of what number?
  14. 12 is  $\frac{3}{4}$  of what number?
  15. 20 is  $\frac{5}{9}$  of what number?
  16. 18 is  $\frac{3}{7}$  of what number?
  17. 14 is  $\frac{7}{9}$  of what number?
  18. 15 is  $\frac{5}{8}$  of what number?
  19. If 16 is  $\frac{4}{5}$  of a number, what is 3 times the number?
  20. If 18 is  $\frac{3}{5}$  of a number, what is 5 times the number?
  21. 12 is  $\frac{1}{2}$  of  $\frac{4}{5}$  of what number?
  22. 30 is  $\frac{1}{3}$  of  $\frac{6}{7}$  of what number?
  23. 18 is  $\frac{3}{5}$  of  $\frac{5}{8}$  of what number?
  24. 20 is  $\frac{5}{8}$  of  $\frac{2}{3}$  of what number?
  25. 24 is  $\frac{2}{3}$  of  $\frac{4}{7}$  of what number?
  26.  $\frac{2}{3}$  of 12 is  $\frac{4}{7}$  of what number?
  27.  $\frac{5}{6}$  of 18 is  $\frac{3}{5}$  of what number?
  28.  $\frac{3}{5}$  of 100 is  $\frac{5}{12}$  of what number?
  29.  $\frac{8}{9}$  of 18 is  $\frac{2}{3}$  of what number?
  30.  $\frac{4}{7}$  of 28 is  $\frac{2}{5}$  of what number?
  31. A hat cost \$6, which is  $\frac{2}{5}$  the cost of a coat; how much did the coat cost?
  32. George is 12 years old, which is  $\frac{3}{5}$  of  $\frac{1}{3}$  of his father's age; how old is the father?
  33. The cost of a sleigh is \$60, which is  $\frac{3}{4}$  of  $\frac{2}{3}$  the cost of a carriage; what is the cost of the carriage?
  34. A boy has 20 hens, and this is  $\frac{5}{8}$  of  $\frac{2}{3}$  of his brother's number; how many has the brother?
  35. A watch is worth \$75, which is  $\frac{3}{4}$  of 5 times what a chain cost; what is the cost of the chain?
  36. If a wagon is sold for \$100, which is  $\frac{5}{8}$  of 2 times its cost, how much is gained?
  37. A man sold his house for \$2400, which was  $\frac{1}{5}$  of 6 times what it cost him; how much did he gain on the sale?
-

## 3.

## COMPARISON OF INTEGERS WITH FRACTIONS.

1. If 6 yards of muslin cost 48 cents, how much will  $1\frac{1}{4}$  yards cost?

ANALYSIS.—If 6 yards of muslin cost 48 cents, 1 yard will cost  $\frac{1}{6}$  of 48 cents, or 8 cents; and  $1\frac{1}{4}$ , or  $\frac{5}{4}$ , yards will cost  $\frac{5}{4}$  of 8 cents, or 10 cents.

2. If 3 tons of coal cost \$15, how much will  $\frac{3}{4}$  of a ton cost?

3. A cow cost \$36 and some sheep  $\frac{5}{6}$  as much; how much did the sheep cost?

4. If a dozen eggs cost 24 cents, how much will  $\frac{2}{3}$  of a dozen cost?

5. When eggs are worth 30 cents a dozen, how much will  $2\frac{3}{4}$  dozen cost?

6. If 8 acres of land produce 240 bushels of wheat, how many bushels will  $3\frac{1}{4}$  acres produce?

7. A farmer had 60 sheep; if he sell  $\frac{2}{3}$  of them, how many will he have remaining?

8. If 3 yards of cloth cost \$9, how much will  $\frac{3}{8}$  of a yard cost?

9. When 4 pounds of tea cost \$3, how much will  $5\frac{1}{2}$  pounds cost?

10. If 6 bushels of oats cost \$2, how much will  $2\frac{3}{4}$  bushels cost?

11. Henry earned \$60 in 10 weeks; how much could he earn in  $4\frac{1}{2}$  weeks?

12. When 7 bushels of corn cost  $\$5\frac{1}{4}$ , how much will  $10\frac{3}{4}$  bushels cost?

13. When  $2\frac{3}{4}$  pounds of cheese cost 44 cents, how much will  $3\frac{1}{8}$  pounds cost?

14. If  $\frac{3}{4}$  of 4 dozen of eggs cost  $\frac{3}{5}$  of a dollar, how much will  $2\frac{1}{4}$  dozen cost?

15. What number is that to which, if  $\frac{3}{4}$  of itself be added, the result will be 56?

16. Henry sold  $\frac{3}{8}$  of his hens and had 35 remaining; how many had he at first?

17. If  $\frac{3}{7}$  of 14 yards of silk cost \$12, how much will  $3\frac{3}{8}$  yards cost?

18. If  $\frac{1}{3}$  of 10 cords of wood cost \$6, how much will  $\frac{1}{4}$  of 3 cords cost?

19. If  $2\frac{1}{4}$  barrels of apples cost \$9, how much will  $3\frac{1}{4}$  barrels cost?

20. When 40 acres of land cost \$1800, how much will  $5\frac{1}{4}$  acres cost?

## 4.

## COMPARISON OF FRACTIONS WITH FRACTIONS.

1. If  $\frac{2}{3}$  of a bushel of wheat cost 64 cents, how much will  $\frac{3}{4}$  of a bushel cost?

ANALYSIS.—If  $\frac{2}{3}$  of a bushel of wheat cost 64 cents,  $\frac{1}{3}$  of a bushel will cost  $\frac{1}{2}$  of 64 cents, or 32 cents; and 1 bushel will cost 3 times 32 cents, or 96 cents. Since 1 bushel of wheat costs 96 cents,  $\frac{3}{4}$  of a bushel will cost  $\frac{3}{4}$  of 96 cents, or 72 cents.

2.  $\frac{3}{4}$  of my age is 30 years; what is  $\frac{2}{3}$  of my age?

3. If  $\frac{3}{8}$  of a pound of cheese cost 6 cents, how much will  $\frac{3}{4}$  of a pound cost?

4. When  $\frac{3}{7}$  of my monthly salary is \$9, how much do I earn in  $\frac{2}{3}$  of a month?

5.  $\frac{2}{3}$  of the cost of my horse is \$100; what do I get for him if I sell him at  $\frac{6}{5}$  of his cost?

6. When  $\frac{3}{4}$  of a dozen of eggs cost 18 cents, how much will  $1\frac{1}{3}$  dozen cost?

7. If  $1\frac{1}{2}$  barrels of apples cost \$6, what must I pay for  $2\frac{3}{4}$  barrels?

8. If  $\frac{1}{5}$  of a box of soap cost 90 cents, what is the cost of  $2\frac{1}{2}$  boxes?

9. If a horse travel 14 miles in  $2\frac{1}{3}$  hours, how far will he travel in  $5\frac{1}{2}$  hours?

10. If  $3\frac{1}{8}$  pounds of meat cost 50 cents, how much will  $4\frac{1}{4}$  pounds cost?

11. If  $\frac{3}{5}$  of a ton of coal is worth  $\$3\frac{3}{4}$ , how much are  $2\frac{1}{4}$  tons worth?

12. How much will  $5\frac{1}{4}$  pounds of sugar cost, if  $2\frac{1}{2}$  pounds cost 20 cents?

13. When  $2\frac{1}{4}$  barrels of flour are worth  $\$13\frac{1}{2}$ , how much are  $1\frac{1}{2}$  barrels worth?

14. 12 years is  $\frac{3}{8}$  of my age; what is twice my age?

15. If  $3\frac{3}{8}$  pounds of butter are worth  $\$1.35$ , what are  $2\frac{1}{2}$  pounds worth?

16. If  $\frac{3}{8}$  of a barrel of vinegar is worth  $\$3\frac{3}{4}$ , how much are  $1\frac{2}{3}$  barrels worth?

17. How much will  $1\frac{3}{4}$  yards of silk cost, if  $\frac{2}{3}$  of a yard cost  $\frac{2}{3}$  of a dollar?

18. If a ship sail  $4\frac{1}{2}$  miles in  $\frac{3}{5}$  of an hour, how far will it sail in 8 hours?

19. Henry can mow an acre of grass in  $10\frac{1}{2}$  hours, and William in  $\frac{2}{3}$  of that time; how long does it take William to mow the acre?

20. When  $3\frac{1}{2}$  dozen of eggs are worth 70 cents, how much are  $3\frac{1}{4}$  dozen worth?

21. If 2 yards of cloth cost  $\$3\frac{1}{2}$ , how many yards can I buy for  $\$5$ ?

22. If a boy can earn  $\$6\frac{1}{2}$  in 4 days, how much can he earn in  $\frac{1}{3}$  of  $\frac{4}{5}$  of a day?

23. How many sheep at  $\$5\frac{1}{2}$  apiece can I get for 5 tons of coal at  $\$4\frac{2}{3}$  a ton?

24. How many pounds of butter at  $\frac{3}{10}$  of a dollar a pound will pay for 16 pairs of chickens at  $\frac{3}{4}$  of a dollar a pair?



25. How many pounds of coffee at  $\frac{3}{10}$  of a dollar a pound can I get for 3 pairs of ducks at  $\frac{5}{8}$  of a dollar a pair?

## 5.

## A FRACTIONAL PART WITH AN INTEGRAL REMAINDER.

1. A boy lost  $\frac{3}{7}$  of his money and had \$12 remaining; how much had he at first?

ANALYSIS.—Since he lost  $\frac{3}{7}$  of his money, he had remaining  $\frac{4}{7} - \frac{3}{7}$ , or  $\frac{1}{7}$ , of his money, which is \$12: if  $\frac{1}{7}$  of his money is \$12,  $\frac{1}{7}$  of his money is  $\frac{1}{4}$  of \$12, or \$3, and  $\frac{7}{7}$ , or his money, is 7 times \$3, or \$21.

2. George spent  $\frac{2}{3}$  of his money and had \$20 remaining; how much had he at first?

3. A farmer sold  $\frac{1}{2}$  of his wheat to one man and  $\frac{1}{4}$  to another, and had 160 bushels remaining; how much had he at first?

4. Mr. A sold  $\frac{1}{3}$  of his corn to one man and  $\frac{1}{5}$  to another, and has 210 bushels remaining; how much had he at first?

5. If Henry spend  $\frac{1}{2}$  of  $\frac{3}{4}$  of his money and has \$30 remaining, how much had he at first?

6. In an orchard  $\frac{1}{2}$  of the trees are peach trees,  $\frac{1}{5}$  pear trees, and  $\frac{1}{6}$  apple trees; the remainder, 24, are plum trees; how many are there of each, and how many together?

7. Samuel spent  $\frac{1}{2}$  of his money, then earned  $\frac{1}{3}$  as much as he spent, and had \$20; how much had he at first?

8. A lady sold  $\frac{1}{2}$  of her hens, then bought  $\frac{2}{3}$  as many as she had at first, and then had 84; how many had she at first?

9. George won 40 marbles, then lost  $\frac{3}{4}$  of what he won, and had 25; how many had he at first?

10.  $\frac{1}{2}$  of a man's money, being increased by  $\frac{1}{3}$  and  $\frac{1}{5}$  of his money, equals \$620; how much money has he?

11. Henry spent  $\frac{2}{3}$  of his money, and then earned  $\frac{3}{4}$  as

much as he had at first, and then had \$65; how much had he at first?

12. My expenses are  $\frac{3}{5}$  of my annual income; what is my income, if I save \$340?

13. A man's board is  $\frac{1}{3}$  of his salary, and his other expenses  $\frac{2}{5}$ ; what is his salary, if he save \$200?

14. What number diminished by its  $\frac{2}{7}$  and its  $\frac{1}{3}$  equals 48?

15. A merchant who owed me failed, and I received only  $\frac{5}{8}$  of my money; what was the debt, if I received \$540?

16. I find that  $\frac{1}{4}$  of  $\frac{1}{5}$  of the trees in my orchard have died, but I still have 76; how many had I at first?

17. If James spends  $\frac{1}{4}$  of his income for board and  $\frac{2}{5}$  for other expenses, what is the income, if he saves \$120?

18. If I pay  $\frac{1}{3}$  of my salary for rent and  $\frac{1}{2}$  of  $\frac{3}{4}$  of it for other expenses, what is the salary, if I have remaining \$210?

19. After spending  $\frac{1}{3}$ ,  $\frac{1}{4}$ , and  $\frac{1}{5}$  of my money I find \$26 is  $\frac{1}{2}$  of the remainder; how much money had I?

20. Mr. Thomas sold  $\frac{1}{5}$  of his potatoes to A,  $\frac{2}{3}$  of the remainder to B, and had 40 bushels remaining; how many bushels had he at first?

21. What number is that to which if you add  $\frac{3}{4}$  of itself the result is 140?

22. A young man, being asked his age, replied, If to my age you add  $\frac{1}{2}$  and  $\frac{2}{3}$  of my age, the sum is 39 years; how old was he?

23. Paid  $\frac{1}{3}$  of my money for a book,  $\frac{1}{5}$  for pens, and 26 cents for a slate, and then had  $\frac{1}{4}$  of my money remaining; how much had I at first?

24. I spent  $\frac{1}{2}$  of my money, then borrowed  $\frac{2}{5}$  as much as I had remaining, when I had 20 cents less than at first; how much had I at first?

25.  $\frac{2}{3}$  of 12 is how many eighths of 16?

26.  $\frac{5}{8}$  of 30 is how many fifths of 25?

27.  $\frac{7}{8}$  of 48 is how many sevenths of 49?

28.  $\frac{9}{10}$  of 80 is how many sixths of 36?
29.  $\frac{8}{9}$  of 72 is  $\frac{4}{5}$  of 10 times what number?
30.  $\frac{3}{4}$  of 80 is  $\frac{3}{5}$  of 20 times what number?
31.  $\frac{5}{7}$  of 56 is  $\frac{2}{3}$  of 5 times what number?
32.  $\frac{9}{11}$  of 88 is  $\frac{3}{4}$  of 12 times what number?
33.  $\frac{5}{6}$  of 60 is  $\frac{2}{3}$  of how many times 5?
34.  $\frac{7}{8}$  of 64 is  $\frac{4}{5}$  of how many times 14?
35.  $\frac{2}{3}$  of 48 is  $\frac{4}{7}$  of how many times 7?
36.  $\frac{3}{4}$  of 40 is  $\frac{5}{6}$  of how many times  $\frac{2}{3}$  of 18?
37.  $\frac{5}{6}$  of 72 is  $\frac{3}{4}$  of how many times  $\frac{2}{5}$  of 25?
38.  $\frac{4}{5}$  of  $\frac{3}{4}$  of 60 is what part of 84?
39.  $\frac{2}{3}$  of  $\frac{6}{7}$  of 28 is what part of 48?
40.  $\frac{3}{5}$  of  $\frac{1}{2}$  of 40 is what part of  $\frac{3}{4}$  of 80?
41.  $\frac{3}{4}$  of  $\frac{1}{2}$  of 32 is what part of  $\frac{3}{5}$  of 120?
42.  $\frac{2}{5}$  of Robert's money equals  $\frac{4}{9}$  of William's, and  $\frac{2}{3}$  of William's is  $\frac{5}{8}$  of George's; how much money has each, if George has \$48?

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#### REVIEW PROBLEMS.

1. Henry had  $\frac{3}{4}$  of a dollar and spent  $\frac{1}{5}$  of a dollar; how much had he remaining?
2. If  $\frac{3}{4}$  be added to a certain fraction, the sum will be  $\frac{9}{5}$ ; what is the fraction?
3. If  $\frac{2}{3}$  of a dozen of oranges cost 16 cents, how much will  $3\frac{1}{2}$  dozen cost?
4. Bought  $\frac{3}{4}$  of a ton of coal in June,  $\frac{4}{5}$  of a ton in July, and  $1\frac{3}{8}$  tons in August; how much did I buy in the three months?
5. Bought a coat for  $\$12\frac{1}{4}$  and a hat for  $\$4\frac{2}{5}$ ; how much change did I get from a 20-dollar bill?
6. Henry is 20 years old, and  $\frac{4}{5}$  of his age is  $\frac{2}{7}$  of his father's age; how old is his father?

7. If to my age you add  $\frac{1}{3}$  and  $\frac{3}{4}$  of my age, the sum will equal 50 years; what is my age?

8. If 3 men can do a piece of work in 10 days, how long will it take 5 men to do the same work?

9. If 4 men do a piece of work in 12 days, how many men will be required to do it in 8 days?

10. A watch and a chain cost \$140; how much does each cost if the chain costs  $\frac{2}{3}$  as much as the watch?

11. A boy sold a ball for 60 cents, which was  $\frac{1}{5}$  less than it cost him; how much did it cost him?

12. A merchant's expenses were \$1020: of this he paid  $\frac{1}{3}$  for insurance,  $\frac{1}{4}$  for interest, and the remainder for rent; how much did he pay for each?

13. Three houses together cost \$29,000: the first cost  $\frac{2}{5}$  as much as the second, and the second  $\frac{2}{3}$  as much as the third; how much did each cost?

14. Having a journey of 600 miles to perform, I traveled  $\frac{2}{5}$  the distance the first day,  $\frac{1}{3}$  the second day, and the remainder the third day; how far did I travel the third day?

15. I spent  $\frac{1}{3}$  of my money for board and  $\frac{2}{5}$  for traveling expenses; if I had \$44 left, how much had I at first?

16. If a bushel of corn cost  $\frac{3}{5}$  of a dollar and a bushel of wheat  $\frac{3}{4}$  of a dollar, what is the difference in the cost of 6 bushels of each?

17. How much more will 2 dozen of oranges at  $\frac{1}{4}$  of a dollar a dozen cost than 3 dozen of apples at 2 for 3 cents?

