Florian Cajori

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THE PRIMARY

PUBLIC SCHOOL ARITHMETIC

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THE PRIMARY PUBLIC SCHOOL ARITHMETIC

BASED ON
McLELLAN AND DEWEY'S "PSYCHOLOGY OF NUMBER"

BY

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PREFACE

This book is strictly introductory to "The Public School Arithmetic," and forms with it a complete course. In both, the method of treatment closely follows "The Psychology of Number." A few special points in the Primary may be noticed.

1. While number work in the first grade may be largely incidental, it ought not to be accidental. The teacher should have a clear conception of the work to be done, and of the order and method by which the child may step by step reach the desired end. When the child enters school the number sense is alert; he is, roughly speaking, in the counting stage of development. Upon the principle "strike while the iron is hot," this counting power should at once be used for further growth by applying it to more definite measurements. Such application arouses fresh interest in number, and is in a high degree educative. On this point Dr. Dewey says, "Unless there is to be arrested development when the child enters school, some function must be found with reference to which he may utilize his ability to count—*the number sense becomes vitalized and truly educative at this point by being largely directed towards the definition of values in the form of measurement.*" This book, therefore, while not

giving first grade work in full, presents in systematic form and in sufficient detail for any primary teacher the amount of work to be done and the method of doing it.

2. Those to whom counting is the whole of number hold that almost the sole object of number-work in primary grades is quickness and accuracy in the figure-work of the fundamental rules. They are inclined to belittle the training of intelligence. Most teachers know, however, that not accurate figure-work and rule-learning is the crux, but rather what figure-work — "what rule" — to apply in given cases. Accordingly, while not unmindful of the use of skill in figure-work, the authors of this book have a wider purpose. Recognizing that number is the "tool of measurement," they have endeavored by a careful grading and an unusual variety of concrete and constructive exercises to develop true ideas of number and numerical operations, as well as trained intelligence and ability to apply what has been learned to the varying problems of social life.

3. There are two extreme views regarding the nature of number leading to two quite different pedagogical methods: one of these, *No ratio in number;* the other, *No number in ratio.* The one begins with the ratio idea, and ignores or subordinates the "how many" (counting) idea, letting it struggle into being incidentally in the development of ratio. The other begins with the vague "how many," and subordinates ratio or rather totally ignores it as not involved in the number process. This book, following as it does "The Psychology of Number," avoids both extremes. It begins with the *how many* (counting) as applied to some total; and keeping together

things which psychologically cannot be separated, viz. number and quantity, proceeds from the vague *how many* and the vague *how much* to the definite *so many* and the definite *so much.* Thus there is gradually yet surely evolved the concept of ratio — a concept which is indispensable in practical life, and without which there can be no Science of Arithmetic. On this important point Dr. Dewey — whose views on the psychical nature of number have never been questioned by a competent critic — says: "When counting is used by the child to value some amount or other the ratio idea is *implied.* It need not, therefore, be consciously or explicitly stated. In fact, I should say that for a considerable period it should not be. It is enough that the child gets a sense for the use and application of number in measurement. When number is so used, the transition to the conscious ratio idea, whether in the form of ratio proper, or fractions, or percentage, is natural and inevitable; this is not a mere doctrinaire statement; it rests upon continuous experimenting and observation in a school where the child's number sense is developed in connection with constructive operations in manual training, in which number relations are introduced as instruments to practical valuation."

4. This has been verified during the preparation of this book. Through the kindness of the publishers printed sheets of the exercises and methods have been placed in the hands of teachers in training (and public) schools, and actually tested in the classes. The reports have been unanimously favorable. The children got hold of the idea of number as "*The Tool* of measurement,"

as playing an important part in the affairs of life; school life was, in one respect at least, seen to be a part of social life. It followed that interest, enthusiasm, self-activity in connection with arithmetical work became the common experience in the schools.

For help in such experimenting our thanks are due to a number of successful teachers, especially to Principal Graham of the London Training School, to Principal Elliott of the Hamilton Training School, to Mrs. Randolph (Los Angeles), and to Principal William Sparks of Chatham.

Teachers are recommended to study with care Dewey and McLellan's "Psychology of Number," and the "Public School Arithmetic," which illustrates so many points in the "Psychology of Number."

The "Teachers' Edition" of this book will contain all needed answers to problems, suggestions for first grade work, some illustrative lessons, and many suggestions as to methods.

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SUGGESTIONS TO TEACHERS

Pages xi to xxvii of Suggestions to Teachers indicate the kind of work that should be done by the class previous to beginning Lesson 1 of this book. Lessons 1 to 8 review the work of this section.

I. Counting. — Counting is of course the first thing to look after: the child can probably count a little when he enters school, but there is now to be counting with a definite *end in view* — the growth of the *relating* process which gives rise to number; there is a *whole* to get an idea of, — there are its *parts;* there is the *how-many;* i.e. the child is counting *something*.

1. (*a*) Start with a whole and count by *single* things. For instance, count the number of girls in the room. Of boys. Of children. Test how far the number names are significant; e.g. name the number and have corresponding objects selected, etc.

(*b*) It may be that the children cannot count — cannot give the consecutive number names and apply them to corresponding groups of objects. In this case the starting-point is the vague *muchness* (ideas of more and less) and the vague *how-many* which must be in the children's minds. Have them make comparisons involving ideas of more and less; e.g. the length of the desk is greater than the width, etc. Also practice in the *how-many* idea; e.g. compare the *how-many* cubes (say 8) in this group with the *how-many* (say 6) in that. They will be led to see that the *muchness* of a quantity is determined by the *how-many* parts in it, etc. Have constructive exercises, bringing out relations of consecutively numbered objects (how five differs from six, etc.), and arousing *interest* in number names; e.g. have them make a picket (*two* splints); try to make a triangle with *two* splints; they will *need one* splint more, and will express the how-many as "two and one," or as "*one*, and *one*, and *one*." Similarly, try to make a square with *three* splints; they will need *one* more splint, and the how-many in the square will perhaps be expressed as "three and one," or "two and one and one," or (as we have often seen) "one and one′ and one′ and one," with some rhythmic movement. They will now fully appreciate the simple number names which are substitutes for the round-about expressions.

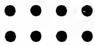
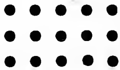
The children will hence soon be ready to see that we cannot find how much one quantity (as a line, area, etc.) differs from another without finding the how-many of some one thing (unit) in each.

2. *Not to be confined to single things.* — Count this *two* rows of girls; of boys; of all, — how many

twos? Count pairs of hands,—how many pairs? Similarly, count groups of 3,—how many threes, etc.? Also appeal to the ear: taps with stick, strokes of bell, vocal sounds (as letters, etc.), this both with *single* sounds, and *groups* of sounds (i.e. sounds rhythmically marked off).

3. Test this relating process, e.g. start counting with 4, i.e. 4, 5, 6 (units of any kind). Show by fingers or marks or dots what *preceded* the 4.

4. Count the same quantity with different units or groups, e.g. these 12 pupils: by 2's, how many? (6). By 3's, by 4's, by 6's, how many in each case? This lot of 24, by 2's, by 3's, by 4's, etc., to determine the different numbers (*how many*) that measure the same quantity. Also count different quantities with the *same* unit of measure. This lot of 6 (pupils, etc.) by 3's. This group of 12 by 3's, this group of 15 by 3's, etc. Use *many familiar units*.

5. *Represent* the various units by dots on the blackboard; e.g. these rows of dots represent groups of two (pupils, cents, etc.) each,  how many? (4). This group of three each,  how many? How many 4's? etc.

6. Let all the foregoing be then extended to *exact* measurements. Count the 2-inches in this foot-rule (or line); the 3-inches, etc. Count the number of 3-inches in lines 12 in., 15 in., 18 in., etc., long, and so on.

7. Cut out of cardboard strips, respectively, 1 in., 2 in., 3 in., . . . 12 in. long. Ask the pupils to select the 3 in. strip, the 5 in. strip, etc.

8. Have bags of sand or other material weighing from 1 to 10 lb. Let the pupils lift these and guess their weights.

9. Make squares whose sides are respectively 2, 3, and 4 in. Cut them into parts each containing 1 sq. in. Count the parts and then put them together again to form the original square. Count the 2-sq. in., etc.

10. Similarly, make oblongs 2 in. by 3 in., or 3 in. by 4 in., for example; divide into inch squares or half-inch squares, count, and again reconstruct the whole from the parts. Count as in 9 the 2-sq. in., etc.

11. Make simple measurements with the foot-rule and tape measure; for instance, measure the width of the desk, the length of the table, the height of the children, the number of inches around the head, the distance around the chest when expanded or contracted.

12. Take two points, say 2 or 3 or 4, etc., yards apart, without the pupils knowing what distance was measured. Let the pupils measure the distance between the points with a yardstick. What number do you get? How many yards? Measure with a foot-rule. How many feet? Measure with a unit one-half foot long. What number do you get? How many half-feet? Write, 2 yd. = 6 ft. = 12 half-feet.

Put (say) 2, 3, 4, etc., quarts of water into a pail. Let the pupils measure it out with a quart measure. What number do you get from the measurement? With a pint measure what number do you get? With a gill measure what number do you get? Write, 2 qt. = 4 pt. = 16 gi.

13. Draw a line 12 in. long, without the pupils knowing its length. Measure it with an inch unit. What number do you get? How many inches? Measured with a 2-inch unit what number? How many 2-inches? With a 3-inch unit what number? How many 3-inches? So also with 4-inch and 6-inch units. Draw and measure other lengths with other units.

II. Instantaneous recognition of the number pictures. — The work suggested in the above outline should lead as directly as possible to the instantaneous recognition of the number pictures — which will aid in complete mastery, especially for the aggregation idea of addition and subtraction, of the numbers from 1–10.

The picturing power should be used, in fact *must* be used, for economy of energy. If this *picturing* is rightly used, the whole *analysis* of ten will be given (perceived at last) in the picture  no matter what units are represented.

It must be understood that the symbolizing dots *stand* for any units whatever; e.g.  stands for not only 5 single cents, but five 2-ct., five 3-ct., five 5-ct., five dollars, five 2 boys, five 3 apples, etc., etc.

1. Let the children count a number of beans, say eight, and separate them into two equal parts. How many parts are there? Separate each part into two equal parts. How many of these parts are there in each part? How many beans are there in each part? Or, arranging in perceptive forms, how many *ones* in $\begin{smallmatrix}\bullet\\\bullet\end{smallmatrix}$? How many *twos* in $\begin{smallmatrix}\bullet&\bullet\\\bullet&\bullet\end{smallmatrix}$? How many *pairs of twos* in $\begin{array}{cc|cc}\bullet&\bullet&\bullet&\bullet\\\bullet&\bullet&\bullet&\bullet\end{array}$? Similar exercises and questions may be given with splints formed into two squares, and into two groups of two pickets each. Treat an oblong 4 in. by 2 in. similarly.

2. Put 1-in. units together to form the 2-in. unit, 2-in. units to form the 4-in. unit, 4-in. units to form the 8-in. unit, and so on. Use also sq. in. units.

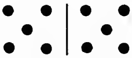
$$\begin{array}{ccc}\bullet&\bullet&\bullet\\\bullet&\bullet&\bullet\end{array}$$

3. In the above arrangement of dots there are how many single units? How many 2-units or twos? How many 3-units or threes? Use this arrangement to fix the place of 5 in the sequence between 4 and 6, i.e. as 1 more than 4 and 1 less than 6. Make with sq. in. a square, side 2 in., and an oblong 2 in. by 3 in. Give the pupils 5 sq. in. to work with.

$$\begin{array}{cc|cc}\bullet&\bullet&\bullet&\bullet\\\bullet&\bullet&\bullet&\bullet\end{array}$$

4. Similarly, use this arrangement to show the

relation of 8 to 4, as two fours, and to fix the place of 7 in the sequence between 6 and 8, i.e. as 1 more than 6 and 1 less than 8.



5. Similarly, show the relation of 10 to 5, and fix the position of 9 in the sequence between 8 and 10, i.e. as 1 more than 8 and 1 less than 10.

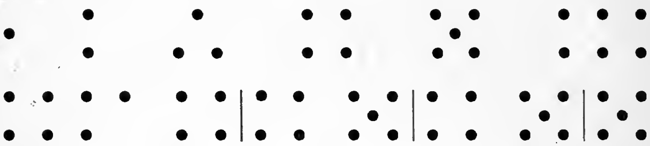
6. In using these dot arrangements, the picturing power should be definitely cultivated. Five dots should be instantly recognized as 5, 6 as 6, 7 as 5 and 2 or 4 and 3, 8 as two 4's or four 2's, 9 as 5 and 4, 10 as two 5's or five 2's, and also other simple relations within the groups.

7. After making the analysis of the visual forms, for instance, $5 + 1 = 6$, $4 + 2 = 6$, etc., cover the 5 dots. How many are hidden? How many are seen? Cover the 4. How many are hidden? How many seen? So on, taking care that 6 is seen as $5 + 1$ and $1 + 5$, $4 + 2$ and $2 + 4$, and so on.

8. In every case practical examples should be used as much as possible; e.g. in the *five*. Cover 2 dots. What do you see? (3). How many are unseen? (2). Then what must be done with the 3 to get 5? With 3¢ to get 5¢? With 3 eggs to make up 6 eggs? With 3 dollars to make up 7 dollars? With 3 dimes to make up 8 dimes? With 3 2-dollar bills to make 5 2-dollar bills? etc. Count 8 by 2's: how many? With 8¢ how many

apples 2¢ each can be bought? etc. *Connecting thus the practical work with the child's own experiences as closely as possible.* With 8 ten-dollar bills bought cows at 2 ten-dollar bills each. How many? All the combinations up to ten (including some of the *factor* relations) can be mastered in a few weeks. The *practical* element will make the work deeply interesting to the child.

9. Arrange on separate pieces of cardboard dots placed thus:



Show these cards separately to the class and have the answer given instantly. Tell how many two's in 6? in 8? in 10? Show the 10 picture an instant; unseen, erase one dot, show for an instant what is left. What number? What was done with the 10? Thus also erase two dots, etc. Similarly, change 6 to 8, 7, 9, etc. Make practical examples as in § 8.

10. Cut out of cardboards units 1 in., 2 in., 3 in., . . . 10 in. long, respectively. Let the children select the units which are together equal to the 3-in. unit; to the 4-in. unit; to the 5-in. unit. Select the units which will make triangles each of whose sides is respectively 6 and 7 in. long. Select the

units which will make squares whose sides are respectively 8 and 9 in. long. Select the units which will make a five-sided figure, each of whose sides is 10 in. long.

11. Simple work from dictation, — for instance, make a square each side of which is 4 in. Out of each corner cut 1 sq. in. Fold, making a box. Give similar constructive work.

12. Count by 2's the number of hands of the children in the first row; of the girls; of the boys; of all the children in the class. Count thus: 2, 4, 6, 8, 10, etc.

13. Give exercises by dot arrangements and measurements leading to and developing the idea that for any given quantity any *one* measurement gives a *second* measurement.

Thus $\begin{smallmatrix}\bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet\end{smallmatrix}$ signifies that the unit 2 measures 6 three times, and also that the unit 3 measures 6 twice. 12 by 3's implies 12 by 4's. 15 by 3's implies 15 by 5's, and so on. Illustrate by dots. 12 in. by 3 in. implies 12 in. by 4 in. Practical examples.

14. Cut a measure 1 ft. long out of cardboard. Cut this foot measure into parts each 6 in. long. How many parts are there? Place two 6-in. measures end to end. How long are they together? Cut a foot measure into parts each 2 in. long. How many parts are there? Place six 2-in. measures end to end. How long are they?

15. Arrange constructive exercises similar to those

in paragraph 14, dividing 1 ft. into 4-in. and 3-in. units, respectively. Make also equilateral triangles and squares and note the number in each case.

16. Cut out of cardboard units of measure respectively 6 in., 4 in., 3 in., and 2 in. long. Find the number of times that each unit measures 1 ft.

17. Divide 1 ft. into 2, 3, 4, and 6 equal parts, respectively. How long are the equal parts?

18. Apply the foot measure to measure the yard. What number do you get? How many ft.? 3 ft. in what? Apply the yard to measure the length of the room and other quantities. How many yd.? 6 yd. in what? Apply the pint to measure the quart, the quart to measure the gallon, and the pint to measure the gallon. What numbers do you get? How many pt.? How many qt.? 4 qt. in what? 8 pt. in what?

19. Count off 12 objects into unit groups of 4 each. What is the number of groups? Similarly, count off 15 objects, 18 objects, etc., into groups of 5, 6, etc., and count the number of groups.

20. Have each child form out of splints two squares with their diagonals, thus: ⊠. Arrange each square into triangles. How many squares are there? How many triangles? How many pairs of triangles?

21. Measure a 12-in. length with a 6-in. unit, and then again with a 3-in. unit. How many 6-in. units in the whole? How many 3-in. units in the 6-in. unit? How many 3-in. units in the whole? Similarly, a 16-in. length with 8-in., 4-in., 2-in. units, etc.

III. Combination of the ten units. — **1.** While the pupils were studying the number pictures in II they were given many practical questions on the combinations of single units. While they study the work outlined in III, give them many similar practical questions on the combinations of the 10-unit, in fact, on *all* the combinations that have been studied in the number pictures. Thus:

(1) I sold 3 cows for 6 ten-dollar bills. How much for each? How many dollars?

(2) A tailor sold 4 suits of clothes, receiving 2 ten-dollar bills for each. How much did he get for all? How many dollars?

(3) I gave $80 for a horse; how many ten-dollar bills will pay for it?

(4) I bought a suit of clothes for $40 and an overcoat for $30. What did both cost? How many ten-dollar bills would pay for both?

(5) I bought a horse for $300 and 2 cows at $40 each. What did all cost?

(6) I gave 4 dimes for a necktie and one-half as many for a collar. What did both cost?

(7) Write in figures: six, twenty-five, forty-four, eighty, one hundred and thirty-six, seven hundred and seventy-two, two hundred and four.

2. Teach combinations of the ten units in the following manner: Take a cubic centimeter (if a cubic centimeter cannot be procured, take a half-inch or an inch cube) for the primary unit of measure; a rec-

tangular prism (a decimeter in length), equal to ten of these units, will be the 10-unit and ten of these the 100-unit. The units may be of different colors and the units of the decimeter alternately white and black. Let the notation accompany thus, — one ten and no units equals 10, two tens and no units equals 20, and so on up to ten tens which equals the new unit one hundred, i.e. 100. Thus a rectangular prism, whose surface is a square decimeter and thickness one centimeter, will be equal to ten of the 10-unit and will be the 100-unit. Ten of these units will be the 1000-unit. Let the notation, as before, accompany the recognition of the facts.

In case the cubes referred to above cannot conveniently be obtained, units, tens, and hundreds can be cut out of cardboard, the square centimeter (about $\frac{2}{5}$ in. on each side) instead of the cubic, a strip 1 decimeter long and 1 centimeter wide for the 10-unit, and a square decimeter, divided into ten strips, colored alternately white and black, for the 100-unit. Extend this as suggested in paragraphs 8 and 9.

3. Give the pupils the number names from one to thirteen inclusive. Explain 13 as 3 and 10, *teen* being *ten*. Ask them to suggest a name for 14, i.e. 4 and 10, which is fourteen, and so on up to 20. For 20 give the name twenty (twain-ty, *twain* being *two* and *ty* ten).

Let the pupils suggest the names for 30 (three-ty or thirty), 40, and so on up to 90. *Ten* tens he will probably call ten-ty, when he should be given the new name *one* hundred and so on with the other numbers he has been using.

4. Count by tens the number of fingers and thumbs of the children in the first row; of the girls; of the boys. Count thus: 1 ten, 2 tens, 3 tens, 4 tens, 5 tens, 6 tens or 60, i.e. 6 tens and no units.

5. Give exercises in counting by tens from a clock face. Count from XII to VI from right to left and from left to right. Count from XII around to XII again.

6. What is the temperature in the schoolroom at 10.30 A.M.? What is it outside? Answer thus: 6 tens and 8° and gradually change to 68°, i.e. 6 tens and 8 units. Continue this work from day to day.

7. Note the time on the clock face counting by tens and minutes, for instance, 2 tens and 3 minutes after 9 o'clock. Change gradually to 23 minutes after 9 o'clock, i.e. 2 ten minutes and 3 minutes.

8. Measure certain distances with a metric stick; for instance, this distance is 2 meters, that is 4 meters, and so on. This distance is 1 meter 6 decimeters; that, 2 meters 4 decimeters. Again, this distance is 2 meters 1 decimeter 5 centimeters; that, 3 meters 5 decimeters 8 centimeters, and so on.

9. Count the number of centimeters in a deci-

meter. One decimeter is equal to 10 centimeters, i.e. 1 decimeter and no centimeters. Two decimeters equal 20 centimeters, i.e. 2 decimeters and no centimeters; and so on. Nine decimeters equal 90 centimeters, i.e. 9 decimeters and no centimeters.

10. One decimeter 1 centimeter is equal to 11 centimeters, i.e. 1 decimeter 1 centimeter. One decimeter 2 centimeters is equal to 12 centimeters, i.e. 1 decimeter 2 centimeters; and so on. One decimeter 9 centimeters is equal to 19 centimeters, i.e. one 1 decimeter 9 centimeters.

So with 2 decimeters 1 centimeter, 2 decimeters 2 centimeters, and so on, as continuously as necessary, up to 9 decimeters 9 centimeters.

Test thus: 2 decimeters 4 centimeters = ? centimeters? 65 centimeters = ? decimeters and centimeters?

11.* Count the number of decimeters in a meter. One meter is equal to 100 centimeters, i.e. 1 meter no decimeters no centimeters. Two meters is equal to 200 centimeters, i.e. 2 meters no decimeters no centimeters, so on up to 9 meters.

One meter 1 decimeter is equal to 110 centimeters, i.e. 1 meter 1 decimeter no meters. One meter 2 decimeters is equal to 120 centimeters, i.e. 1 meter 2 decimeters no centimeters, and so on up to 1 meter 9 decimeters, and so on as continuously as necessary up to 9 meters 9 decimeters.

* This notation need not be extended beyond 99, unless thought desirable, until after Lesson 14.

One meter 1 decimeter 1 centimeter is equal to 111 centimeters, i.e. to 1 meter 1 decimeter 2 centimeters.

Develop 112, 113, 114, etc., 121, 122, 123, etc., as continuously as necessary up to 999.

Test thus: 5 meters 4 decimeters 8 centimeters is equal to how many centimeters? 2 meters 6 centimeters is equal to how many meters?

516 or 607 centimeters is equal to how many meters, decimeters, and centimeters?

In the above work use contractions, viz. *m* for meter, *dm* for decimeter, and *cm* for centimeter.

12. Count ten pennies, using toy or, better, real money. What coin is equal to ten pennies? Write the sum thus: 10 ¢, i.e. 1 dime and no pennies. Similarly, for 2 dimes write 20 ¢, i.e. 2 dimes and no pennies, and so on.

Count sums of money, using dimes and pennies. Write the results thus: 12 ¢, i.e. 1 dime 2 ¢; 46 ¢, i.e. 4 dimes 6 ¢. Test the work as before in § 10.

Count by tens from 0 to 90 (using dimes as a basis), from 1 to 91 (using 1 ¢ and dimes), 2 to 92 (using 2 ¢ and dimes); and so on.

Count ten dimes. What coin is equal to ten dimes? Write the sum thus: 100 ¢, i.e. $1, no dimes, no pennies. Similarly, for $2 write 200 ¢, i.e. $2, no dimes, no pennies; and so on.

Count by 100's from 0 to 1000. Count by 100's from 10 to 910; 11 to 911; 12 to 912; and so on.

Count by 10's from 0 to 100; 0 to 300; 0 to 500; 500 to 1000.

13. Have the pupils name and write down all numbers from 1 to 100 as indicated in the following table:

0	10	20	30	40	50	60	70	80	90
1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99

Write the upper horizontal row first and then fill out each column.

Vary the exercise by writing the first column first and then construct the horizontal rows in succession. Let the children similarly construct the 200 table, the 300 table, and so on.

14. Review Lessons 1–8 are founded on the above outline. The teacher is urged in this connection to read the PSYCHOLOGY OF NUMBER and especially Chapters VIII and IX on *Primary Number Teaching.*

IV. Related number work. — Although all the work suggested in the foregoing outlines is related to the normal activities and experience of the child, still there is another phase of related number work that should be carefully thought out and systematically developed by the primary teacher, namely, that in which number is distinctly related to the various occupations of the schoolroom. Its purpose is the development of the number sense rather than acquiring information or facility in number manipulation.

It aids in laying a basis for future work, tends to secure exactness, and holds the child's interest.

It may be grouped under four headings:

1. In connection with the school administration.

Thus a pupil who is selected to pass pencils to his row of six pupils, counts out the number he needs, or he is given four and finds that he is two short, or eight and finds that he has two too many.

2.* In connection with the making of things, — involving length, surface, weight, size, bulk. An instance of this is given, page xiii, § 11.

3.* In connection with other subject matter, especially science.

4. In connection with number games, — involving guessing, comparison, etc.

* "One Year's Outlines of Work in First Primary Grades" by Flora J. Cooke of the Chicago Normal School is suggestive.

SUGGESTIVE LESSONS

I. Counting

See Suggestion under Counting, p. xi. (b.)

CLASS. Six pupils, Willie, Charlie, Frank, Maud, Edna, Edith.

TEACHER. Class, we shall have a talk to-day about counting chairs, pencils, and other things. Charlie, which is the tallest pupil in the class? Edith is.