18. A boy is  $\frac{2}{7}$  as old as his father and  $\frac{4}{9}$  as old as his mother; how old is each, if the boy is 16 years of age?

19. I buy turkeys at the rate of 3 for \$5: if I sell them at \$1.75 each, how much do I make on four?

20. George is 12 years old: if 4 years be added to his age, the sum will be  $\frac{4}{11}$  of his father's age; how old is the father?

21. If  $\frac{2}{3}$  of  $\frac{8}{9}$  of the cost of a cow is \$32, and I sell her for  $\frac{3}{4}$  of  $\frac{8}{9}$  of \$81, how much do I make?

22. I have \$75: I buy 40 turkeys at the rate of 6 for \$4; how much money have I remaining?

23. If a boy runs  $15\frac{1}{2}$  miles in  $2\frac{1}{2}$  hours, how far does he run in an hour?

24. I have \$20: if I buy books at  $\$3\frac{1}{2}$  a dozen and have \$6 left, how many books do I buy?

25. George has  $\$2\frac{2}{3}$  and Henry has  $\$3\frac{1}{4}$ : if they share their money equally, how much has each?

26. A man gave  $\frac{3}{5}$  of his money for a cow, then bought some fowls for \$6, and had  $\frac{1}{4}$  of his money remaining; how much had he at first?

27. A has  $\$24\frac{1}{2}$ , B has  $\$5\frac{3}{4}$  more than A, and C has  $\$10\frac{1}{5}$  less than A and B together; how many dollars have B and C each?

28. A boy bought oranges at the rate of 15 cents a dozen and sold them at the rate of two for five cents; how much did he make on each orange? How much on a dozen?

29. If by selling a house for \$1800 I lose  $\frac{1}{6}$  of its value, what was the house worth?

30. If by selling a horse for \$160 I gain  $\frac{1}{4}$  of the cost, what did he cost?

31. A boy is  $\frac{1}{3}$  as old as his father and  $\frac{3}{8}$  as old as his mother; how old is each if the boy is 15 years of age?

32. How many barrels of flour at  $\$5\frac{1}{4}$  a barrel can I get for 35 bushels of corn at  $\frac{3}{5}$  of a dollar a bushel?

33. If I can earn  $\$5\frac{1}{4}$  in  $2\frac{1}{2}$  days, how much can I earn in a day?

34. If I were 3 times as old as I am now,  $\frac{2}{3}$  of my age would be 24 years; how old am I?

35. If  $\frac{3}{4}$  of the sum of two numbers is 27, what are the numbers if one is twice as great as the other?

36. Henry is 20 years old: if his age were increased  $\frac{3}{5}$ , the sum would be  $2\frac{2}{3}$  times his brother's age; how old is his brother?

37. If 6 men can do a piece of work in 5 days, how much of the work can 3 men do in 8 days?

38. How many ducks can I buy for four dollars at the rate of five ducks for two dollars?

39. If a man can earn \$40 in  $1\frac{1}{3}$  months, how much can 27 men earn in  $2\frac{1}{2}$  months?

40. I sold my house for  $\frac{2}{3}$  of the cost, and lost \$1500; how much would I have made if I had sold it for  $1\frac{1}{5}$  times the cost?

41. I bought a horse for  $\$87\frac{1}{2}$  and sold him at a gain of  $\frac{2}{7}$  of the cost; how much did I get for him?

42. What number added to 3 times  $\frac{3}{7}$  of 16 will equal 26?

43.  $\frac{2}{3}$  of  $\frac{4}{5}$  of 60 is how many times  $\frac{3}{5}$  of  $7\frac{1}{2}$  times 6?

## DENOMINATE NUMBERS.

A *Denominate Number* is one whose unit is named; as 2 feet, 6 pounds, etc.

Numbers are of the same denomination when they have the same unit; as, 3 inches, 6 inches, etc.

A *Compound Number* is one consisting of two or more denominations of the same nature; as, 2 yards, 2 feet, 3 inches.

## MEASURES.

A *Measure* is a standard unit used in estimating.

A *Quantity* is measured by finding how often it contains the standard unit of measurement.

NOTE.—United States Money has been treated of on pages 39–41.

## ENGLISH OR STERLING MONEY.

*English or Sterling Money* is the currency used in England.

## TABLE.

4 farthings (qr.)	= 1 penny, d.
12 pence	= 1 shilling, s.
20 shillings	= 1 pound, £.
21 shillings	= 1 guinea. G.

1. How many farthings in 2 pence? In 3 pence? In 4 d.? In 5 d.? In 8 d.? In 10 d.?

2. How many pence in 8 farthings? In 12 farthings? In 20 farthings? In 60 farthings?

3. How many pence in 3 shillings? In 4 s.? In 5 s.? In 7 s.? In 10 s.?

4. How many shillings in 36 pence? In 60 d.? In 24 d.?

5. How many shillings in 5 £? In 3 £? In 6 £?

6. How many pounds in 40 shillings? In 80 s.? In 60 s.?

7. What part of a pound is 5 shillings?

8. What part of 2 shillings is 6 pence?

## LONG MEASURE.

*Long Measure* is used in measuring length and distance.

In measuring distance the following table is used :

## TABLE.

12 inches (in.)	= 1 foot, ft.
3 feet	= 1 yard, yd.
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet	= 1 rod, rd.
320 rods, or 5280 feet	= 1 mile, mi.

NOTE.—The following also are used:

1 *hand* equals 4 inches, used in measuring horses.

1 *size* equals  $\frac{1}{3}$  inch, used by shoemakers.

1 *span* equals 9 inches, used by sailors.

1 *fathom* equals 6 feet, used by sailors.

1 *pace* equals 3 feet, used in measuring distances.

1 *league* equals 3 miles, used in measuring distances at sea.

1. How many inches in 3 feet? 5 feet? 8 feet?
  2. How many feet in 24 inches? 60 inches? 36 inches?
  3. How many feet in 3 yards? 6 yards? 10 yards?
  4. How many yards in 6 feet? 15 feet? 21 feet?
  5. How many yards in 2 rods? 4 rods? 5 rods?
  6. How many rods in 11 yd.? In 44 yd.? In  $16\frac{1}{2}$  yd.?
  7. How many rods in 3 miles? In 5 miles?
  8. How many miles in 640 rods? In 960 rods?
  9. How many inches in 5 yd.? In 3 yd.? In 2 yd.?
  10. How many inches in 2 ft. 5 in.? In 5 ft. 4 in.?
  11. How many rods in  $\frac{1}{4}$  of a mile? In  $\frac{1}{2}$  mi.?
  12. How many inches in  $4\frac{1}{4}$  ft.? In  $6\frac{1}{3}$  yd.?
  13. What part of a foot is 2 inches? 4 in.? 8 in.?
  14. What part of a yard is 1 ft.?  $1\frac{1}{2}$  ft.? 10 in.?
  15. How many feet and inches high is a horse  $16\frac{1}{4}$  hands high?
  16. How many feet deep is water 5 fathoms deep?
  17. What is the difference in size between a number 3 shoe and a number 5 shoe?
  18. The width of a street is 20 paces; how many feet wide is it?
  19. How far from land is a ship that is 8 leagues distant?
  20. What part of a foot is  $\frac{1}{2}$  inch?
  21. What part of a yard is  $\frac{1}{3}$  inch?
  22. How many inches in  $1\frac{1}{2}$  yards?
  23. How much greater is  $\frac{1}{2}$  yard than  $\frac{1}{2}$  foot?
-



## SURFACE OR SQUARE MEASURE.

*Square Measure* is used in measuring areas or surfaces.

The area of a surface, which has length and breadth only, is expressed by the product of the numbers representing these two dimensions.

In measuring surfaces the following table is used :

TABLE.

144 square inches (sq. in.)	= 1 square foot,	sq. ft.
9 square feet	= 1 square yard,	sq. yd.
30 $\frac{1}{4}$ square yards, or } 272 $\frac{1}{4}$ square feet }	= 1 square rod or perch,	rd. or P.
160 square rods	= 1 acre,	A.
640 acres	= 1 square mile,	sq. mi.

NOTE.—The rood, equal to 40 square rods, is now but seldom used.

1. How many square inches in 2 sq. ft.? In 3 sq. ft.?
2. How many square feet in 244 sq. in.? In 432 sq. in.?
3. How many square feet in 2 sq. yd.? In 5 sq. yd.?
4. How many square yards in 27 sq. ft.? In 54 sq. ft.?
5. How many rods in 3 A.? In 5 A.? In  $\frac{1}{2}$  A.?
6. How many rods in a piece of land 40 rods long and 8 rods wide? How many acres?
7. How many acres in  $\frac{1}{2}$  sq. mi.? In  $\frac{1}{4}$  sq. mi.?
8. How many acres in a township 6 miles square?
9. What is the difference between 4 feet square and 4 square feet?
10. How many acres in a plot of ground 24 rods long and 20 rods wide?
11. My garden is 150 feet long and 40 feet wide; how many square feet does it contain, and how many square yards?

## CUBIC OR SOLID MEASURE.

*Cubic Measure* is used in measuring the contents of solids.

The volume of a body is expressed by the product of its three dimensions, length, breadth, and thickness.

The following is the table used in measuring solids :

## TABLE.

1728 cubic inches (cu. in.)	= 1 cubic foot,	cu. ft.
27 cubic feet	= 1 cubic yard,	cu. yd.
128 cubic feet	= 1 cord,	C.

NOTE.—A cubic yard of earth is called a load.  $24\frac{3}{4}$  cu. ft. equals a *perch* of stone or masonry.

1. How many cubic inches in 3 cu. ft.? In 2 cu. ft.?
  2. How many cubic feet in 3456 cu. in.?
  3. How many cubic feet in 2 cu. yd.? In 4 cu. yd.?
  4. How many cubic yards in 81 cu. ft.? In 54 cu. ft.?
  5. How many cubic feet in 3 perch of stone?
  6. In a 3-in. cube how many cubic inches?
  7. How many cubic feet in 5 cords?
  8. What is the difference between a 4-in. cube and 4 cubic inches?
  9. How many cubic inches in a block 8 in. long, 5 in. deep, and 4 in. wide?
  10. How many cubic feet in a wall 10 ft. long, 6 ft. high, and  $1\frac{1}{2}$  ft. thick?
  11. How many cords in a pile of wood 40 ft. long, 5 ft. high, and 4 ft. wide?
  12. How many cubic feet in a piece of timber 16 ft. long,  $1\frac{1}{2}$  ft. wide, and 2 ft. thick?
  13. How many loads of clay in a cellar 20 ft. wide, 30 ft. long, and 4 ft. deep?
-

## WEIGHT.

## AVOIRDUPOIS WEIGHT.

*Avoirdupois Weight* is that used in weighing produce, coal, iron, groceries, etc., but not gold, silver, or precious stones.

The following is the table used:

TABLE.

16 ounces (oz.)	= 1 pound,	lb.
100 pounds	= 1 hundredweight,	cwt.
20 hundredweight, or 2000 pounds	= 1 ton,	T.

NOTES.—1. The Avoirdupois pound contains 7000 grains.

2. In collecting duties the U. S. custom-house officers use what is called the long ton (2240 lb.).

The following units also are used:

196 lbs. of flour	= 1 barrel, bbl.
200 lbs. of beef or pork	= 1 barrel.
100 lbs. of dry fish	= 1 quintal.
100 lbs. of nails	= 1 keg.

1. How many ounces in 3 lb.? In 5 lb.? In  $2\frac{1}{2}$  lb.?
  2. How many pounds in 32 ounces? In 48 oz.?
  3. How many pounds in 5 tons? In 4 tons?
  4. How many tons in 6000 lb.? In 4000 lb.?
  5. How many pounds in  $3\frac{1}{2}$  tons? In  $4\frac{1}{4}$  tons?
  6. How many pounds in  $\frac{1}{2}$  barrel of flour? In  $\frac{1}{4}$  barrel?  
In  $\frac{1}{8}$  barrel?
  7. If I sell 2 T. 3 cwt. of straw at 80 cts. a hundredweight, and take corn in exchange at 40 cents a bushel, how much corn do I get?
-

## TROY WEIGHT.

*Troy Weight* is used in weighing gold, silver, gems, and precious stones.

The following is the table :

TABLE.

24 grains (gr.)	= 1 pennyweight,	pwt.
20 pennyweights	= 1 ounce,	oz.
12 ounces	= 1 pound,	lb.

NOTE.—The Troy pound is 5760 grains. The Troy ounce is therefore 480 grains, while the Avoirdupois ounce is  $\frac{1}{16}$  of 7000 grains, or  $437\frac{1}{2}$  grains.

1. How many grains in 2 pwt.? In 4 pwt.?
2. How many pennyweights in 72 gr.? In 120 gr.?
3. How many pennyweights in 3 oz.? In 5 oz.?
4. How many ounces in 24 pwt.? In 48 pwt.?
5. How many ounces in 4 lb.? In 6 lb.?
6. How many pounds in 36 oz.? In 60 oz.?
7. How much heavier is a pound of iron than a pound of gold?
8. How much heavier is an ounce of gold than an ounce of feathers?
9. How many ounces in 3 lb. 3 oz. Troy?
10. How many spoons, each weighing  $1\frac{1}{2}$  ounces, can be made from a silver bar weighing 2 lb. 3 oz.?

## CAPACITY.

## LIQUID MEASURE.

*Liquid Measure* is used in measuring liquids.

The following is the table used :

TABLE.

4 gills (gi.)	= 1 pint,	pt.
2 pints	= 1 quart,	qt.
4 quarts	= 1 gallon,	gal.

NOTE.—The standard liquid gallon contains 231 cubic inches.

The barrel and the hogshead are no longer fixed measures, but in estimating the capacity of cisterns, reservoirs, etc.  $31\frac{1}{2}$  gallons are allowed to a barrel, and  $7\frac{1}{2}$  gallons to a cubic foot.

1. How many gills in 2 pints? In 4 pt.? In  $3\frac{1}{2}$  pt.?
2. How many pints in 12 gills? In 16 gi.? In 60 gi.?
3. How many pints in 4 quarts? In 12 qt.? In  $8\frac{1}{2}$  qt.?
4. How many quarts in 6 pints? In 10 pt.? In 16 pt.?
5. How many quarts in 3 gallons? In 5 gal.? In  $4\frac{3}{4}$  gal.?
6. How many gallons in 8 quarts? In 30 qt.? In 12 qt.?
7. If a pint of vinegar is worth 3 cents, how much is 1 gallon worth?
8. How much will a pint of oil cost at 40 cents a gallon?
9. How much will 3 gal. 1 pt. of molasses cost at 20 cents a quart?
10. How many pints in  $3\frac{1}{2}$  gallons?

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### DRY MEASURE.

*Dry Measure* is used in measuring grain, fruit, salt, soft coal, etc.

The following is the table used:

TABLE.

2 pints (pt.)	= 1 quart,	qt.
8 quarts	= 1 peck,	pk.
4 pecks	= 1 bushel,	bu.

NOTES.—1. A pint dry measure equals nearly  $1\frac{1}{8}$  pints liquid measure.

2. In measuring seeds, grain, etc. the measure must be even full.

A heaped measure is equal to  $1\frac{1}{4}$  even measures.

1. How many quarts in 2 pecks? In 5 pk.? In  $4\frac{1}{4}$  pk.?
2. How many pecks in 16 quarts? In 40 qt.? In  $3\frac{1}{4}$  qt.?
3. How many pecks in 3 bushels? In  $4\frac{1}{4}$  bu.? In 5 bu. 1 pk.?
4. How many bushels in 12 pecks? In 18 pk.? In 21 pk.?
5. How many quarts in 1 bu. 1 pk.? In 43 pk.?
6. How many quarts in 3 bu. 1 pk. 3 qt.?
7. How much will  $3\frac{1}{4}$  bushels of beans cost at 6 cents a quart?
8. When potatoes are worth 50 cents a bushel, how much are they worth a peck?
9. What is the cost of 1 peck 3 quarts of beans at \$1.60 a bushel?
10. When chestnuts are worth \$2.56 a bushel, how many quarts can I get for 80 cents?

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### TIME.

*Time Measure* is used in measuring time or duration.  
The following is the table:

TABLE.

60 seconds (sec.)	= 1 minute, min.
60 minutes	= 1 hour, hr.
24 hours	= 1 day, da.
7 days	= 1 week, wk.
365 days	= 1 year, yr.
366 days	= 1 leap year.
12 calendar months	= 1 year.
100 years	= 1 century, C.

NOTES.—1. In business transactions 30 days are considered a month, and 12 months a year.

2. A. M. denotes before noon; M., noon; and P. M., after noon.

3. The months of April, June, September, and November have 30 days each. February has 28 days, except in leap year, when it has 29. All the other months have 31 days each.

4. Every year whose number is divisible by 4 is a leap year, except the centennial years that are not divisible by 400.

1. How many seconds in 5 minutes? In  $\frac{1}{2}$  min.? In  $2\frac{1}{8}$  min.?

2. How many minutes in 120 seconds? In 30 sec.? In 80 sec.?

3. How many minutes in 4 hours? In  $1\frac{1}{4}$  hr.? In 2 hr. 7 min.?

4. How many hours in 180 minutes? In 90 min.? In 48 min.?

5. How many hours in 3 days? In  $2\frac{1}{2}$  da.? In 5 da. 6 hr.?

6. How many days in 72 hr.? In 60 hr.? In 48 hr.?

7. How many days in 5 wk.? In 3 wk. 4 da.?

8. How many days from June 1 to July 16 inclusive?

9. How much time passes between 6 o'clock in the morning and half-past 2 in the afternoon?

10. How long is it from 10 minutes of 8 in the morning to 12 minutes of 8 in the evening?

11. How long is it from 15 minutes of 7 in the morning to 12 minutes past 8 in the evening?

12. If I give a note June 1 for 90 days, when is it due?

## ANGLES.

*Circular or Angular Measure* is used in measuring angles and arcs of circles.