TEACHER. Which is the smallest boy, Edna? Willie is.

TEACHER. Is this pointer equal to Willie's height, Frank? I can't tell.

TEACHER. How may we find out, Maud? By putting them together.

TEACHER. Do so, Maud, and tell me which is the taller. The pointer.

TEACHER. Here are two piles of blocks; which has the most, Willie? That one.

TEACHER. Class, how shall we find out how much larger it is? Put the blocks of each pile on top of one another, and see which is the higher pile.

TEACHER. Charlie, hold this apple for me. How many apples has Charlie, Edith? One.

TEACHER. Edna, hold this one. How many has Edna, Frank? One.

TEACHER. Charlie, give yours to Edna. How many has Edna now, Willie? One apple and one apple.

TEACHER. How many pairs of shoes have Willie and Charlie on their feet, Maud? One pair and one pair.

TEACHER. We shall get some chairs now, and let you sit down. Willie, get a chair and sit at this side of the table. Charlie, get chairs for Frank and yourself to sit at that end. How many chairs must Charlie bring, Edith? One chair and one chair.

TEACHER. Frank will bring over one and one chairs for all the girls to sit at the side? That will not be enough.

TEACHER. Why, Frank? There are more girls than that.

TEACHER. Class, how many girls are there? One and one and one.

TEACHER. How many chairs shall Frank bring, then, Maud? One and one and one.

TEACHER. How many thumbs at this end of the table, Willie? One and one.

TEACHER. Wouldn't you like a shorter way of naming the one and one, class? Yes.

TEACHER. Well, we name the one and one, *two*. Frank, how many eyes have you? Two.

TEACHER. How many eyes have Charlie and Frank, Maud? Two eyes and two eyes.

TEACHER. How many cents have I in this hand, Edna? Two.

TEACHER. In this one, Edith? Two.

TEACHER. In both, Maud? Two two-cents.

TEACHER. How many girls are there, Frank? One and one and one.

TEACHER. Edith, you move your chair and sit behind Edna and Maud. Willie, tell me in another way how many girls there are? Two and one.

TEACHER. Putting Edith first, how many girls are there, Charlie? One and two.

TEACHER. Willie, you sit at this end with Charlie and Frank. How many pairs of shoes have the boys, Edna? Two pairs and one pair.

TEACHER. I will now tell you a shorter name for the two and one. We call the two and one, *three*. How many boys in our class, Edith? Three.

TEACHER. How many boys and girls in our class, Maud? Three boys and three girls.

TEACHER. How many three-pupils in the class, Charlie? Two three-pupils.

TEACHER. Willie, count the girls, beginning with Edith. One, two, three.

TEACHER. Beginning with Edna, Frank. One, two, three.

TEACHER. I want a boy and a girl to sit on each side of the desk. How many on all sides, Maud? Three twos.

TEACHER. Charlie, count the pairs of shoes in the class. One two-pairs, two two-pairs, three two-pairs.

TEACHER. Frank and Maud, please move, and sit behind Willie and Edna. How many chairs at this end of the table, Edith? Two chairs and two chairs.

TEACHER. How many ears at this end, Charlie? Two two-ears and two two-ears.

TEACHER. Frank, move in front with Willie and Edna. Tell me in another way, how many chairs at this end, Edith. Three and one.

TEACHER. Another way, Maud. One and three.

TEACHER. A shorter way of saying this: two and two is *four*. How many hands have Charlie and Edith, Willie? Four.

TEACHER. Count the slates at this end of the table, Charlie, beginning with Edna's. One, two, three, four.

TEACHER. Beginning with Maud's, count the pencils, Frank. One, two, three, four.

TEACHER. How many pupils in our class, Charlie? Four and two.

TEACHER. How many dresses in our class, Willie? Three.

TEACHER. How many coats? Three.

TEACHER. How many suits of clothes? Three and three, or two threes.

TEACHER. Class, count the fingers you have on one hand, leaving out the thumb. One, two, three, four.

TEACHER. Count them on the other hand, beginning with the little finger. One, two, three, four.

TEACHER. Counting the thumb with the four fingers, how many in all, Edna? Four and one.

TEACHER. Putting your hands together, finger to finger and thumb to thumb, how many on both hands, Maud? Four twos and one two.

TEACHER. Four and one is called *five*.

(Give exercises on five, and then give the name *six*, etc.).

II. Measuring

(Lesson in Number given to first grade pupils)

The children are rejoicing in the possession of their new books, slates, and, above all, rulers. First grade pupils always want rulers, probably because they see them in use in the higher grades. The children come with brand new foot rulers, joy in their hearts and on their faces; for the teacher has told them that to-day they are to have their first lesson in measuring, and therefore will have a chance to use their treasures. The teacher has provided many different colored slips of paper, varying in length from one foot to six feet (no inches used to-day), which the children are to measure; also long slips of paper, tape, or ribbon rolled up into a ball from which different lengths can be cut. "Now, children, we shall measure so many things to-day, all these bright pieces of paper, our aprons, and desks, and we want to see how tall the littlest girl is. Who is the littlest girl, do you think?" (Class unanimous in favor of Violet.) "Very well; we will measure Violet, and I think some one had better measure me. I want to know how tall I am." (Hands wave frantically in the air.) "But first we must know how long our rulers are; hold them up straight in front of you to see if they are all the same length." (Cries of Yes, yes.) "Well, how long is that, Katie?" (Katie does not know.) "Charlie, do you know?" "Yes, it's one foot." "Right, Charlie. Now children, how long is each ruler?" "One foot." "Now let us measure this pretty slip of blue paper first." (Ethel measures and finds it to be one foot.) "This piece." (Hazel measures and finds it to be one foot.) "Surely we have some longer pieces. Who is a good enough guesser to find me a piece about two feet long, a piece twice as long as the ruler?" (Charlie holds up a piece.) "Well, Charlie, measure it and let us see if you guessed right." (Children anxiously watch the measuring.) "Was he right, children?" (Cries of Yes, yes.) "How long is it?" "Two feet." "Now I shall give each one of you a slip on your desk; let me see who can measure the most carefully." (During the few moments that this measuring is going on, the teacher passes quickly from child to child in order to see that each one understands thoroughly what he is doing, questions here and there regarding the color of the paper, comparing the piece on one desk in color and length to that on another desk, etc., etc.) "I see you all understand that very well indeed.

"Now I believe you can measure well enough to see how tall I am." (Cries of Oh yes, we can, we can.) "Well, I am going to choose a nice soft ruler and have some quiet child measure me." (Children try to look decorous.) "Well, George, you try." (George carefully measures the teacher's height, while class looks on in breathless interest.) "Well, Katie, how tall am I?" "Please, I counted four feet." "Hazel?" "I counted five feet." (Most of the class answer five feet.) "Well, George, try again and then tell me." After another careful measurement the class decide that the teacher is five feet and a "little bit more." "Very well, we shall not say anything about this *little bit more* to-day; some other day we shall talk about that; we will say that I am five feet. Now let us measure Violet; Mary, you try." Violet is measured and found to be four feet. Similarly the tallest boy is measured, Hazel's beautiful golden hair, the ribbon that ties it, the teacher's apron, etc., etc. (All this measuring is done by repeating the unit of measurement one foot; it may be a foot of soft ribbon or a slip of paper or the ruler, but it is the same unit all the way through.)

"Now, children, we shall have some cutting and measuring, too." (Holding up and unwinding the ball of colored paper.) "I want some one to come and cut off exactly a foot." (John measures a foot very carefully and as carefully cuts it off.) "Give that to Mary; she wants it for a sash for her doll. Is that enough, Mary?" (Mary answers No, so John cuts her two feet more.) "Now, children, how many feet has Mary altogether?" "She has three feet." "How many did she have first? And then how many? How many does that make? Very well, I want some one to make a picture on the blackboard to show how many feet of ribbon or paper Mary has." (Some child comes to the blackboard and draws something like this: | | |.) "That is very well, but sometimes we just make little dots like this" (making three dots on the blackboard, thus). "Now, Katie, come and show us with dots how many feet of ribbon Mary has. Let us give Joe some ribbon now for the tail of his kite; cut him three feet, Ethel." (Ethel cuts three feet, measuring with ruler.) "He says that is not enough, Ethel; give him two feet more. How much has he now, children?" Nearly every child will answer five; those who do not know may count. Teacher may drill by getting Joe to hold the three pieces in one hand, the two in the other, by making three colored dots and two white ones, thus , or by drawing a line between them, thus . Many little devices will present themselves to the mind of the teacher.

She, too, will learn by *doing*. It is better not to confine oneself to the combinations of any particular number during the first lessons, and it may be well not to have any addition at all, but simply the measurements. At any rate, no effort should be made at this early stage to memorize the combinations. In a similar way may the yard and the inch unit of measurement be introduced. This lesson is spoken of as the first lesson. Much has been gained if during this time the child has learned to measure with the units of measurement — the inch, the foot, and the yard — and got an idea of the *use* of *Number*.

III. Counting and Measuring

Suggestions for teaching the relation of 3 to 2 and 4, 5 to 4 and 6, 7 to 6 and 8, etc.

After the pupil has a good working idea of 2, and has been drilled in constructive exercises in twos and groups of twos, he will have a fair idea of four, as two twos, but to reach a complete idea of four the pupil must pass through the number three, *i.e.* he must learn 3 as 1 more than 2, and 1 less than 4. Similar remarks apply to 5, 7, and 9.

To teach 3, or 5, or 7, etc.

Give constructive exercises in which the numbers 2, or 4, or 6, as the case may be, are prominent, but in which the ideas of 3, or 5, or 7, are present. *E.g.* with these splints (6) construct two triangles, and then, with the same number of splints, make as many pickets as possible. Having done so, question the class as to the number of splints it requires to make a triangle, viz. two and one. How many pickets were made? Two and one. Similarly treat 5 in its relation to 4, etc.

Many such constructive exercises will show the relation of three to two, viz. as one more than two, or two and one; now, to show its relation to 4, construct a square with these splints (4). How many splints did you use? Two twos or two and two? Construct another with these (3). Pupils cannot do it. It takes 2 twos to make a square. They have 1 less than 2 twos, or two and 1, as before.

Having given many constructive exercises on three in this way, with splints, blocks, measures, etc., the name three may be given as a more convenient way of saying two and one, and one less than two twos (the expression two twos being used as the name four has not yet been given).

The name three having been given, drill should be given in constructive exercises in which threes and groups of threes are prominent, and four should now be taught as 3 and 1, and the name four given.

When the pupil knows 3 thoroughly, he really knows 6 as 2 threes, and as he knows 4 also, the intermediate number 5 may be taught as 3 has been.

After plenty of drill with different units of measure and groups of units of measure, the number-picture for 3 ⁚• may be given, in which the dots may represent any unit of measure, and the symbol, 3, may now be introduced in association with its number-picture, and this will serve to impress both idea and symbol on the mind.

IV. The Tens

"Who was it came in late this morning, John, and spoiled our nice clean record?" John being the culprit hangs his head and says nothing. "Can any one tell me how late John was?" (Various answers are given; the teacher, however, accepts the "few minutes" answer, as the five minute is the unit of measure desired for this lesson.) "Well, some of you are almost right, but I will tell you exactly: he was just five minutes late; but how do you think I knew, Katie?" "I saw you look at the clock." "Let us all look at the clock." (Holding up clock or paper clock face with hands that turn easily, see how many marks it has to tell time by.) Let us begin at one and count. The class counts from I to XII, it being understood, of course, that the children are not expected to learn these Roman numerals, excepting, perhaps, I, II, III, IIII, and possibly X; that is, no special effort should be made to learn them.

"Very well; I see you can count to twelve; now what do you call these little things that *point to the marks* so that we may know which one to take? Well, this big hand is the one that told me about

John's being five minutes late. Now you see it is just nine o'clock" (moving hands to that time). "Who can move this big hand so that it will be five minutes later than nine?" (Katie moves it a five-minute space.) "Very well, move it five minutes more, Ethel; five minutes more, Charlie; five more, John. I see you all know that from one big mark to another makes five minutes. Now I want you all to count while I move the big hand, to see if you can tell how many 5's I go over." (Moves hand slowly from XII to I; children count as one five from I to II; children count two 5's from II to IV; children count three 5's, etc., etc.) The teacher drills well on counting the 5's before touching upon the hour or the minute unit of measurement, and before counting the 10's. The counting (10's and by 10's) from a clock face may be taken up somewhat as follows:

The teacher has a paper clock face; the children know that from one big mark (called *big* to distinguish it from the little minute mark which is to be taken up later) to another there is one 5; *e.g.* "If I move this minute hand from XII to I, how many 5's, children?" "One five." "If I move it from I to II?" "Two 5's." "Five minutes and five minutes. Make a picture of that in dots, Charlie." (These pictures have become familiar to them in previous lessons, so Charlie at once makes  and the class at once recognizes it as 10.) "Very well, indeed; now I shall put a little red mark at this ten-minute place" (making red stroke at II on the paper clock face), "so as not to lose it, for we want to count 10's now if we can. Dora, come and move this big hand ten minutes more; how many 5's must you have, Dora?" (Dora moves the hand from II to IIII, and the teacher puts another red stroke to indicate 10 minutes more, and so on until the six tens are each indicated by the red stroke. The class then counts the 10's from the one first marked to the one last marked, from the last to the first, and in every conceivable way, understanding all the time that any *two five minute* spaces, no matter what their position as regards the big marks, make ten minutes. Then they count from the clock face, from the paper face with the strokes erased, etc., etc. In this counting by 10's, ten-cent pieces may be used to good advantage.)

In introducing the *minute* unit of measurement, some such plan as the following may be adopted: "Now, children, here is our face again. We have been talking all the time about these big marks" (pointing to XII, I, II, III, etc.). "How many are there?" ("Twelve, twelve.") "Oh, I see you all know that; well, now I want you to put on your spectacles and see if you can find me any little marks. Well, Dora, show them to me. Now, count how many there are from I to II." Dora counts five. "Now, children, what does each of these little marks show?" "One minute." These minute marks may have been introduced in the lesson on the five-minute unit of measurement, but as it is better at first to deal with but one unit of measurement at a time, it is supposed that if there has been any mention of these minute marks, it was merely a casual mention; the time has now come for giving attention to them.

"Now, children" (taking up the clock face with the 10 minute spaces indicated by the red strokes), "let us see if we were right when we marked these ten minutes; count the minute marks." Children count the minute marks in each 10 minute space, and agree that the strokes were correctly placed. "Now, let us count 10's once all the way round." (Class counts, "one ten, two tens, three tens, four tens, five tens, six tens, or *sixty*.") "Very well; now the minute hand is going on a journey, but I am going to make him run so fast that he will have to rest quite often; when he stops to rest, you call out the name of the station" (turns hand quickly from XII to II). (Class calls out, "One 10.") "That is right; now this station?" (turning hand from II to IIII). (Class calls Two 10's.) "Good; but can any one tell me what other name this station has; two tens are how many?" Perhaps some child can tell. If not, the teacher counts with them, two 10's or twenty minutes, three 10's or 30 minutes, four 10's or 40 minutes, five 10's or 50 minutes, six 10's or 60 minutes. "And what do you think, children, this last station has another name yet; it has three names. It has the same name as the little hand; now you know." (Some one in the class will say *hour*.) "That is good; now let us say all together the three names of this station, "*Six tens* or *sixty minutes* or *one hour*."

Of course, much drill will be necessary and much variety in the modes of presentation. The dollar may be taught in the same way with ten-cent pieces as unit of measurement, *e.g.* one ten, two tens, or 20 cents, three tens or 30 cents . . . ten tens or 100 cents or one dollar. So also with metric units. After a thorough drill in lessons of this kind, there will be very little difficulty in such lessons as are indicated in "Suggestion" III, 13. Practical questions are, of course, given as soon as possible, *e.g.* If I am five feet tall and Violet is four feet, how much taller am I than Violet? Katie's ribbon is six feet, Violet's piece is two feet. How many times can Violet's be cut out of Katie's? Mary has 20 cents; how many oranges can she buy if one cost 5 cents? How many minutes in one hour? in one-half hour? How many ten-cent pieces in fifty cents? How many dollars in 6 ten-dollar bills? etc.

V. Constructive Exercises

The importance of constructive exercises in teaching arithmetic will be evident if we keep in view that number is the instrument of measurement, and as such contains three factors; viz. the vague whole of quantity to be measured, the unit of measurement, and the times of its repetition to measure or equal the whole quantity.

This necessitates from the very first exercises in parting (breaking up or measuring off into units of measure) and wholing (putting together or relating these units to equal the whole).

Hence, for a short time the beginner may be exercised in constructive acts without formal drill on the how-many idea. For example: breaking up a large cube, composed of, say, three small blocks, into its parts, and putting them together again. Breaking up and forming triangles, pickets, squares, lines, etc.

Having spent some time in such work, the numbers may be introduced gradually; thus, one and one splint make one picket, one picket and one picket, two pickets, two splints and one splint make a triangle, two twos make a square, etc. Thus the need for a certain number in each case is shown, and children see the use and value of number. Such exercises as, Construct a cube with 8 blocks, or rectangular "bricks" of given dimensions, according to the advancement of the child, also show the value of number.

Then, in addition and subtraction, such exercises as: The edge of a slate is measured by the parts 5 inches and 6 inches. How long is the slate?

A pail is measured by a pint measure, a 2-pint measure, and an 8-pint measure. How many pints does the pail hold? etc. Let the children take the actual units and do the measuring, for a time at least, until the operation is thoroughly familiar.

In multiplication and division:

How many square inches in a rectangle which is 9 in. long and 3 in. wide? Construct such a rectangle, or rather let the class construct it, and, in fact, whatever new idea you are introducing, do it by use of constructive exercises, and thus let the child actually see the meaning and use of the different operations. Now, let the inch stand for foot. What is the problem? The result?

How many cords of wood in a pile 16 ft. long, 8 ft. high, and 4 ft. wide? Construct such a pile, using cubic inches to represent cubic feet.

How many yards of carpet, or how many rolls of paper, will be required for a room? Use strips of colored paper or pasteboard to represent strips of carpet or paper, and place these side by side on a larger piece of cardboard which represents the floor or wall of the room.

VI. The Two Measurements

First by simple constructive exercises show that one measurement carries with it a related one.

Measure a 6-inch line by a 2-inch measure, then by a 3-inch measure, and from the class get their result in the form that 3 times 2 inches equals 6 inches, and 2 times 3 inches equals 6 inches, and then in the form 3 times 2 in. = 2 times 3 in. = 6 in., or 2×3 in. $= 3 \times 2$ in. $= 6$ in. Show with dots.

Then with blocks, cubic inches, 3×2 cu. in. $= 2 \times 3$ cu. in. $= 6$ cu. in. Use many units of measure until you lead the class to see that 3×2 units $= 2 \times 3$ units $= 6$ units, whatever unit of measure may be used.

Similarly with other sets of factors, as $4 \times 8 = 8 \times 4 = 32$, etc.

Having thus shown that this "law of commutation" is true, simple problems may be worked out, showing how it is true, and the use of this essential principle.

Give such a problem as:

I. A rectangular piece of board (actually present the board to the class) is 6 in. wide and 8 in. long. How many square inches does the surface measure? (Cover this board with square inches made of cardboard.)

1	2	3	4	5	6	7	8
2							
3							
4							
5							
6							

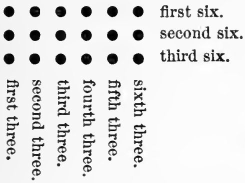
Using horizontal row as unit of measure, what is the number?

Using a vertical row as unit of measure, what is the number?

It follows that 8×6 sq. in. $= 6 \times 8$ sq. in.

This is probably the simplest application of the law of commutation.

II. Among 3 boys a number of pennies are divided, giving 6 to each. How many pennies were there?



A whole of 3 sixes or 6 threes.

Let the dots on the board represent the pennies. I may divide these pennies in one of two ways, and it is immaterial which way I divide them.

(*a*) I may give the first boy his whole share at once, then the second boy, etc. In that case I should have 6 cents taken 3 times $= 3 \times 6$ cents $= 18$ cents.

(*b*) Again, I may give a cent to the first boy, another to the second, and another to the third, making a whole of 3 cents. This may be repeated 6 times, making in all 6 times 3 cents $= 18$ cents.

The operations are identical, but viewed from two standpoints.

VII. Fractions

1. Let pupils measure a foot line with a 6 in., 4 in., 3 in., 2 in., 1 in., and $\frac{1}{2}$ in. measure. Hence, have pupils draw 6 lines, each a foot long, and mark them off with these units. How many equal parts in the first line? Two. One of these is one out of how many? How many equal parts in the second line? Three. One part is one out of how many? Two are two out of how many? etc., etc. This is how we express *one* out of *two*: $\frac{1}{2}$ ft. Ask class to show how to express 1 out of 3, 4, 5, . . . 100, x.

2. How many equal parts in the third line? Four. Show how to express one of these. $\frac{1}{4}$. Now, we wish to express 2 out of 4, instead of 1 out of 4; how shall we do so? By putting 2 in place of the 1. $\frac{2}{4}$. Express 3 out of 4, 4 out of 4, 7 out of 12, 8 out of 24, etc.

3. From this, draw from the class that 1 part of the first line is $\frac{1}{2}$ of the whole, 2 parts, $\frac{2}{2}$, or the whole line; 1 part of the second line is $\frac{1}{3}$; 2 parts, $\frac{2}{3}$; 3 parts, $\frac{3}{3}$, or the whole line; etc., etc. Finally, $\frac{2}{2}=\frac{3}{3}=\frac{4}{4}=\frac{6}{6}=\frac{12}{12}=\frac{24}{24}$; $\frac{1}{2}=\frac{2}{4}=\frac{3}{6}=\frac{6}{12}=\frac{12}{24}$, and $\frac{1}{3}=\frac{4}{12}=\frac{8}{24}$, etc. From many other examples, lead pupils to tell you that

$$\frac{1}{1}=\frac{2}{2}=\frac{3}{3}=\frac{4}{4}=\frac{5}{5}\ \cdots\ =\frac{n}{n};$$

$\frac{1}{4}=\frac{2}{8}=\frac{3}{12}=\frac{4}{16}=\ \ldots$ ad inf.; etc., etc.

4. The meaning of the numerator and denominator may now be impressed more strongly on the pupils' minds. Thus: What is the name of each part in the fourth line? A sixth. Express 1 part, 3 parts, 6 parts. $\frac{1}{6}$, $\frac{3}{6}$, $\frac{6}{6}$. Express 4 parts of the last line. $\frac{4}{24}$, etc. What does the denominator of each fraction tell us? The name of the part and the size of it. Again, in the fifth line, what is the name of each part? A twelfth. What is the number of such parts in the whole line? 12. How many such parts in $\frac{1}{2}$ the line? 6. Express the 6 parts? $\frac{6}{12}$. What does the 12 tell? The name. What does the nu-

merator tell? The number of parts that make up the quantity. Give many other examples.

5. Give a pupil a strip of cardboard and ask him to cut off a piece of it, equal to one of the parts in the third line. How long is this strip of cardboard? $\frac{1}{4}$ ft. Use it to measure each of these lines that I have drawn (9 in., 1 ft., $1\frac{1}{4}$ ft., $2\frac{1}{2}$ ft., etc., any length whatever). How many parts in each? 3, 4, 5, 10, etc. What is the name of each part? $\frac{1}{4}$ ft. How long, then, is the first line? $\frac{3}{4}$ ft. The second? $\frac{4}{4}$ ft. The third? $\frac{5}{4}$ ft. The fourth? $\frac{10}{4}$ ft., etc. Use many other examples.

NOTE.—The five points developed above have been, for brevity, developed by means of lines only. Teacher should use many other units, as $\frac{1}{10}$ of a dollar, $\frac{1}{12}$ of an hour, etc., etc.; *e.g.* show that 40 cents is 4 dimes or $\frac{4}{10}$ \$; \$1.30 is 13 dimes or $\frac{13}{10}$ \$, and so on. Fractions are thus simply another way of expressing numbers that pupils have handled from the first.

VIII. Number = The Tool of Measurement

TEACHER. To-day, boys and girls, let us have a little talk on buying and selling, measuring and counting, etc., with a view to finding out why such processes are carried on. For example, why do people in buying butter measure (weigh) it? And why is it dear at one season and cheap at another?

PUPIL. Because butter is got only by hard work, and because it is more plentiful at one time than another.

TEACHER. How is butter generally sold?

PUPIL. By the pound.

TEACHER. Well, how do we generally buy butter?

PUPIL. With money.

TEACHER. When people are selling butter, are they very particular about weighing it (whether they are giving more than a pound or not)?

PUPIL. Yes.

TEACHER. When people are buying butter do they always like to get it as cheap as possible, or will a few cents more make any difference?

PUPIL. Yes.

TEACHER. Well, let us consider the question from the buyers' and the sellers' standpoint, and discover what makes a transaction a fair one. First, why is the farmer so particular in weighing his butter?

PUPIL. Because it is got only by hard work.

TEACHER. Now let us consider what it has cost the farmer to produce butter. Name as many things as you can that go to make up the cost.

PUPIL. He must buy the cows, pay for their feed and attendance, churn the butter, bring it to market, etc.

TEACHER. Well, then, do you think it right that he should receive some remuneration for his labor and expense by charging for the butter?

PUPIL. Certainly.

TEACHER. Well, why is the one who buys the butter so anxious to get his right weight and also anxious to buy as cheaply as possible?

PUPIL. Because he has to work hard for his money, and desires therefore to make it go as far as possible.

TEACHER. Therefore, in fairness both to buyer and seller we must measure (weigh), *i.e.* find out the exact quantity of butter and of money.