The following is the table used:

## TABLE.

60 seconds (")	= 1 minute, (')
60 minutes	= 1 degree, (°).
30 degrees	= 1 sign, S.
12 signs or } 360 degrees }	= 1 circle, C.

1. How many degrees in the circumference of any circle?  
In  $\frac{1}{2}$  the circumference? In  $\frac{1}{4}$  the circumference?
2. How many seconds in 3'? In  $2\frac{1}{2}'$ ?
3. How many minutes in 120''? In 90''?
4. How many minutes in 2°? In  $2\frac{1}{4}^\circ$ ? In 5°?
5. How many degrees in 180'? In 150'? In 300'?
6. How many degrees in  $\frac{1}{8}$  of a circle? In  $\frac{1}{3}$  of a circle?

## MISCELLANEOUS TABLES.

## COUNTING.

## TABLE.

12 things = 1 dozen,	doz.
12 dozen = 1 gross,	gro.
12 gross = 1 great gross,	G. gro.
20 things = 1 score.	

## PAPERS AND BOOKS.

## TABLE.

24 sheets = 1 quire.
20 quires = 1 ream.
2 reams = 1 bundle.
5 bundles = 1 bale.

In printing books—

When a sheet is folded into	The book is called	And 1 sheet makes
2 leaves	a folio,	4 pp. (pages).
4 leaves	a quarto, or 4to,	8 pp.
8 leaves	an octavo, or 8vo,	16 pp.
12 leaves	a duodecimo, or 12mo,	24 pp.
16 leaves	a 16mo,	32 pp.
18 leaves	an 18mo,	36 pp.



1. How many are  $5\frac{1}{2}$  dozen?  $3\frac{1}{2}$  gross?
2. How many are 4 score and 10?
3. How many screws in  $2\frac{1}{4}$  gross?
4. How many sheets of paper in  $\frac{1}{2}$  quire? In  $2\frac{1}{4}$  quires?
5. How many quires of paper in  $\frac{1}{2}$  ream? In  $3\frac{1}{4}$  reams?
6. How many sheets of paper in a ream? In  $\frac{1}{2}$  ream?  
In  $\frac{1}{4}$  ream?
7. How many sheets of paper does it take to make a 12mo book of 288 pages?

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#### MEASUREMENT OF LUMBER.

Lumber is known by various names, thus: 1. *Boards*; 2. *Dimension Stuff*; 3. *Foot Stuff*; 4. *Laths*; 5. *Shingles*.

1. *Boards* are sold at 1 inch, or less if specified. They are—

1. Stock boards, 12 in. wide;
2. Fencing, 6 in. wide;
3. Flooring, varying in width;
4. Siding or clapboards.

2. *Dimension Stuff* consists of—

1. Scantling or studding, from 2 inches to 4 inches thick and from 3 inches to 4 inches wide.
2. Joists, 2 inches wide and any width.
3. Plank, 2 inches thick, wider than 4 inches.
4. Timber, more than 2 inches thick and wider than 4 inches.

3. *Foot Stuff*, sold by linear or the running foot, consists of—

1. Battens, for covering cracks.
2. Moulding, for finishing
4. *Laths*.—4 feet long,  $1\frac{1}{2}$  inches wide, 50 in a bunch.

5. *Shingles*.—4 inches wide, 250 to the bunch, sold by the thousand. Shingles may vary in width, but every 4 inches in width is reckoned as one shingle.

NOTE.—Most lumber is sold by board measure. A board foot is the equivalent of a board one foot square and one inch thick.

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### PROBLEMS.

1. How many feet of lumber in a board 10 inches wide and 12 feet long?

NOTE.—The number of inches in length multiplied by the number of inches in width, divided by 144, gives the contents in square feet, board measure; and the number of inches in width multiplied by the number of feet in length, divided by 12, gives the contents in board measure.

Hence,  $\frac{12 \times 10}{12} = 10$  feet, contents of board.

How many feet, board measure, in the following?

2. An 8-in. board, 12 ft. long.
3. A 10-in. board, 12 ft. long.
4. A 12-in. board, 16 ft. long.
5. Two 12-in. boards, 12 ft. long.
6. Two 12-in. boards, 14 ft. long.
7. Six 10-in. boards, 12 ft. long.
8. Six 8-in. boards, 16 ft. long.
9. Twenty pieces 3 in. flooring, 16 ft. long.
10. Thirty pieces 4 in. siding, 16 ft. long.
11. A plank  $2 \times 10$ , 12 ft.

NOTE.—This is usually read 2 by 10, 12.

SUG.—The contents are  $\frac{2 \times 10 \times 12}{12}$  ft., or 20 ft.

Find the value of—

12. One plank  $2 \times 8$ , 12 ft.
13. Three planks  $2 \times 10$ , 12 ft.

14. Six planks  $2 \times 9$ , 16 ft.
15. One joist  $2 \times 6$ , 12 ft.
16. Six joists  $2 \times 8$ , 14 ft.
17. Ten pieces scantling  $3 \times 4$ , 12 ft.
18. Twelve pieces scantling  $2 \times 4$ , 16 ft.
19. Four pieces timber  $3 \times 8$ , 12 ft.
20. Twelve pieces timber  $6 \times 6$ , 10 ft.
21. Ten planks  $2 \times 9$ , 12 ft.
22. Six pieces 14-ft. fencing.
23. Twenty scantling  $3 \times 4$ , 16 ft.
24. Two pieces timber  $6 \times 8$ , 32 ft.
25. Four planks  $1\frac{3}{4} \times 10$ , 12 ft.

NOTE.—Lumber less than 1 inch thick is counted as 1 inch; from  $1\frac{1}{4}$  to  $1\frac{1}{2}$ , as  $1\frac{1}{4}$  in.; from  $1\frac{3}{8}$  to  $1\frac{1}{2}$ , as  $1\frac{1}{2}$  in.; from  $1\frac{3}{4}$  to 2, as 2 in.

A table like the following is generally used by lumber-dealers as a matter of convenience:

LUMBER TABLE.

Size.	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
$2 \times 6$	12	14	16	18	20										
$2 \times 8$	16	19	21	24											
$3 \times 4$	12	14	16												
$4 \times 6$	24	28													
$2 \times 4$	8														
$2 \times 3$															

1. Let the pupil prove the results given.
2. Let the pupil complete the table.

SUG.—Let each of the pupils suggest problems under Measurement of Lumber for others to solve, including cost of lumber at a certain amount per thousand feet.

## REVIEW PROBLEMS.

1. What is the cost of digging 5 yd. 2 ft. of ditch, at the rate of 20 cents a foot?
2. What must I pay for 4 yd. 1 ft. of ribbon, at 30 cents a yard?
3. What is the cost of 6 square yards of cloth, at 5 cents a square foot?
4. How much must I pay for a piece of oilcloth  $4\frac{1}{2}$  ft. wide and 10 feet long, at 60 cents a square yard?
5. When land is worth \$1.20 a square rod, what is the cost of  $2\frac{1}{4}$  acres?
6. When marble is worth \$3 a cubic foot, how much must I pay for a block 2 ft. thick, 3 ft. long, and 2 ft. wide?
7. How much will 6 lb. 4 oz. of butter cost, at 30 cents a pound?
8. What is the cost of 5 lb. 6 oz. of butter, at 20 cents a pound?
9. When coal is worth 25 cents a hundredweight, how much will  $\frac{3}{4}$  of a ton cost?
10. What is the cost of 16 pounds of flour, at the rate of \$3 per hundredweight?
11. Find the value of 6 tons 3 hundredweight of hay, at \$15 a ton.
12. How much will 5 tons 4 cwt. of coal cost, at \$5 a ton?
13. What is the value of 2 ounces 2 pennyweights of gold, at \$1 per pennyweight?
14. How much will 2 quarts and 1 pint of molasses cost, at 18 cents a quart?
15. How much will 1 gallon and 1 quart of oil cost, at 8 cents a quart?
16. Find the cost of 2 gallons 3 quarts of wine, at \$1.20 a gallon.

17. If I buy chestnuts at \$2 a bushel and sell them at 10 cents a quart, how much do I make on a bushel?

18. How much do I make on 3 bushels 2 pecks of chestnuts that cost me \$2.50 a bushel, if I sell them at 12 cents a quart?

19. What is the cost of 5 bu. 3 pk. of salt, at 2 cents a quart?

20. How many half-pint bottles can be filled from 3 gallons of water?

21. What is the cost of 8 buttons, at 15 cents a dozen?

22. I bought collars at 25 cents a box, each box containing 10 collars; how much per box will I gain by selling the collars at 4 cents apiece?

23. If I buy 3 shovels at the rate of \$8 a dozen, how much do they cost me?

24. How many feet high is a horse that is 16 hands high?

25. When apples sell at 15 cents a peck, how much will 2 bushels cost?

26. What is the cost of 5 hats, at the rate of \$24 a dozen?

27. A stationer buys lead-pencils at \$4.50 a gross and retails them at 5 cents each; what is his profit on a gross?

28. A stationer buys lead-pencils at 50 cents a dozen and sells them at 5 cents apiece; how much does he make on 3 dozen?

29. If a merchant buys paper at \$1.20 a ream and sells it at 10 cents a quire, what is his profit on a quire?

30. A merchant buys paper at \$1.40 a ream and sells it at a cent a sheet; what is his profit on  $1\frac{1}{2}$  reams?

31. How many hands high is a horse that is 5 feet 3 inches high?

32. A grocer bought cranberries at \$4.80 a bushel; how must he sell them to gain 3 cents a quart?

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## LONGITUDE AND TIME.

*Longitude* is the distance east or west from a given meridian.

A *meridian* is a line passing from pole to pole through the equator.

Since the earth revolves on its axis from west to east in 24 hours, the sun appears to pass around the earth, or through 360 degrees of longitude, in the same time, or through 15 degrees of longitude in *one hour* of time. In 1 minute of time it passes through  $\frac{1}{60}$  of 15°, or  $\frac{1}{4}$  of a degree, equal to 15' of longitude; and in 1 second of time it passes through 15" of longitude; hence—

For a difference of	There is a difference of
15° in longitude,	1 hour of time.
15' " "	1 minute " "
15" " "	1 second " "

Or,

1° of longitude is equivalent to 4 minutes in time.

1' of longitude " " " 4 seconds in time.

1" of longitude " " "  $\frac{1}{15}$  of a second in time.

1. Over how many degrees of the earth's surface does the sun pass in 24 hours? In 12 hr.? In 6 hr.?

2. Over how many degrees does the sun pass in 1 hr.? In 4 hr.? In 10 hr.?

3. Over how many degrees does the sun pass in 2 hr.? In  $\frac{1}{2}$  hr.? In 20 min.? In 10 min.?

4. How many degrees of longitude are equivalent to 1 hr.? 2 hr.? 4 hr.? 10 hr.? 8 hr.?

5. When it is noon at any place, what time is it 15° east? 15° west? 30° west? 30° east?

6. What is the difference in time between two places which have a difference of 15° longitude? 30°? 60°? 120°?

7. When it is 4 o'clock at St. Louis, what o'clock is it  $30^\circ$  east?  $30^\circ$  west?  $60^\circ$  west?

8. When it is 6 o'clock at St. Paul, how far east or west is it 4 o'clock? 3 o'clock? 7 o'clock? 9 o'clock?

9. What difference in longitude indicates a difference of 4 minutes in time? 1 minute? 8 minutes? 1 hour?  $\frac{1}{2}$  hour?

10. How far east or west of Indianapolis is a man whose watch is  $1\frac{1}{2}$  hours slow, if he has correct Indianapolis time?

11. What is the difference in time of sunrise between two places  $36^\circ$  of longitude apart?

12. If after traveling a month I find my watch  $2\frac{1}{2}$  hours faster than local time, am I east or west of the starting-point, and how many degrees?

13. Two men look at their watches at the same moment; both have correct time: one's watch marks 9 o'clock 15 minutes; the other's marks 11 o'clock 30 minutes; how many degrees apart are they, and which is the farther west?

## PERCENTAGE.

*Percentage* is the name applied to computations in which the unit of measure is 100.

*Per cent.* is an abbreviation of the Latin phrase *per centum*, meaning *by the hundred*.

NOTE.—One per cent. of any number is  $\frac{1}{100}$  of it; 5 per cent. is  $\frac{5}{100}$ , and so on.

1. How many hundredths of a number is 2 per cent. of it? 10 per cent.? 20 per cent.? 40 per cent.?

2. How many hundredths of anything is 3 per cent. of it?  $12\frac{1}{2}$  per cent.? 50 per cent.? 150 per cent.?  $\frac{1}{2}$  of 1 per cent.?

3. What per cent. of a number is  $\frac{25}{100}$  of it?  $\frac{35}{100}$  of it?  
 $\frac{12\frac{1}{2}}{100}$  of it?  $\frac{27}{100}$  of it?

*Per cent.* is usually expressed % ; thus 12% is read 12 per cent.

4. How many hundredths in 25% ? In 50% ? In  $6\frac{1}{2}$ % ?  
 In  $33\frac{1}{3}$ % ? In  $56\frac{1}{4}$ % ?

5. What per cent. of a number is  $\frac{1}{4}$  of it?

SUGGESTION.— $\frac{1}{4} = \frac{25}{100}$ , or 25%.

6. What per cent. of a number is  $\frac{1}{2}$  of it?  $\frac{1}{5}$ ?  $\frac{1}{10}$ ?  $\frac{1}{20}$ ?  
 $\frac{1}{25}$ ?  $\frac{1}{3}$ ?  $\frac{2}{3}$ ?  $\frac{3}{4}$ ?  $\frac{3}{10}$ ?  $1\frac{1}{4}$ ?

7. What fractional part of a number is 30% of it?

SUGGESTION.—30% =  $\frac{30}{100} = \frac{3}{10}$ ; hence 30% of a number is  $\frac{3}{10}$  of it.

8. What fractional part of a number is 10% of it? 20% ?  
 5% ? 25% ? 75% ? 60% ?  $37\frac{1}{2}$ % ?  $33\frac{1}{3}$ % ?  $12\frac{1}{2}$ % ?  
 $6\frac{1}{4}$ % ?  $87\frac{1}{2}$ % ?  $66\frac{2}{3}$ % ? 140% ?

9. What part of a number is  $\frac{1}{3}$ % of it?

SUGGESTION.— $\frac{1}{3}\% = \frac{1}{3} \times \frac{1}{100} = \frac{1}{300}$ .

10. What part of a number is  $\frac{1}{2}$ % of it?  $\frac{1}{4}$ % ?  $\frac{1}{5}$ % ?  
 $\frac{3}{4}$ % ?  $\frac{5}{9}$ % ?

## 1.

### TO FIND THE PERCENTAGE.

1. What is 30% of 40 barrels of apples?

ANALYSIS.—30% is  $\frac{30}{100}$ , or  $\frac{3}{10}$ ;  $\frac{3}{10}$  of 40 barrels of apples is 12 barrels.

What is—

2. 10% of 90?

7. 15% of 200?

3. 5% of 40?

8. 8% of 75?

4. 6% of 50?

9.  $12\frac{1}{2}$ % of 48?

5. 20% of 30?

10.  $33\frac{1}{3}$ % of 120?

6. 25% of 84?

11. 55% of 400?



12. What is  $62\frac{1}{2}\%$  of 16 sheep?
13. What is  $6\%$  of \$350?
14. What is  $5\%$  of \$140?
15. Henry had \$120, but spent  $50\%$  of it for a watch; what did the watch cost?
16. A farmer sold a cow worth \$40 at a loss of  $10\%$ ; what did he receive for her?
17. A merchant bought goods at 50 cents a yard and sold it at a gain of 20 per cent.; what price did he receive for the goods?
18. A farmer who had 500 bushels of wheat sold 24 per cent. of it; how much did he sell?
19. A manufacturer who paid his laborers \$1.50 a day advanced their wages 10 per cent.; how much did he pay them then?
20. If laborers who receive \$2 a day have their wages reduced 12 per cent., how much do they then receive?
21. A piece of cloth measuring 150 yards shrunk 5 per cent.; how long was it then?
22. I buy a bill of goods for \$52, but get a discount of 5 per cent. for paying cash; what do I pay to cancel the bill?
23. Harry had 40 chickens, but they increased 150 per cent.; how many had he then?
24. Having \$300, I paid  $30\%$  for board,  $20\%$  for clothing, and  $15\%$  for other expenses; how many dollars have I remaining?
25. Oliver bought silk for 60 cents and sold it at a gain of  $20\%$ ; what did he get for it?
26. If I buy 6 barrels of flour for \$30 and sell it at an advance of  $25\%$ , how much do I get per barrel?
27. A collector receives  $5\%$  of a bill of \$4820; how much money does he receive?
28. A man's wages were \$2 a day: they were reduced  $10\%$ , and then increased  $10\%$ ; what are his wages now?

## 2.

## TO FIND THE RATE.

1. What per cent. of 45 is 9? -

ANALYSIS.—9 is  $\frac{1}{5}$  of 45, or  $\frac{1}{5}$  of 100% of 45, which is 20% of 45.

What per cent.—

2. Of 30 is 6?

8. Of \$25 are \$3?

3. Of 40 is 10?

9. Of 60 sheep are 5 sheep?

4. Of 50 is 5?

10. Of 65 books are 13 books?

5. Of 24 A. are 18 A.?

11. Of 200 is 50?

6. Of 180 lb. are 60 lb.?

12. Of  $2\frac{1}{4}$  is  $\frac{1}{2}$ ?

7. Of 48 ft. are 6 ft.?

13. Of  $37\frac{1}{7}$  cents are 10 cents?

14. What per cent. of \$2 are 60 cents?

15. What per cent. of 5 quarts are 3 pints?

16. What per cent. of money is  $\frac{2}{5}$  of it?

17. A boy carried 5 dozen of eggs to a store, but in falling he broke 6 eggs; what per cent. did he break?

18. I had 80 sheep, but I have sold 16; what per cent. did I sell?

19. What per cent. of  $\$3\frac{3}{4}$  is  $\frac{3}{4}$  of a dollar?

20. If I have \$50 and spend \$10 for books and \$6 for board, what per cent. of my money remains?

21. If from a barrel containing 30 gallons I take 12 gallons, what per cent. do I take?

22.  $\frac{3}{5}$  of 80 is what per cent. of  $\frac{1}{2}$  of 120?

23.  $\frac{2}{3}$  of 24 is what per cent. of  $\frac{3}{4}$  of 60?

24.  $\frac{3}{4}$  of 40 is what per cent. of  $\frac{5}{8}$  of 180?

25. A man who had earned \$520 spent at one time 25% and at another 30% of it; how much did he spend each time?

26. A man whose income was \$1600 a year spent \$300 for board, \$160 for books, and \$40 for travel; what per cent. did he spend for each, and what per cent. did he save?

## 3.

## TO FIND THE BASE.

1. 42 is 14% of what number?

ANALYSIS 1.—14% is  $\frac{14}{100}$ , or  $\frac{7}{50}$ . If 42 is  $\frac{7}{50}$  of a number,  $\frac{1}{50}$  of that number is  $\frac{1}{7}$  of 42, or 6, and  $\frac{50}{50}$ , or the number, is 50 times 6, or 300.

ANALYSIS 2.—If 14%, or  $\frac{14}{100}$ , of a number is 42,  $\frac{1}{100}$  is  $\frac{1}{14}$  of 42, or 3, and  $\frac{100}{100}$ , or the number, is 100 times 3, or 300.

NOTE.—Either analysis may be used.

2. 16 is 4% of what?                      6. 20 bu. are  $33\frac{1}{3}\%$  of what?

3. 25 is 5% of what?                      7. 8 qt. are 40% of what?

4. 40 is 32% of what?                      8.  $6\frac{1}{2}$  is 13% of what?

5. 32 lbs. are 8% of what?                9.  $7\frac{1}{2}$  is 12% of what?

10. 10 quarts are 40% of how many gallons?

11. A farmer gained \$6 on a horse, which was 3% of his value; what was the value?

12. \$18 is 4 per cent. of my money; how much have I?

13. I rent a house at \$120, which is 8% of the cost of the house; how much did it cost?

14. George spends \$40 a year for cigars, which is 8% of his income; what is his income?

15. I paid \$30 for a chain, which is 24% of the cost of my watch; what is the cost of my watch?

16. My board costs me \$310 a year, which is 40% of my salary; what is my salary?

17. A farmer sold 160 bushels of corn, which was 32% of his crop; what was the crop?

18. If by selling cloth at 20% gain I make 14 cents, what was the cost of the cloth?

19. Mr. Henry, owning  $\frac{1}{4}$  of a ship, sold 30% of his share for \$9000; what was the value of the whole ship?

20. 2 pk. 3 qt. was 25% of the nuts Harry gathered; how many did he gather?

## REVIEW PROBLEMS.

1. A miller sold flour at \$6, and thereby gained 20% ; what was the cost of the flour?

SOLUTION.—20% equals  $\frac{1}{5}$ ;  $\frac{1}{5}$ , the cost, plus  $\frac{1}{5}$ , the gain, equals  $\frac{6}{5}$ , or the selling price. If  $\frac{6}{5}$  of the cost of the flour is \$6,  $\frac{1}{5}$  is  $\frac{1}{6}$  of \$6, or \$1, and  $\frac{1}{5}$ , or the cost, is 5 times \$1, or \$5.

2. A horse was sold at \$40 more than cost, which was at a gain of 50% ; what was the cost?

3. A knife was sold at 30 cents less than cost, which was at a loss of 60% ; what was the cost?

4. A miller sold some damaged flour at \$6, and thereby lost 25% ; what was the price of the flour?

5. A bookseller retails books at 75 cents each, and thereby gains 25% on cost ; what did they cost him?

6. I bought a cow of my neighbor and sold her for \$46, which was at a gain of 15% ; how much did I pay for her?

7. If a merchant sells damaged cloth at \$2 a yard, and thereby loses 20% , what was the cost of the cloth?

8. If a merchant make 8% by selling sheeting at 27 cents a yard, what did he pay for it?

9. What number, increased by 20% of itself, equals 48?

10. What number, increased by 75% of itself, equals 28?

11. 80 is 25% more than what number?

12. What number, diminished by 30% of itself, equals 28?

13. What number, diminished by 75% of itself, equals 16?

14. 63 is 30% less than what number?

15. What number, increased by the difference between 70% and 40% of itself, equals 52?

16. When cloth is sold at \$1.65 a yard, at a gain of 10% , what is the cost?

17. I sold flour at \$7.50 a barrel, at a gain of 20% ; what was the cost of the flour?

18. Two boys have 110 marbles: one has 20% more than the other; how many has each?

19. What is the length of a ditch whose length, increased by 40% and 5 feet, equals 89 feet?

20. A horse and carriage cost \$188: the horse cost 35% more than the carriage; how much did each cost?

21. In a school of 115 pupils the number of boys is 30% greater than the number of girls; how many are there of each?

22. What fraction, increased by  $33\frac{1}{3}\%$  of itself, equals  $\frac{4}{5}$ ?

23. Rudolph has 36 marbles, which is 25% less than William's number; how many has William?

## PROFIT AND LOSS.

1. I bought corn at 40 cents a bushel and sold it at a gain of  $12\frac{1}{2}\%$ ; how much did I get for it?

ANALYSIS 1.—If I gain  $12\frac{1}{2}\%$ , I gain  $\frac{12\frac{1}{2}}{100}$ , or  $\frac{1}{8}$ .  $\frac{8}{8}$ , the cost, plus  $\frac{1}{8}$ , the gain, equals  $\frac{9}{8}$ , or the selling price.  $\frac{9}{8}$  of 40 cents is 45 cents.

ANALYSIS 2.— $12\frac{1}{2}\%$  equals  $\frac{1}{8}$ ;  $\frac{1}{8}$  of 40 cents is 5 cents; hence I sold the corn for 40 cents plus 5 cents, or 45 cents.

2. If I buy a cow for \$40, how must I sell her to gain 20%?

3. How must I sell eggs for which I pay 20 cents a dozen, so as to gain 30%?

4. If a boy pay 30 cents a dozen for oranges, how must he sell them apiece so as to gain 60%?

5. If I buy 10 barrels of apples for \$25, how must I sell them per barrel to gain 20%?

6. A merchant paid 80 cents a yard for silk; how must he sell it to gain  $12\frac{1}{2}\%$ ?

7. A house cost \$2000, and was sold at a gain of  $5\frac{1}{2}\%$ ; at what price was it sold?

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1. If a sheep is bought for \$4 and sold for \$6, what is the gain per cent.?

ANALYSIS.—If a sheep is bought for \$4 and sold for \$6, the gain is \$6 minus \$4, or \$2. \$2 is  $\frac{1}{2}$  of \$4, or  $\frac{1}{2}$  of 100%, which is 50%.

2. If I buy a cow at \$30 and sell her at \$36, what is the gain per cent.?

3. When a dealer buys melons at \$12 a hundred and sells them at \$16 a hundred, what is his gain per cent.?

4. What is the gain per cent. on a book that is bought at 40 cents and sold at 50 cents?

5. A produce dealer buys eggs at 25 cents a dozen and sells them at 30 cents a dozen; what is his gain per cent.?

6. A merchant buys potatoes at 60 cents a bushel and retails them at 25 cents a peck; what is his gain per cent.?

7. A butcher buys beef at 6 cents a pound and retails it at 10 cents a pound; what is his gain per cent.?

8. A huckster buys oranges at 25 cents a dozen and retails them at 5 cents apiece; what is his gain per cent.?

9. When a bushel of chestnuts costs \$2 and is retailed at 10 cents a quart, what is the gain per cent.?

10. I sold  $\frac{2}{3}$  of a farm for what the whole farm cost me; what was the gain per cent.?

11. What is the loss per cent. when  $\frac{3}{4}$  of an article is sold for the value of  $\frac{2}{3}$  of it?

12. A piano was bought for \$250, and after several years' use was sold for \$150; what was the loss per cent.?

13. A dealer bought flour at \$6 a barrel and sold it at 90 cents a sack ( $\frac{1}{2}$  of a barrel); what was his gain per cent.?

14. How must goods costing \$3 be marked so that the seller may drop 10% in his price and still make 20%?

1. A boy sold a book for 15 cents more than cost, and gained 10%; what was the cost?

ANALYSIS.—10%, or the gain, is  $\frac{1}{10}$  of the cost. If  $\frac{1}{10}$  of the cost is 15 cents,  $\frac{1}{10}$ , or the cost, is 10 times 15 cents, or \$1.50.

2. If a farmer sell a horse at \$30 more than cost, and thereby gain 15%, what was the cost?

3. A miller sold damaged flour at \$1.50 less than its actual value, and thereby lost 25%; what was the real value of the flour?

4. A piano was sold at \$30 less than cost, which was at a loss of 15%; what was the cost?

5. If I lose 40 cents by selling an article at  $12\frac{1}{2}\%$  below its value, what is the value?

6. A man's property having increased 30% in value, he sold it for \$600 more than cost; what did it cost him?

7. Property having depreciated in value, I sold my house for \$2500 less than cost, and thereby lost 50%; what was the cost of the house?

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1. If by selling eggs at 30 cents a dozen I make 20%, what did the eggs cost me?

ANALYSIS.—Since I gained 20%, or  $\frac{1}{5}$  of the cost, I sold the eggs at  $\frac{6}{5} + \frac{1}{5}$ , or  $\frac{7}{5}$ , of the cost. If  $\frac{6}{5}$  of the cost is 30 cents,  $\frac{1}{5}$  of the cost is  $\frac{1}{6}$  of 30 cents, or 5 cents, and  $\frac{7}{5}$ , or the cost, is 5 times 5 cents, or 25 cents.

2. A jeweler sold a watch for \$75, thereby gaining 25%; what did he pay for the watch?

3. If by selling coffee at 28 cents I make 12%, what was the cost of the coffee?

4. A boy sold his knife for 40 cents, which was 20% less than cost; at what price must he have sold it to gain 10%?

5. A gentleman sold a horse for \$168 and a carriage for \$84; he gained on each 12%; what was the cost of each?

6. If by selling two articles at \$10 each I gain on the first 25% and on the second lose 25%, do I gain or lose?

7. By selling sugar at 7 cents a pound I gain  $16\frac{2}{3}\%$ ; what is the cost of the sugar?

8. An investment pays a profit of \$200 at 8%; what would it pay at  $9\frac{1}{2}\%$ ?

9. A miller had 50 barrels of flour worth \$6 a barrel: 10 barrels were destroyed by fire; how must he sell the remainder to clear 8% on the lot?

10. A gentleman bought a watch for \$56, which was 20% less than its value; how must he sell it to gain 10% on its value?

#### COMMISSION AND BROKERAGE.

1. An attorney collects a debt of \$400 on a commission of 3%; what is his commission?

SUG.—His commission is 3% of \$400.

2. A tax-collector receives a commission of 2% for collecting \$8000 taxes; what is his commission?

3. If an agent sell a house for \$5000 and charge a  $2\frac{1}{2}\%$  commission, what amount does he receive?

4. What is the expense of collecting a debt of \$1200 on a commission of 5%?

5. A commission merchant sells \$650 worth of berries on 10% commission; what is his commission?

1. An agent charges \$12 for collecting a bill of \$240; what per cent. does he charge?

ANALYSIS.—If he charges \$12 for collecting \$240, on \$1 he charges  $\frac{1}{20}$  of \$12, or  $\frac{1}{20}$ , equal to  $\frac{1}{20}$ , or 5%.

2. A lawyer collects a debt of \$600 for \$24; what per cent. does he charge?



3. If a tax-collector receives \$54 for collecting \$1800, what is his rate of commission?

4. A commission merchant charges \$40 for selling \$800 worth of produce; what is his rate of commission?

5. If an agent charge \$25 for selling a property worth \$1000, what is his rate of commission?

1. A tax-collector receives \$180 for collecting taxes on a 3% commission; what is the amount collected?

ANALYSIS.—3% =  $\frac{3}{100}$ ; if \$180 is  $\frac{3}{100}$  of the amount collected,  $\frac{1}{100}$  is  $\frac{1}{3}$  of \$180, or \$60, and  $\frac{100}{1}$  is 100 times \$60, or \$6000.

2. A commission merchant charges \$42 for selling goods on 10% commission; what amount did he sell?

3. An architect charges \$40 on a 2% commission for the plans of a building; what is the cost of the building?

4. An agent sells goods on a 4% commission; his salary for the first month is \$120; what amount of goods did he sell?

5. An attorney charges his client \$60 on a 5% commission for collecting a debt; what is the amount of the debt?

1. What amount of goods can I purchase for \$520, if my agent charges me 4% on the amount expended?

ANALYSIS.—4%, or  $\frac{4}{100}$ , of the amount expended, plus  $\frac{2}{5}$ , equals  $\frac{2}{5}$ , or \$520;  $\frac{1}{25}$  of the amount expended equals  $\frac{1}{25}$  of \$520, or \$20, and  $\frac{2}{5}$ , or the amount expended, equals 25 times \$20, or \$500.

2. What amount of goods can be purchased for \$420, if the agent's commission is 5%?

3. If an agent charge me 2% for buying goods, how much will he purchase for \$510?

4. I send an agent \$315 to purchase goods for me: he charges 5% commission; what amount of goods does he purchase?

## STOCKS.

NOTE 1.—When stock is at a premium its market value is the par value plus the premium; and when at a discount, the market value is the par value less the discount.

NOTE 2.—When the par value is not mentioned it is understood to be \$100 a share.

1. When stock is at a premium of 10%, what is the value of \$1 worth? \$100? \$50?

2. When stock is at a discount of 20%, what is \$1 worth? \$100? \$10? \$50?

3. What is the cost of 10 shares of railway stock at 15% premium?

4. What is the cost of 5 shares of railway stock at 20% premium?

5. What is the cost of 10 shares of stock at 10% discount?

1. If I buy stock at 92 and sell at 96, and thereby make \$120, how many shares do I buy?

ANALYSIS.—If I buy stock at 92 and sell it at 96, I gain on each share \$96 — \$92, or \$4; I therefore buy as many shares as \$4 is contained times in \$120, or 30 shares.

2. A man bought stock at 90 and sold at 85, thereby losing \$60; how many shares had he?

3. A speculator bought bank stock at 120 and sold at 127, thereby gaining \$840; how many shares had he?

4. If Mr. A buys stock at 92 and is compelled to sell at 88, thereby losing \$200, how many shares has he?

1. A company declares a dividend of 6%; how much dividend does Mr. Walters get, if he owns 30 shares?

SUG.—Since the dividend is \$6 on a share, Mr. Walters gets 30 times \$6, or \$180.

2. If a bank declare a dividend of 5%, what is that man's dividend who has 20 shares of stock?

3. A railway company declares a dividend of 3 per cent.; what is Mr. A's dividend, if he own 80 shares of stock?

4. A manufacturing company declares a dividend of 8 per cent.; what is my dividend, if I hold 40 shares of stock?

1. A company declares a dividend of 4%; how much stock do I own, if I receive \$400 dividend?

ANALYSIS.—Since my dividend is 4%, or  $\frac{1}{25}$ , \$400 is  $\frac{1}{25}$  of my stock;  $\frac{25}{25}$ , or the value of my stock, is 25 times \$400, or \$10,000.

2. If Mr. B's share of a 5% dividend is \$200, how much stock does he own?

3. A stockholder in a bank receives \$60 as his share of a 3% dividend; how much stock does he own?

4. Mr. Lindsey receives \$540 as his share of a 5% dividend; how much stock does he own?

1. If \$500 worth of stock earn \$30, what rate of dividend may be declared?

ANALYSIS.—If \$500 gain \$30, \$1 gains  $\frac{1}{500}$  of \$30, or  $\frac{30}{500}$ , equal to  $\frac{6}{100}$ , or 6%.

2. When \$800 earns a profit of \$40, what rate of dividend may be declared?

3. What rate of dividend may be declared on stock, if \$5000 of it gain \$400?

4. 10 shares of bank stock, worth \$100 each, pay an annual dividend of \$80; what is the rate per cent.?

1. What amount of stock at 10% premium can I buy for \$440?

ANALYSIS.—At 10% premium, stock is worth \$110 a share; hence \$440 will buy as many shares as \$110 is contained times in \$440, or 4 shares.

2. When stock is selling at 30% premium, what amount may be bought for \$6500?

3. If railroad stock sells at 25% discount, how much may be bought for \$1500?

4. How much stock at 20% premium may be bought for \$2400, if the shares are \$50 each?

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### INSURANCE.

1. How much will it cost to insure a house worth \$3000 at  $1\frac{1}{4}\%$ ?

SUG.—It will cost  $1\frac{1}{4}\%$  of \$3000, or \$37.50.

2. A house was insured for \$4000 at 1%; what was the premium, or cost of insuring?

3. What is the premium on a house worth \$4500, insured for 5 years at  $1\frac{1}{2}\%$ ?

4. If I pay \$30 insurance on a \$3000 house, what is the rate?

5. A merchant insured his store for \$4000, and paid \$100 insurance; what was the rate?

6. If I pay \$75 insurance on a property worth \$5000, what is the rate?

7. Mr. Jenkins insured his furniture at 2% and paid a premium of \$20; what is the amount of the insurance?

8. If a man pay \$30 insurance at  $1\frac{1}{4}\%$ , what amount of insurance does he get?

9. The insurance on a barn at  $\frac{3}{4}\%$  costs \$18; what is the amount of insurance?

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### INTEREST.