TEACHER. Now, let us suppose that I am a buyer. I wish to buy some eggs, and John Smith (one of the pupils) has this basket of eggs to sell (teacher hands John Smith a basket containing say a dozen blocks, representing eggs). I look at the eggs and I see that they are nice eggs, and I wish to have them. What must I do?

PUPIL. You will ask the price of them.

TEACHER. Well, John, what are you asking for your eggs?

JOHN. 16¢ a dozen.

TEACHER. What shall I do now?

PUPIL. If you think that is a reasonable price, you will buy them.

TEACHER. Is it right for John to ask me anything for them? Why?

PUPIL. Yes. Because John had to buy the hens, pay for their feed, take care of them, collect the eggs, etc.

TEACHER. Well then, is it right for me to be so careful about getting nice eggs, and at the same time cheap ones, when John has been put to so much expense and trouble? Why?

PUPIL. Yes. Because you had to work hard for your money, and if you were not careful with it, you would not have enough for all your needs.

TEACHER. Well, John, as long as it is a fair bargain, here is your money for the eggs. (Teacher lays a pile of pennies on John's desk and takes the eggs.)

JOHN. Very well, there is just one dozen in the basket.

TEACHER. Will John at once put the money in his pocket, and will I take the eggs off home?

PUPIL. No; I think John will see if you gave him enough money, and you will see if you have exactly a dozen eggs.

TEACHER. Is this done because John may think I am dishonest, or wish to cheat him if I could, and because I think John is dishonest?

PUPIL. No; but because people sometimes make mistakes unintentionally.

TEACHER. Well, let us consider this pile of John's money first, and see how John is going to find out whether he has the right money or not. What is all he knows about it as it stands?

PUPIL. He knows that it is a pile of coins?

TEACHER. Does he or do any of you know exactly how many there are?

PUPIL. No.

TEACHER. How shall we find out?

PUPIL. Count the pennies.

Teacher. Can we count them just as they lie in a pile?

Pupil. No.

Teacher. What must be done with them?

Pupil. They must be separated into parts.

Teacher. (Separates them.) They are separated now. (If pupils can count by twos, fours, etc., they may be separated in different ways.) How many parts are there?

Pupil. We cannot tell except by counting the *number* of parts.

Teacher. All of you see if John counts them right. How many, John?

John. Eight parts of 2 cents each (or 16 parts of 1¢ each, 4 parts of 4¢ each, as the case may be), or 16 cents.

Teacher. Then, I made no mistake. Now, about my eggs; do any of you know for sure how many eggs there are in this basket?

Pupil. No.

Teacher. How can I make sure?

Pupil. By separating into parts and counting the parts.

Teacher. Do so for me (one pupil is asked to find out). How many?

Pupil. Six twos or 12 eggs.

Teacher. Into what size parts was the basket of eggs divided?

Pupil. Twos.

TEACHER. What was the number of twos?

PUPIL. Six.

TEACHER. Let us go back a little; in the case of the eggs and the money, what did we start with?

PUPIL. A pile (quantity) of money in one case and a pile (or quantity) of eggs in the other.

TEACHER. What did we want to find?

PUPIL. The exact value or size of the pile.

TEACHER. How did we do this?

PUPIL. By separating into known parts and finding the *number* of parts.

TEACHER. Couldn't we have found out without separating into parts of some kind?

PUPIL. No.

TEACHER. Well, after we had separated into parts (ones, or twos, or threes), could we not tell, without finding out the number of parts?

PUPIL. No.

TEACHER. Let us now see if we do the same in all cases. Suppose this stick that I have is a moulding I bought for framing a small picture, and I wish to know how much moulding I have; can any of you tell me exactly?

PUPIL. No; but I think I could guess pretty near it.

TEACHER. Yes; but mere guessing would not be fair either to buyer or seller; we found that out in the case of butter and eggs. How can I find out exactly?

PUPIL. By measuring it.

TEACHER. What shall I use to measure it?

PUPIL. One-inch, two-inch, six-inch, foot, or any length-measure you wish.

TEACHER. Well, it would take too long with a 1-inch measure; we shall use the 6-inch. How am I to measure it, now that I have chosen what to measure with?

PUPIL. Apply the 6-inch measure, and mark off as many as there are.

TEACHER. Well, Frank, you do so for me. What have we done so far?

PUPIL. We have separated it into parts.

TEACHER. Do we know the measure of the moulding yet? What is to be done yet?

PUPIL. No, the number of parts must be found by counting. There are six 6-inch parts, or the moulding is 3 feet long.

TEACHER. Now tell me what we started with in the case of the moulding and the successive steps we went through?

PUPIL. We started with an unknown length or quantity, divided it into parts, and found the number of the parts.

TEACHER. Did we do exactly the same thing as in each of the other cases?

PUPIL. Yes.

TEACHER. Similarly, if we wish to find the number of cords in a pile of wood, or the number of cattle in a field; in fact, if we wish to get a right idea of any quantity, what do we always start with?

PUPIL. We always start with the quantity and try to get an exact idea of it.

TEACHER. In order to do this what must be done?

PUPIL. We must choose some part or measure by which to measure the whole, and break up the whole into as many of these parts as it contains.

TEACHER. What still remains to be done before the quantity becomes known definitely?

PUPIL. The *number* of parts must be found by counting.

TEACHER. I may now tell you that the part we have used in each case to measure (to get a correct idea of) the whole is called the *unit of measure.* What unit of measure might we use to measure a pail of milk? A quantity of potatoes? etc.

PUPIL. Pint, 2-pint, or quart. Peck, bushel, etc.

TEACHER. But even after we had separated the whole into minor parts by use of the unit of measure, what in each case had to be done before we knew the exact measurement of the quantity we desired to measure?

PUPIL. We had to find the *number* of parts.

TEACHER. Well, then, what might we say number is?

PUPIL. It is that which tells us how many parts or "units" make up the whole quantity.

TEACHER. Could we find exactly *how much* a quantity is without finding *how many* units (parts) make it up?

PUPIL. No.

TEACHER. What do we call this how many?

PUPIL. Number.

TEACHER. For that reason we say briefly that *number* is the instrument we use in order to measure quantities or is "*the tool of measurement.*"

IX. Multiplication.

A LESSON LEADING TO THE MULTIPLICATION TABLE.

TEACHER. Count the number of hands there are in this class.

PUPIL. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

TEACHER. Find out by adding by twos.

PUPIL. Two and two are four; four and two are six, etc.

TEACHER. It may be done more quickly still by counting by twos.

PUPIL. Two, four, six, etc.

TEACHER. Count the pupils by **twos**, and tell me how many *times* there are two hands in the class.

PUPIL. Two, four, six. Six *times* two hands.

TEACHER. I am going to make a large square of these small squares, and I want you to tell me how many small ones there are. How many in each row?

PUPIL. Nine squares. Three in each row.

TEACHER. Count them by thre

PUPIL. Three, six, nine.

TEACHER. How many *times* have we three small squares to make one large square?

PUPIL. Three *times*.

TEACHER. Here is a cardboard oblong and a 2-inch measure for each of you. I want you to mark off the length and width in units of 2 inches, and find how many times the unit is repeated for each.

PUPIL. Length, 5 times 2 inches; width, 3 times 2 inches.

TEACHER. Add up the length and width, and find out the dimensions of the oblong.

PUPIL. Length, 10 inches; width, 6 inches.

TEACHER. Then what is 5 times 2 inches? What is 6 inches equal to?

PUPIL. 5 times 2 inches = 10 inches; 6 inches = 3 times 2 inches.

TEACHER. With these blocks I want you all to lay two rows of blocks from one end of your slate to the other, and then tell me how many twos you had to place to do so.

PUPIL. Eight twos.

TEACHER. Now find out how much eight times two is.

PUPIL. Eight times two blocks is 16 blocks.

TEACHER. Now here is a stick 16 inches long.

What unit shall we use to find how many 2-inches in the length of it?

PUPIL. Two-inch measure.

TEACHER. Now measure it and tell me how many times 2 inches make 16 inches.

PUPIL. Eight times 2 inches make 16 inches.

TEACHER. How much would 8 times 2 blocks be?

PUPIL. Eight times 2 blocks is 16 blocks.

TEACHER. Eight times $2? 2 apples? 2 anything?

PUPIL. Sixteen.

TEACHER. You found out what 3 times 2 inches makes; what would 3 times $2 make? 3 times 2 lb.? 3 times 2 anything?

PUPIL. Six dollars, six pounds, etc.

TEACHER. Here are some additions I would like you all to do. What shall we say each 2 stands for to-day?

PUPIL. Pounds. $$\left\{\begin{array}{ccccc} 2 & 2 & 2 & 2 & \\ \underline{2} & 2 & 2 & 2 & \\ & \underline{2} & 2 & 2 & \text{etc.} \\ & & \underline{2} & 2 & \\ & & & \underline{2} & \end{array}\right\}$$ (to twelve twos).

TEACHER. Now I would like to know your answers.

PUPIL. 4, 6, 8, 10, etc., pounds.

TEACHER. What do we call the numbers we add?

PUPIL. Addends.

TEACHER: Can you tell me anything peculiar about the addends in these questions?

PUPIL. They are all twos.

TEACHER. How many twos in the first, second, third, etc., questions?

PUPIL. 2, 3, 4, etc., twos.

TEACHER. When you were adding the twos did you think of *how many* addends there were?

PUPIL. No.

TEACHER. What made 4 in the first question?

PUPIL. Two and two.

TEACHER. But tell me the same thing in another way.

PUPIL. Two times two.

TEACHER. Now what do you learn from second question? third? etc.

PUPIL. Three times 2 lb. make 6 lb., 4 times 2 lb. make 8 lb., etc.

TEACHER. How did you get the numbers 3, 4, etc.?

PUPIL. By counting the addends.

TEACHER. Did you do that when adding?

PUPIL. No.

TEACHER. Then you see we have started something different from adding.

Now write out on your slates what we learn from each of the above questions.

PUPIL. $\left\{\begin{array}{c}\text{2 times 2 makes 4,}\\ \text{3 times 2 makes 6,}\\ \text{4 times 2 makes 8,}\\ \text{etc.}\end{array}\right\}$

Teacher. How many times did you write the words "times" and "makes"?

Pupil. Eleven.

Teacher. Now I will show you a shorter way of writing it, as that takes too long. For "times" we use the sign "×", and for "makes" the sign "=," which means equals. Then we have

$$2 \times 2 = 4,$$
$$3 \times 2 = 6,$$
$$4 \times 2 = 8,$$
etc.

Teacher. This is what we call the multiplication table for two times, and I would like you all to learn it for me, because you see how handy it is to say that 8 times 2 anything is 16, instead of adding up 8 twos. I will show you how handy it is. We will build up an oblong block of small cubic inch blocks, and I would like you to find out, when it is built, how many small blocks we have used, without counting or adding. (Size 5″ high, 2″ wide, 2″ thick.) How will you do it?

Pupil. By finding how many twos in it.

Teacher. How many layers have we?

Pupil. Five.

Teacher. How many in each layer?

Pupil. Four.

Teacher. Yes; but how many twos is that?

Pupil. Two twos.

TEACHER. Well, how many two-twos shall we have in five layers?

PUPIL. Five two-twos.

TEACHER. How many twos will that make?

PUPIL. Ten twos.

TEACHER. Now, what is ten twos?

PUPIL. Twenty blocks, 20 cu. in.

X. Reduction

The following lesson is suggested to precede Lesson 23, questions 1, 2, 7, 8. Establish in the mind of the children the relation between the pint and the quart by actual measurement. Let the teacher measure 3 qt. of water into a pail without the class knowing how much is put in. Ask the class individually to state how much water is in the pail. Answers will vary, thus showing the necessity for accurately measuring the quantity. Pupils will suggest the quart as the unit of measure. On counting, as the water is measured, they will get the number 3; *i.e.* there were 3 qt. in the pail. Write on the board 3 qt.

What number will you get if you measure with a pint? Measure; the pupils count 6, *i.e.* 6 pt. Write on the board 3 qt. = 6 pt. In the same way, without the class knowing how much water is put in the pail, measure 2 qt., 4 qt., etc. Let the class count the corresponding numbers and derive 2 qt. = 4 pt., 4 qt. = 8 pt., and so on.

This by actual measurement. Now express these relations without actual measurement.

5 qt. = ? pt. 6 qt. = ? pt. 8 qt. = ? pt.

? qt. = 4 pt. ? qt. = 6 pt. ? qt. = 10 pt.

and so on.

● ● ●

● ● ●

Again:

If each dot represents 1 pt., what will 2 dots represent (1 qt.)?

Count by pints (1, 2, 3, 4, 5, 6). Count by quarts (1, 2, 3). 6 pt. = 3 qt.

● ● ● ●

● ● ● ●

If these dots represent the quantity of water in the pail, each dot representing 1 pt., how much water is in the pail? (4 qt.) How many pints? (8 pt.) 4 qt. = 8 pt.

● ● ● ● ●

● ● ● ● ●

If these dots represent the quantity of water in a pail, how many pints are in the pail? (10.) How many quarts? (5.) 10 pt. = 5 qt. And so on.

Ask pupils to represent on the board the water in a pail containing, say, 4 qt.

What other measurement is indicated? (8 pt.) What is assumed about the dots?

Do the same kind of work, putting into the pail 3 qt. 1 pt., 2 qt. 1 pt., 4 qt. 1 pt., and so on. Use the dots to give facility in operation as soon as the actual measurement has been done.

It will be seen that in the above work the children start with a *whole unmeasured quantity* which they have a *motive* for measuring.

In order to measure the quantity, they select a *unit*, and while measuring count the *number* which arises out of the measurement. The unit and the number together (3 qt.) measure the *quantity*, which is now definitely known. A second measurement with a different unit gives rise, in a similar way, to 6 pt., and establishes the relation 3 qt. = 6 pt. After the process is once understood by actual measurement, the symbolic representation by means of dots enforces and gives facility in the operations. Similarly, for the more complex reductions, 3 qt. 1 pt. = 7 pt. and 7 pt. = 3 qt. 1 pt.

SUGGESTIONS

Lessons 1–8

"Suggestions to Teachers," Sections I.–IV., have special reference to these lessons.

Lesson 9

From the preceding work the children know that 2 and 3 are 5. Draw a line 15 in. long and measure one part 12 in. long. How long is the other part? Test the answers by measuring.

Draw a line 25 in. long and measure one part 3 in. long. How long is the other part? Measure.

Similarly draw and divide a line 35 in. long. A yard stick divided into inches can be used for measuring. Express the results orally and in writing on the board. Give many practical questions such as question 2.

In question 3 let the class note where the 5-min. mark is. Turn the hand through 2 minute spaces. How many more to reach the 5-min. mark? Similarly for 15 min. Turn the hand through 3 minute spaces. How many more? Similarly for 25 min.

Turn through 22 minute spaces. How many more? Continue this work until the sum equals 55 min., constantly giving the children the opportunity to make inferences.

The children will then infer that

$$62 + 3 = 65. \quad 72 + 3 = 75.$$

This work at the board should precede Lesson 1, and, in fact, all or nearly all of the succeeding lessons should be preceded by oral work on the part of the teacher with the class. Teach and use contractions from the first, and constantly intersperse the work with simple practical questions such as questions 2, 4, 7, 13.

In adding and subtracting use many different units as in questions 16, 17, and 18.

Lesson 10

Introduce this lesson by actual measurement as in Lesson 9. In question 13 let it be understood that each dot represents some unit of measure as 1 in., 1¢, 2 lb., 3 yd., and repeat the question, using different units. Thus, 5 3-yd. = 4 3-yd. + 1 3-yd., and so on.

In question 15 let the class discover that there are only four combinations that give 5.

Gradually develop the idea that the unit and the number together measure quantity. Thus, let the teacher draw on the board a line without the pupils knowing how long it is. Ask the pupils to judge of its length. Answers will vary, showing the need of a definite method of measurement. Measure with a foot measure. How many times did you measure? (4.) Thus the pupils had an *unknown quantity* to be measured and a *unit of measure.* In process of measurement they got by counting the *number* 4. Thus the quantity, which is now known to be 4 ft., is definitely measured in terms of the number 4 and the unit 1 ft. Other quantities and units may be chosen. See "Suggestions to Teachers," I., §§ 12 and 13.

Lesson 11

Questions 1, 2, 3, 10, are a preparation for subtraction. The pupils have already learned that 2 and 3 are **5** (Addition), which carries with it the idea that 2 and **3** are 5 (Subtraction). In oral drill put the questions also in the form of Lesson 12, question 19. See "Public School Arithmetic," §§ 42, 44.

In such questions as 12, 13, let the teacher place the points *without the pupils knowing* how far they are apart. Measure first with a yardstick, and again with a foot rule. In question 17 apply the same principle to the water put into the pail. As soon as it can be done intelligently suggest the more economical way of reducing without actually measuring. The placing of dots as in question 18 will assist in this. See "Suggestions," X. Reduction.

Lesson 14

Before this lesson is studied let the pupils measure different lengths, as the length of the table, and express their results thus, 1 yd. 2 ft. 6 in. Have the children read these results. This will show the necessity of the three units of length. Having done this, measure such lengths as are given in the lesson; add, and verify results by actual measurement.

Make such simple practical questions as 13–21.

Lesson 15

In this lesson and also in subsequent lessons, when necessary, use the foot ruler or clock face, and illustrate the additions as in Lesson 1.

Give many questions in subtraction, here and elsewhere, complementary to such questions as 2, 3, 4, 6, 8, 9, etc.

Thus:

Subtract:	*7	*17	26	27	6	26	26
	4	14	24	3	2	21	4

Lesson 17

Read question 1, not $2 + 2 = 4$, $4 + 2 = 6$, but 2, 4, 6; 1, 3, 6, etc.

In adding such questions as 2, the lowest number or 12 (see footnote, page 40) had better be omitted after a little practice, the pupil simply saying 14, 16.

* Read $4 + 3 = 7$; $14 + 3 = 17$.

In adding 21¢ to 13¢, think of the 2 in 21¢ as 2 dimes, and the 1 in 13¢ as 1 dime.

Lesson 18

In the operations in questions 7, 8, and 9, let the pupil fancy that he is doing addition with the sum at the top, and as he works set down the figures 3 and 1.

Lesson 19

Use such questions as 16, 17, 18, gradually to develop the idea (1) that the quantity is found by multiplying the unit by the number, (2) that the number is found by dividing the quantity by the unit, (3) that the unit is found by dividing the quantity by the number.

Lesson 30

Note that in question 1 the *sums* are found by addition. In question 2 we find that the $2 in the last column is repeated 6 times.

Thus we think of the unit $2 and the number 6, giving as their *product* $12.

For this change from addition to multiplication see the "Public School Arithmetic," § 47.

Read the sign × as *times*, thus 3 × $2 = 3 times $2.

Use the dots to develop the law of commutation, viz.: $2 \times 3 = 3 \times 2$; $4 \times 6 = 6 \times 4$, etc.

Lesson 31

Develop some parts of the multiplication tables by actual measurement with units of different lengths. Thus, cut out of cardboard 12 units of lengths, respectively, 1 in., 2 in., 3 in., ⋯ 12 in. long. Draw a line on the board and measure along this line with each unit, twice. Then, with a yardstick, measure results, and we have the table of 2. Or, again, repeat the unit 2 in. from 1 to 12 times, write the corresponding results, and by the law of commutation we have the table of 2.

Extend the table as in questions 3, 4, 7, 8, 9.

Have the class make simple practical examples, founding them on questions 11 and 12, or give them such a price list as is found on page 75, question 23.

Lesson 33

Bring out the fact that in measuring distance we have the units 1 in., 1 ft., 1 yd., and 1 mi. We measure the value of things with the units 1¢ and $1. We measure milk with the unit 1 qt., kerosene with the unit 1 gal., and so on. Hence to measure area (a different kind of quantity), we need a new unit, and this we naturally derive from the unit 1 in. Give plenty of work to precede this lesson, and let the children draw and cut out and divide simple areas.

Teach the area of an oblong somewhat after this fashion. Have the pupils draw oblongs, say 4 in.

by 3 in. Divide them into square inches. Count the number of square inches. Count again by 4 sq. in. How many (3 4 sq. in. or 12 sq. in.)? Count again by 3 sq. in. How many (4 3 sq. in. or 12 sq. in.)? Which of the three methods is most economical? (Either of the last two, *i.e.* find the area by multiplication, not by addition.) What would be the area if the oblong were 5 in. long and 3 wide? 6 in. long? 8 in. long? 5 in. long and 4 in. wide, and so on? Use other units of length (2 in., 3 in., 1 ft., 1 yd., 1 mi.).

Lesson 34

The purpose of this lesson is to prepare the way for division. Just as the preceding work in addition and subtraction has made of the two substantially *one* process, so the child should be led to think of multiplication and division as substantially *one* process. In multiplication 4 and 2 are factors of ? In division 4 and ? are factors of 8.

See "Public School Arithmetic," preface, § 2, and also §§ 60–63.

Lesson 35

Write the multiplication table of 2 on the board in a column, thus:

$$\begin{array}{rcl} 2 \times 1 \text{ in.} &=& 2 \text{ in.} \\ 2 \times 2 \text{ in.} &=& 4 \text{ in.} \\ . \quad . \quad . &=& . \quad . \\ 2 \times 12 \text{ in.} &=& 24 \text{ in.} \end{array}$$

Drill thus :

$\frac{1}{2}$ of 2 in. = ? $\frac{1}{2}$ of 4 in. = ? $\frac{1}{2}$ of 6 in. = ? and so on in any order. Also $\frac{1}{2}$ of 20 in. = ? $\frac{1}{2}$ of 200 in. = ? and so on. Illustrate, if necessary, by drawing lines 4 in., 6 in., 8 in., etc., and dividing them into two equal parts.

Similarly, drill thus :

4 in. ÷ 2 in. = ? 6 in. ÷ 3 in. = ? 8 in. ÷ 4 in. = ? and so on in any order. Also 40 in. ÷ 2 in. = ? 80 in. ÷ 4 in. = ? 80 in. ÷ 40 in. = ? and so on. Illustrate, if necessary, by cutting from cardboard strips 2 in., 3 in., 4 in., 5 in., etc., and using these lines as units to measure the lines respectively 4 in., 6 in., 8 in., etc. Drill until this is mastered in any order. Use other units instead of 1 in., as $1, 1¢, 1 lb., 1 qt., etc. Throughout this work give many practical examples. (See Lesson 34, questions 8–14.) Give also such examples as the following :

16 pt. ÷ 2 pt. = ?	How many quarts in 16 pt. ?
8 qt. ÷ 4 qt. = ?	How many gallons in 8 qt. ?
16 qt. ÷ 8 qt. = ?	How many pecks in 16 qt. ?
8 pk. ÷ 4 pk. = ?	How many bushels in 8 pk. ?
24 in. ÷ 12 in. = ?	How many feet in 24 in. ?

$\frac{1}{2}$ of 4 pt. = ? What unit of measure ? $\frac{1}{2}$ of 8 qt. = ? What unit ? $\frac{1}{2}$ of 16 qt. = ? What unit ? $\frac{1}{2}$ of 8 pk. = ? What unit ? $\frac{1}{2}$ of 24 in. = ? What unit ?

Name the odd numbers from 1 to 25. What number must be subtracted from these odd numbers to make them exactly divisible by 2 ?

It is expected that with the price list furnished in question 23, the pupils will make examples similar to questions 14, 21, 22.

Lesson 36

Correlate the work in ratio with counting and measurement. For instance, measure a 12-in. line with a 2-in. unit, a 3-in. unit, a 4-in. unit, a 6-in. unit. Count the number of measurements each time. 6 is often called the *ratio* of 12 in. to 2 in., 4 that of 12 in. to 3 in., 3 that of 12 in. to 4 in., and 2 that of 12 in. to 6 in. Again what part of 12 in. is equal to 6 in.? ($\frac{1}{2}$) $\frac{1}{2}$ is often called the *ratio* of 6 in. to 12 in., and so on.

After the children have noted by drawings the simple instances given in the lessons, write the multiplication table of 2 on the board, thus:

2 times		
1¢	is	2¢
2¢	"	4¢
3¢	"	6¢
4¢	"	8¢
. .	. .	. .
12¢	"	24¢

Then note from this table what 2 is the ratio of and what $\frac{1}{2}$ is the ratio of. Give such examples as $\frac{1}{2}$ is the ratio of 4¢ to ? 6¢ to ? Of ? to 12¢. Of ? to 18¢. Of 11¢ to ?

Give similar examples with 2 as the ratio. Use other units. Give easy concrete examples similar to the questions in Lesson 40.

Lesson 38

See suggestions, Lesson 36.

Lesson 39

Do as much actual measurement as is necessary to illustrate this lesson. Measure the length and width of the room, of tables, desks, books, height of pupils, and so on. Note the size of books as measured by the number of pages. Measure the quantity of water in a pail or pitcher, the unit being 1 pt. or 1 qt. or 1 gal. Weigh different articles, and find the weight of different pupils. Make it clear that in order to measure any quantity we must use a suitable *unit of measure* and we must find the *number* of units that measures the quantity.

Lesson 42

Be sure that the pupils know by actual measurement that 1 gal. = 4 qt., and similarly with other tables referred to in this book.

Lesson 43

Make the method of finding the area of an oblong clear by drawings on paper and on the board. Emphasize the fact that the area is measured by the number and the unit. Develop the fact that the number measuring the area is the product of the numbers measuring the sides. Then use this fact to find the measure of the areas and the areas of the oblongs. Measure the dimensions of oblongs in the room and calculate their areas. Let this work as usual *precede* the study of the lesson by the children.