*Interest* is a certain percentage paid for the use of money. It is estimated at a certain rate per cent. for each year.

The *Principal* is the sum on which the interest is paid.

The *Rate* is the percentage paid per annum.

The *Amount* is the sum of the principal and the interest.

In computing interest 30 days are considered a month, and 12 months a year.

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### GENERAL METHOD.

1. What is the yearly interest of \$40 at 6% ?

ANALYSIS.—At 6%,  $\frac{6}{100}$ , or  $\frac{3}{50}$ , of the principal equals the interest.  $\frac{3}{50}$  of \$40 is \$2.40; hence the interest of \$40 for 1 year at 6% is \$2.40.

2. What is the yearly interest of \$300 at 6% ?
  3. What is the yearly interest of \$225 at 4% ?
  4. What is the yearly interest of \$50 at 8% ?
  5. What is the yearly interest of \$60 at 5% ?
  6. What is the yearly interest of \$40 at 7% ?
  7. What is the yearly interest of \$120 at  $12\frac{1}{2}\%$  ?
  8. What is the yearly interest of \$500 at  $5\frac{1}{2}\%$  ?
  9. What is the yearly interest of \$140 at 3% ?
  10. What is the yearly interest of \$90.50 at 6% ?
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1. What is the interest of \$500 for 3 yr. at 6% ?

SOLUTION.—At 6%,  $\frac{6}{100}$ , or  $\frac{3}{50}$ , of the principal equals the interest for 1 year; and for 3 years, 3 times  $\frac{3}{50}$ , or  $\frac{9}{50}$ , of the principal equals the interest;  $\frac{9}{50}$  of \$500 is \$90; hence the interest of \$500 for 3 yr. at 6% is \$90.

2. What is the interest of \$40 for 2 yr. at 5% ?
3. What is the interest of \$100 for 3 yr. at 6% ?
4. What is the interest of \$80 for 5 yr. at 4% ?
5. What is the interest of \$90 for 4 yr. at 5% ?
6. What is the interest of \$120 for 3 yr. at 5% ?
7. What is the interest of \$350 for 2 yr. at 8% ?
8. What is the interest of \$200 for  $2\frac{1}{2}$  yr. at 6% ?
9. What is the interest of \$400 for  $3\frac{1}{4}$  yr. at 6% ?

10. What is the interest of \$300 for  $3\frac{1}{3}$  yr. at 5% ?

11. What is the interest of \$300 for 3 yr. 4 mo. at 6% ?

SOLUTION.—2 yr. 4 mo. equal  $2\frac{1}{3}$  yr. If the interest for one year is 6%, for  $2\frac{1}{3}$  yr. it is  $2\frac{1}{3}$  times 6%, or 14% ; 14% of \$300 is \$42. Therefore, etc.

What is the interest—

12. Of \$200 for 2 yr. 8 mo. at 6% ?

13. Of \$250 for 3 yr. 6 mo. at 4% ?

14. Of \$400 for 4 yr. 3 mo. at 5% ?

15. Of \$120 for 6 yr. 3 mo. at 8% ?

16. Of \$1000 for 3 yr. 7 mo. at 6% ?

17. Of \$450 for 2 yr. 5 mo. at 8% ?

18. Of \$500 for 2 yr. 9 mo. at 5% ?

19. Of \$20 for 1 yr. 6 mo. at 7% ?

20. Of \$340 for 2 yr. 6 mo. at 6% ?

21. What is the interest of \$300 for 2 yr. 3 mo. 18 days at 5% ?

SOLUTION.—18 days equal  $\frac{1}{4}$ , or  $\frac{3}{8}$ , of a month ; hence 3 months and 18 days equal  $3\frac{3}{8}$  months, or  $\frac{1}{2}$  months.  $\frac{1}{2}$  of a month equals  $\frac{1}{2}$  of  $\frac{1}{12}$  of a year, or  $\frac{1}{24}$  of a year, and  $\frac{1}{2}$  months equal 18 times  $\frac{1}{24}$ , or  $\frac{3}{4}$ , of a year ; hence 2 yr. 3 mo. and 18 days equal  $2\frac{3}{4}$  years. If the interest for 1 year is 5%, for  $2\frac{3}{4}$  years it is  $2\frac{3}{4}$  times 5%, or  $12\frac{1}{2}$  % ;  $12\frac{1}{2}$  % of \$300 is \$37.50. Therefore, etc.

What is the interest—

22. Of \$400 for 5 yr. 3 mo. 18 da. at 10% ?

23. Of \$500 for 3 yr. 7 mo. 6 da. at 5% ?

24. Of \$600 for 1 yr. 6 mo. 20 da. at 9% ?

25. Of \$300 for 2 yr. 7 mo. 6 da. at 5% ?

26. Of \$150 for 4 yr. 3 mo. 20 da. at 6% ?

27. What is the amount of \$250 for 6 yr. at 5% ?

NOTE.—The *amount* is the sum of the principal and the interest.

SOLUTION.—For 6 yr. at 5%, 30%, or  $\frac{3}{10}$ , of the principal equals the interest.  $\frac{3}{10}$  of \$250 is \$75 ; \$250 plus \$75 are \$325, the amount.

What is the amount—

28. Of \$240 for 4 yr. at 10% ?
29. Of \$650 for 5 yr. at 6% ?
30. Of \$800 for  $6\frac{1}{2}$  yr. at 4% ?
31. Of \$600 for 3 yr. 6 mo. at 6% ?
32. Of \$250 for 4 yr. 3 mo. at 5% ?
33. Of \$600 for 8 yr. 5 mo. at 6% ?
34. Of \$1000 for 3 yr. 2 mo. 12 da. at 5% ?
35. Of \$800 for 4 yr. 24 da. at 5% ?
36. Of \$200 for 2 yr. 7 mo. 6 da. at 5% ?
37. A has \$400, which amount is  $\frac{2}{3}$  of C's money ; what is the interest on each one's money for  $3\frac{1}{2}$  yr. at 6% ?
38. I build a house for \$4000 when money is worth 5% ; what is the yearly interest on the value of the house ?
39. If a house cost me \$3000 when money is worth 6% , and my taxes and insurance amount to 3% , what does the use of the house cost me each year ?

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### INTEREST BY DAYS.

When the number of days for which money draws interest does not exceed 123, a short method much used is that of moving the decimal point two places to the left in the principal to find the interest for 60 days at 6%.

Thus, the interest of \$200 for 60 days at 6% is \$2.00. For 63 days it is \$2.00 and  $\frac{1}{20}$  of \$2.00, or \$2.10, because the 3 days is  $\frac{1}{20}$  of 60 days.

Find the interest of—

- |                            |                             |
|----------------------------|-----------------------------|
| 1. \$360 for 60 da. at 6%. | 6. \$200 for 93 da. at 6%.  |
| 2. \$720 for 60 da. at 6%. | 7. \$400 for 60 da. at 5%.  |
| 3. \$407 for 60 da. at 6%. | 8. \$600 for 60 da. at 10%. |
| 4. \$100 for 63 da. at 6%. | 9. \$800 for 63 da. at 5%.  |
| 5. \$200 for 33 da. at 6%. | 10. \$200 for 93 da. at 5%. |

- |                              |                              |
|------------------------------|------------------------------|
| 11. \$600 for 93 da. at 8%.  | 18. \$660 for 93 da. at 6%.  |
| 12. \$100 for 63 da. at 8%.  | 19. \$330 for 93 da. at 8%.  |
| 13. \$200 for 33 da. at 8%.  | 20. \$550 for 60 da. at 6%.  |
| 14. \$600 for 60 da. at 7%.  | 21. \$600 for 45 da. at 6%.  |
| 15. \$900 for 63 da. at 7%.  | 22. \$800 for 63 da. at 6%.  |
| 16. \$1200 for 95 da. at 6%. | 23. \$500 for 63 da. at 5%.  |
| 17. \$840 for 63 da. at 6%.  | 24. \$400 for 33 da. at 10%. |

## GENERAL PROBLEMS IN INTEREST.

## 1.

## TO FIND THE RATE.

1. At what per cent. will \$200 gain \$36 in 3 years?

SOLUTION 1.—The interest on \$200 for 1 yr. at 1% is \$2, and for 3 yr. it is 3 times \$2, or \$6. For \$200 to gain \$36 will therefore require a rate of as many per cent. as \$6 is contained times in \$36, or 6%.

SOLUTION 2.—At 1% the interest on \$1 for 3 years is 3 cents, and on \$200 it is 200 times 3 cents, or \$6; it will therefore require as many per cent. as \$6 is contained times in \$36, or 6%.

2. At what per cent. will \$300 gain \$30 in 2 yr.?
3. At what per cent. will \$150 gain \$27 in 3 yr.?
4. At what per cent. will \$180 gain \$36 in 6 yr.?
5. At what per cent. will \$40 gain \$16 in 8 yr.?
6. At what per cent. will \$250 gain \$35 in  $3\frac{1}{2}$  yr.?
7. At what per cent. will \$60 gain \$12 in 5 yr.?
8. At what per cent. will \$80 gain \$10 in  $2\frac{1}{2}$  yr.?
9. At what per cent. will \$90 amount to \$108 in 4 yr.?
10. At what per cent. will \$500 amount to \$605 in  $3\frac{1}{2}$  yr.?
11. At what per cent. will \$30 in 4 yr. 2 mo. amount to \$37.50?
12. At what per cent. will \$300 in 5 yr. 3 mo. amount to \$363?



13. At what per cent. will a principal double itself in 10 yr.? 20 yr.? 4 yr.? 5 yr.? 25 yr.?

NOTE.—In order to double itself it must gain 100%, or once itself.

14. At what per cent. will a principal treble itself in 4 yr.? 5 yr.? 10 yr.? 20 yr.? 25 yr.? 40 yr.?

15. At what per cent. will a principal quadruple itself in 4 yr.? 5 yr.? 10 yr.? 15 yr.? 30 yr.?

16. At what rate will the interest of \$600 for 3 yr. 3 mo. 6 days be \$102?

17. The amount of a certain principal for 5 years at a certain per cent. is \$750, and for 3 years, \$690; what are the principal and the rate per cent.?

18. The amount of a certain principal for 4 years at a certain per cent. is \$650, and for 7 years, \$710; what are the principal and the rate per cent.?

---

## 2.

### TO FIND THE TIME.

1. In what time will \$300 at 6% give \$54 interest?

SOLUTION.—\$300 in 1 year, at 6%, will yield \$18 interest, hence to yield \$54 will require as many years as 18 is contained times in 54, or 3 years.

2. In what time will \$100 at 5% yield \$15 interest?

3. In what time will \$200 at 6% yield \$24 interest?

4. In what time will \$100 at 4% yield \$32 interest?

5. In what time will \$300 at 5% yield \$60 interest?

6. In what time will \$140 at 5% yield \$28 interest?

7. In what time will \$150 at 6% yield \$45 interest?

8. In what time will \$60 at 5% yield \$7.50 interest?

9. In what time will \$25 at 6% yield \$7.50 interest?

10. In what time will \$200 at 7% yield \$42 interest?

11. In what time will \$300 at 6% yield \$24 interest?

12. In what time will \$400 at 6% amount to \$460?

13. In what time will \$540 at 5% amount to \$621?

14. In what time will any principal double itself at 5%?  
10%? 20%? 40%? 25%? 50%?

15. In what time will any principal treble itself at 5%?  
10%? 20%? 25%? 40%? 16 $\frac{2}{3}$ %?

16. In what time will a principal quadruple itself at 5%?  
10%? 15%? 20%? 25%? 12 $\frac{1}{2}$ %?

17. The amount of a certain principal for a certain time at 5% is \$600, and for the same time at 8%, \$660; what are the principal and the time?

18. If I invest my money in bank stock yielding a dividend of 10 per cent., it will in a certain time amount to \$9000; but if I loan it at 6% for the same time, it will amount to only \$7800; what is the amount of money, and what the time?

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### 3.

#### TO FIND THE PRINCIPAL.

1. What principal will in 6 yr. 6 mo. at 4% give \$52 interest?

SOLUTION 1.—6 yr. 6 mo. equals 6 $\frac{1}{2}$  years. The interest on \$1 for 6 $\frac{1}{2}$  yr. at 4% is 26 cents; hence \$52 is the interest on as many dollars for the given time as 26 cents is contained times in \$52, or \$200.

SOLUTION 2.—For 6 yr. 6 mo., or 6 $\frac{1}{2}$  yr., at 4%,  $\frac{1}{5}$  of the principal equals the interest. Since \$52 is  $\frac{1}{5}$  of the principal,  $\frac{1}{5}$  of the principal is  $\frac{1}{5}$  of \$52, or \$4, and  $\frac{5}{5}$ , or the principal, is 50 times \$4, or \$200.

2. What principal will in 5 yr. at 4% yield \$20 interest?  
\$60? \$200? \$1200?

3. What principal will in 6 yr. at 5% yield \$60 interest?  
\$150? \$600? \$9?

4. What principal will in 8 yr. at 4% yield \$80 interest?  
\$160? \$640? \$200?

5. What principal will in 6 yr. 8 mo. at 6% yield \$100 interest? \$120? \$640? \$1200?

6. A man pays annually on borrowed money \$450, at 5%; how much has he borrowed?

7. How much money has a man on interest at 5%, if his annual income is \$1030?

8. A gentleman sold his farm, to be paid for at the end of 1 yr. 4 mo., interest at 6%. When payment was made the amount was \$12,960; what was the price of the farm?

9. How much money must be put on interest to amount to \$690 in 3 years at 5%?

10. What principal will in 1 yr. 6 mo. at 8% amount to \$224?

11. A debt which has been drawing interest for 6 yr. 4 mo. at 6% amounts to \$552; what is the debt?

12. Mr. Williams invested  $\frac{3}{4}$  of his money in the lumber trade, and at the end of 2 yr. 6 mo. sold his share for \$10,800, at a profit of 8 per cent. yearly gain; how much money had he at first?

## PRESENT WORTH.

The *Present Worth* of a debt is a sum which, if placed on interest at the legal rate for the given time, will amount to the face of the debt when it comes due.

1. What is the present worth of \$440, due 2 yr. hence, at 5%?

SOLUTION.—Since the amount of \$1 for 2 yr. at 5% is \$1.10, the present worth of \$440 is as many dollars as \$1.10 is contained times in \$440, or \$400.

2. What is the present worth of \$420, due 4 yr. hence, at 10%?

3. What is the present worth of \$26, due 5 yr. hence, at 6%?

4. What is the present worth of \$600, due 4 years hence, at 5%?

5. What is the present worth of \$360, due  $3\frac{1}{3}$  yr. hence, at 6%?

6. What is the present worth of \$530, due 18 months hence, at 4%?

7. The amount due on a mortgage which has been on interest for 8 years at 5% is \$4900; what is the face of the mortgage?

8. If I buy a bill of paper amounting to \$203, payment to be made in 3 months, what amount of cash will pay the bill now, interest at 6%?

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#### TRADE DISCOUNT.

Manufacturers, and sometimes wholesale merchants, have a fixed price on their goods, known as their *list price*. From this they make discounts varying as the market varies. Such discount is known as the *trade discount*, and the amount paid, as the *net price*. Frequently several discounts are given; as, 10% off and 5% for cash; or 30% and 10% off.

In all such cases the discounts are deducted separately from the remainder left after each preceding discount has been deducted. Thus, in goods sold at \$40 with 10% off and 5% for cash, 10% of \$40, or \$4, is first deducted, and then 5% from the \$36 remaining.

1. Find the net price of goods sold at \$25, discount 20 and 10.

SOLUTION.—20% of \$25 is \$5; \$25 — \$5 equals \$20; 10% of \$20 is \$2; \$20 — \$2 = \$18.

2. Sold a bill of goods for \$60, discount 20% and 5% off for cash; what was the net price?

3. If I buy books at \$10 a dozen, discount being 40 and 10, what is the net price?

4. The list price of goods is \$1.50; what is the net price if the discount is 10 and 20?

5. Which is the better for the purchaser, a discount of 10 and 20, or a discount of 20 and 10?

6. The list price of shoes is \$40 a dozen, and the discount is 25 and 10; what do they cost a pair?

7. The list price of goods on 3 months' time is \$4, the discount is 10% and 5% for cash; what is the net price?

8. What is the net price of goods listed at \$10, discount 40, 25, and 10?

## BANK DISCOUNT.

Bank Discount is the allowance made to a bank for the payment of a note before it comes due.

Bank discount is the interest on the face of the note for the time it has to run, including three days of grace.

1. What is the bank discount of \$120 for 60 days at 6%?

SUG.—The time is 63 days; the interest of \$120 for 63 days at 6% is \$1.26.

Find the bank discount of—

- |                             |                                |
|-----------------------------|--------------------------------|
| 2. \$100 for 60 da. at 6%.  | 10. \$720 for 90 da. at 6%.    |
| 3. \$120 for 30 da. at 6%.  | 11. \$200 for 60 da. at 5%.    |
| 4. \$200 for 90 da. at 8%.  | 12. \$500 for 90 da. at 6%.    |
| 5. \$600 for 30 da. at 10%. | 13. \$300 for 95 da. at 6%.    |
| 6. \$140 for 60 da. at 6%.  | 14. \$800 for 60 da. at 5%.    |
| 7. \$125 for 60 da. at 6%.  | 15. \$500 for 30 da. at 6%.    |
| 8. \$700 for 60 da. at 6%.  | 16. \$150 for 45 da. at 6%.    |
| 9. \$300 for 45 da. at 6%.  | 17. \$120.30 for 90 da. at 6%. |

## PROPORTIONAL PARTS.

1. Two men hire a pasture for \$60: the first pastures 4 cows and the second 6 cows; how much should each pay?

SOLUTION.—Since the first pastured 4 cows and the second 6, they together pastured 10 cows. If the pasturage of 10 cows cost \$60, the pasturage of 1 cow cost  $\frac{1}{10}$  of \$60, or \$6; hence the pasturage of 4 cows cost 4 times \$6, or \$24, and the pasturage of 6 cows, 6 times \$6, or \$36.

2. If two men hire a horse for \$25, the first using it 10 days and the second 15 days, how much should each pay?

3. Three boys bought 60 apples, the first paying 3 cents, the second 4 cents, and the third 5 cents; how many apples should each receive?

4. The pasturage of 5 cows for 4 weeks and 10 sheep for 4 weeks cost \$30; how much does the pasturage of each cost, if the pasturage of a cow cost 4 times as much as the pasturage of a sheep?

5. Smith and Martin undertake to do a piece of work for \$100: Smith sends 5 men for 6 days, and Martin 4 men for 5 days; how much should each receive?

6. 3 men, A, B, and C, undertake to do a piece of work for \$348: A with 3 assistants works 10 days; B with 5 assistants works 6 days; and C with 9 assistants works 4 days; how much should each receive?

7. A furnishes 10 men, and B 16 boys, to do a piece of work for \$90; how much should each receive, if the work of a man is worth twice that of a boy?

8. Three men hire a pasture for \$124. C puts in 4 horses; D 10 cows; and E 30 sheep; how much should each pay if a cow eats twice as much as a sheep, and a horse three times as much as a sheep?

9. A puts into a pasture 20 sheep for 5 weeks; B, 10 cows for 4 weeks; and C, 5 horses for 6 weeks; how much should

each pay if a cow eat twice as much as a sheep, and a horse twice as much as a cow, the rent of the pasture being \$60?

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10. Divide the number 180 into three such parts as shall be to one another as 3, 4, and 5.

SOLUTION.—Since the parts are to one another as 3, 4, and 5, we divide the number 180 into  $3 + 4 + 5$ , or 12, equal parts: 1 of these parts is  $\frac{1}{12}$  of 180, or 15; 3 parts are 3 times 15, or 45; 4 parts are 4 times 15, or 60; and 5 parts are 5 times 15, or 75.

11. Divide 60 into two parts that are to each other as 5 and 7.

12. The sum of three numbers is 200, and the numbers are to one another as 3, 2, and 5; what are the numbers?

13. Divide 650 in the proportion of  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and  $\frac{1}{4}$ .

14. Three men caught 120 fish, their proportions being as 2,  $1\frac{1}{2}$ , and  $\frac{1}{2}$ ; how many did each catch?

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15. Mary and Susan have \$45: Mary has \$5 more than Susan; how much money has each?

SOLUTION.—Susan's number plus \$5 equals Mary's, which, added to Susan's, equals twice Susan's, plus \$5, or \$45; hence \$45 minus \$5, or \$40, equals twice Susan's number. Susan's number is therefore  $\frac{1}{2}$  of \$40, or \$20, and Mary's is \$20 plus \$5, or \$25.

16. Divide the number 33 into two such parts that one shall be 5 greater than the other.

17. A watch cost \$50 more than a chain, and they together cost \$110; how much did each cost?

18. My coat cost \$20 more than my boots, and together they cost \$40; how much did each cost?

19. A hat cost \$3 more than a pair of shoes, and a shawl \$8 more than the hat; they together cost \$25; what was the cost of each?

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20. James and John gathered 60 melons: James gathered 3 times as many as John; how many did each gather?

SOLUTION.—Since James gathered 3 times as many as John, 3 times John's number equals James' number, which, added to John's, is 4 times John's, or both. If 4 times John's number is 60, his number is  $\frac{1}{4}$  of 60, or 15, and James' number is 3 times 15, or 45.

21. Two boys have 30 marbles: the first has twice as many as the second; how many has each?

22. Mary and Ella gathered 60 roses: Ella gathered 2 times as many as Mary; how many did each gather?

23. The ages of two men are 45 years: one is  $\frac{4}{5}$  as old as the other; how old is each?

24. If Charles and Simon gather 24 quarts of berries, and Charles gathers  $1\frac{2}{3}$  times as many as Simon, how many quarts does each gather?

25. Two men have \$3400:  $\frac{2}{3}$  of what the first has equals  $\frac{3}{4}$  of what the second has; how much money has each?

26. A house, a farm, and a store cost \$12,000: the farm cost twice as much as the house, and the store 3 times as much as the house; how much did each cost?

27. A man bought three properties: the second cost twice as much as the first, and the third 3 times as much as the second; what was the cost of each, if they together cost \$13,500?

28. Three times Henry's money equals 4 times Arthur's: they together have \$140; how much has each?

29. Two boys sold 90 tickets; how many did each sell if 4 times what the first sold equals 5 times what the second sold?

30. The sum of two fractions is  $1\frac{7}{12}$ :  $\frac{2}{3}$  of the first equals  $\frac{3}{5}$  of the second; what are the fractions?

31. Bought a hen, a duck, and a turkey: the duck cost 15 cents less than the hen, and the turkey 3 times as much as the duck; what was the price of each, if they together cost \$1.90?



## PARTNERSHIP.

1. Two men in partnership gain \$600. B owns  $\frac{3}{4}$  of the stock, lacking \$100, and his gain is \$400; how much stock has each?

SOLUTION.—If A had owned  $\frac{3}{4}$  of the stock, his gain would have been  $\frac{3}{4}$  of \$600, or \$450; but he gained only \$400, therefore the \$100 would have gained the difference between \$450 and \$400, or \$50. If it requires \$100 to gain \$50, it requires \$2 to gain \$1, and to gain \$600 it requires 600 times \$2, or \$1200; hence A had  $\frac{3}{4}$  of \$1200, or \$900, less \$100, which equals \$800; and B, \$1200 minus \$800, or \$400.

2. Mr. Smith and Mr. Handy enter into partnership and gain \$300. Mr. Smith owns  $\frac{2}{3}$  of the stock, less \$200, and his share of the gain is \$60; how much stock does each own?

3. Mr. A and Mr. B gain in partnership \$320. Mr. A owns  $\frac{1}{4}$  of the stock, + \$60, and his share of the gain is \$110; what amount of stock has each?

4. C and D bought a store, and in selling it cleared \$1500. C owned  $\frac{1}{2}$  of it, less \$600, and his share of the gain was \$600; what amount did each pay?

5. Charles and Henry agree to plow some land for \$60. Charles plowed  $\frac{1}{3}$  of the land and 10 acres more, and received \$40; how much did each plow?

6. If a man builds  $\frac{1}{4}$  of a wall and 6 rods more and receives \$48, how long is the wall, if the total cost of building it is \$120?

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THE METRIC SYSTEM.

The *Metric System* is a decimal system of weights and measures having the meter for its base or unit.

The system was first adopted in France in 1795, and it is now used in France, Germany, Spain, Portugal, Belgium, Greece, Mexico, Brazil, and most of the other states of South America.

Its use is authorized by law also in Great Britain and the United States. The system is used chiefly by scientific men, as being the simplest system of weights and measures in existence.

The principal metric units are—

1. The **Meter**, for lengths.
2. The **Are**, or square meter, for surfaces.
3. The **Stere**, or cubic meter, for volumes.
4. The **Liter** (lee'ter), or cubic decimeter, for capacities.
5. The **Gram**, for weights.

The **Meter**, the primary unit of the system, is  $39\frac{37}{100}$  inches.

The names of the denominations lower than a unit are indicated by prefixing the Latin words *milli* ( $\frac{1}{1000}$ ), *centi* ( $\frac{1}{100}$ ), and *deci* ( $\frac{1}{10}$ ) to the unit; thus, millimeters, centimeters, etc.

The names of the denominations greater or higher than a unit are formed by prefixing the Greek terms *deca* (10), *hecto* (100), *kilo* (1000), and *myria* (10,000) to the unit; thus, decagrams, hectograms, etc.

Metric numbers are written as decimals, with the decimal point after the unit. Thus, 15 meters and 5 centimeters is written 15.05 m. This may be read 15 and  $\frac{5}{100}$  meters, or 15 meters and 5 centimeters.

The following are the tables of the metric system:

### 1.

#### LINEAR MEASURE.

10 millimeters (mm.)	= 1 centimeter	(cm.)
10 centimeters	= 1 decimeter	(dm.)
10 decimeters	= 1 meter	(m.)
10 meters	= 1 decameter	(Dm.)
10 decameters	= 1 hectometer	(Hm.)
10 hectometers	= 1 kilometer	(Km.)
10 kilometers	= 1 myriameter	(Mm.)

The **Meter**, a little less than 1 yd.  $3\frac{3}{8}$  inches, is used in measuring short distances.

The **Kilometer**, a little less than  $\frac{5}{8}$  of a mile, is used in measuring long distances.

## 2.

### SURFACE MEASURE.

100 sq. millimeters (mm.)	= 1 sq. centimeter (sq. cm.)
100 sq. centimeters	= 1 sq. decimeter (sq. dm.)
100 sq. decimeters	= 1 sq. meter (sq. m) = 1 centiare (ca.)
100 sq. meters	= 1 sq. decameter (sq. Dm.) = 1 are (a.)
100 sq. decameters	= 1 sq. hectometer (sq. Hm.) = 1 hectare (Ha.)
100 sq. hectometers	= 1 sq. kilometer (sq. Km.)

Also—

100 centiares = 1 are.

100 ares = 1 hectare.

Land is measured by the **Are**, about  $10\frac{3}{4}$  sq. feet, and the **Hectare**, about  $2\frac{1}{2}$  acres.

## 3.

### CUBIC MEASURE.

1000 cu. millimeters (cu. mm.)	= 1 cu. centimeter (cu. cm.)
1000 cu. centimeters	= 1 cu. decimeter (cu. dm.)
1000 cu. decimeters	= 1 cu. meter = 1 stere.

The cubic meter, or *stere*, used for measuring wood, embankments, etc., is about  $1\frac{1}{8}$  cu. yard, or .2759 of a cord. The following table also is used :

10 decisteres (ds.) = 1 stere (st.)

10 steres = 1 decastere (Ds.)

## 4.

## LIQUID OR DRY MEASURE.

The **Liter** is the unit of the measure of capacity. It is equal to a cube each of whose sides is  $\frac{1}{10}$  of a meter, and is equivalent to about  $1\frac{1}{8}$  liquid quarts or  $\frac{9}{10}$  of a quart dry measure.

10 milliliters (ml.)	= 1 centiliter	(cl.)
10 centiliters	= 1 deciliter	(dl.)
10 deciliters	= 1 liter	(l.) = 1 cu. dm.
10 liters	= 1 decaliter	(Dl.)
10 decaliters	= 1 hectoliter	(Hl.)
10 hectoliters	= 1 kiloliter	(Kl.)

NOTE.—1 milliliter = 1 cu. cm.

The **Hectoliter** is used in measuring liquids, grains, fruits, and roots in large quantities. It is equal to about  $2\frac{5}{8}$  bu.

A **Kiloliter** is a cubic meter or stere.

## 5.

## WEIGHT.

The **Gram**, the unit of weight, is equal to a cube of distilled water the edge of which is  $\frac{1}{100}$  of a meter, equal to 15.432 Troy grains in weight.

10 milligrams (mg.)	= 1 centigram	(cg.)
10 centigrams	= 1 decigram	(dg.) [of water.
10 decigrams	= 1 gram	(g.) = Wt. of 1 cu. cm.
10 grams	= 1 decagram	(Dg.)
10 decagrams	= 1 hectogram	(Hg.) [water.
10 hectograms	= 1 kilogram	(Kg.) = 1 cu. dm. of
10 kilograms	= 1 myriagram	(Mg.)
10 myriagrams	= 1 quintal.	
10 quintals	= 1 tonneau or ton	= 1 cu. m. of water.

The **Gram**, the **Kilogram** (Kilo), and the **Ton** are the units used in actual weighing, except in cases where jewelers, druggists, and others find it necessary to use the other units in weighing very small or very expensive articles.

The **Kilogram**, or **Kilo**, is used in common trade. It is a little less than  $2\frac{1}{5}$  lb. avoirdupois.

The **Tonneau**, or **Ton**, equal to 1000 kilos, is used for weighing heavy articles. It is equal to a little less than 2205 lb.

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### PROBLEMS FOR ANALYSIS.

1. If I buy a certain number of hens at 40 cents, I shall have 60 cents remaining, but if I buy the same number at 45 cents, I shall have only 10 cents remaining; how many are there?

SOLUTION.—By the conditions of the problem each hen at the second price will cost 5 cents more than a hen at the first price, and the difference in the price of the whole number is 60 cents less 10 cents, or 50 cents; hence there are as many hens as 5 is contained times in 50, or 10.

2. A girl bought apples at 1 cent each and had 12 cents remaining; had she bought as many oranges at 3 cents each, she would have had no money remaining; how many apples did she buy?

3. Mr. Rogers bought sheep at \$5 each and had \$45 remaining; had he bought as many hogs at \$7 each, he would have had only \$5 remaining; how many sheep did he buy?

4. A boy bought ducks at 35 cents each and had 30 cents remaining; had he bought the same number of hens at 25 cents each, he would have had 80 cents remaining; how many did he buy?

5. A farmer, desirous of purchasing a certain number of cows, found that if he bought those at \$30 each, he would have \$40 remaining, but if he bought those at \$40 a head, he

would lack \$20 of having money enough to pay for them; how many did he wish to buy?

6. James bought a number of oranges at 3 cents each and had 6 cents remaining; had he bought the same number of bananas at 5 cents each, he would have lacked 4 cents to pay for them; how many did he buy?

7. A gentleman gave to an equal number of boys and girls \$1.80, giving to each boy 4 cents and to each girl 5 cents; how many were there of each?

NOTE.—He gave to 1 boy and 1 girl, 9 cents; hence there were as many of each as 9 is contained times in 180.

8. I bought an equal number of oranges and bananas for 49 cents, giving 4 cents for the oranges and 3 cents for the bananas; how many did I buy of each?

9. I bought an equal number of pears, apples, and peaches for 60 cents, the pears costing 5 cents, the peaches 3 cents, and the apples 2 cents each; how many of each did I get?

10. A gentleman distributed 90 cents among some poor children, giving to each child 6 cents: there were twice as many girls as boys; how many were there of each?

11. Mr. B distributed 84 cents among some poor children, giving to each girl 5 cents and to each boy 4 cents; how many were there of each if there were twice as many girls as boys?

12. Samuel bought a number of oranges at 5 cents each, and three times as many apples at 2 cents each, spending for all 66 cents; how many of each did he buy?

13. Three men agree to build a wall for \$55: A is to have  $\$1\frac{1}{2}$  a day, and B and C each \$2 a day; how long does it take to build the wall?

14. Mr. Brown and Mr. Smith agree to do a piece of work for \$110, Brown receiving  $\$2\frac{1}{2}$  a day, and Smith receiving \$2 a day, but Smith works  $1\frac{1}{2}$  times as many days as Brown; how many days did each work?

1. A miller paid \$28 for 50 bushels of corn of two grades : for the first he paid 60 cents a bushel, and for the second 50 cents a bushel ; how many bushels of each did he buy ?

SOLUTION.—Had all the corn been of the first grade, he would have paid \$30, or \$2 more than he did pay ; each bushel of the second grade cost 10 cents less than a bushel of the first grade, hence there were as many bushels of the second grade as 10 cents is contained times in \$2, or 20 bushels. The number of bushels of the first grade was  $50 - 20$ , or 30.

2. A drover sold 40 sheep for \$210 : for the best he received \$6 each, and for the others \$5 each ; how many were there of each ?

3. Bought 30 hens and ducks for \$14 : the hens were worth 50 cents each, and the ducks 40 cents each ; how many were there of each ?

4. Paid a coal dealer \$60 for 12 tons of coal : for stove coal I paid \$5.25 a ton, and for nut coal \$4.50 ; how many tons were there of each ?

5. A gentleman paid \$90 to 40 laborers for a day's work : the men received \$2.50 each, and the boys \$1.50 each ; how many of each were there ?

6. Paid \$9.80 for 12 bushels of grain : wheat at 90 cents a bushel and corn at 70 cents a bushel ; how many bushels were there of each ?

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7. A man agreed to work 40 days for \$1.25 a day and board, but was to pay 75 cents a day for his board whenever he was idle ; at the end of the time he received \$42 ; how many days was he idle ?

SOLUTION.—Had he worked every day, he would have received 40 times \$1.25, or \$50 ; he therefore lost by idleness \$50 less \$42, or \$8. His loss for a single day was his wages, \$1.25, and his board, 75 cents, or \$2 ; hence he was idle as many days as \$2 is contained times in \$8, or 4 days.

8. A mechanic agrees to work at the rate of \$3 a day for 30 days: at the end of the time he receives \$75; how many days did he lose?

9. A laborer agrees to work 20 days at 75 cents a day and board, but he is to pay 50 cents a day boarding for every day he is idle: at the end of the time he receives \$12.50; how many days does he work?

10. A man agrees to work 40 days for \$100, but at the end of the time gets only \$90; how many days was he idle?

11. An engineer agrees to work 25 days for \$100, but forfeits \$1 for every day he is idle: at the end of the time he receives \$85; how many days does he work?

12. A clerk who receives \$5 a day for his work pays \$7 a week for his boarding: at the end of 6 weeks he has saved \$118; how many days did he lose?

13. A man receives \$2 a day for his labor and pays 50 cents a day for his board: at the end of 30 days he has saved \$40; how many days did he work?

14. The head of a fish is 4 inches long, the tail is as long as the head, plus  $\frac{1}{3}$  of the length of the body, and the body is as long as the head and the tail both; what is the length of the fish?