Lesson 45

See suggestions, Lesson 35. Use the table of 3.

Lesson 47

Let the oral work preceding this lesson be objective until it is clearly understood. In question 3, for instance, draw lines $1\frac{1}{2}$ ft. and 2 ft. long. Measure with a $\frac{1}{2}$ ft. unit, when the number of measurements will be respectively 3 and 4, hence $1\frac{1}{2}$ ft. $= \frac{3}{2}$ ft. and 2 ft. $= \frac{4}{2}$ ft. How can you reduce $2\frac{1}{2}$ ft. to half feet without actually measuring? Similarly, in questions 4 and 5, measure if necessary. In question 8, take a string 6 in. long, cut off one part $4\frac{1}{2}$ in. long. How long is the remainder? Hence, $4\frac{1}{2}$ in. $+ 1\frac{1}{2}$ in. $= 6$ in. Similarly with other parts of this question.

Lesson 48

In such questions as 16 let it be clearly understood, not that 4 is contained in 16 4 times, but that 4 is contained in 16 *tens* 4 tens. Drill on such questions as 18 until the pupil can readily see in any number the next smaller number of which 4 is a factor and can give the remainder. Such measurements as are indicated in question 19 will give meaning to the process. Let the pupils state simple practical questions corresponding to 20 and 21.

Lesson 49

Practise reduction at first by actual measurement. Where this is done it is better that the teacher or some pupil should fix on some quantity without the class knowing what it is. Measure this quantity with two or more units, and let the result be, say, 2 ft. 4 in. Measure with the smaller unit, and the result is found to be 28 in. This, stated as a *relation of equality*, is 2 ft. 4 in. = 28 in. In this work the children have the *unknown quantity*, the *unit* or *units*, the *number*, then the *measured quantity*, and the *relation of equality* growing out of two separate measurements with different units. How do such expressions as 2 ft. 6 in., 3 qt. 1 pt., and 1 hr. 30 min. arise in the measuring process?

As soon as this measuring process gives significance to the operation, let the pupils deduce the rule and *use* it as the more economical method. You reduce 3 gal. 2 qt. to quarts by multiplying 4 qt. by 3 and adding 2 qt. to the product. Practically it is awkward to be constantly changing the multiplier. Hence, by the law of commutation, we have: To reduce gallons and quarts to quarts, multiply the number of gallons by 4 and add the number of quarts. What is the multiplier in reducing yards to feet?

Lesson 50

An oblong 4 in. long and 3 in. wide contains 12 sq. in.; one 4 2-in. long and 3 2-in. wide contains 12 2-in. squares or 12 4 sq. in., *i.e.* 48 sq. in. An oblong 10 in. (5 2-in.) long and 8 in. (4 2-in.) wide contains 5×4, or 20, 2-in. squares or 20 4 sq. in., *i.e.* 80 sq. in. Here the unit that measures the length is 2-in. and that which measures the area is the 2-in. square or 4 sq. in.

Lesson 52

Teach the pupil to take $\frac{1}{3}$ of a quantity by dividing it by 3. This is much more economical practically than for him to think of one operation for finding $\frac{1}{3}$ of a quantity and another for dividing it by 3. Teach him to take $\frac{2}{3}$ of a quantity by dividing it by 3 and multiplying by 2, or by multiplying the quantity by 2 and dividing the product by 3.

Lesson 54

See suggestions, Lesson 36.

In order to make the oral lesson in ratio apply to the solution of problems, it is not sufficient merely to state the ratio of the given quantities. State also the ratio of their cost, for instance. What is the ratio of 20 lb. to 5 lb.? Of 5 lb. to 20 lb.? Of the cost of 20 lb. of sugar to that of 5 lb.? Of the cost of 5 lb. of sugar to that of 20 lb.? If 5 lb. of sugar cost 25¢, what will 20 lb. cost? If 20 lb. of sugar cost 104¢, what will 5 lb. cost?

Again, what is the ratio of 20 mi. to 4 mi.? Of the time a boy can ride 20 mi. to that which he will need to ride 5 mi.? If a boy rides on his bicycle 5 mi. in $\frac{1}{2}$ hr., how long will it take him, at the same rate, to ride 20 mi.? Connect closely the ratio and its *reciprocal*. What is the ratio of 20 mi. to 5 mi.? What is the (reciprocal) ratio of 5 mi. to 20 mi.? So also with practical examples, as follows:

(1) If a man drives 5 mi. in $\frac{3}{4}$ hr., how long will it take him, at the same rate, to drive 20 mi.?

(2) If a train ran 20 mi. in 36 min., how long did it take on the average for each 5 mi.?

Questions (1) and (2) involve reciprocal ratios.

Lesson 57

Question 10, etc. Take points on the board 2 ft., 3 ft., and so on apart, without the pupils knowing the distance. Measure with the 1-ft. unit. Measure also with the units $\frac{1}{2}$ ft., $\frac{1}{3}$ ft., $\frac{1}{4}$ ft., and deduce the relations 2 ft. $= \frac{4}{2}$ ft. $= \frac{6}{3}$ ft. $= \frac{8}{4}$ ft.; 3 ft. $= \frac{6}{2}$ ft. $= \frac{9}{3}$ ft. $= \frac{12}{4}$ ft. Develop the rule that to reduce a number of feet to halves, thirds, or fourths, you multiply the number of feet by 2, 3, or 4, as the case may be. Similarly develop the fact that $2\frac{1}{2}$ ft. $= \frac{5}{2}$ ft., and the corresponding rule. So also for thirds and fourths. Apply your rules.

Lesson 59

This lesson is an exercise in numeration and notation, with special reference to Lesson 60, and should be thoroughly mastered. Special drill should be given in questions like 12, 13, 14, 15.

Lesson 60

As the pupils add and carry or subtract, be sure that they understand the place value of the different numbers. Question 6 is a preparation for the subtraction that follows in questions 7 and 8.

Lesson 61

When such questions as 5 and 10 occur in this and the following lessons, frequently have the pupils make out bills neatly and accurately.

Lesson 63

Note that any number ending in 0 or 5 is divisible by 5. As in question 6, find the common factor of pairs of numbers and illustrate its meaning by measurement. To bring out the meaning of common factor more effectually, select a unit that is a factor of only one of the numbers and measure the corresponding quantities with the given unit.

Lessons 66–68

Lessons 66, 67, 68, are review lessons. If any question is found to be too hard, make easier questions of the same kind leading up to the problem in the book.

In question 17, page 141, the *whole quantity* is \$50, the *number* is 5 and the *unit* is \$10 (*i.e.* \$50 ÷ 5), which is the cost of the chain. In Lesson 68, question 4, the pupil is given the unit 12¢ and the number $3\frac{1}{2}$ to find the quantity $3\frac{1}{2} \times 12$¢, or 42¢. The following are the two questions required:

(1) At 12¢ a yd., how many yards of ribbon will cost 42¢?

(2) If $3\frac{1}{2}$ yd. of ribbon cost 42¢, what is the cost per yd.?

Lesson 74

The method of finding the volume of a prism is indicated in question 1. Count again first by 2's, then by 6's (3×2). Count again first by 3's, then by 12's (4×3), and so on. Let pupils measure the dimensions of prisms in the room, such as boxes, and calculate their volumes. What units of volume have we? (1 cu. in., 1 cu. ft., 1 cu. yd., 1 cord.) Why have we no larger unit of volume than 1 cord?

Lesson 76

Develop clearly and apply in practice that to take $\frac{3}{7}$ of \$28 you divide \$28 by 7 and multiply the quotient by 3; that to take $\frac{5}{8}$ of a quantity, you divide the quantity by 8 and multiply the quotient by 5; that, in general, to take a fractional part of a quantity, you divide by the denominator and multiply by the numerator. Can you first multiply by the numerator and then divide by the denominator? Show instances where the latter method is more economical. ($\frac{3}{8}$ of \$13, $\frac{4}{5}$ of \$$3\frac{1}{2}$.) See that the pupils master this principle and are able to use either method quickly and accurately.

Lesson 77

Develop addition and subtraction of fractions in the order indicated in Lessons 77, 78, 79. Much oral work will be needed. Have the pupils illustrate their work by placing dots and marking them off as in questions 8, 15, 19. In some cases verify by actual measurement. Let the pupils memorize the simpler sums and differences. Let the work gradually develop into the more generalized form indicated by Lesson 78, questions 9, 10, 11. Finally, have the children perform the simpler operations mentally. Throughout the oral work preceding these lessons give and let the pupils give many illustrative practical examples.

Lesson 80

Many interesting and practical questions may be asked in connection with this lesson. Red raspberries are sold in pint boxes because they would crush if put up in quart boxes. Black raspberries, gooseberries, etc., being firmer, are sold in quart boxes. Why are strawberries early in the season frequently sold in pint boxes? Which is the fairer way to buy and sell eggs, by the pound or by the dozen? Why? Illustrate questions 13 and 14 by actual measurement. The principles indicated in question 22 are important and of frequent application.

Lesson 81

Precede this lesson in sections by exercises with the class, making questions similar to those in the lesson, easier at first but gradually becoming more difficult. Questions 5 and 6 illustrate this method.

The following examples relate to question 1:

What quantity is measured by:

1. The number 4 and the unit 1 pt.? (2 qt.)
2. The number 4 and the unit 1 qt. 1 pt.? (6 qt.)
3. The number 4 and the unit 2 qt. 1 pt.? (10 qt.)
4. The number 6 and the unit 2 qt. 1 pt.? (15 qt.)
5. The number 8 and the unit 2 qt.? (4 gal.)
6. The number 8 and the unit 2 gal. 1 qt.? (18 gal.)
7. The number 6 and the unit 1 gal. 2 qt.? (9 gal.)
8. Find the number of gallons of milk in 6 cans, each of which contains 2 gal. 2 qt.

Lesson 86

In question 8 the word "*accurately*" is emphasized, because while it is important that pupils should work rapidly, it is *essential* that their work should be accurate. The question to the class should be not, "How many questions did you work correctly?" but "How many of you worked correctly *every question* that you did?"

Lesson 87

If pupils are to master long division so that they will not lose time in guessing in a haphazard way at the successive quotients, they must become expert in the use of the *trial divisor* and the *trial dividend.*

Lesson 88

In questions 11 and 12 emphasize the place value of the numbers. \$29 divided by 4 gives \$7 as quotient and \$1 as remainder. \$1 6 dimes equals 16 dimes. 16 dimes divided by 4 equals 4 dimes. 4¢ divided by 4 equals 1¢. The quotient is \$7.41. Similarly with the long division.

Lessons 91–94

These lessons indicate the method of teaching decimals. First make use of the pupil's knowledge of the notation and numeration of dollars and cents.

Then use the metric stick, since a practical knowledge of it is useful in itself, and since it makes the development of decimals objective. Pass on from this to quantities expressed in terms of other units of measurement.

Lesson 95

Percentage is simply a special case of fractions, and should be so taught. A quantity divided into fourths is measured by 4 units, and each part is $\frac{1}{4}$ of the quantity. Three parts are equal to $\frac{3}{4}$ of the quantity. Similarly with regard to quantities divided into fifths, sixths, etc. A quantity, considered in percentage, is divided into 100 parts, and is measured by 100 units. Each part is $\frac{1}{100}$ or 1% of the quantity, and 5 parts are $\frac{5}{100}$ or 5% of it. On the other hand, 1% of a quantity is one-hundredth of it, and 5% is five-hundredths of it.

Lesson 100

Section XIII. contains questions in review. They will be found to be especially helpful in preparing the pupils for the opening chapters of the "Public School Arithmetic."

ARITHMETIC

SECTION I

Lesson 1

1. Count the number of girls in your room. How many? How many boys? How many boys and girls?

2. Count the number of windows in the room. Of window panes. Of windows in the school building.

3. Count the number of desks in your room. The number that are not occupied.

4. Count the number of boards in the floor of your room from one side to another.

5. Count the number of letters in this example.

6. Count the number of pieces of crayon in a box of crayon.

7. Count the number of inches in a foot. Of inches in a yard. Of feet in a yard.

8. Measure with a yardstick and count the number of yards in the width of the room. In the length.

9. Count the number of steps you take in going from one side of the room to the other. From the front to the back of the room.

10. Measure with a foot rule and count the number of feet in the width of the room. In the length.

11. How many yards long is the blackboard? How many feet? How many feet high?

12. How many inches long is this book? How many wide? How many pages does it contain?

13. How tall are you? How old? How many pounds do you weigh?

14. How many days of this week are gone? How many days of this month? Weeks of this month? How many months of this year?

15. Fill a quart measure with a pint measure. How many times do you empty the pint measure? How many pints in a quart?

16. Fill a gallon measure with a quart measure. How many quarts in a gallon?

17. Fill a gallon measure with a pint measure. How many pints in a gallon?

18. How many pennies in a nickel? In a dime? In a 25-cent piece?

19. Count on a clock face the number of minutes in a quarter of an hour. In half an hour. In three-quarters of an hour. In one hour.

20. Ask your teacher to make raps with a stick, strokes with a bell, or to pronounce the names of letters. Count the number each time.

21. How can you get the expression 5 yd. by measuring? What number will you obtain if you measure the same distance with a foot rule?

22. How can you get the expression 3 qt. by measuring? What number will you get if you measure the same quantity with a pint?

Lesson 2

1. Count the pupils in the first two rows by 2's. How many 2's? Count all the pupils in the room by 2's. How many 2's?

2. Count the number of pairs of hands in the room. How many pairs?

3. Count the pupils in groups of 3. How many groups? In groups of 4. How many groups?

4. Count the number of fingers and thumbs in the room by 10's. How many 10's? Count by 5's. How many 5's?

5. Count the number of pieces of crayon in a box of crayon by 12's. How many dozen in the box?

6. Count the number of 5-minute spaces in one hour. Of 10-minute spaces. Of 15-minute spaces.

7. In counting, what numbers do you count before the number 4? Before 6? Before 10? Before 15? Before 25?

8. Ask your teacher to make taps with a stick, strokes with a bell, or to pronounce the names of the letters in groups of 2 or 3. Count the number of groups.

9. Count 12 pupils by 2's. How many 2's? Count by 6's. How many 6's? By 3's. How many? By 4's. How many?

10. Count 18 pupils by 3's. By 6's. By 2's. By 9's. How many in each case?

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11. Count by 2's. How many 2's in 8? How many 2¢ in 8¢? How many 4's in 8? How many 4¢ in 8¢?

12. With 8¢ how many lemons can you buy at 2¢ each? How many oranges at 4¢ each?

13. A man gave 2¢ to each of 4 children. How much did he give away? How many pounds in 4 2-lb. cans of corn?

14. How many 2's in 8? What is one-fourth of 8? What is $\frac{1}{4}$ of 8 apples? If I have 8 apples and give $\frac{1}{4}$ of them away, how many do I give away? How many are left?

15. How many 4's in 8? What is one-half of 8? There are 8 trees on one side of the yard and $\frac{1}{2}$ as many on the opposite side. How many are on the opposite side?

16. Draw a line 2-in. long. Draw another line 2 2-in. long. 4 2-in. long. 6 2-in. long. How many inches long is each line?

Lesson 3

1. Place ten dots. How many 2's in 10? How many 5's in 10? What are 5 2's equal to? What are 2 5's equal to?

2. How many marbles can I get for 5¢ at the rate of 2 for a cent?

3. How many lead pencils at 2¢ each can you buy for a dime? How many tablets at a nickel apiece can you buy for a dime?

4. A boy picked 10 pt. of raspberries. How many quarts did he pick?

5. A coat costs $10. How many $2 bills will pay for it? How many $5 bills?

6. How many 2's in 10? What is one-fifth of 10? James paid 10¢ for a ball and $\frac{1}{5}$ as much for an apple. What did the apple cost him? What did both cost?

7. A boy earns half a dollar a day. How much will he earn in 10 da.?

8. If it takes 2 boys 5 hours to do a piece of work, how long would it take one boy to do it? Five boys?

9. Place twelve dots. Let each dot represent 1¢. How many 2¢ in 12¢? How many 6¢ in 12¢? At $2 a bbl. for apples, how many bbl. for $12?

10. Let each dot represent 1 pt. What unit of measure do 2 dots represent?

How many quarts in 12 pt.? How many pints in 6 qt.? Out of a pail containing 12 pt. of water 2 qt. are taken. How many quarts are left?

11. How many qt. in 2 pt.? 4 pt.? 6 pt.? 8 pt.? 10 pt.? How many pt. in 1 qt.? 2 qt.? 3 qt.? 4 qt.? 5 qt.?

12. How much will a man earn in 2 wk. at $1 a day? If he is paid in two-dollar bills, how many bills does he get?

13. How many pounds of butter are there in 6 2-lb. rolls? In 2 5-lb. pails?

14. How many 2's in 12? What is one-sixth of 12? How many inches in $\frac{1}{6}$ of a foot rule? If I have $12 in my purse and spend $\frac{1}{6}$ of it, how much do I spend? How much have I left?

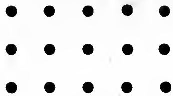
15. How many 6's in 12? What is one-half of 12? What will half-a-dozen eggs cost at 2¢ each?

16. Count 12 dots by 4's. How many 4's in 12? What is one-third of 12? What is one-fourth of 12?

If I pay $12 for 3 bbl. of flour, what is the cost per barrel?

17. Make simple practical questions illustrating $\frac{1}{2}$ of 8¢ = 4¢, and $\frac{1}{2}$ of 10 = 5.

Lesson 4



1. Count these dots by 3's. How many 3's in 15? How many 5's in 15?

2. If each dot represents 1 ft., what unit do 3 dots represent?

How many yards in 15 ft.?

3. Draw lines dividing these 15 dots into 5 equal parts. What is $\frac{1}{5}$ of 15? What is $\frac{1}{3}$ of 15?

Paid 15 dimes for 5 yd. of cloth, what was the price per yard?

4. An overcoat was paid for with 3 five-dollar bills. How many dollars did it cost?

5. Count the number of 2-in. lengths in a yard. How many? How many 3-in. in 36 in.? How many 12-in. in 36 in.? How many 4-in. in 36 in.? How many 9-in.? How many 6-in.?

6. What is the cost of 3 pt. of molasses, at 12¢ a pt.?

In 36 eggs how many dozen?

7. If I work 9 hr. a day, how many hours shall I work in 4 da.?

If 1 lb. of raisins cost 9¢, how many pounds can you buy for 36¢?

8. Measure two points 15 in. apart. Measure this distance with 3-in. and 5-in. units. How many?

Measure two points 18 in. apart with 2-in., 9-in., 3-in., 6-in. units. How many?

9. Make simple, practical questions like questions 6 and 7.

10. Cut out of cardboard a unit 3 in. long; use this unit to measure a line 9 in. long. How many 3 in. in 9 in.?

How many 3¢ in 9¢? 3 dimes in 9 dimes? 3 lb. in 9 lb.? At 3¢ a yard, how many yards of tape can you buy for 9¢?

11. Use the 3-in. unit to measure lines respectively 12 in., 18 in., 24 in., 30 in., 36 in. long. How many 3-in. units in each case? How many 3 oranges in 12 oranges? In 18 oranges? How many cents in 8 3-ct.? In 10 3-ct.?

12. A boy divided 12 oranges among his playmates, giving 3 oranges to each. How many playmates were there?

13. What will 6 lemons cost, at 3¢ apiece? At 3¢ each, how many lemons can you buy for 24¢?

14. Cut out of cardboard a unit 4 in. long; use it to measure a line 8 in. long. How many 4-in. in 8 in.? How many 4-ct. in 8 ct.? How many cents in 2 4-ct.? In 4 2-ct.?

15. What will 2 hats cost at $4 each? How many apples at 2¢ each can you buy for 8¢?

16. Use the 4-in. unit to measure lines, respectively, 16 in., 24 in., 32 in. long. How many 4-in. units in each case? How many 4¢ in 24¢? How many cents in 4 4¢? How many miles in 6 4-mi.?

17. How many pounds of soap, at 4¢ a pound, can you buy for 24¢? How far will a man walk in 6 hr., at the rate of 4 mi. an hour?

18. Use the 5-in. unit to measure lines, respectively, 15 in., 20 in., 30 in., 35 in. long. Use the 6-in. unit to measure lines, respectively, 12 in., 24 in., 36 in. Into how many parts has each been divided?

15 in. ÷ 5 in. = ? 24 in. ÷ 6 in. = ? 25 in. ÷ 5 in. = ?

19. Divide a line 12 in. long into 2 equal parts. How long is each part? Into 3 equal parts. Into 4. Into 6. How long is each part in each case? What is $\frac{1}{2}$ of 12 in.? $\frac{1}{3}$ of 12 in.? $\frac{1}{4}$ of 12 in.? $\frac{1}{6}$ of 12 in.?

20. What is the meaning of 18 in. ÷ 3 in. = 6? Of $\frac{1}{3}$ of 18 in. = 6 in.? Of 18 in. ÷ 3 = 6 in.?

21. Can you *exactly* measure a line 23 in. long with a 2-in. unit? 3-in. unit? 4-in. unit? 5-in. unit? 6-in. unit?

What remainder in each case?

Lesson 5

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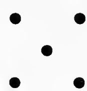
1. With a piece of paper cover all of these dots but one. How many do you see? How many are covered? What must be done with 1 to get 4? With 1¢ to get 4¢? With 1 dime to make 4 dimes? With a line 2 in. long to get a line 4 2-in. long? With 1 5-dollar bill to get 4 5-dollar bills?

2. Cover all the dots but 2. How many do you see? How many are covered? What must be done with 2 to get 4?

I have 2 doz. eggs. How many must I buy to have 4 doz.?

3. I have 4 dimes, and pay 10¢ for a yard of cotton. How many dimes have I left?

A gallon measure contains 3 qt. of water. How much must I pour in to fill it?



4. Cover all these dots but 1; all but 2; all but 3; all but 4. In each case how many do you see? How many are covered?

5. I want to give an apple to each of 5 boys. If I have 3 apples, how many more must I get?

6. I buy a 2-ct. postage stamp. What change do I get back from a nickel?

Bought 2 yd. of cloth, at \$2 a yard. What change do I get out of a 5-dollar bill?

7. Draw a line one part of which is 3 2-in. long and the other 2 2-in. long. How many 2 in. in the length? How many inches?

8. I paid $1 for a pair of gloves and 2 two-dollar bills for a pair of shoes. What did both cost?

9. Mary was at school on Thursday, but was kept at home the rest of the week on account of illness. How many days was she absent?

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10. Cover all the dots but 5; all but 4; all but 3; all but 2; all but 1. In each case how many do you see? How many are covered? Practise this until you can do it correctly and quickly.

11. I spent $6 for a hat and a pair of shoes. If the hat cost $2, what did the shoes cost? Three rolls of butter weighed 6 lbs. What was the average weight per roll?

12. A grocer has 6 50-lb. sacks of flour and sells 3 of them. How many sacks has he left?

13. How many 3-lb. packages of wafers weigh 6 lb.? 6 10-dollar bills are changed for 20-dollar bills; how many 20's are received?

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14. How many dots all together? Cover all but 6; all but 5; all but 4; all but 3; all but 2; all but 1. In each case how many do you see? How many are covered? Practise this until you can do it quickly and accurately.

15. A boy has 7 mi. to go. If he rides 5 mi., how far does he walk?

16. The sum of what two numbers equals 7?

17. Henry had 7 marbles and lost 4 of them; how many had he left?

18. A boy has 7 dimes and buys 3 collars at 10¢ each. How many dimes has he left?

19. On Wednesday morning how many days of the week are gone? How many are still left.

20. How many nickels will pay for 5 2-cent postage stamps? How many dimes will pay for 10 apples at 1¢ each? How many 25-ct. pieces will pay for 25 lemons at 3¢ each?

21. I have 7 25-ct. pieces and buy 25 one cent stamps. How many handkerchiefs can I buy with the remainder at 25¢ each?

22. I have 7 nickels and buy 5 apples at 2¢ each. How many nickels have I left?

23. Seven 10-dollar bills are changed for 5-dollar bills, how many 5's are received?

Lesson 6

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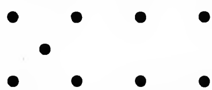
1. How many dots all together? Cover all but 7; all but 1; all but 6; all but 2; all but 5; all but 3; all but 4. In each case how many do you see? How many are covered?

2. A grocer has 8 6-lb. boxes of starch, and sells 3 of them. How many has he left?

3. How many pairs of two in eight?

4. If I carry home a parcel containing a 3-lb. can of tomatoes and 5 lb. of sugar, what is the weight of my parcel?

5. At 2 dimes a dozen, how many eggs for 8 dimes? How many hours will it take a man walking 4 miles an hour, to go 8 miles?



6. What must be done with 8 dots to make 9 dots? This did what with 4 of the 8 dots?

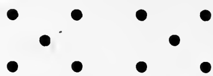
7. Cover all these dots but 9; all but 8; all but 7; all but 6; all but 5; all but 4; all but 3; all but 2; all but 1. In each case how many do you see? How many are covered?

8. A child is 4 yr. of age. In how many years will it be 9?

9. 6 is one more than what number? One less than what number? 7 is one more than what number? One less than what number? 8 and 9 are each one more than what number? One less than what number?

10. 9 boys were skating and 3 went home at 5 o'clock. How many remained?

11. How many 3 in. in 9 in.? 3 ft. in 9 ft.? 3 dimes in 9 dimes? 3 5-dollars in 9 5-dollars? 3 tens in 9 tens?



12. If each dot represents 1¢, what unit of money do all represent? How many nickels?

13. Cover all these dots but 9; all but 1; all but 8; all but 2; all but 7; all but 3; all but 6; all but 4; all but 5. In each case how many do you see? How many are covered?