SOLUTION.— $\frac{1}{3}$  of the length of the body, plus 4 inches, equals the length of the tail, which, added to the length of the head, equals  $\frac{1}{3}$  of the length of the body, plus 8 inches; and this, by the condition of the problem, equals  $\frac{2}{3}$ , or the body. Since  $\frac{2}{3}$  of the length of the body equals  $\frac{1}{3}$  of the length of the body, plus 8 inches,  $\frac{2}{3}$  minus  $\frac{1}{3}$ , or  $\frac{1}{3}$ , of the length of the body is 8 inches;  $\frac{1}{3}$  of the length of the body is 4 inches; and  $\frac{2}{3}$ , or the body, is 3 times 4 inches, or 12 inches. The length of the fish is therefore 12 inches plus 4 inches plus 8 inches, or 24 inches.

15. The foundation wall of a house is 3 ft. high; the gable is as high as the foundation, plus  $\frac{1}{4}$  of the body of the house;



and the body is twice as high as the gable and the foundation; what is the height of the house?

16. The head of a fish is 6 inches long, the tail is as long as the head, plus  $\frac{1}{4}$  of the body, and the body is as long as the head and the tail; what is the length of the fish?

17. From A to B is 15 miles; from B to C is as far as from A to B, plus  $\frac{1}{5}$  the distance from C to D; and from C to D is twice as far as from A to C; how far from A to D if A, B, C, and D are in a straight line?

18. A has \$10, B has as much as A, +  $\frac{1}{4}$  as much as C, and C has 3 times as much as A and B; how much has each?

19. John earned \$30, Henry earned as much as John and  $\frac{1}{5}$  as much as Samuel, and Samuel earned twice as much as John and Henry; how much did each earn?

20. George has 20 cents, Henry has as much as George and  $\frac{1}{3}$  as much as William, and William has as much as George and Henry together; how much has each?

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1. If a man can do a piece of work in 5 days, how much of it can he do in 1 day?

2. If a man do  $\frac{2}{3}$  of a piece of work in a day, how long will it take him to do  $\frac{1}{3}$  of it? How long to do the whole work?

3. If one boy can do a piece of work in 3 days, and another in 5 days, how much can each do in a day, and how much can both?

4. George can do a piece of work in 4 days, Henry in 5 days, and Isaac in 3 days; how much can each do in a day, and how much can they all do?

5. One man can do  $\frac{2}{5}$  of a piece of work in a day, and another  $\frac{3}{4}$  of the same work; how much can they together do in 1 day, and how long will it take them to do the work together?

6. Arthur can do a piece of work in  $1\frac{1}{2}$  days, and Peter in  $2\frac{1}{3}$  days; how much can each do in 1 day, and how much can they together do?

7. Two boys can dig a ditch in 3 days; the first can dig it in 5 days; how long will it require the second?

8. A boy can earn a dollar in  $\frac{4}{5}$  of a day; how much can he earn in a day?

9. Henry can earn a dollar in  $\frac{3}{4}$  of a day, and Simon in  $\frac{4}{5}$  of a day; how much can they together earn in a day?

10. If John can earn a dollar in  $\frac{4}{5}$  of a day, and Calvin in  $\frac{5}{6}$  of a day, how long will it require each of them to earn \$10?

11. If James can earn a dollar in  $\frac{3}{4}$  of a day, and Frank in  $\frac{4}{5}$  of a day, how long will it take them, working together, to earn \$8?

12. A can do a piece of work in 4 days, B in 5 days, and C in 6 days; in what time can they together do the work?

13. If George and Luther can plow a piece of land in 3 days, and George alone can plow it in 5 days, how long will it take Luther alone to plow it?

14. Mr. Thompson can build a wall in 20 days, but he and Mr. Robinson together can build it in 12 days; how long would it take Mr. Robinson alone to build it?

15. If one pipe can fill a cistern in 8 hours, and another in 12 hours, how long will it take if they work together?

16. A cistern has three pipes, two for filling and one for emptying it. One pipe can fill it in 6 hours, and the other in 10 hours, while the third can empty it in 8 hours; how long will it take to fill it if all the pipes are flowing at the same time?

17. If a barrel of flour last two families 3 months, and it last the first family 5 months, how long would it last the second?

18. A, B, and C can do a piece of work in 3 days: A can do it in 8 days, and B in 9 days; how long would it take C to do it?

19. A, B, and C can do a piece of work in 4 days: A and B can do it in 6 days, and B and C in 7 days; how long would it take each alone to do the work?

20. D, E, and F can build a wall in 6 days: D and E can build it in 10 days, and E alone in 16 days; how long would it take each to build it?

21. A and B can do a piece of work in 8 days, B and C in 10 days, and A and C in 9 days; how long would it take each to do it, and how long all of them when they work together?

22. Jacob and Silas can mow a field in 4 days, and Silas alone can mow it in 6 days; how long will it take Jacob to mow the remainder after they have worked together 3 days?

23. B and C can clear a piece of land in 3 weeks: B alone can clear it in 5 weeks; how long will it require C to clear what remains after B has worked 3 weeks?

24. 2 men or 3 boys can do a piece of work in 10 days; how long will it take 2 men and 3 boys to do the work?

25. 2 men or 3 boys can do a piece of work in 8 days; how long will it take 2 men and 2 boys to do it?

26. 2 men or 3 boys can do a piece of work in 6 days; how long will it take 3 men and 2 boys?

27. John can earn a dollar in  $\frac{1}{4}$  of a day, and Henry in  $\frac{1}{5}$  of a day; how long will it take them together to earn a dollar, and how many dollars can they earn in a day?

28. Howard can plant 40% of a field in a week, and James can plant 30% of it in a week; how long will it require them together to plant the field?

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1. Mr. A bought a number of turkeys for \$50, but 10 of them having been stolen, he sold  $\frac{1}{3}$  of the remainder at cost and received \$12.50; how many did he buy?

SOLUTION.—Since  $\frac{1}{3}$  of the remainder cost \$12.50,  $\frac{2}{3}$ , or the remainder, cost 3 times \$12.50, or \$37.50; and since the whole number cost \$50, the ten that were stolen cost \$50 less \$37.50, or \$12.50: if 10 turkeys cost \$12.50, 1 cost  $\frac{1}{10}$  of \$12.50, or \$1.25; hence Mr. A bought as many as \$1.25 is contained times in \$50, or 40 turkeys.

2. Mary purchased a quantity of gingham for \$3.20, but after using 4 yards of it she sold  $\frac{3}{4}$  of the remainder for cost and received \$1.80; how many yards did she buy?

3. A boy had some ducks worth \$8: he killed 4, and then sold  $\frac{1}{3}$  of the remainder for \$2; how many had he at first?

4. Mr. Jones bought a number of geese for a certain sum: he lost 4, and then sold  $\frac{1}{2}$  of the remainder at cost and received \$12, which was \$18 less than all cost; how many had he?

5. A lady had a number of chickens: she killed 10, then sold  $\frac{2}{5}$  of the remainder for \$10, which was \$20 less than the value of her flock at first; how many had she at first?

6. A farmer, having purchased a number of sheep, sold 8 to his neighbor, and then  $\frac{1}{3}$  of the remainder to a butcher at cost for \$20, which was \$80 less than the flock cost; how many did he buy?

7. Mr. Jackson, having purchased some cows, sold 2 at cost, and sold  $\frac{1}{2}$  of the remainder at \$20 more than cost, receiving \$140, which was \$160 less than the lot cost; how many did he buy?

8. Samuel bought a number of pigs for \$80; he killed 4, and then sold  $\frac{1}{2}$  of the remainder, lacking 2, at cost and received \$24; how many did he buy?

9. Henry purchased a number of hens for \$30: having killed 10, he sold  $\frac{2}{5}$  of the remainder and 2 more at cost and received \$11; how many did he buy?

10. Mr. Evans, having bought a number of sheep for \$80, sold 4 to a neighbor, and then sold to a butcher  $\frac{1}{4}$  of the remainder and 2 more, at cost, for \$56 less than the cost of all; how many did he buy?

11. A farmer lost  $\frac{1}{5}$  of his hogs: had he sold the remainder at cost, he would have received \$80; but, reserving 4, he sold  $\frac{1}{3}$  of the remainder at cost and received \$20; how many had he at first?

12. Mr. Williams bought a certain number of calves, and sold 5 of them to a butcher: had he sold the remainder at cost, he would have received \$40; but he reserved 2, and, selling  $\frac{3}{4}$  of the remainder at cost, he received \$24; how many had he?

13. Mr. A's family ate  $\frac{1}{3}$  of his chickens: he then found that if he sold  $\frac{3}{4}$  of the remainder at cost, he would receive \$12, but if he kept 20 and sold  $\frac{3}{4}$  of the remainder at cost, he would receive \$6; how many had he?

14. Mr. Lewis lost  $\frac{2}{5}$  of his sheep: now, if he finds 2,  $\frac{2}{5}$  of what he then has are worth at cost price \$40; but if he loses 3,  $\frac{2}{5}$  of the remainder are worth only \$30; how many had he?

1. Two boys have 80 marbles:  $\frac{2}{3}$  of A's number equals  $\frac{2}{5}$  of B's; how many has each?

2. A pole 76 feet in length is so broken that  $\frac{2}{3}$  of the shorter piece equals  $\frac{2}{5}$  of the longer piece; how long is each?

3. Henry and James together earned \$77:  $\frac{3}{4}$  of what Henry earned, + \$6, equals  $\frac{2}{3}$  of what James earned; how much did each earn?

4.  $\frac{2}{3}$  of Michael's money + \$12, equals  $\frac{5}{7}$  of Albert's money; they together have \$46; how much has each?

5. A coat and a vest cost \$27:  $\frac{1}{4}$  the cost of the coat, plus \$2, equals the cost of the vest; how much does each cost?

6. Mr. Jones bought a horse, a cow, and some hens for \$208: the cow cost  $\frac{1}{4}$  as much as the horse, and the hens  $\frac{1}{5}$  as much as the cow; how much did each cost?

7. A lady had 66 fowls:  $\frac{1}{4}$  of the number of ducks equaled the number of turkeys, and  $\frac{2}{5}$  of the number of ducks equaled the number of hens; how many had she of each?

8. George, having 60 cents, lost  $\frac{2}{5}$  of it, and then found  $\frac{1}{3}$  as much as he had remaining; how much had he then?

9. Samuel found 10 cents, then lost  $\frac{1}{4}$  of what he had, and still had  $\frac{9}{10}$  as much as at first; how much had he at first?

10. William, George, and James earned \$72: William earned  $\frac{1}{3}$  as much as George, and George earned  $\frac{3}{5}$  as much as James; how much did each earn?

11. Cyrus has 72 cents, which is  $\frac{3}{4}$  as much as Robert has; if each give the other  $\frac{1}{2}$  his money, how much will each then have?

12. Five times a number equals 6 times  $\frac{3}{4}$  of the same number, + 5; what is the number?

13. Four times a number equals 3 times the same number plus 5; what is the number?

14. Six times a number equals 4 times  $\frac{5}{6}$  of the same number increased by 8; what is the number?

15. A house and a lot cost \$3000: the lot cost  $\frac{1}{4}$  as much as the house; how much did each cost?

16. The cost of a house and a farm was \$7800: the house cost  $\frac{2}{5}$  as much as the farm, + \$800; what was the cost of each?

17. A man spent  $\frac{3}{4}$  of his money, then earned  $\frac{2}{3}$  as much as he spent, and had \$27; how much had he at first?

18. Henry earned \$40, then spent  $\frac{1}{2}$  of his money, and still had \$50; how much had he at first?

19. A man, being asked his age, said, 10 years ago I was  $\frac{5}{7}$  as old as I am now; how old was he?

20. Henry is  $\frac{3}{7}$  as old as his father, and the sum of their ages is 70 years; how old is each?

21. If to my age you add its  $\frac{1}{3}$ , its  $\frac{2}{5}$ , and 16 years, the sum will be 3 times my age; how old am I?

22. Saul is 16 years older than John, and  $\frac{2}{7}$  of Saul's age equals  $\frac{2}{3}$  of John's; how old is each?

23. Mr. Rambo and Mr. Kerr own two farms: Mr. Rambo owns  $\frac{3}{4}$  as much land as Mr. Kerr, and Mr. Kerr owns 25 acres more than Mr. Rambo; how many acres does each own?

24. Mr. S and Mr. T own a number of sheep: Mr. S's number is  $1\frac{1}{5}$  times Mr. T's number, and Mr. T's number is 40 less than Mr. S's; how many has each?

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1. In a school of 50 pupils there are 3 boys to every 2 girls; how many boys must leave that there may be an equal number of boys and girls?

2. In the same school how many girls should be admitted that the number of boys and girls may be equal?

3. In a school of 45 pupils the number of boys is to the number of girls as 3 to 2; how many boys must leave that the number of boys may be to the number of girls as 2 to 3?

4. In the same school how many girls must be admitted to make the proportion of girls to boys as 3 to 2?

5. In a school of 40 pupils, if the proportion of boys to girls is as 5 to 3, how many girls must be admitted to make the proportion of boys to girls as 5 to 6?

6. In an alloy of 40 pounds there are 30 pounds of copper and 10 pounds of tin; how much tin must be added that there may be 2 pounds of tin to every 3 of copper?

7. In an alloy of copper and silver there are 4 pounds of copper and 6 of silver; how much copper must be added that there may be 2 pounds of copper to 1 of silver?

8. A pole 124 feet in length was broken so that  $\frac{3}{8}$  of the

longer piece equaled  $\frac{2}{5}$  of the shorter; how much must be cut from the longer that  $\frac{9}{10}$  of its length may be  $\frac{3}{4}$  of the shorter?

9. If an alloy contain 30 oz. of gold and 2 oz. of silver, how much silver must be added that 24 oz. of the alloy may contain 20 oz. of gold?

SUG.—Since 24 oz. of the alloy contain 4 oz. of silver, 30 oz. will contain  $1\frac{1}{4}$  times 4 oz. of silver, or 5 oz. of silver; there must therefore be added 5 oz. minus 2 oz., or 3 oz., of silver.

10. If an alloy contain 18 pounds of silver and 1 pound of copper, how much copper must be added that 10 pounds of the alloy may contain 9 parts silver and 1 part copper?

11. If alcohol is 90% strong, how much water may be added to a gallon so that the alcohol may remain 75% strong?

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12. For every cow a farmer keeps he allows 2 acres of pasturage and 1 acre of corn; how many cows can he keep on 12 acres?

SUG.—Each cow requires 3 acres.

13. If a farmer can pasture 2 cows on 4 acres, and 2 cows will eat the produce of 1 acre of roots, how many cows can he keep on 15 acres?

14. If a man allow 2 acres of roots for every 5 cows he keeps and 4 acres of pasturage for every 2 cows, how many cows can he keep on 36 acres, and how much land must he have in pasture, and how much in roots?

15. If a farmer allow one acre of corn for every 6 sheep and an acre of grass for every 4 sheep, how many sheep can he keep on 20 acres?

16. Mr. A has 36 sheep: he allows 1 acre of corn for every 6 sheep and 1 acre of grass for every 4 sheep; how many acres does he use?

17. A farmer allows 6 acres of pasturage for every 3 cows and 1 acre of roots for every 3 cows; he also allows 1 acre



of corn for every 6 sheep and 2 acres of grass for every 8 sheep; how many acres does it require to keep 12 cows and 24 sheep?

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18. How far may a person ride in the cars at the rate of 20 miles an hour and return by carriage at the rate of 8 miles an hour, if he is gone 7 hours?

SOLUTION.—If he goes 20 miles an hour, he travels 1 mile in  $\frac{1}{20}$  of an hour; if he returns at the rate of 8 miles an hour, he travels 1 mile in  $\frac{1}{8}$  of an hour; hence to go one mile and return requires  $\frac{1}{20} + \frac{1}{8}$ , or  $\frac{7}{40}$ , of an hour. He therefore can go and return as many miles as  $\frac{7}{40}$  is contained times in 7, or 40 miles.

19. How far may a person ride in a coach going 6 miles an hour and be gone 9 hours, returning on foot at the rate of 3 miles an hour?

20. I drive to the city at the rate of 6 miles an hour and return by rail at the rate of 30 miles an hour; how far is it if I traveled the distance in 6 hours?

21. If I travel to the city by steamer at the rate of 15 miles an hour and return by rail at the rate of 30 miles an hour, how far is it if I spend  $2\frac{1}{2}$  hours in the city and return in  $8\frac{1}{2}$  hours?

22. A boat that sails at the rate of 10 miles an hour goes down a stream whose current is 2 miles an hour; it returns in 5 hours; how far did it travel?

23. A steamer goes up a river at the rate of 12 miles an hour and returns at the rate of 16 miles an hour; it is gone 7 hours; how far did it travel, and what is the rate of the current?

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24. A dinner was engaged for 20 persons, but 4 were absent, whereby the expense of each of the others was increased 50 cents; what was the total cost of the dinner?

SOLUTION.—Since the expense of each of the remaining 16 was increased  $\$ \frac{1}{2}$ , the total increased expense was 16 times  $\$ \frac{1}{2}$ , or \$8, which

should have been paid by the 4 absentees: the expense to each was therefore  $\frac{1}{4}$  of \$8, or \$2, and to the 20, 20 times \$2, or \$40.

25. Eight men hire a coach, but by taking in 4 others the expense of each was reduced 25 cents; how much did they pay for the coach?

26. Four men buy a store, but by taking in an equal partner the amount to be paid by each was reduced \$2000; what was the cost of the store?

27. Six men buy a boat, but afterward take in 2 partners, and thereby reduce the amount paid by each \$5000; what was the amount paid for the boat?

28. An excursion party of 50 hire a boat, but 10 having failed to pay, the expense of each of the others was increased 50 cents; what was the charge for the boat?

29. Three boys, A, B, and C, camped together: A furnished 4 loaves of bread, and B 5 loaves, while C paid 30 cents; how should this money be divided?