14. How many 5's do you see in 10? How many 2's? How many oranges at 5¢ apiece can you buy for one dime? How many eggs at 2¢ each?

15. If I pay 7¢ for a cake of sapolio, what change do I get back from a dime?

16. What is the cost of 2 cakes of soap at 4¢ apiece and a yeast cake at 2¢?

17. What is the weight of 2 3-lb. cans of corn and 3 1-lb. cans of peas?

18. A line 10 in. long is divided into 5 equal parts. How long is each part? Draw the line.

19. With ten dimes how much butter can be bought at two dimes a pound? Bought flour at $5 a barrel and paid for it with a ten-dollar bill. How many barrels?

20. How many $2 in $10? 2 ft. in 10 ft.? 5 miles in 10 miles? 5 ten-dollar bills in 10 ten-dollar bills?

21. If I bought two lead pencils at 4¢ each and an eraser for 2¢, what did all cost?

22. How many 5-cent pieces make 50¢?

I gave James one dime and Robert $\frac{1}{2}$ as much. What did I give Robert? What did I give both?

23. I divided 10 quarter-dollars equally among 5 children. What did each receive? How many cents?

24. How many strips of wall paper, each 2 ft. wide, will be needed for the side of a room 10 ft. in width?

25. I have a dime and buy a tablet for 4¢. How many yards of ribbon at 3¢ a yd. can I buy with the change?

Lesson 7

1. How many cents in 2 dimes? 4 dimes? 5 dimes? 8 dimes?

What will 6 yd. of ribbon cost at one dime a yard?

2. How many cents in 3 dimes 2¢? 6 dimes 4¢? 7 dimes 1 nickel?

I gave 6 dimes and 3¢ for a book. How many cents did it cost?

3. I paid 3 ten-dollar bills and a five-dollar bill for a cow. How many dollars did the cow cost me?

4. How many dimes in 40¢? 60¢? 90¢? How many dimes and cents in 24¢? 56¢? 89¢?

I paid in dimes and cents 23¢ for a comb. How many of each did I pay, there being 5 coins in all?

5. I paid in dimes and nickels 75¢ for a pair of gloves. How many of each did I pay, there being 8 coins in all? How many of each, there being 9 coins in all?

6. What unit of money is equal in value to 2 dimes and a nickel? 5 dimes? 10 dimes? 20 dimes?

7. I have 2 dimes. How many dimes must I put with these to be able to exchange them for half-a-dollar?

30 mi. + 6 mi. = ? mi. 20 mi. + 8 mi. = ? mi.

8. A man drove ten miles an hour for 4 hr. and then walked 2 mi. How far did he go?

9. A lady bought a rug for 4 ten-dollar bills, a desk for 2 ten-dollar bills, and a chair for $8. What did all cost her?

10. A grocer had 9 10-lb. sacks of flour and sold 6 of them. How many had he left, and how many pounds did they weigh?

11. The minute hand of a clock moves through 5 10-min. spaces and 3 10-min. spaces in how many minutes?

12. The thermometer registers 4 ten degrees. Through how many ten degrees must the temperature rise to register 7 ten degrees? How many degrees will it then register?

13. A boy has $1 and spends 4 dimes. How much has he left?

14. From 85 lb. of flour how many 10-lb. sacks can be put up, and how many pounds will be left over?

15. 64 gal. are equal to 6 ten-gallons and 4 gal. Read the following in the same way: 32 yr.; 27 da.; 43 min.; 58 mi.; 64 lb.; 25 qt.

16. Write in figures and use contractions: Twenty-five cents; ninety-four dollars; sixty-six gallons; eighty quarts; sixteen years; thirty-one days.

17. Write in figures: Fourteen; fifty-five; forty; ninety-one; twenty-eight.

18. What number is equal to

$2 + 10$?	$3 + 10$?	$4 + 10$?	$5 + 10$?
$8 + 10$?	$9 + 10$?	$20 + 2$?	$30 + 4$?
$5 + 40$?	$6 + 60$?	$7 + 80$?	$9 + 90$?

19. Harriet is 3 yr. old and her sister Caryl 10. What is the sum of their ages?

20. How many cents in a nickel and a dime?

21. A man bought 4 lb. of lump sugar and 20 lb. of granulated. How many pounds of sugar did he buy?

Lesson 8

1. What is the cost of 3 yd. of lace at 2 dimes a yard? How many cents?

2. How many dimes in 20¢?

How many yards of ribbon at 20¢ a yd. can you buy for 8 dimes?

3. What is the cost of 2 gal. of syrup at 5 dimes a gallon? How many dollars?

4. If 3 2-lb. cans of fruit cost 9 dimes, how many dimes will one can cost? How many cents?

5. What will 10 lb. of canary seed cost at $\frac{1}{2}$ dime per pound?

6. A lady bought 4 yd. of ribbon at 2 dimes a yard, and two bunches of tape for 6¢. How many cents did both cost?

7. I paid 25¢ for a handkerchief and a spool of thread. If the handkerchief cost 2 dimes, what did the thread cost?

8. A lady spent 5 ten-dollar bills for a sofa, a five-dollar bill for a chair, 2 ten-dollar bills for a table. How much did she spend in all?

9. I bought a horse for $200 and 3 cows at $30 each. What did all cost?

10. A farmer sold horses for $600, cows for $80, and a sheep for $6. How much did he receive for all?

11. 645 gal. are equal to 6 one hundred-gal., 4 ten-gal., and 5 gal. Read the following in the same way: 432 yr.; 227 da.; 543 min.; 258 mi.; 164 lb.; 325 qt.

12. Write in figures and use contractions: Three hundred twenty-four dollars; one hundred thirty-four miles; six hundred forty acres; five hundred four years; nine hundred ninety-nine years; seven hundred three pounds; one thousand dollars; two thousand dollars; three thousand dollars.

13. Write in figures: Six hundred forty-nine; two hundred fifty; eight hundred fifty; three hundred thirteen; seven hundred fifty; six hundred five.

14. $100 + 62 = ?$ $200 + 45 = ?$ $300 + 17 = ?$
$200 + 50 + 4 = ?$ $6 + 40 + 100 = ?$
$300 + 40 + 5 = ?$ $2 + 10 + 200 = ?$

15. A man weighs 200 lb. and his son 64 lb. What is the sum of their weights?

16. If I paid $3 for a hat, $20 for a suit of clothes, and $100 for two rugs, what did all cost?

17. I paid $300 for a piano, $40 for a sofa, and $8 for a chair. What was the cost of all?

18. How many cents in a dime? Dimes in a dollar? How many single units in a ten-unit? Ten-units in a hundred-unit?

19. A farmer sold a horse for one hundred dollars, a cow for thirty dollars, and a sheep for six dollars. What did he get for all?

SECTION II

Lesson 9

Add:

1.	3 in.	3 in.	3 in.	3 in.
	2 "	12 "	22 "	32 "

2. What is the sum of 32 in. and 3 in.?

James can take a step 32 in. long and John 3 in. farther. How far can John step? Draw a line on the board and mark off the two steps.

3.	3 min.	3 min.	3 min.	3 min.
	2 "	12 "	22 "	32 "
	3 min.	3 min.	3 min.	3 min.
	42 "	52 "	62 "	72 "

4. 22 min. + 3 min. = ? min. 42 min. + 3 min. = ? min.

Agnes takes 22 min. to learn her lesson, and Mary 3 min. longer. How long does Mary take?

5.	3 ft.	3 ft.	3 ft.	3 ft.
	2 "	22 "	32 "	52 "

6.

3¢	3¢	3¢	3¢
2¢	12¢	22¢	42¢

7. George paid 3¢ for an orange and 12¢ for a pound of nuts. What did both cost?

8.

2 in.	2 in.	2 in.	2 in.
3 "	13 "	23 "	32 "

2 in.	2 in.	1 in.	2 in.
43 "	53 "	63 "	73 "

9.

2 min.	2 min.	2 min.	2 min.
3 "	13 "	23 "	32 "

2 min.	2 min.	2 min.	2 min.
43 "	50 "	73 "	93 "

10.

3	3	3	3	3	3	3	3	3
2	12	22	31	42	52	60	72	82

11.

2	2	2	2	2	2	2	2	2
3	11	23	33	42	53	63	73	80

12.

3	2	3	2	3	2	3	2	2
2	3	12	13	22	23	32	33	42

13. Harry paid twenty-three cents for a book, and two cents for an eraser. What did both cost?

14. Add 3 to each of the following numbers, and read their sums: 2, 12, 22, 32, 42, 52, 62, 72, 82, 92. Memorize these results.

15. Add 2 to each of the following numbers, and read their sums: 3, 13, 23, 33, 43, 53, 63, 73, 83, 93. Memorize these results.

16. What is the sum of 3 1-cent pieces and 2 1-cent pieces? Of 3 5-cent pieces and 2 5-cent pieces? Of 3 10-cent pieces and 2 10-cent pieces? Of 3 units of any kind and 2 units of the same kind?

17. What is the sum of 2 half-dollars and 3 half-dollars? Of 2 quarter-dollars and 3 quarter-dollars?

18. Draw two lines, end to end, one 3 2-in. long and the other 2 2-in. long. How many 2-in. in the sum of their lengths? How many inches? How many 2-in. in 10-in.?

19. Measure with a ruler the length of this book. How many inches long is it? One inch is called the **unit of measure.**

20. How many cents did this book cost? One cent is the *unit* that measures the cost of this book.

21. Measure the blackboard with the pointer. How many pointers long is it? Measure it with a twelve-inch rule. How many 12-in. in its length?

22. What unit of measure did you use in each case above?

23. Harry, how would you proceed to measure the height of Charlie? What units of measure would you use?

24. What use do we make of these different units?

Lesson 10

Add:

1.	1 in.	1 in.	1 in.	1 in.	1 in.
	4 "	14 "	24 "	33 "	44 "

2.	1 min.	1 min.	1 min.	1 min.	1 min.
	4 "	14 "	22 "	34 "	44 "
	1 min.	1 min.	2 min.	1 min.	1 min.
	54 "	60 "	72 "	84 "	94 "

3.	1 ft.	1 ft.	1 yd.	1 yd.	1 mi.
	4 "	14 "	14 "	21 "	24 "

4. Two boys run a race; the first runs 24 yd., and the second comes in 1 yd. ahead. How many yards does the second boy run?

5.	1¢	1¢	3¢	\$ 1	\$ 1
	4¢	24¢	41¢	\$44	\$54

6. A man paid \$34 for a suit of clothes and \$1 for a necktie. What did both cost? What three bills would pay for both?

7.	4 in.	4 in.	4 in.	4 in.	2 in.
	1 "	11 "	20 "	31 "	41 "

8. I took 11 min. to walk to the depot and then had to wait 4 min. for the train. How many minutes before train time did I leave home?

9.

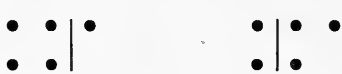
4 min.	4 min.	4 min.	4 min.	4 min.
1 "	11 "	21 "	31 "	41 "

10. Add 1 to each of the following numbers, and read their sums: 4, 14, 24, 34, 44, 54, 64, 74, 84, 94. Memorize these results.

11. Add 4 to each of the following numbers, and read their sums: 1, 11, 21, 31, 41, 51, 61, 71, 81, 91. Memorize these results.

12. What is the sum of 4 half-hours and 1 half-hour? Of 1 5-lb. pail of butter and 4 5-lb. pails of butter? Of 4 2-lb. rolls of butter and 1 2-lb. roll of butter? Of 4 units of any kind and 1 unit of the same kind?

13. The distance from A to B is 25 miles; the distance from B to C is 4 miles. How far is it from A to C? What unit was used to measure the distance from A to B? From A to C?



14. Read these dots from left to right, and also from right to left. Thus, $5 = 4 + 1$, or $1 + 4$.

15. Make 5 dots and draw lines through them in any direction. Read your results.

16. What two numbers give 5 when added? 15? 25? 35? 45?

17. A boy is 5 ft. high. What unit is used to measure his height?

18. November 7 William was 12 mo. old, how old will he be Feb. 7 of the next year?

19. With a yardstick measure a piece of string 3 yd. long. Measure it again with a foot rule and count the number of times you measure. What number did you get? 3 yd. = ? ft.

20. Measure a piece of string 4 ft. long with a unit half-a-foot long. What number did you get? 4 ft. = ? half-feet.

21. Draw two lines, end to end, one 4 3-in. long, and the other 1 3-in. long. How many 3-in. in the sum of their lengths? How many inches? How many 3-in. in 12 in.?

22. Measure the length of a table. What unit or units did you use?

23. How long is your morning recess? What is the unit that measures the length of your recess?

Lesson 11

1.	2 in. + 3 in. = ? in.	2 in. + ? in. = 5 in.
	3 in. + 2 in. = ? in.	3 in. + ? in. = 5 in.
2.	4¢ + 1¢ = 5¢	4¢ + ? ¢ = 5¢
	1¢ + 4¢ = 5¢	1¢ + ? ¢ = 5¢
3.	3 + ? = 5	4 + ? = 5
	1 + ? = 5	2 + ? = 5

4. James had 2¢, and his father gave him 23¢. How many cents did he then have?

5. Harry had 12 marbles and found 3. How many did he then have?

6. A man travelled 24 mi. by train and walked 1 mi. How far did he go?

7. I paid $5 for a hat and a pair of gloves. The hat cost $4. What did the gloves cost?

8. I bought a book for 22¢ and a pencil for 3¢. What did I pay for both?

9. I gave a quarter of a dollar for a yard of ribbon and received 2¢ in change. What did the ribbon cost me?

10. $12 + ? = 15$ $22 + ? = 25$ $? + 3 = 25$
$32 + ? = 35$ $? + 3 = 45$ $? + 3 = 15$

11. I paid $25 for a suit of clothes and a pair of shoes. I paid $22 for the suit. What did the shoes cost?

12. Take two points 2 yd., 3 yd., and again 4 yd. apart. Measure each of these distances with a foot rule. What numbers do you get? 1 yd. = ? ft. 2 yd. = ? ft. 3 yd. = ? ft. 4 yd. = ? ft. 5 yd. = ? ft.

13. Measure two points 1 yd. 2 ft. apart, 2 yd. 1 ft. apart, and again 3 yd. 2 ft. Measure each of these distances again with a foot rule. What numbers do you get? 1 yd. 2 ft. = ? ft. 2 yd. 1 ft. = ? ft. 3 yd. 2 ft. = ? ft. 4 yd. 1 ft. = ? ft.

14. Measure the length of things in the room as the table in yards and feet, and again in feet.

15. Find by measuring the number of yards and feet in 8 ft.; 14 ft.; 16 ft.; 20 ft.

16. What units does the milkman use to measure milk?

17. Put 3 qt. of water into a pail. Measure this again with a pint measure, and count as you do this. What number do you get? Do the same with 4 qt. of water. 1 qt. = ? pt. 2 qt. = ? pt. 3 qt. = ? pt. 4 qt. = ? pt. 5 qt. = ? pt.

● ● ● ● ● ●

● ● ● ● ● ●

18. How many dots? Count by twos. How many twos? If each dot represents 1 pt., what do 2 dots represent? How many pints are represented? How many quarts?

19. Place dots to represent 4 pt. of water in a pail. 6 pt., 8 pt., 10 pt., 12 pt. How many quarts are represented each time?

20. 4 pt. = ? qt. 6 pt. = ? qt. 8 pt. = ? qt.
10 pt. = ? qt. 12 pt. = ? qt.

21. A line is measured by the *unit* 2 in. and the *number* 6. How many inches long is the line? Draw it. With the unit 3 in., what number would measure its length? With the unit 4 in.?

Lesson 12

Add:

1.

1 min.	1 min.	1 min.	1 min.	1 min.
5 "	15 "	25 "	35 "	45 "

2.

5¢	5¢	4¢	5¢	5¢	5¢
1¢	11¢	21¢	31¢	40¢	51¢

3. 15 min. + ? min. = 16 min.
1 min. + ? min. = 16 min.

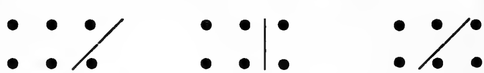
A boy takes 16 min. to walk to school. If he is 1 min. late, how many minutes before school time did he leave home?

4. Harry has 31¢, and his brother 5¢. How much have they together?

5.

1	1	3	1	1	5
55	65	72	85	95	41
5	5	2	5	5	5
50	61	72	81	91	11

6. Five years ago a young man was twenty-one years old. What is his age at present?



7. Read these dots from left to right and also from right to left.

8. Read your answer to question 6 again, letting each dot represent one dime, one half-dollar, one 2-lb. package of oatmeal, one 3-qt. can of peas.

9. What is the meaning of $5 + 1 = 6$? Of $4 + 2 = 6$? Of $3 + 3 = 6$?

10. Make 6 dots and draw lines through them in any direction. Read your results.

11. Memorize:

$$\begin{array}{ccccc} 1 & 5 & 2 & 4 & 3 \\ \underline{5} & \underline{1} & \underline{4} & \underline{2} & \underline{3} \\ 6 & 6 & 6 & 6 & 6 \end{array}$$

12. What is the value of one nickel and 1 penny? Of one five-dollar bill and \$1?

13. What is the weight of 3 2-lb. packages of cakes and 3 2-lb. packages of wafers? How many pounds?

14. What is the sum of 4 2-qt. cans of berries and 2 2-qt. cans. How many quarts?

15. Add 2 to each of these numbers:

3, 4, 14, 24, 23, 33, 44, 13, 54

16. Add 4 to each of these numbers:

1, 2, 12, 22, 31, 42, 51, 61, 82

17. Add 3 to each of these numbers:

1, 2, 3, 12, 21, 23, 31, 43, 52

18. $5 + 1 = ?$ $\quad 5 + ? = 6$ $\quad 1 + ? = 6$

$4 + ? = 6$ $\quad 2 + ? = 6$ $\quad 3 + ? = 6$

19. Subtract: *

6	6	6	6	6	16	26
5	1	4	2	3	12	22

20. A grocer has 6 10-lb. sacks of flour, and sells 3. How many has he left? How many lb.?

21. A family bought 6 2-lb. packages of oatmeal for the month, and used 3. How many lb. were left?

22. With a foot rule measure points on the board 1 ft. 6 in. apart. Measure the same distance with a yardstick divided into inches. 1 ft. 6 in. = ? in.

23. Take two points on the blackboard not far apart. Measure the distance between them with a foot rule and then with a yardstick. Write your result thus: 1 ft. 8 in. = 20 in. Select other points, measure, and write your results in the same way.

24. Measure different things, as the width of the table, of the desk, of the door, with a yardstick and then with a foot rule. Write your results thus: 27 in. = 2 ft. 3 in.

25. 1 ft. = ? in. 1 ft. 2 in. = ? in. 1 ft. 4 in. = ? in.

Lesson 13

1. 5¢ + 1¢ = ? 25¢ + 1¢ = ? 13¢ + 2¢ = ?

2. John paid 5¢ for paper and 1¢ for a pen. How much did he pay for both?

* Read 5 and **1** are 6, 1 and **5** are 6. Write down **1** under the 5, and **5** under the 1.

3. James paid 1¢ for a slate pencil and 25¢ for a book. How much did he pay for both?

4. If I paid 24 dimes for a hat and 2 dimes for a collar, how much did I pay for both?

5. If I paid 5 half-dollars for a pair of shoes and 1 half-dollar for a hat, how much did I pay for both?

6. Represent this quantity on the blackboard by dots, each 2 dots representing 1 half-dollar. What will 1 dot represent? What quantity will be represented by 4 dots?

7. A boy spent 13¢ for a top and 2¢ for a string. How much did he spend?

8. 4¢ + 2¢ = ?   4¢ + ? = 6¢   22¢ + ? = 25¢

9. A boy has 6¢ and spends 2¢ for a postage stamp. How much has he left?

10. A boy has 6 nickels and buys 4 oranges at a nickel apiece. How much has he left?

11. I buy a gallon of vinegar for 22¢. What change do I get back out of a 25¢ piece?

12. If in the purchase of a ball a boy receives 3 cents change from a 25 cent piece, what is the cost of the ball?

13. A piece of ribbon 16 yd. long is cut into two pieces; one part is 12 yd. long. How long is the other part?

14. \$12 + \$3 = ?   \$32 + \$4 = ?   \$4 + ? = \$36.

15. A man paid $12 for an overcoat and $3 for an umbrella. What did both cost him?

16. A man paid $4 for a calf and $32 for a cow. What did he pay for both?

17. There were 16 marbles in a ring; Arthur shot away 3. How many were left in the ring?

18. A man paid 5 five-dollar bills for a suit of clothes and 1 five-dollar bill for a pair of shoes. What did both cost him?

Lesson 14

Copy and add:

	ft.	in.	ft.	in.	ft.	in.
1.	1	2	1	1	1	2
	1	3	1	4	1	4

How do you add ft. and in. to ft. and in.?

	ft.	in.	ft.	in.	ft.	in.
2.	2	1	2	3	1	3
	1	5	3	3	5	2

	yd.	ft.	in.	yd.	ft.	in.
3.	1	1	1	1	1	2
	1	1	4	1	1	3

How do you add yd., ft., and in. to yd., ft., and in.?

	yd.	ft.	in.	yd.	ft.	in.
4.	1	0	1	2	1	3
	2	2	4	2	1	3

5. A chain 3 ft. 4 in. long is joined to another chain 2 ft. 2 in. long. How long is the chain formed from the two?

6. Represent these lengths by lines of the given length. Measure the line formed by joining these. How many feet and inches in this line?

7. Add and memorize:

1	1	1	2	1	2	1	2	3
1	2	3	2	4	3	5	4	3

Subtract:

8.	*2	3	3	4	5	5	5	5
	1	2	1	2	4	1	3	2
9.	6	6	6	6	6	15	26	36
	5	1	4	2	3	12	24	32

Copy and subtract:

	ft.	in.	ft.	in.	ft.	in.
10.	2	5	4	6	5	6
	1	3	2	3	3	4

How do you subtract ft. and in. from ft. and in.?

	ft.	in.	ft.	in.	ft.	in.
11.	5	4	6	6	4	5
	4	1	3	4	1	3

Find the difference in length between two ropes, one 8 ft. 6 in. long, the other 3 ft. 4 in.

* Read 1 and **1** are 2, 1 and **2** are 3.

	yd.	ft.	in.		yd.	ft.	in.
12.	2	2	4		6	2	5
	1	1	2		3	1	4

How do you subtract yd., ft., and in. from yd., ft., and in.?

13. From a rope 5 yd. 2 ft. 6 in. long a piece 3 yd. 2 ft. 4 in. has been cut. How much is left?

14. Measure the length of the rope on the blackboard or floor. Measure the length cut off. Now measure the remaining part. How much is left?

15. Measure in ft. and in. the length of the table, and also the width. Find their difference.

16. Measure in ft. and in., and write down the heights of different pupils in the room.

17. Find the difference in the heights of the tallest and the shortest girl in the class. Of the tallest and the shortest boy.

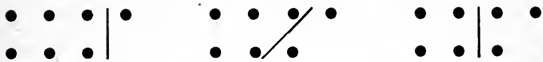
18. Find the difference in the heights of the tallest boy and the tallest girl in the class.

19. Measure the heights of several pupils in yd., ft., and in., and make questions about the sum or difference of their heights.

20. James is 6 yr. 4 mo. old, and his sister Mary 2 yr. 3 mo. James is how much older than Mary?

21. A milkman pours 3 gal. 2 qt. of milk from a can, and has 2 gal. 1 qt. left in the can. How much was in the can at first?

Lesson 15



1. What can each of these dots represent? Read these dots from left to right and from right to left.

Add:

2.	1	2	3	6	5	4		
	6	5	4	1	2	3		
3.	1	1	2	1	1	1	1	1
	6	16	24	36	45	56	63	76
4.	6	6	6	4	6	6	3	6
	1	11	31	51	71	91	22	41

5. What is the sum of 71 in. and 5 in.?

Arthur can jump 71 in. and James 5 in. beyond Arthur. How far can James jump?

6.	2	2	2	2	2	2	2
	5	25	45	64	85	33	55

7. How many dollars in 3 ten-dollar bills and a two-dollar bill?

I paid 3 ten-dollar bills and a two-dollar bill for a desk, and a five-dollar bill for a chair. What did both cost?

8.	5	5	5	5	5	3	5
	2	12	31	42	62	82	92

9.

3	4	3	4	3	4	3
4	3	14	13	24	23	34

10. A lady is 34 yr. of age, and her husband is 3 yr. older. What is his age?

11. What numbers added give 7?

12. If in question 1 each dot represents 1 pt., how many qt. and pt. are represented by the 7 dots?

13. What is the weight of 4 10-lb. sacks of flour and 3 10-lb. sacks?

How many cents in 5 dimes and 2 dimes?

14. If a boy is 16 yr. old to-day, when was he 13 yr. old?

Add:

15.

2	2	2	2	2	2
3	13	113	3	23	223

16.

3	3	3	3	3	3
4	14	114	4	34	134

17. 134 mi. + 3 mi. = ? 3 mi. + 134 mi. = ? 134 mi. + ? = 137 mi. 3 mi. + ? = 137 mi.

A gentleman travels 134 mi. by train and drives 3 mi. from the station to his friend's house. How far does he go all together?

18.

2	2	2	2	2	2
5	25	125	5	44	145

19.	6	6	6	6	6	6
	1	11	111	1	81	181

20. 5¢ + 2¢ = ? ¢   5¢ + 1¢ = ? ¢   5¢ + ? = 7¢

21. 1 nickel = ? ¢   1 nickel 1¢ = ? ¢
1 nickel 2¢ = ? ¢   4 nickels = ? dimes

22. If I pay 2¢ more than a nickel for a loaf of bread, what does it cost?

23. Draw two lines, end to end, one 5 3-in. long, and the other 2 3-in. long. How many 3-in. in the whole line? How many inches? How many 3-in. in 21 in.?

Lesson 16

1. 4 + 3 = ?   24 + 3 = ?   32 + ? = 36

2. A boy spends 4¢ for an orange and 3¢ for a lemon. How much does he spend?

3. A pound of butter costs 24¢, and a pint of milk 3¢. What do both cost?

4. I bought a bicycle for $36, and paid $32 cash. How much did I then owe?

5. Henry has a 25-cent piece and 2¢. How much money has he?

6. A box is 33 in. long. It is how many inches shorter than a yardstick?

7. I gave a five-dollar bill for a pair of shoes and 2 one-dollar bills for a hat. What did both cost?

8. My milkman left me 3 qt. 1 pt. of milk, and I paid him in pint tickets. How many did I give him? Represent by dots.

9. What unit does the grocer use to measure kerosene? To weigh butter?

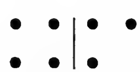
10. What other units might be used in each of these cases? How does each of the latter units compare in weight with each of the former?

11. What is butter worth a pound? What is kerosene worth a gallon? What unit measures the value of a pound of butter, and also of a gallon of kerosene?

12. Measure a gallon of water with a quart measure. What number of quarts did you get?

13. Put 1 gal. 3 qt. of water into a pail. Measure this with a quart measure. What number did you get? 1 gal. 3 qt. = ? qt.

14. Empty 5 qt. of water into a pail. Measure this with gallon and quart measures. 5 qt. = ? gal. ? qt.



15. If each dot represents 1 qt., what do 4 dots represent? What do these dots represent? How many qt.?

16. Represent 2 gal. 2 qt. by dots. How many qt.? Represent 15 qt. by dots. How many gal. and qt.? Make other questions.

17. 1 gal. = ? qt. 1 gal. 2 qt. = ? qt.
1 gal. 3 qt. = ? qt. 6 qt. = ? gal. ? qt.

18. 1 yr. = ? mo. 1 yr. 3 mo. = ? mo.
1 yr. 5 mo. = ? mo. 14 mo. = ? yr. ? mo.
16 mo. = ? yr. ? mo.

19. Harry is 1 yr. and 5 mo. old, Charlie is 3 yr. and 7 mo. old. What is the sum of their ages?

20. Charlie is how much older than Harry?

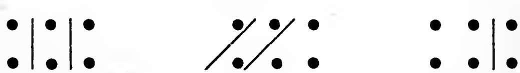
21. Represent by dots on the board the age of Charlie in months, each dot to represent 1 mo. Mark off by a line the number of dots representing Harry's age in months.

22. 1 da. = ? hr. 1 da. 2 hr. = ? hr.
25 hr. = ? da. ? hr. 27 hr. = ? da. ? hr.

23. If a cow gives a gallon of milk in the morning and 3 qt. at night, how many quarts does she give in a day?

24. A baby is 1 yr. 4 mo. old. How many months old is he?

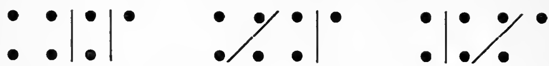
Lesson 17



1. Read these dots in opposite directions, and write your results thus: $2 + 2 + 2 = 6$.

2. Add:

2	2*	1	1*	1	1
2	2	3	3	1	1
2	12	2	22	4	34



3. Count 6 dots by 2's. How many 2's? If each dot represents a pint, how many quarts are there?

4. How many quarts in 3 2-qt.? How many days will 5 2-qt. jars of fruit last a family that eats 1 qt. a day?

5. How many days will 3 2-lb. rolls of butter last a family that eats $\frac{1}{2}$ lb. a day?

6. Read these dots in opposite directions, and write down your results.

Add:

7.	1	1	1	1	2	2
	2	2	3	3	3	3
	4	24	3	43	2	52
8.	1	1	3	1	2	3
	2	4	1	2	1	2
	13	12	23	34	62	71

9. What is the sum of 32¢, 1¢, 3¢? Of 23¢, 2¢, 2¢? Of 41¢, 4¢, 2¢? James spent 22¢ for a Reader,

* Add thus: 12, 14, 16; 22, 25, 26.

3¢ for a lead pencil, and 2¢ for an eraser. What did all cost?

10. A boy had 52¢ in the Penny Savings on Monday. Tuesday he put in 2¢, and Wednesday 3¢. How much did he then have?

11. Copy and add:

21¢	22¢	32¢	26¢	30¢	14¢
13¢	12¢	14¢	31¢	44¢	63¢

12. I paid 21¢ for a lb. of butter and 13¢ for a lb. of cheese. What was the cost of both?

13. Question 12 is founded on the first problem in number 11. Make similar questions, using the quantities given in number 11.

14. Copy and add:

11	15	21	20	20	22
14	30	11	30	25	21
22	32	33	25	31	14

15. Name two units each of which is used to measure potatoes.

16. Make questions, using the following price-list:

Coffee at 31¢ a lb.
Baking powder at 22¢ a can
Gelatine at 13¢ a package
Matches at 10¢ a package
Nuts at 12¢ a lb.
Candles at 15¢ a lb.

Lesson 18

Subtract:

1.	2	3	3	4	4	4	5	5	5	5	5
	1	2	1	3	1	2	4	1	3	2	5
2.	6	6	6	6	6	7	7	7	7	7	7
	5	1	4	2	3	6	1	5	2	4	3
3.	3	6	4	5	7	7	6	4	2	7	6
	0	2	4	1	7	2	1	0	2	3	1

4. What is the meaning of $4 - 3 = 1$? Of $5 - 2 = 3$? Of $6 - 2 = 4$? Of $7 - 4 = 3$?

5. I paid 7¢ for an apple and an orange. The orange cost 5¢; what did the apple cost?

6. From A to C is 6 mi. If it is 4 mi. from A to B, how far is it from B to C?

Copy and subtract:

7.	*35¢	46¢	75¢	66¢	57¢	61¢
	22¢	24¢	31¢	26¢	14¢	30¢
8.	45	56	72	43	26	77
	21	11	22	13	21	15

9. Write the second quantity under the first and subtract: 65 mi. and 23 mi.; $74 and $33.

* Subtract thus: 2 and **3** are 5, 2 and **1** are 3.

10. From A to C is 35 mi. If it is 22 mi. from A to B, how far is it from B to C?

11. A man pays $42 on a bicycle that cost $65. How much more will he have to pay?

12. A man is 57 yr. of age, and his son 25 yr. How much older is the father than the son?

13. A yard is 36 in. How many inches are there in a stick that is 11 in. shorter than a yard?

14. From a box containing 72 pencils 30 have been taken. How many are left in the box?

15. Of a class of 46 pupils 34 are dismissed. How many remain?

16. A boy had 75¢, and spent 32¢ for an Arithmetic. How much had he left?

17. There are seventy-seven pupils in the first two grades of a school. If there are forty-three in the first grade, how many are in the second?

Lesson 19

1.	$4 + ? = 6$	$14 + ? = 16$	$2 + ? = 26$
	$6 - 4 = ?$	$16 - 14 = ?$	$26 - 2 = ?$

2. I buy 4 qt. of milk each morning and 2 qt. each evening. How much milk do I buy a day?

3. A man rides 14 mi. and walks 2 mi. How far does he travel?

4. If 22 pupils out of a class of 26 are present, how many are absent?

5. If 2 in. of snow fell on Monday and 5 in. on Tuesday, how much fell on the two days?

6. A boy spent 16¢ in one day. In the morning he spent 5¢. What did he spend in the afternoon?

7. Two boys have 17 marbles. If the first has 13, how many has the second?

8. Robert has a 25-cent piece, and Walter a 2-cent piece. How much money have the two boys?

9. John had 16¢ and spent 4¢ for an orange. How much had he left?

10. The schoolroom thermometer registered 63° and then rose 3°. What did it then register?

11. What is the unit that measures temperature?

12. What is the sum of four and twelve?

13. Find the cost of two rugs, one costing $25, and the other $42.

14. How much more must I pay for a waste paper basket costing 75¢, than for one costing 55¢?

15. Draw a line 4 2-in. long. How many inches long is it? If a line is measured by the number 5 and the unit 2-in., how long is it? Draw the line.

16. The weight of a parcel is measured by the number 4 and the unit 3-lb. How many pounds does it weigh?

17. A line 12 in. long is measured by the unit 2-in. What *number* of 2-in.? 6 is often called the *ratio* of 12 in. to 2 in.

18. A line 10 in. long is measured by the number 5 and a certain unit. What is the *unit?* Divide the line into 5 equal parts, and measure each part.

19. Memorize:

1	2	1	2	1	2	3	1	2	3
3	2	4	3	5	4	3	6	5	4
4	4	5	5	6	6	6	7	6	7

Lesson 20

Add:

1.	2 dimes	2 dimes	3 dimes	1 dime
	2 "	3 "	3 "	4 dimes
2.	20 ¢	20 ¢	30 ¢	10 ¢
	20 ¢	30 ¢	30 ¢	40 ¢
3.	1 dime	3 dimes	3 dimes	2 dimes
	5 dimes	4 "	2 "	5 "
4.	10 ¢	30 ¢	30 ¢	20 ¢
	50 ¢	40 ¢	20 ¢	50 ¢
5.	10 min.	10 min.	20 min.	30 min.
	10 "	20 "	30 "	30 "

6.	10 in.	20 ft.	20 yd.	40 mi.
	20 "	20 "	40 "	30 "

7.	20 min.	30 hr.	30 da.	20 da.
	10 "	10 "	30 "	50 "

8. A boy takes 30 min. to go on an errand, and 20 min. to return. How long is he gone?

9. There are 30 da. in April and the same number in June. How many days in both months?

10. What is the weight of two parcels, one weighing 10 lb., and the other 40 lb.?

11.	3	30	3	30	3	30
	2	20	12	120	22	220
12.	4	40	4	40	4	40
	2	20	12	120	22	210
13.	4	40	4	40	4	40
	3	30	13	130	23	230
14.	1	10	100	1	10	100
	1	10	100	2	20	200
15.	2	20	200	2	20	200
	3	30	300	5	50	500

Subtract:

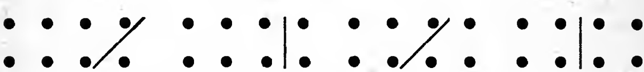
16.	40	40	50	50	60	70
	30	20	10	20	30	40

17.	300	500	400	600	700
	200	400	100	200	500

18. I paid 20¢ for 1 lb. of meat. What change did I get back out of a fifty-cent piece?

19. A farmer had 500 bu. of wheat and sold 300? How many bushels had he left?

Lesson 21



1. Read these dots from left to right and from right to left.

2. If each dot represent (*a*) a cent, (*b*) an inch, (*c*) a year, (*d*) \$2, (*e*) 1 2-lb., read the result from right to left and from left to right. Place these readings in columns for addition, and add.

Add:

3.	1	2	3	4	5	6
	7	6	5	4	3	2

4.	1	1	1	1	1	1
	7	17	26	37	47	50

5.

2	2	2	2	2	2
6	46	56	64	76	86

6.

3	3	3	3	3	3
5	15	115	25	125	135

7.

4	4	4	4	4	4
4	14	114	124	134	144

8. Add and memorize:

1	1	1	2	1	2	1	1	2	3
1	2	3	2	4	3	5	5	4	3

1	2	3	1	2	3	4
6	5	4	7	6	4	4

9. A boy rode 15 mi. and walked 3 mi. How far did he travel?

10. Helen had 50¢ and earned 30¢ more. How much did she then have?

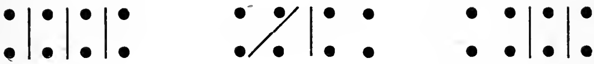
11. Find the cost of 2 lb. of sugar at 5¢ a lb., and 3 cakes of soap at 3¢ each.

12. A sack of flour cost 60¢, and a pound of coffee 30¢. What did both cost?

13. A young man is 20 yr. old, and his father is 50 yr. old. Find the sum of their ages.

14. I paid $87 for a horse and $55 less for a cow; find the cost of the cow.

Lesson 22



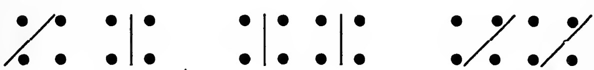
1. Read these dots in opposite directions, and write your results in columns for addition, thus:

2
2
2
2
8

Add:

2.	2	2	3	3	2	2
	3	3	3	3	2	2
	3	23	2	12	4	44
3.	4	2	2	3	2	1
	2	4	3	3	3	1
	22	22	33	52	22	45

4. What is the meaning of $22 + 4 + 2 = 28$? Of $33 + 2 + 3 = 38$?



5. Read these dots in opposite directions, and write your results in columns for addition.

Add:

6.	2	2	3	3	2	1
	5	6	1	1	5	4
	1	21	2	42	32	53

7.	1	5	3	1	2	1
	5	1	3	2	4	3
	22	22	41	65	72	84

8. Count 8 dots by twos. How many twos? If each dot represents a pint, how many quarts are there?

Count by fours. How many fours? If each dot represents a quart, how many gallons are there?

9. If each of the 8 dots represent $1, how many two-dollar bills are represented? If each dot represents half-a-dollar, how many dollars are there?

10. Count 8 dots by twos. How many twos? If a family buys 2 qt. of milk a day, how many quarts will it use in 4 days?

Copy and add:

11.	43	23	25	42	66	16
	41	51	43	25	21	71
12.	325	123	404	260	152	203
	132	261	162	427	233	642
13.	10	23	31	22	31	11
	22	21	14	10	30	21
	13	22	23	35	17	36

14. Make groups of eight dots and draw lines as in question 1. Write as many different columns for addition as you can.

15. What two numbers give 8 when added?

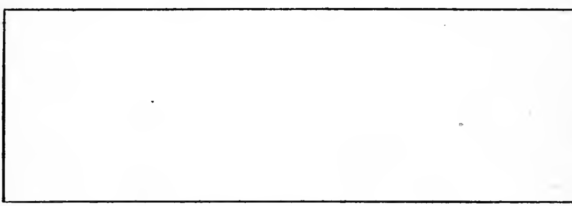
16. What three numbers give 8 when added?

17. I carried home from the store a 2-lb. can of corn, 4 lb. of nuts, and a 2-lb. roll of butter. How many pounds did my parcel weigh? How many 2-lb.? How many 4-lb.?

18. The cost of a chair is measured by the number 5 and the unit $2. What is its cost?

19. A debt of $10 is measured by the unit $5 and a certain number. What is the number?

Lesson 23

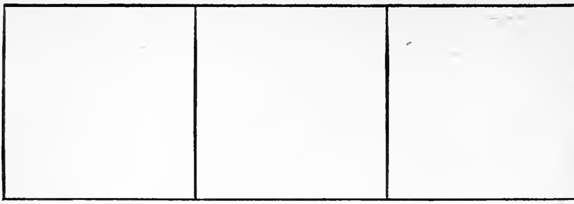


1. How long is this oblong? How wide?

2. Draw a line as long as the four sides of this oblong. How long is it? The *perimeter* of this oblong is 8 in.

3. Draw an oblong 2 in. long and 1 in. wide. What is the length of its perimeter?

4. Draw a square each side of which is 2 in. What is the length of its perimeter?



5. Draw a square each side of which is 1 inch. This is called a *square inch.* Draw a square each side of which is 4 inches. How many square inches in this square? How many 4-sq. in.? What units of measurement are used in the measurement of this 4-inch square?

6. How long is this oblong? How wide? It contains 3 square inches (3 sq. in.). One square inch is the unit that measures the area of the oblong.

7. Draw an oblong 4 in. long and 1 in. wide. Divide it into square inches. What is its area?

8. What is the area of an oblong 5 in. long and 1 in. wide? 6 in. long and 1 in. wide?

9. Draw an oblong containing 8 sq. in. How many 2-sq. in. does it contain? How many 4-sq. in.?

Add:

	hr.	min.	hr.	min.	hr.	min.
10.	3	2	4	20	5	4
	2	4	3	30	1	22

	da.	hr.	da.	hr.	yr.	da.
11.	2	5	20	1	3	30
	5	3	40	6	4	30

12. A boy is 8 yr. 6 mo. old, and his sister 5 yr. 2 mo. What is the difference between their ages?

13. A table is 3 ft. 6 in. long and 2 ft. 6 in. wide. What is the sum of the length and width? What is the perimeter of the table?

Lesson 24

1. Read these dots from left to right and from right to left.

2. Make two groups of 9 dots each. Draw lines and show that

$$9 = 8 + 1, \text{ or } 1 + 8; \quad 7 + 2, \text{ or } 2 + 7.$$

Add:

3.	1	1	1	1	1	3	1	1	1
	8	18	26	38	48	53	68	70	88

4.	2	2	2	2	2	2	2	2
	7	17	117	125	137	147	153	167
	3	3	3	3	3	3	3	3
	6	16	113	216	316	326	335	346

5. A man paid \$65 for a bicycle, and spent \$4 in repairs during the year. What was the entire cost?

6.

4	5	4	5	4	5	4	5
5	4	15	14	25	24	35	34

7. Memorize:

$9 = 8 + 1$, or $1 + 8$; $7 + 2$, or $2 + 7$;
$6 + 3$, or $3 + 6$; $5 + 4$, or $4 + 5$.

8. Arrange 9 dots in groups of 3. How many 3 dots in 9 dots? If each dot represents a foot, what unit of length do 3 dots represent?

9. If each dot represents 1 lb. of lard, how many 3-lb. pails of lard are represented by 9 dots?

10. Add 3 to each of the following numbers:

6, 16, 26, 36, 46, 56, 66, 76, 86, 96.

11. I paid \$35 for a sofa, the price of which had been reduced \$4. What was the original price?

12. Subtract 4 from each of the following numbers:

9, 19, 29, 39, 49, 59, 69, 79, 89, 99.

13. I paid \$49 for a rug, less \$5 for cash. What did the rug cost?

14. Copy and add:

25	27	32	40	36	54	16	60
34	42	51	46	63	24	53	19

15. Copy and subtract:

76	92	48	78	63	76	59	99
23	81	34	37	12	26	41	64

16. A debt is measured by the number 5 and the unit $2. What is the debt? With the unit $5, what number would measure the debt?

Lesson 25

1. $8 + 1 = ?$ $8 + ? = 9$ $7 + 2 = ?$ $7 + ? = 9$

2. $6 + ? = 9$ $3 + ? = 9$ $5 + ? = 9$ $4 + ? = 9$

3. Subtract:

9	8	6	9	9	7	9	8	9	6
6	3	4	2	1	2	7	4	5	0

4. Bertha is 4 yr. old, and her sister 9. In how many years will Bertha be as old as her sister is now?

5. A post 9 ft. long is 3 ft. below ground. How long is the part above ground? Draw this post.

6. Write the following numbers under each other, and add: 12 and 36; 25 and 51; 42 and 27; 33 and 53.

7. A boy is 12 yr. old, and his father 36. What is the sum of their ages?

8. It took me 26 min. to ride 4 mi. on a bicycle against the wind, and 21 min. to return with the wind. How long was I gone and how far did I ride?

9. There are 28 da. in Feb. and 31 da. in March. How many days are there in the two months?

10. Write the following numbers under each other, and subtract the smaller from the larger: 86 and 64; 78 and 31; 18 and 89; 95 and 34.

11. A boy has earned \$32 toward buying a \$55 bicycle. How much has he still to earn?

12. Albert has 75¢, and his sister Florence 50¢. Albert has how much more than Florence?

Lesson 26

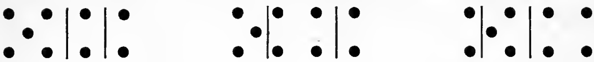
Subtract:

1.	5	15	25	6	16	26	6	26
	3	3	3	2	2	2	3	3
2.	7	27	6	36	8	48	9	49
	5	5	4	4	3	3	7	7
3.	8	58	7	37	9	29	9	19
	6	6	4	4	2	2	4	4

4. A person having a 25¢ piece buys two 2¢ postage stamps. What change does he get in return?

5. Out of 18 baskets of plums 3 baskets are spoiled. How many are good?

6. It took me 19 min. to row a certain distance up stream, and 6 min. less to return. How long did it take to return?



7. Read these dots from left to right and from right to left, and write your results in columns for addition.

8. If each dot represents \$1, what unit of money will 5 dots represent? 2 dots? How many dollars in a five-dollar bill and 2 two-dollar bills?

9. If each dot represents 1 ft., what unit does a group of 3 dots represent? What is the sum of 2 ft., 1 yd., and 4 ft.?

10. Make 9 dots in groups of 3 dots. How many 3's in 9? Three yd. of tape at 3¢ a yd., find the cost. Paid \$9 for 3 bbl. of apples. Find cost per bbl.

11. Arrange 9 dots in groups of 2's. Let each dot represent 1 pt. Make two questions. Arrange in groups of 4's. Let each dot represent 1 qt. Make two questions.

12. Make groups of 9 dots and draw lines as in question 7. Write as many different columns for addition as you can.

Add:

13.	1	1	2	5	1	2
	5	5	3	3	6	3
	3	13	22	31	72	83

14.	3	2	2	4	1	2
	3	2	5	3	3	5
	63	42	31	12	64	72

15. Three years ago I was 32 years old. How old shall I be 4 years from now?

16. I paid $61 for a bicycle, $2 for a lamp, and $6 for a bicycle suit. What was the entire cost?

Lesson 27

1. Copy and add:

123	203	216	14	201	464
212	231	101	301	462	301
333	543	672	484	125	213

2. Copy and subtract:

762	968	650	934	687	989
421	265	120	323	534	232

3. Write the following numbers under each other and add: 323 and 462; 236 and 423; 683 and 214; 337 and 542.

4. Write the following numbers under each other and subtract the smaller from the larger: 697 and 182; 265 and 495; 108 and 279; 848 and 316.

5. I pay $250 for a span of horses and $220 for a carriage. Find the cost of both.

6. There are 255 pupils in the grammar school and 41 in the high school. How many pupils are there in the entire school?

7. There are 35 pupils in the first grade, 32 in the second, and 30 in the third. How many pupils are there in the first three grades?

8. There are 48 pupils in the Kindergarten, of whom 26 are between 5 and 6 years old. How many are between 4 and 5?

9. Of a school of 255 pupils, 231 were present on Friday. How many were absent?

10. If I read 122 pages of a book containing 346 pages, how many will I have still to read?

Lesson 28

1. Read these dots from left to right and from right to left.

2. Count 10 by 5's. How many 5's in 10? How many nickels in a dime? Count 10 by 2's. How many 2's in 10? How many \$2 in \$10?

3. If each dot represents a nickel, what unit of money will 5 dots represent? What unit, if each dot represents 1 dime? \$1? \$2?

4. Arrange 10 dots in groups of 2, 3, and 4, and let each dot represent 1 pt., 1 ft., or 1 qt. Make questions similar to Lesson 16, questions 16 and 17.

5. If \$10 is counted by a \$2 unit, what is the *number?* 5 is often called the *ratio* of \$10 to \$2?

6. Make three groups of 10 dots each. Draw lines and show that

$10 = 9 + 1$ or $1 + 9$; $8 + 2$ or $2 + 8$; $6 + 4$ or $4 + 6$.

7. Name the number which added to each of the following numbers gives 10:

8, 5, 3, 1, 7, 4, 9, 2, 0, 6, 10.

8. Fill the blanks:

$6 + ? = 10$ $5 + ? = 10$ $2 + ? = 10$ $7 + ? = 10$

9. Add:

2	2	3	3	4	4	5	5
8	18	17	27	26	36	45	55

10. What unit of money is equal to 10¢? 5¢? 25¢? 50¢? 100¢?

11. If I buy two 2¢ postage stamps, how much change shall I get back out of a dime?

12. If I buy a postal card, how much change will I get back out of a dime? Out of a half-dollar?

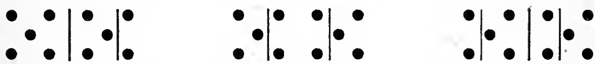
13. Some boys spent 45¢ for melons and 5¢ for peaches. How much did they spend? What unit of money would pay for both?

14. A farmer sows 16 A. with wheat and 3 A. with oats. How many acres did he sow?

15. A man is 27 yr. old, and his son 3 yr. What is the sum of their ages? What is the difference?

16. Two boys hire a boat one hour for 20 ¢. If the first pays 15 ¢, what does the second pay?

Lesson 29



1. Read these dots from left to right and from right to left, and write your results in columns for addition.

2. Make groups of 10 dots and draw lines as in question 1. Write as many different columns for addition as you can.

Add:

3.	2	4	4	5	1	3
	3	2	2	3	3	4
	5	4	24	42	66	83

4.	4	2	1	2	5	3
	2	4	3	3	1	3
	12	33	56	72	94	102

5. Copy and add:

231	222	212	102	202
321	134	303	214	471
215	541	584	683	416

6. Find the sum of \$142, \$225, and \$312.

7. Subtract:

10	9	10	8	10	9	10	10
6	2	5	1	2	4	1	3

8. Copy and subtract:

942	896	107	1085	1077
611	703	63	823	562

9. On a debt of $685 I pay $435. How much do I still owe?

10. Write the following numbers under each other and add:
21, 60, and 15; 42, 27, and 30; 333, 324, and 511.

11. Write the following numbers under each other and subtract the smaller from the larger:

899 and 473; 1064 and 521; 1056 and 823.