30. Silas, Wilson, and Milton lunched together: Silas furnished 3 eggs, and Milton 6, while Wilson paid 10 cents; to whom should the money be paid?

31. Four men camped together: A furnished 4 loaves of bread, B 5 loaves, and C 7 loaves, while D contributed 40 cents; how should the money be divided?

1. What is the time of day if  $\frac{1}{3}$  of the time past midnight equals the time to noon?

SOLUTION.—Since  $\frac{1}{3}$  of the time past midnight equals the time to noon,  $\frac{2}{3}$ , or the time past midnight, plus  $\frac{1}{3}$  of the time past midnight, or the time to noon, equals  $\frac{4}{3}$  of the time past midnight, or the time from midnight to noon, 12 hours. If  $\frac{4}{3}$  of the time past midnight equals 12 hours,  $\frac{1}{3}$  of the time equals  $\frac{1}{4}$  of 12 hours, or 3 hours, and  $\frac{2}{3}$ , or the time past midnight, equals 3 times 3 hours, or 9 hours; hence it is 9 o'clock A. M.

NOTE.—It will be helpful to the pupil first to draw a diagram in solving these questions, as follows, in which P represents the present time:

$$\begin{array}{ccccccc} \text{M} & & \frac{3}{8} & & \text{P} & & \frac{1}{8} & & \text{N} \\ \hline & & & & & & & & \end{array}$$

2. What is the time of day if the time past midnight equals the time to noon?

3. What is the time of day if the time past noon equals  $\frac{1}{2}$  of the time to midnight?

4. What is the time of day if  $\frac{1}{2}$  the time past midnight equals the time to noon?

5. What is the time of day if  $\frac{1}{4}$  the time past midnight equals the time to noon?

6. What is the time of day if  $\frac{1}{2}$  the time past midnight equals the time to midnight again?

7. What is the time of day if  $\frac{2}{3}$  of the time past noon equals the time to noon again?

8. What is the time of day if  $\frac{1}{2}$  the time past noon equals the time to midnight?

9. What is the time of day if  $\frac{1}{5}$  the time past midnight is the time past noon?

10. What is the time of day if  $\frac{2}{3}$  of the time to midnight is the time past noon?

11. What is the time of day if  $\frac{1}{3}$  the time past midnight equals the time past noon?

12. How many more spaces does the minute-hand of a clock pass over in an hour, than does the hour-hand?

13. How many spaces does the minute-hand gain on the hour-hand in 1 hour? In 2 hours? In 4 hours?

14. How long does it take the minute-hand to gain one space on the hour-hand? 3 spaces? 6 spaces?

15. At what time after one o'clock are the hour-hand and the minute-hand together?

REMARK.—The minute-hand gains one space.

16. At what time between 3 and 4 o'clock are the hour-hand and the minute-hand together?

17. At what time between 4 and 5 o'clock do the hour-hand and the minute-hand point in opposite directions?

18. At what time after 6 o'clock are the hour-hand and the minute-hand one space apart?

19. It is after 4 o'clock, and the hour-hand and the minute-hand of a watch form a right angle; what time is it?

20. It is between 1 and 2 o'clock; what is the time if the hour-hand and the minute-hand of a watch form a right angle?

21. When  $\frac{2}{5}$  of the time to midnight equals the time past 9 o'clock, what is the hour?

22. When  $\frac{2}{5}$  of the time past 10 o'clock A. M. equals  $\frac{2}{3}$  of the time to 6 o'clock P. M., what is the time?

23.  $\frac{1}{5}$  of the time to 8 P. M. equals the time to noon; what is the time?

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1. A is 40 yards ahead of B; if B runs 5 yards while A runs 4, how many yards must B run to overtake A?

2. Henry is 20 feet ahead of Frank, but Frank runs 5 feet while Henry runs 2; how many feet will Frank run to overtake Henry?

3. A rabbit is 60 yards ahead of a hound, but the hound runs 5 yards while the rabbit runs 4; how far must the hound run to catch the rabbit?

4. A hound attempts to catch a rabbit which is 40 leaps ahead; the rabbit takes 3 leaps while the hound takes 2, but 1 of the hound's leaps equals 2 of the rabbit's; how many leaps will each take before the hound catches the rabbit?

5. A thief is 30 steps before an officer, and takes 6 steps while the officer takes 5, but 5 of the officer's steps equal 7 of the thief's; how far will each run before the thief is caught?

6. A man ran 160 yards to catch a boy;  $\frac{3}{5}$  of the distance the boy ran equals the distance he was ahead at the start; how far was he ahead at the start?

7. William takes 20 steps to overtake Edgar; how far was Edgar ahead when they started if William takes 4 steps while Edgar takes 5, and 4 of William's equal 6 of Edgar's?

8. James and Nelson are 100 yards apart and approach each other, James walking 3 yards while Nelson walks 2; how far will each travel before they meet?

9. Rufus and Edwin are 110 yards apart and approach each other; how far will each travel if Rufus takes 2 steps while Edwin takes 3, and 4 of Rufus' steps equal 5 of Edwin's?

10. Robert and Edward are 220 of Edward's steps apart, and approach each other; how many steps will each take before they meet if 3 of Robert's steps equal 5 of Edward's and Robert takes 2 steps while Edward takes 4?

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11. The sum of two numbers is 15, and twice the first plus 4 times the second equal 48; what are the numbers?

SUGGESTION.—Twice the first and twice the second is 30, hence twice the second is  $48 - 30$ , or 18.

12. The sum of two numbers is 20, and twice the first plus 3 times the second is 52; what are the numbers?

13. A cord of wood and a ton of coal cost \$8, and 3 cords of wood and 5 tons of coal cost \$34; what was the cost of each?

14. The difference between two numbers is 4, and 4 times the first less 3 times the second is 18; what are the numbers?

15. The difference between two numbers is 5, and 5 times the first less 2 times the second is 34; what are the numbers?

16. A man by working 12 hours a day can do a piece of work in 6 days; how many days will it require if he work 8 hours a day?

17. If a man complete a piece of work in  $5\frac{1}{4}$  days by working 8 hours a day, in how many days can he finish it by working 10 hours a day?

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1. Albert is 14 years old and Lucy is 6; how soon will Albert be twice as old as Lucy?

SOLUTION.—At the required time twice Lucy's age will equal Albert's age; then the difference of their ages is once Lucy's age; but the difference in their ages is always  $14 - 6$ , or 8, years; hence at the required time Lucy's age is 8 years. She is now 6 years old, hence in  $8 - 6$ , or 2, years Albert will be twice as old as Lucy.

2. Albert is 10 years old and his father is 40; how long before the father will be twice as old as Albert?

3. Mary is 6 years old and James is 30; how long before James will be 3 times as old as Mary?

4. Mr. Jones is twice as old as his son, who is 25 years old; how long since he was 6 times as old?

5. B is 40 years old and his son 13; how long since B was 4 times as old as his son?

6. Jennie is  $\frac{1}{5}$  as old as her father, who is 40 years old; how long since she was  $\frac{1}{3}$  as old as her father?

7. Harry is 4 times as old as Alice; the difference in their ages is 21 years; how long before he will be only twice as old as Alice?

8. Samuel is 3 times as old as Harry; the sum of their ages is 40; how long ago was Samuel 5 times as old as Harry?

9.  $\frac{1}{2}$  of A's age is equal to  $\frac{1}{3}$  of B's, and the difference in their ages is 12 years; how soon will  $\frac{1}{3}$  of A's age equal  $\frac{1}{4}$  of B's?

10.  $\frac{3}{5}$  of John's age equals  $\frac{2}{3}$  of Henry's, and the difference of their ages is 3 years; how long since John was twice as old as Henry?

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11. Philip is now 5 times as old as Susan, but in 8 years he will be only 3 times as old; how old is each?

SOLUTION.—By the first condition of the problem the difference in their ages is 4 times Susan's age; hence once her age is  $\frac{1}{4}$  of the difference of their ages. In 8 years the difference in their ages is twice Susan's age, or her age is  $\frac{1}{2}$  of the difference, therefore 8 years is  $\frac{1}{2} - \frac{1}{4}$ , or  $\frac{1}{4}$ , the difference of their ages, and  $\frac{4}{1}$ , or the difference of their ages, is 4 times 8 years, or 32 years. If 4 times Susan's age is 32 years, her age is  $\frac{1}{4}$  of 32 years, or 8 years; and Philip's age is 5 times 8 years, or 40 years.

12. Henry is 6 times as old as Paul, but in 8 years he will be only twice as old as Paul; how old is each?

13. A is 5 times as old as B, but in 3 years he will be only 3 times as old as B; how old is each?

14. Mrs. R is 3 times as old as her daughter, but in 10 years she will be just twice as old as her daughter; how old is each?

15. When Mr. Porter married he was twice as old as his wife, but at the end of 20 years she was  $\frac{2}{3}$  as old as he; how old was each when they married?

16. When Mr. Thomson married, his wife's age was  $\frac{4}{5}$  of his, but after 6 years her age will be  $\frac{5}{6}$  of his; how old was each?

17. Eighteen years ago Benjamin was  $\frac{1}{3}$  as old as his uncle; now he is  $\frac{1}{2}$  as old; how old is each?

18. Four years ago Ida's age was  $\frac{1}{4}$  her sister's age, but 12 years hence it will be  $\frac{3}{4}$  her sister's age; how old is each?

1. Mr. Smith bought a certain number of cattle for \$120: had he bought 2 additional at \$10 less each, they would have cost him \$160; how many cattle did he buy?

SUGGESTION.—The additional two at \$10 less each would have cost the difference between \$160 and \$120, or \$40, hence each would have cost  $\frac{1}{2}$  of \$40, or \$20, which, increased by \$10, is \$30, the price of those purchased. Therefore there were as many bought as \$30 is contained times in \$120, or 4.

2. A drover sold a certain number of sheep for \$80: had he sold 5 more at \$1 less each, he would have received \$100 for the lot; how many were there?

3. A farmer sold a number of hogs for \$60: had he sold 3 additional at \$2 more each, he would have received \$96; how many did he sell?

4. Henry sold some hens for \$4: had he sold twice as many and 5 more, he would have received \$10; how many did he sell?

5. Mary sold some ducks for \$1.50: had she sold 3 times as many, less 2, she would have received \$3.50; how many did she sell?

6. Samuel bought a number of turkeys for \$4.50: had he bought 4 times as many, plus 2, they would have cost him \$21; how many did he buy?

7. Mr. Jones bought some cows for \$90: had he bought four times as many at \$10 more each, they would have cost him \$480; how many did he buy?

8. George and William built a wall for \$60: George built 3 times as many rods as William, less 12 rods, and received \$36; how many rods did each build?

9. Two men agree to do a piece of work for \$50: the first works as many days as the second, less 3 days, and receives \$22; how many days did each work?

10. Two men had an equal sum of money: had the first given the second 80 cents and the second given the first 20 cents, the second would have had 4 times as much as the first; how much had each?

11. Henry and James agree to do a piece of work for \$72:  $\frac{3}{4}$  of the number of days Henry works, plus 4, equals  $\frac{4}{5}$  of the days James works, and Henry receives \$32; how many days did each work?

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1. A lady had two watches and a chain. The chain and the first watch were worth 3 times as much as the second watch; and the chain and the second watch were worth as much as the first watch, the second watch being worth \$40; what was the value of each?

SOLUTION.—Since the first watch and the chain were worth 3 times as much as the second watch, they were worth 3 times \$40, or \$120, and the value of both watches and the chain was \$120 plus \$40, or \$160. Since the value of the second watch and the chain was equal to the value of the first watch, the first watch was worth  $\frac{1}{2}$  of \$160, or \$80, and the chain was worth \$120 — \$80, or \$40.

2. A gentleman owned two horses and a carriage. The first horse and the carriage were worth twice as much as the second horse, and the carriage and the second horse were worth  $1\frac{1}{2}$  times as much as the first horse; what was the value of each, if the second horse was worth \$125?

3. A man has a horse, a buggy, and a sleigh: the horse and the sleigh are worth twice as much as the buggy, and the buggy and the sleigh are worth as much as the horse; what is the value of each, if the horse is worth \$150?

4. Mary has two cups and a cover that fits each: the first cup when covered weighs twice as much as the second cup, and the second cup when covered weighs  $\frac{4}{5}$  as much as the first cup; what is the weight of each, if the first cup weighs 10 ounces?

5. Samuel's age is 16 years: his age and William's age are 3 times Mary's age, and William's age added to Mary's age is  $1\frac{1}{2}$  times Samuel's; how old is each?

6. Henry has 80 cents, and his money plus Irwin's is 4 times Simon's; Irwin's money plus Simon's is  $\frac{7}{8}$  of Henry's; how much money has each?

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7. A boy lost 35 cents and then found  $\frac{1}{5}$  as much as he had remaining; he then had  $\frac{1}{2}$  as much as at first; how much had he at first?

SOLUTION.—After finding  $\frac{1}{5}$  as much as he had remaining, he had  $\frac{5}{5} + \frac{1}{5}$ , or  $\frac{6}{5}$ , of what remained after losing 30 cents, which equals  $\frac{1}{2}$  of what he had at first; hence  $\frac{1}{5}$  of the remainder equals  $\frac{1}{6}$  of  $\frac{1}{2}$  his first amount, or  $\frac{1}{12}$  of what he had at first, and  $\frac{5}{6}$  equals  $\frac{5}{12}$  of what he had at first; the difference between  $\frac{11}{12}$  and  $\frac{5}{12}$ , or  $\frac{6}{12}$ , of what he had at first, is 35 cents, etc.

8. John, having a certain sum of money, earned 50 dollars, and then spent \$30, and still had  $1\frac{1}{2}$  times as much as at first; how much had he at first?

9. A man spent \$30 and then earned  $\frac{1}{3}$  as much as he had remaining, and found that he had  $\frac{8}{9}$  as much as at first; how much had he at first?

10. Simon, having a certain sum of money, borrowed 40 cents, and then spending  $\frac{1}{4}$  of what he had, found there remained  $1\frac{1}{4}$  times what he had at first; how much had he?

11. A boy spent 15 cents and then earned 60 cents, when he found he had  $1\frac{3}{5}$  times as much as at first; how much had he at first?

12. Moore and Good lost \$6000, and the next year gained  $\frac{1}{8}$  of the remainder of their capital, which was  $\frac{1}{8}$  of the original capital; how much had each invested if Moore's capital was  $\frac{1}{2}$  as much as Good's?

13. A and B lost 20 marbles, then found  $\frac{3}{4}$  as many as they had remaining, and then had  $\frac{7}{9}$  as many as at first; how many had they each at first if A's number was twice B's?

14. John and his brother, having earned a sum of money, spent \$30, then earned  $\frac{2}{3}$  as much as they had remaining, and then had  $\frac{3}{4}$  as much as at first; how much did each earn if John earned  $1\frac{1}{2}$  times as much as his brother?

15. If two men earn a certain sum of money in three weeks, then spend \$15 each, and then earn  $\frac{2}{3}$  as much as they have remaining, and have  $1\frac{1}{7}$  times as much as at first,

how much does each earn in a week if the first earns  $1\frac{1}{3}$  times as much as the second?

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16. Henry went to a friend, borrowed as much money as he had, and gave away 6 cents; he then went to a second friend, and, borrowing as much as he had, spent 16 cents, and had nothing remaining; how much had he at first?

SOLUTION.—After borrowing the second time he had twice as much money as before he borrowed, or 16 cents; therefore before borrowing, his money was  $\frac{1}{2}$  of 16 cents, or 8 cents, which he had after spending 6 cents: before spending any he had 8 cents and 6 cents, or 14 cents, half of which, or 7 cents, he had before borrowing.

17. A boy in one week earned as much money as he had and then spent \$8; he earned as much the second week as he had remaining at the end of the first week, and then had \$20; how much had he at first?

18. George had a certain number of marbles. In play he won as many more, then he lost 10, and again won as many as he had remaining, and after losing 16 had none remaining; how many had he at first?

19. A boy had a certain sum of money: he lost  $\frac{1}{3}$  of it, then earned as much as he had remaining, and, spending  $\frac{1}{3}$  of what he then had, there still remained 40 cents; how much had he at first?

20. If, having a certain sum of money, I borrow an equal amount, then spend \$6, and again borrow as much as I have remaining and spend \$12, and still have \$16 remaining, how much had I at first?

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1. If a merchant buys goods at a discount of  $\frac{1}{5}$ , what per cent. does he make by selling them at regular price?

2. If I buy goods at a discount of  $\frac{1}{4}$ , what per cent. profit do I make by selling them at regular price?

3. When wool that costs 25 cents a pound loses 10 per cent. in cleansing, how must I sell it per pound to make 20 per cent. profit?

4. If I buy goods at a discount of 20 and 10, what per cent. do I make by selling them at regular rates?

5. A merchant bought books at a discount of 50% from retail price, and sold them at a discount of  $\frac{1}{3}$  from retail; what per cent. did he make?

6. A merchant bought iron at a discount of 40 and 10, and sold it at an advance of 25%; what per cent. of the regular price did he receive?

7. If I buy goods at a discount of 40 and 20, how must I sell them to gain 25%?

8. If a manufacturer gives a dealer a discount of 40 and 25, and the dealer sells the goods at 60% of list price, what per cent. does he make?

9. A merchant buys cloth worth \$1.25 a yard, at a discount of 20 and 10; he sells it at regular price, \$1.25, and gives a discount of 10 per cent. for cash; what profit does he make per yard?

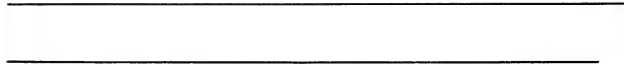
10. If a merchant buys books worth \$18 a dozen, at a discount of 40 and 10, and retails them at \$1.20, allowing a discount of 5% for cash, what per cent. profit does he make?







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