12. I bought three bicycles, paying for the first $40, for the second $22, and for the third $16. What did I pay for all three?

13. James weighs 107 lb., and George 82 lb. How much more does James weigh than George?

14. I paid 10¢ for bread, 32¢ for coffee, and 56¢ for butter. What did I pay for all?

15. A farmer planted 12 cherry trees, 24 apple trees, and 13 plum trees. If eleven died, how many trees were there in his orchard?

SECTION III

Lesson 30

1. Add:

				$2
			$2	2
		$2	2	2
	$2	2	2	2
$2	2	2	2	2
2	2	2	2	2

2. What is the sum of the last column? Count the number of $2 in the last column. $6 \times \$2 = \$12$.

3. $2 \times \$2 = ?$ $3 \times \$2 = ?$ $4 \times \$2 = ?$ $5 \times \$2 = ?$

4. If 1 hat costs $2, what will 6 hats cost?

● ● ●

● ● ●

5. Count these dots by 2's. How many 2's in 6? Count by 3's. How many 3's in 6?

$$6 = 3 \times 2 \text{ or } 2 \times 3.$$

6. If each dot represents a pint, how many represent a quart? How many quarts in 6 pt.? What will 6 pt. of syrup cost at 2 dimes a quart?

7. If each dot represents 1¢, how many represent the value of a 2¢ postage stamp? What will 3 2-cent postage stamps cost?

8. If each dot represents 1 ft., what unit will 3 dots represent? How many feet in 2 yd.? What will 6 ft. of tape cost at 3¢ a yd.?

9. 3×2 dimes = ? 2×3 dimes = ?

3×2 tens = ? tens 2×3 tens = ? tens

3×2 5-lb. = ? 5-lb. 2×3 5-lb. = ? 5-lb.

10. What is the cost of 3 yd. of ribbon at 2 dimes a yd.? How many ten yard lengths of carpet in 3 times 2 ten yard lengths?

11. Count 8 dots by 2 dots; 8¢ by 2¢; 8 dimes by 2 dimes; 8 3-lb. by 2 3-lb.; 8 2-yd. by 2 2-yd.; 8 6-sq. in. by 2 6-sq. in. How many 2's in each case? How many 2-units in an 8-unit quantity?

12. Count again by 4's. How many 4 dots in 8 dots? 4¢ in 8¢? 4 dimes in 8 dimes? 4 3-lb. in 8 3-lb.? 4 2-yd. in 8 2-yd.? 4 6-sq. in. in 8 6-sq. in.? How many 4-units in an 8-unit quantity?

13. How many 2's in 8? How many 4's in 8?

$$8 = 4 \times 2 \text{ or } 2 \times 4.$$

14. Place 10 dots, count by 2's and 5's, and show that

$$10 = 5 \times 2 \text{ or } 2 \times 5.$$

Count again as in questions 11 and 12.

15. Place 12 dots so as to show that

$$12 = 6 \times 2 \text{ or } 2 \times 6.$$

16. Place 14, 16, 18, 20 dots, and make similar questions.

17. Memorize:

$$6 = 2 \times 3 \text{ or } 3 \times 2.$$
$$8 = 2 \times 4 \text{ or } 4 \times 2.$$
$$10 = 2 \times 5 \text{ or } 5 \times 2.$$
$$12 = 2 \times 6 \text{ or } 6 \times 2.$$

18. 2 and 3 are called *factors* of 6. What are the factors of 8? 10? 12? 14? 16? 18? 20?

19. 2 is one factor of 18. What is the other? How many 2¢ stamps can you buy for 18¢?

20. How many 2-lb. bricks of codfish weigh 24 lb.?

21. A board 12 ft. long is cut into 4 pieces. Find length of each piece. If cut into 4 ft. pieces, how many pieces?

22. What is the total weight of 5 2-lb. cans of peas, 2 3-lb. cans of tomatoes, 2 6-lb. boxes of starch, and 1 10-lb. sack of flour?

23. Vegetables are put up in 1, 2, and 3-lb. cans, and flour in 10-lb. sacks. Using this, make examples like question 22.

24. Name the *even* numbers from 2 to 12. What number is a factor of all these even numbers? Name all the odd numbers from 1 to 11. Is 2 a factor of these? How can you change an odd number to an even number?

Lesson 31

1.	2×1 in. = ?	2×5 in. = ?	2×9 in. = ?
	2×2 in. = ?	2×6 in. = ?	2×10 in. = ?
	2×3 in. = ?	2×7 in. = ?	2×11 in. = ?
	2×4 in. = ?	2×8 in. = ?	2×12 in. = ?
2.	3×2 ft. = ?	3×2 yd. = ?	3×2 mi. = ?
	2×3 ft. = ?	2×3 yd. = ?	2×3 mi. = ?
3.	$3 \times \$2 = ?$	$3 \times \$20 = ?$	$3 \times \$200 = ?$
	$2 \times \$3 = ?$	$2 \times \$30 = ?$	$2 \times \$300 = ?$
4.	$4 \times \$2 = ?$	$4 \times \$20 = ?$	$4 \times \$200 = ?$
	$2 \times \$4 = ?$	$2 \times \$40 = ?$	$2 \times \$400 = ?$

5. A dealer sold 4 sets of furniture at $200 each, and 2 bookcases at $30 each. What did all sell for?

6. A farmer received $200 for a span of horses, $20 apiece for 3 cows, and $4 apiece for 2 sheep. What did he receive all together?

7.	$4 \times \$20 = ?$	$5 \times \$20 = ?$	$6 \times \$20 = ?$
	$2 \times \$40 = ?$	$2 \times \$50 = ?$	$2 \times \$60 = ?$
8.	$7 \times \$20 = ?$	$8 \times \$20 = ?$	$9 \times \$20 = ?$
	$2 \times \$70 = ?$	$2 \times \$80 = ?$	$2 \times \$90 = ?$
9.	$10 \times \$20 = ?$	$11 \times \$20 = ?$	$12 \times \$20 = ?$
	$20 \times \$10 = ?$	$20 \times \$11 = ?$	$20 \times \$12 = ?$

10. What is the cost of 3 2-lb. rolls of butter at 20¢ a lb., 2 lb. of coffee at 30¢ a lb., and 2 cakes of soap at 4¢ a cake?

11. Find the cost of 2 lb. meat at 12¢ a lb., 1 can corn at 13¢, 1 doz. lemons at 30¢ a doz., and 1 lb. bacon at 12¢ a lb.

Copy and multiply:

12.	22¢ 2	22¢ 3	22¢ 4	21¢ 5	21¢ 6	21¢ 7
13.	$23 2	$43 2	$34 2	$54 2	$63 2	$82 2

14. Place 2 under each of these quantities, and multiply: 24¢, $42, 13 lb., 52 mi., 30 da., 64 yr.

15. There are 24 hr. in 1 da. How many hours in 2 da.?

16. If there are 21 hills of potatoes in a row, how many hills are there in 6 rows?

17. Multiply 23 lb. by 2, and 21 lb. by 3. Add your results.

18. What is the cost of 5 doz. eggs at 21¢ a dozen, and 2 lb. of tea at 42¢ a pound?

19. Memorize:

Two times

1 is 2	5 is 10	9 is 18
2 is 4	6 is 12	10 is 20
3 is 6	7 is 14	11 is 22
4 is 8	8 is 16	12 is 24

20. What is the meaning of $2 \times 3 = 6$? Of $4 \times 2 = 8$?

21. Place dots so as to show that the factors of 14 are 2 and 7 or 7 and 2. How many pounds of rice at 7¢ a pound can you buy for 14¢?

22. How many 8-lb. pails of butter can you get from 16 lb.? From 160 lb.?

23. A length of 24 ft. is measured by the unit 4 ft., what is the *number?* Draw this length, making 1 in. for 1 ft., and measure, counting the number. If the number is 4, what is the unit of measure?

24. What are the factors of 16 ($16 = 2 \times 8$ or 8×2), 18, 20, 22, 24?

Lesson 32

1.

1 qt. = ? pt.	8 qt. = ? pt.	10 qt. = ? pt.
3 qt. = ? pt.	5 qt. = ? pt.	12 qt. = ? pt.
6 qt. = ? pt.	9 qt. = ? pt.	11 qt. = ? pt.

2. How many times must a pint measure full of water be emptied into a quart measure to fill it? By what number must you multiply to reduce quarts to pints? A pint is what part of a quart?

3. A pitcher holds 3 qt. of milk. How many pints will it hold?

4.

2 qt. 1 pt. = ? pt.	6 qt. 1 pt. = ? pt.
3 qt. 1 pt. = ? pt.	10 qt. 1 pt. = ? pt.
7 qt. 1 pt. = ? pt.	12 qt. 1 pt. = ? pt.

5. How do you reduce 8 qt. and 1 pt. to pints? Multiply the number of quarts by 2, and add 1 to get the number of pints.

6. $\frac{1}{2}$ of 6 in. = ? in. $\frac{1}{2}$ of 18 in. = ? in.
$\frac{1}{2}$ of 10 in. = ? in. $\frac{1}{2}$ of 24 in. = ? in.
$\frac{1}{2}$ of 14 in. = ? in. $\frac{1}{2}$ of 16 in. = ? in.

7. $\frac{1}{2}$ of \$4 = ? $\frac{1}{2}$ of \$40 = ? $\frac{1}{2}$ of \$400 = ?

8. $\frac{1}{2}$ of 6 pt. = ? pt. $\frac{1}{2}$ of 16 pt. = ? pt.
$\frac{1}{2}$ of 8 pt. = ? pt. $\frac{1}{2}$ of 22 pt. = ? pt.
$\frac{1}{2}$ of 12 pt. = ? pt. $\frac{1}{2}$ of 18 pt. = ? pt.

9. 2 pt. = 1 qt. 6 pt. = ? qt. 20 pt. = ? qt.
4 pt. = ? qt. 12 pt. = ? qt. 24 pt. = ? qt.

10. 5 pt. = ? qt. ? pt. 15 pt. = ? qt. ? pt.
9 pt. = ? qt. ? pt. 23 pt. = ? qt. ? pt.

11. What will 8 yd. of silk cost at \$2 a yd.?

12. If a boy rides 9 mi. an hour, how far will he ride in 2 hr.?

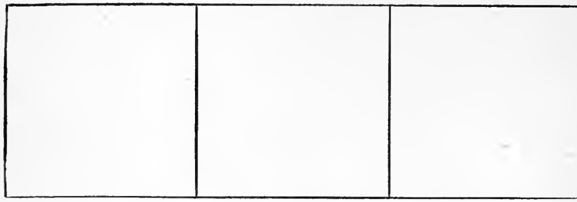
13. What will 5 qt. 1 pt. of milk cost at 2¢ a pt.?

14. What will 4 pt. of milk cost at 6¢ a qt.?

15. What is the price of 2 qt. 1 pt. of milk at 6¢ a quart?

16. There are 29 fruit trees in an orchard, 5 are cherry trees, 4 plum, and the rest apple; how many apple trees are there?

Lesson 33



1. How long is this oblong? How wide?

2. How many square inches does it contain?

3. The unit of length used to measure short distances is 1 in. The unit of area used to measure small areas is 1 square inch (1 sq. in.).

4. Draw an oblong 4 in. long and 1 in. wide, and divide it into sq. in. What is its area?

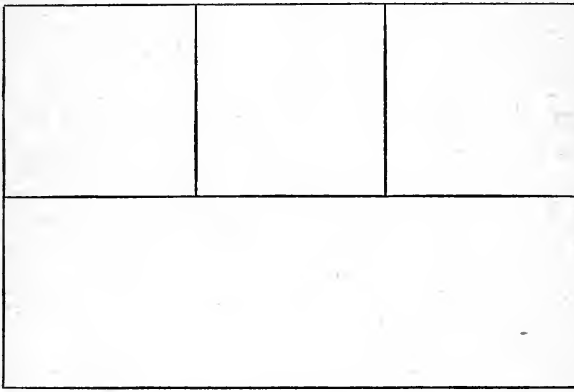
5. Draw an oblong 6 in. long and 1 in. wide, and divide it into sq. in. What is its area?

6. What is the area of an oblong 8 in. long and 1 in. wide? 10 in. long? 12 in. long?

7. Make an oblong 4 in. long and 2 in. wide. Divide it into sq. in. How many sq. in.? Count by 4's. How many 4 sq. in.? Count by 2's. How many 2 sq. in.?

8. Make an oblong 8 in. long and 2 in. wide. Divide it into sq. in. How many sq. in.? Count by 8's. How many 8 sq. in.? Count by 2's. How many 2 sq. in.?

9. Make other oblongs, divide them into sq. in., and count their areas by sq. in., 2 sq. in., and so on.



10. How long is this oblong? How wide?

11. Into how many rows is it divided? What is the area of each row? What is the area of the oblong?

12. The area of this oblong is measured by the *number* 6 (2×3) and the *unit* 1 sq. in.

13. Make an oblong 4 in. long and 2 in. wide. Divide it as the oblong in question 7 is divided.

14. What number measures its area? What is its area?

15. What number measures the area of an oblong 5 in. long and 2 in. wide? What is its area?

16. What is the area of an oblong 6 in. long and 2 in. wide?

17. How do you find the number of sq. in. in an oblong 3 in. long and 2 in. wide? 4 in. long and 2 in. wide? 6 in. long and 2 in. wide? 8 in. long and 2 in. wide? 10 in. long and 2 in. wide? Any length and any width?

18. Make problems like questions 15 and 16.

Lesson 34

1. $2 \times 3 = 6$. 2 and 3 are called *factors* of 6. 6 is the *product* of 2 and 3.

2. 2 and 4 are the factors of what number? 4 and 2 are the factors of what number?

3. 2 and 6 are the factors of what number? 2 and 7? 9 and 2? 2 and 11? 12 and 2?

4. 2 is one factor of 8. What is the other factor? 4 is one factor of 8. What is the other factor?

5. 2 is one factor of each of the following numbers, what is the other factor? 12, 18, 24, 16, 6, 14, 10, 22.

6. 7 is one factor of 14. What is the other factor? 9 is one factor of 18. What is the other factor?

7. What are the factors of each of the following numbers: 6, 10, 12, 8, 20, 16, 24, 14, 22?

8. If 1 yd. of silk costs $3, what will 2 yd. cost?

9. If 2 is one factor of 10, what is the other factor? If 2 loaves of bread cost 10¢, what will 1 loaf cost?

10. If a man walks 1 mi. in 20 min., how long will he take to walk 4 mi.?

11. If 1 horse costs $200, what will 4 such horses cost?

12. What must 8¢ be multiplied by to give 16¢? At 8¢ a pound, how many pounds of rice will cost 16¢?

13. What will 2 doz. lead pencils cost at 24¢ a dozen?

14. What will 5 boxes of note paper cost at 20¢ a box?

Lesson 35

1. $2 \times 3¢ = 6¢$. $\frac{1}{2}$ of $6¢ = ?$ $6¢ \div 3¢ = ?$
$2 \times 6¢ = 12¢$. $\frac{1}{2}$ of $12¢ = ?$ $12¢ \div 6¢ = ?$
$2 \times 9¢ = 18¢$. $\frac{1}{2}$ of $18¢ = ?$ $18¢ \div 9¢ = ?$
$2 \times 12¢ = 24¢$. $\frac{1}{2}$ of $24¢ = ?$ $24¢ \div 12¢ = ?$

2. What is the meaning of $\frac{1}{2}$ of $8 = 4$? Of $\frac{1}{2}$ of $12 = 6$?

3. $\frac{1}{2}$ of $16 = ? $\frac{1}{2}$ of \$160 = ? $\frac{1}{2}$ of 24 mi. = ?
$\frac{1}{2}$ of 240 mi. = ? $\frac{1}{3}$ of 6 in. = ? $\frac{1}{4}$ of 8 ft. = ?

4. 1 ft. = 12 in. $\frac{1}{2}$ ft. = ? in. 2 ft. = ? in.

5. 1 dime = 10¢. $\frac{1}{2}$ dime = ? ¢. $2\frac{1}{2}$ dimes = ? ¢.

6. \$1 = 100¢. \$$\frac{1}{2}$ = ? ¢. \$$2\frac{1}{4}$ = ? ¢.

7. 1 doz. = 12. $\frac{1}{2}$ doz. = ? $2\frac{1}{2}$ doz. = ?

8. 1 hr. = 60 min. $\frac{1}{2}$ hr. = ? min. $2\frac{1}{2}$ hr. = ? min.

9.	1 da. = 24 hr.	$\frac{1}{2}$ da. = ? hr.	$\frac{1}{2}$ yr. = ? mo.
10.	1 gal. = 4 qt.	$\frac{1}{2}$ gal. = ? qt.	$2\frac{1}{2}$ gal. = ? qt.
11.	1 qt. = 2 pt.	$6\frac{1}{2}$ qt. = ? pt.	10 qt. = ? pt.

12. If 1 gal. of kerosene costs 1 dime, what part of a dime will $\frac{1}{2}$ gal. cost? How many cents will $\frac{1}{2}$ gal. cost?

13. If 1 lb. of sugar costs 6¢, how many cents will $2\frac{1}{2}$ lb. cost?

14. What will half-a-dozen lemons cost at 24¢ a doz.? Half-a-doz. silver spoons at $22 a doz.? $1\frac{1}{2}$ doz.?

15. A pail contains 8 qt. of water. How many quarts will be left in the pail after 10 pt. are taken out?

16. If 1 qt. of molasses costs 40¢, what will 1 pt. cost? What will 2 qt. 1 pt. cost?

17. A dish holds 3 qt. of berries and 1 pint more. How many pints did it hold, and what did they cost at 10¢ a qt.?

18. How many quarts in 2 gal. 2 qt.? How many pints in 2 gal. 2 qt. 1 pt.? In 1 gal. 3 qt. 1 pt.?

19. What is the cost of 2 gal. 2 qt. 1 pt. of milk at 2¢ a pt.?

What does a milkman gain by buying 1 gal. 3 qt. 1 pt. of milk at 2¢ a pt. and selling it at 3¢ a pt.?

20. Copy and multiply:

21¢	32¢	44¢	53¢	64¢	72¢
2	2	2	2	2	2

21. How much more will 2 yd. of cloth cost at 44¢ a yd. than 3 yd. at 22¢ a yd.?

22. A boy walks 2 mi. to the depot, rides on the train for 2 hr. at the rate of 32 mi. an hour, and then drives 4 mi. to his friend's house. What is the whole distance?

23. Make questions using the following price list:

Coffee at 30¢ a lb.	Butter at 24¢ a lb.
Eggs at 14¢ a doz.	Fruit at 22¢ a qt.

Lesson 36

a

b

1. How long is the line *a*? How long is the line *b*?

2. Compare *b* with *a*. The line *b* is measured 2 times by the line *a*. The *ratio* of *b* to *a* is 2.

3. Compare *a* with *b*. What part of *b* is needed to make *a*? *a* is $\frac{1}{2}$ of *b*. The *ratio* of *a* to *b* is $\frac{1}{2}$.

a

b

4. How long is *a*? How long is *b*?

5. Compare *b* with *a*. *b* is measured how many times by *a*? The *ratio* of *b* to *a* is what?

6. Compare *a* with *b*. What part of *b* needed to make *a*? The *ratio* of *a* to *b* is what?

7. Compare 4 in. with 2 in. A 4-in. line is measured how often by a 2-in. line? The *ratio* of 4 in. to 2 in. is 2.

8. Compare 2 in. with 4 in. What part of 4 in. is needed to make up 2 in.? 2 in. is $\frac{1}{2}$ of 4 in. The *ratio* of 2 in. to 4 in. is $\frac{1}{2}$.

9. Draw a line 3 in. long. Draw a line 6 in. long. Divide this line into parts each 3 in. long.

10 Compare 6 in. with 3 in. 3 in. measures 6 in, how many times? The ratio of 6 in. to 3 in. is 2.

11. Compare 3 in. with 6 in. What part of 6 in. is needed to make up 3 in.? 3 in. is what part of 6 in.? The *ratio* of 3 in. to 6 in. is what?

12. Memorize: $\frac{1}{2}$ is the ratio of 1 in. to 2 in.; of 2 in. to 4 in.; of 3 in. to 6 in.

Lesson 37

Copy and add:

1.	2	1	2	3	2	2	4	6
	3	3	2	3	1	6	4	1
	2	4	4	3	5	2	1	3

2.	2	3	3	5	3	2
	4	2	6	1	4	1
	22	33	40	51	62	73

3.	4	6	3	1	4	3
	1	2	3	3	3	3
	10	81	43	61	12	92

4.

21	12	54	66	73	24
11	30	21	10	14	30
51	46	34	22	12	25

5.

231	111	121	545	324
222	304	502	123	130
314	182	375	331	533

6. There are 102 pages in the First Reader, 150 in the Second, and 245 in the Third. How many pages are there in the three Readers?

Copy and subtract:

7.

32	45	64	96	85	69
11	31	22	73	32	26

8.

245	329	675	486	1065
123	115	254	232	253

9. A man's salary is $840, in addition to which he has an income of $245. If his yearly expenses are $625, how much can he save?

10.

896	678	795	888	999
273	207	385	543	601

11.

2345	3546	6547	9861	7209
1223	2314	4236	2341	2106

12. A span of horses weighs 2469 lb. If one weighs 1224 lb., what does the other weigh?

Copy and multiply :

13.	232¢	423¢	634¢	804¢	306¢
	2	2	2	2	2

14. Make simple practical questions illustrating $\$8 \div 2 = \$4$, and $\$8 \div \$2 = 4$. What is the meaning of $6 \div 2 = 3$?

Copy and divide :

15. 2)42 2)84 2)66 2)28 2)46 2)88

16. 2)246 2)128 2)642 2)804 2)188

17. $\$636 \div 3 = ?$ $\$488 \div \$4 = ?$ $\$168 \div 8 = ?$

18. If a 2-lb roll of butter costs 64¢, what is the price per lb.?

19. What is the price of cheese per lb. when 4 lb. cost 84¢?

20. Out of a bag containing 159 nuts 4 children each took a handful and there were still left in the bag 119 nuts. How many nuts did the children take? How many did each get on the average?

Lesson 38

1. Draw a line 1 ft. long. Draw a line 2 ft. long. Divide this line into parts each 1 ft. long.

2. Compare 2 ft. with 1 ft. The ratio of 2 ft. to 1 ft. is what?

3. Compare 1 ft. with 2 ft. What part of 2 ft. is needed to make up 1 ft.? 1 ft. is what part of 2 ft.? The ratio of 1 ft. to 2 ft. is what?

4. What is the ratio of 1 yd. to 2 yd.? Of 1¢ to 2¢? Of \$1 to \$2? Of 1 da. to 2 da.? Of 1 hr. to 2 hr.?

5. If \$2 will buy 12 yd. of ribbon, what part of 12 yd. will \$1 buy? How many yards?

6. If a train travels 60 mi. in 2 hr., what is the rate per hour?

7. Draw a line 4 in. long. Draw a line 8 in. long. Divide this line into parts each 4 in. long.

8. Compare 8 in. with 4 in. 8 in. is measured how many times by 4 in.? The ratio of 8 in. to 4 in. is what number?

9. What is the ratio of 8 ft. to 4 ft.? Of 8¢ to 4¢? Of \$8 to \$4? Of 8 da. to 4 da.? Of 8 hr. to 4 hr.

10. A boy walks 10 mi. in 4 hr. At the same rate, how many times 10 mi. will he walk in 8 hr.? How many miles?

11. If \$4 buys 3 yd. of cloth, how many yards will \$8 buy?

12. Compare 4 in. with 8 in. What part of 8 in. is needed to make up 4 in.? 4 in. is what part of 8 in.? What is the ratio of 4 in. to 8 in.?

13. What is the ratio of 4 ft. to 8 ft.? Of $4 to $8? Of 4 yr. to 8 yr.? Of 4 lb. to 8 lb.?

14. At the rate of $8 a doz., what part of a dozen pairs of stockings will cost $4? How many pairs? What will 4 bars of soap cost, at the rate of 8 for 50¢?

15. Draw lines 5 in. long and 10 in. long. Divide the line 10 in. long into parts each 5 in. long.

16. What is the ratio of 10 in. to 5 in.? Of 5 in. to 10 in.?

17. What is the ratio of 2 to 4? 3 to 6? 4 to 8? 5 to 10?

18. Name other numbers that $\frac{1}{2}$ is the ratio of.

19. 2 is the ratio of what numbers?

20. What is the ratio of 12 to 6? Of 6 to 12? Of 16 to 8? Of 8 to 16?

21. What will 8 lb. of sugar cost, when 16 lb. are sold for 84¢? What will 12 lb. cost?

22. What is the ratio of 1 qt. to 1 pt.? Of 1 pt. to 1 qt.? Of 1 dime to 1 nickel? Of 1 nickel to 1 dime? Of one-quarter dollar to one-half dollar?

Lesson 39

1. The length of a sheet of drawing-paper is 9 in. Here the *unit of measure* is 1 in. The *number* that measures the length is 9.

2. The width of a sheet of drawing-paper is 6 in. What is the *unit of measure?* What is the *number* that measures the width?

3. The length of a table is 4 ft. What is the unit of measure? What is the number that measures its length? 4 is the ratio of the length to 1 ft.

4. The width of a room is 6 yd. What is the unit of measure? What is the number?

5. The distance between two cities is 30 mi. What is the unit of measure? What is the number of units?

6. A pitcher holds 3 qt. of milk. What is the unit of measure? What number measures the quantity of milk?

7. A pail holds 6 2-qt. cans of milk. What is the unit of measure? What is the number of units? How many gallons will the pail hold?

8. The quantity of kerosene in a can is measured by the number 5 and the unit of measure 1 gal. How much kerosene is there in the can?

9. I buy 10 bu. of potatoes. What is the unit? What number measures the quantity of potatoes?

10. A family eats 2 5-lb. pails of butter in 1 mo. What is the unit? How many units of 1 lb. each.? How many 2-lb rolls of butter would the family eat in one month?

11. When a grocer sells sugar, why does he weigh it? What unit does he use?

12. A book contains 250 pages. What number measures the size of the book? What is the unit?

13. A room is 8 yd. 1 ft. 6 in. long. What three units are used to measure the length of the room?

14. The quantity of berries in a crate is measured by the number 16 and the unit 1 qt. How many quarts of berries are there in a crate?

15. The cost of a yard of ribbon is measured by the number 2 and the unit 1 dime. How many cents did it cost? What is the ratio of the cost to 1 nickel?

16. If the unit of money is a ten-dollar bill, how many dollars are there in 2 units? If there are 2 units of money in 20 ¢, what is the unit? Paid an account of $50 with 5 coins of equal value. How many dollar units is each coin worth?

17. Draw two oblongs each of which will contain 6 sq. in.

18. An oblong contains 6 sq. in. What is the unit of measure? What number measures the area? With a 2-sq. in. unit, what number? With a 3-sq. in. unit, what number?

Lesson 40

1. What is the ratio of 1 in. to 2 in.? Of 1 ft. to 2 ft.? Of 1 yd. to 2 yd.?

2. If 2 yd. of cloth cost $1, what part of $1 will 1 yd. cost.? How many cents?

3. If 2 yd. of ribbon cost 12¢, what part of 12¢ will 1 yd. cost.? How many cents?

4. What is the ratio of 2 lb. to 4 lb.? If 4 lb. of sugar cost 20¢, what part of 20¢ will 2 lb. cost.? What will 2 lb. cost?

5. If 4 loaves of bread cost 24¢, what part of 24¢ will 2 loaves cost? What will 2 loaves cost?

6. What is the ratio of 4 to 2? If 2 lead pencils cost 5¢, what will 4 lead pencils cost?

7. What is the ratio of 3 to 6? If 6 spools of thread cost 22¢, what part of 22¢ will 3 spools cost? What will 3 spools cost?

8. What is the ratio of 8 to 4? If 4 lemons costs 10¢, how many times 10¢ will 8 lemons costs? What will 8 lemons cost?

9. What is the ratio of a nickel to a dime? If a dime will buy 12 bananas, how many will a nickel buy?

10. What is the ratio of 4 lb. to 2 lb.? If 2 lb. of coffee cost 70¢, how many times 70¢ will 4 lb. cost? What will 4 lb. cost?

11. What is the ratio of a 50¢ piece to a 25¢ piece? Of a 25¢ piece to a 50¢ piece?

12. If a 50¢ piece will buy 16 lb. of walnuts, how many pounds will a 25¢ piece buy?

13. What is the ratio of 1 unit of any kind (as 2 lb., 3 yd., or $4) to two units of the same kind (as 4 lb., 6 yd., or $8)? If 2 units of ribbon (as 6 yd.) cost 80¢, what will 1 unit (or 3 yd.) cost?

14. Draw an oblong 3 in. long and 2 in. wide. Draw an oblong 3 in. long and 1 in. wide. What is the ratio of the first oblong to the second?

Lesson 41

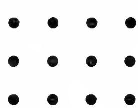
1. Memorize:

Three times

1 is 3	5 is 15	9 is 27
2 is 6	6 is 18	10 is 30
3 is 9	7 is 21	11 is 33
4 is 12	8 is 24	12 is 36

2. Count by 3's from 3 to 36.

3. Count by 3's from 36 to 3.



4. Count the number of these dots by 4's; by 3's.
There are how many counts of 4 dots?
There are how many counts of 3 dots?

$$12 = 3 \times 4 \text{ or } 4 \times 3.$$

5. If each dot represents 1 ft., what do 3 dots represent? How many yards in 12 ft.? How many feet in 8 yd. 2 ft.?

6. If each dot represents 1 qt., how many dots represent 1 gal.? How many quarts in 3 gal.? What is the price of 3 gal. 2 qt. of kerosene at 12¢ per gal.?

7. If each dot represents 1 sq. in., draw the figure represented by the 12 dots? How long is it? How wide? What is the area of an oblong 4 in. long and 3 in. wide? 4 yd. long and 3 yd. wide? Draw a square yard on the blackboard.

8. Place 15 dots so as to show that

$$15 = 3 \times 5 \text{ or } 5 \times 3.$$

How many feet in 5 yd.? The area of an oblong 5 in. long is 15 sq. in. How wide is it?

9. 3 is one factor of each of the following numbers, what is the other: 6, 18, 12, 21, 30, 24, 36, 27, 33?

10. 9 is one factor of 18. What is the other factor? 8 is one factor of 24? What is the other factor?

11. What are the two factors of each of the following numbers:

21 (3×7 or 7×3), 12, 27, 9, 33, 18, 36, 15, 30?

12. 12 is one factor of 36, what is the other? How many feet in 36 in.? A dozen yards of cloth cost 36 dimes, what is the cost of 1 yd.? How many cents?

Copy and multiply:

13.	21	33	42	63	52	13
	3	3	3	3	3	3

14.	72	53	81	92	60	82
	3	3	3	3	3	3

15.	112	221	321	231	333	203
	3	3	3	3	3	3

16.	7	3	5	3	3	3	3	3
	3	7	3	5	9	6	8	12

17.	30	31	32	31	34	31
	5	7	4	9	2	5

18. Find the total cost of:

3 lb. crackers at 7¢ a lb.
2 lb. wafers at 12¢ a lb.
7 lb. oatmeal at 3¢ a lb.
3 lb. of raisins at 10¢ a lb.

19. A man walked east 3 hr. at the rate of 3 mi. an hr., and then walked west 5 mi. How far was he then from his starting-point? Draw a line to represent the road, and mark the distances.

20. 3)39 3)63 3)96 3)246 3)336 3)696

21. 5)105 6)186 7)140 8)248 9)279 9)189

22. How many weeks are there in 210 da.? How many gallons in 128 qt.? How many yd. in 150 ft.?

23. A man walks 12 mi. at the rate of 3 mi. an hr., and returns at the rate of 4 mi. an hour. How many hours is he gone?

24. A farmer divides 336 A. equally among his 3 sons. What is the share of each?

Lesson 42

Multiply:

1.	4	40	50	200	30	30	110
	3	3	3	3	6	8	3
2.	60	30	120	80	30	700	300
	3	9	3	3	5	3	4

3. A milkman traded 3 horses worth $80 each for 7 cows worth $30 each. How much money should he receive in addition?

4. 2 ft. = ? in. 2 ft. 6 in. = ? in. 3 ft. 2 in. = ? in.

5. 24 in. = ? ft. 28 in. = ? ft. ? in. 39 in. = ? ft. ? in.

6. 1 gal. = 4 qt. 3 gal. 2 qt. = ? qt. 3 gal. 3 qt. = ? qt.

7. 6 yd. = ? ft. 6 yd. 2 ft. = ? ft. 8 yd. 1 ft. = ? ft. How do you reduce yards to feet?

8. 12 ft. = ? yd. 8 ft. = ? yd. ? ft. 28 ft. = ? yd. ? ft. How do you reduce feet to yards?

9. 17 ft. = ? yd. ? ft. 23 ft. = ? yd. ? ft.
34 ft. = ? yd. ? ft.

10. A jug contains 3 gal. 2 qt. of cider. How many quarts of cider are there in the jug?

11. A room is 6 yd. 2 ft. long. How many feet long is it?

12. A rope is 15 ft. long. Into how many pieces each 1 yd. long can it be cut?

13. From a piece of cloth 4 yd. long a piece 2 ft. long has been cut. How many feet of cloth are left?

14. If 1 qt. of milk costs 6¢, find the cost of 1 qt. and 1 pt. Of 2 qt. and 1 pt.

15. If 1 yd. of cambric costs 12¢, find the cost of 2 yd. 1 ft. Of 3 yd. 1 ft.

16. What will a man earn in 1 wk. 3 da. at $3 a day.

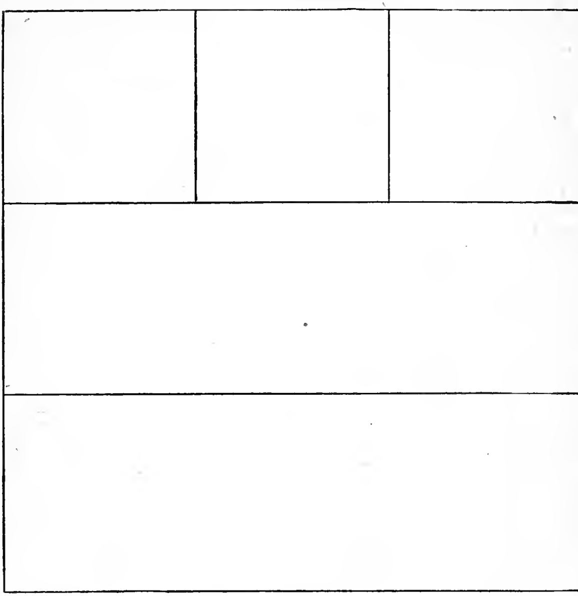
17. If a boy picks 8 pt. of berries in 1 hr., how many quarts will he pick in 3 hr.?

18. My chicken coop is 3 yd. 1 ft. long and 2 yd. wide. How long must a rope be to go around it?

19. If my hens lay 6 eggs a day, how many dozen do they lay in one week? What are they worth at 20¢ a doz.?

20. I divide $\frac{1}{2}$ of 24¢ equally among 3 boys. What does each get? $\frac{1}{2}$ of 24 is 3 times what number? $\frac{1}{2}$ of 16 is 4 times what number? $\frac{1}{2}$ of 42 is 3 times what number?

Lesson 43



1. What is the length of this oblong? What is its width? How many square inches are there in the first row? How many rows? The area = 3 × 3 sq. in. = 9 sq. in.

2. Draw an oblong 4 in. long and 3 in. wide. Divide it as the oblong in question 1. What is its area?

3. Represent the area of the oblong in question 2 by dots, putting one dot for each square inch.

4. What is the area of an oblong 6 in. long and 3 in. wide? 8 in. long and 3 in. wide?

5. Make examples like question 3.

6. Draw on the board an oblong 3 ft. long and 2 ft. wide. What is its area? Draw a square yard. How many square feet in its area?

7. What is the area of an oblong 4 ft. long and 3 ft. wide? 6 ft. long and 3 ft. wide? 6 yd. long and 3 yd. wide?

8. Draw the last oblong in question 6, making 1 in. for 1 yd. What does 1 sq. in. in your drawing represent?

9. An oblong contains 12 sq. in. The unit of measure is 1 sq. in. The number 12 measures the area.

10. What number and what unit measure the area of an oblong containing 8 sq. in.? 16 sq. in.? 6 sq. ft.? 10 sq. ft.? 9 sq. yd.? 14 sq. yd.?

11. An oblong is 4 in. long and 3 in. wide. What number measures its area? What is its area?

12. An oblong is 8 in. long and 3 in. wide. What number measures its area?

13. What numbers measure the areas of the following oblongs, and what are their areas?

Length	Width	Length	Width
4 in.	2 in.	10 in.	3 in.
6 in.	2 in.	7 ft.	3 ft.
9 in.	3 in.	8 yd.	3 yd.

14. A room is 12 ft. long and 9 ft. wide. How many square yards of carpet are needed to cover it?

15. One oblong is 7 in. long and 2 in. wide. Another is 5 in. long and 3 in. wide. Which is larger, and how much?

16. A rug is bought for a room 15 ft. by 12 ft. If the edge of the rug is everywhere 1 ft. from the wall, what are its length and breadth? Draw the room and rug on the board, making 1 in. for 1 ft.

Lesson 44

1. What will 8 lemons cost at 3¢ each?

2. What will $3\frac{1}{2}$ yd. of ribbon cost at 8¢ a yd.?

3. What is the cost of 12 yd. of tape at $2\frac{1}{2}$¢ a yd.?

4. If 3 bbl. of flour cost $18, what will 1 bbl. cost?

5. What is the cost of one dozen oranges at 3¢ apiece?

6. A man walks 3 mi. an hour for 6 hr. How far does he walk? How long is he gone if he returns at the rate of 9 mi. an hr.?

7. A man travels 6 hr. at the rate of 30 mi. an hour. How far does he travel?

8. How many days are there in 3 wk. 2 da.?

9. How many hours will it take to drive 24 mi., at the rate of 8 mi. an hour?

10. If a bag holds 3 bu. of potatoes, how many bags will hold 36 bu.?

11. Place 3 under each of these quantities and multiply: \$22, 31¢, 42 qt., 52 lb.

12. Find the cost of 3 bicycles at \$32 apiece.

13. A milkman has 92 customers who take on the average 3 qt. of milk a day. How many quarts of milk does he sell a day?

14. Divide each of these quantities by 3: \$60, 39¢, 66 qt., 93 lb., 216 bu.

15. If 3 bu. contain 96 qt., how many quarts are there in 1 bu.?

16. In how many weeks will a person pay \$156 for board at the rate of \$3 a week?

17. If 1 boy can do a piece of work in 6 da., how long will it take 3 boys to do it?

Lesson 45

1. $\frac{1}{3}$ of 6 in. = ? $\frac{1}{3}$ of 18 in. = ? $\frac{1}{3}$ of 24 in. = ?
$\frac{1}{3}$ of 33 in. = ? $\frac{1}{3}$ of 150 in. = ? $\frac{1}{3}$ of 210 in. = ?

2. 12 in. ÷ 3 in. = ? 12 in. ÷ 3 = ?
21 in. ÷ 3 in. = ? 21 in. ÷ 3 = ?
18 in. ÷ 6 in. = ? 18 in. ÷ 6 = ?

3. 1 ft. = ? in. $\frac{1}{2}$ ft. = ? in. $\frac{1}{3}$ ft. = ? in.
$\frac{1}{3}$ yd. = ? ft. 1 yd. = ? in. $\frac{1}{3}$ yd. = ? in.

4. 1 da. = ? hr. $\frac{1}{2}$ da. = ? hr. $\frac{1}{3}$ da. = ? hr.
1 hr. = ? min. $\frac{1}{2}$ hr. = ? min. $\frac{1}{3}$ hr. = ? min.

5. 1 min. = ? sec. $\frac{1}{2}$ min. = ? sec. $\frac{1}{3}$ min. = ? sec.
$\frac{1}{2}$ doz. = ? $\frac{1}{3}$ doz. = ? $\frac{1}{2}$ doz. + $\frac{1}{3}$ doz. = ?

6. If 3 lb. of sugar cost 15¢, what will 1 lb. cost? What will 2 lb. cost?

7. I paid $18 for coal at $6 a ton. How many tons did I buy?

8. If 3 gal. of kerosene cost 36¢, what will 1 gal. cost? What will 2 gal. cost?

9. Mary spends 24¢ for lace at 12¢ a yd. How many yards does she buy?

10. Divide 2 dozen roses equally among 3 persons.

11. A man buys 2 horses for $220. What is the cost of each horse?

12. An oblong is 4 in. long and 3 in. wide. How many square inches does it contain?

13. An oblong contains 15 sq. in. If it is 3 in. wide, how long is it? Draw the oblong.

14. I bought $1\frac{1}{3}$ doz. bananas at the rate of 15¢ a doz. What did I pay for them?

15. A mason earns 30¢ an hour. How much will he earn in 1 da., if he works 9 hr. a day?

Lesson 46

1. Draw a line 2 in. long. Draw a line 6 in. long. 6 in. is measured how many times by 2 in.? The ratio of 6 in. to 2 in. is what? The ratio of 2 in. to 6 in. is what?

2. Draw lines 4 in. and 12 in. long. 12 in. is measured how many times by 4 in.? The ratio of 12 in. to 4 in. is what?

3. The ratio of 12 apples to 4 apples is what? If 4 apples cost 5¢, how many times 5¢ will 12 apples cost? What will 12 apples cost?

4. What is the ratio of 15 in. to 5 in.? What is the ratio of 5 in. to 15 in.?

5. What is the ratio of 18 in. to 6 in.? What is the ratio of 6 in. to 18 in.?

6. What is the ratio of 6 to 2? 2 to 6? 8 to 4? 4 to 8? 15 to 5? 5 to 15? 18 to 6? 6 to 18?

7. What is the ratio of 5 ft. to 15 ft.? 18 lb. to 6 lb.? 18 doz. to 6 doz.? $8 to $24?

8. If 15 lb. of butter cost $3, what will 5 lb. cost?

If 5 yd. of silk cost $8, how many yards will cost $24?

9. $\frac{1}{3}$ is the ratio of 4 to ? 5 to ? 6 to ? 7 to ? 8 to ? 9 to ? 10 to ? 11 to ? 12 to ?

10. 3 is the ratio of 12 to ? 15 to ? 18 to ? 21 to ? 24 to ? 27 to ? 30 to ? 33 to ? 36 to ?

11. $\frac{1}{3}$ is the ratio of what numbers? 3 is the ratio of what numbers?

12. What is the ratio of 6 doz. to 18 doz.? If 18 doz. eggs cost \$3, what will 6 doz. cost?

13. What is the ratio of 1 yd. to 1 ft.? If 1 ft. of ribbon cost 5¢, what will 1 yd. cost?

14. What is the ratio of 1 ft. to 1 yd.? If 1 yd. of lace costs 30¢, what will 1 ft. cost?

15. What is the ratio of 8 wk. to 24 wk.? If I pay \$120 for board for 24 wk., what part of \$120 must I pay for 8 wk.? What must I pay for board for 8 wk.?

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

17. The ratio of the value of a purse to its contents is $\frac{1}{2}$. If the purse is worth \$3, how much money does it contain?

Lesson 47

1. $\frac{1}{2}$ of \$60 = ? $\frac{1}{2}$ of \$48 = ? $\frac{1}{3}$ of \$63 = ?
$\frac{1}{2}$ of 88 = ? $\frac{1}{3}$ of 39 = ? $\frac{1}{3}$ of 99 = ?

2. Draw a line 1 ft. long, and divide it into halves. How many halves are there in 1 ft.?

1 ft. = $\frac{2}{2}$ ft. (Read, 1 ft. = 2 halves of a foot.)

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

How do you reduce $5\frac{1}{2}$ ft. to halves of a foot?

4. $\frac{4}{2}$ ft. = ? ft. $\quad$ $\frac{5}{2}$ ft. = ? ft. $\quad$ $\frac{7}{2}$ ft. = ? ft.
$\frac{8}{2}$ ft. = ? ft. $\quad$ $\frac{9}{2}$ ft. = ? ft. $\quad$ $\frac{11}{2}$ ft. = ? ft.

5. 1 qt. = ? pt. $\quad$ $\frac{1}{2}$ qt. = ? pt. $\quad$ $4\frac{1}{2}$ qt. = ? pt.
$6\frac{1}{2}$ qt. = ? pt. $\quad$ $8\frac{1}{2}$ qt. = ? pt. $\quad$ $12\frac{1}{2}$ qt. = ? pt.

How do you reduce $5\frac{1}{2}$ qt. to pints?

6. 1 pt. = ? qt. $\quad$ 4 pt. = ? qt. $\quad$ 5 pt. = ? qt.
9 pt. = ? qt. $\quad$ 15 pt. = ? qt. $\quad$ 21 pt. = ? qt.

How do you reduce 7 pt. to quarts?

7. What is the cost of 5 pt. of milk at 6¢ a qt.?

8. $3 + 2\frac{1}{2} = ?$ $\quad$ $1\frac{1}{2} + 2 = ?$ $\quad$ $2\frac{1}{2} + \frac{1}{2} = ?$
$4\frac{1}{2} + 1\frac{1}{2} = ?$ $\quad$ $5\frac{1}{2} + 3\frac{1}{2} = ?$ $\quad$ $8\frac{1}{2} + 2\frac{1}{2} = ?$

9. What is the weight of a parcel containing $1\frac{1}{2}$ lb. of ham and $2\frac{1}{2}$ lb. of steak?

Add:

10.	$\$2\frac{1}{2}$	$\$4$	$\$3\frac{1}{2}$	$\$4\frac{1}{2}$	$\$2\frac{1}{2}$	$\$10\frac{1}{2}$
	$3\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	6	12	$10\frac{1}{2}$
11.	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$
	$2\frac{1}{2}$	$12\frac{1}{2}$	$22\frac{1}{2}$	$4\frac{1}{2}$	$24\frac{1}{2}$	$44\frac{1}{2}$
12.	$21\frac{1}{2}$	$32\frac{1}{2}$	45	$31\frac{1}{2}$	$18\frac{1}{2}$	$46\frac{1}{2}$
	14	$33\frac{1}{2}$	$44\frac{1}{2}$	$56\frac{1}{2}$	$10\frac{1}{2}$	$52\frac{1}{2}$
13.	221	$243\frac{1}{2}$	$315\frac{1}{2}$	$604\frac{1}{2}$	$230\frac{1}{2}$	$356\frac{1}{2}$
	$232\frac{1}{2}$	$512\frac{1}{2}$	$423\frac{1}{2}$	314	$425\frac{1}{2}$	$421\frac{1}{2}$

14. I paid $\$2\frac{1}{2}$ for a hat and \$5 for a coat. What change should I get back out of a ten-dollar bill?

15. What is the price of two rugs, one costing $\$12\frac{1}{2}$ and the other $\$16\frac{1}{2}$?

16. $3 + 1\frac{1}{2} = ?$ $\quad 3 + ? = 4\frac{1}{2}$ $\quad \frac{1}{2} + ? = 1$

$3\frac{1}{2} + 2\frac{1}{2} = ?$ $\quad 3\frac{1}{2} + ? = 6$ $\quad 4\frac{1}{2} + ? = 8$

17. James is 6 yr. old, and his brother $4\frac{1}{2}$. What is the difference in their ages?

Subtract:

18.	$6\frac{1}{2}$	$8\frac{1}{2}$	$7\frac{1}{2}$	4	9	10
	4	5	$2\frac{1}{2}$	$2\frac{1}{2}$	$4\frac{1}{2}$	$6\frac{1}{2}$
19.	$37\frac{1}{2}$	$58\frac{1}{2}$	$85\frac{1}{2}$	$43\frac{1}{2}$	64	58
	24	13	$61\frac{1}{2}$	$20\frac{1}{2}$	$22\frac{1}{2}$	$36\frac{1}{2}$
20.	$626\frac{1}{2}$	$349\frac{1}{2}$	567	$216\frac{1}{2}$	475	$703\frac{1}{2}$
	504	$129\frac{1}{2}$	$424\frac{1}{2}$	204	$444\frac{1}{2}$	$602\frac{1}{2}$

21. What is the difference in price between two china closets, one of which costs $\$52\frac{1}{2}$ and the other $\$32$?

22. I select the cheaper of two bookcases, one of which costs $\$77\frac{1}{2}$ and the other $\$62\frac{1}{2}$. With the difference in price how many chairs can I buy at $\$5$ apiece?

H

SECTION IV

Lesson 48

1. Count by 4's from 4 to 48.
2. Count by 4's from 48 to 4.
3. Memorize:

Four times

1 is 4	5 is 20	9 is 36
2 is 8	6 is 24	10 is 40
3 is 12	7 is 28	11 is 44
4 is 16	8 is 32	12 is 48

4. Give two factors of each of the following numbers: 12, 28, 36, 8, 44, 32, 48, 24, 20, 16, 40.

5. 5 is one factor of 15, what is the other? 5 apples cost 15¢, what will 3 cost?

6. 5 is a factor of 15 tens, what is the other? 3 is a factor of 15 tens, what is the other?

At 3 dimes a dozen, how many dozen oranges can you buy for 12 dimes? How many oranges?

Multiply:

7.	21¢	32¢	$52	$41	72 mi.	81 mi.
	4	4	4	4	4	4

8.

321	434	233	523	312	422
2	2	3	3	4	4

9. What is the cost of 4 doz. eggs at 21¢ a dozen, and 6 bunches of celery at the rate of 3 for 10¢?

10. What is the cost of 4 lb. of coffee at 32¢ a lb., and $\frac{1}{2}$ lb. of tea at 60¢ per lb.?

11. An express train runs 42 mi. an hour. How far does it go in 4 hr.? How much farther than a train that runs at half the rate?

12.

6	4	4	4	4	4	4	4
4	6	8	7	9	11	12	10

13.

41	40	31	41	21	41
6	8	5	9	6	7

14. Divide:

8)32   4)32   9)36   4)48   7)28   4)16

15. 4 is one factor of 16 tens, what is the other? Of 20 tens, what is the other? How often is 6 contained in 24 tens? 8 in 32 tens? 4 in 8 hundreds?

16. Copy and divide:

4)164   4)208   6)246   8)328   4)804

17.

$8+1=?$	$12+2=?$	$24+?=27$
$4\times2+1=?$	$4\times 3+2=?$	$4\times 6+?=27$

18. What number smaller than 9 has 4 for a factor? $8\div4=?$ $9\div4=?$

19. What number smaller than 14 has 4 as a factor? Smaller than 13? 15? 19? 21? 34? 35? 27? 38?

20. Draw on the board lines 13 in., 19 in., and 31 in. long. Measure each line with a 4-in. unit and find out *how many* times the unit measures the lines and note the *remainder* in each case.

Divide:

21. 4 in.)13 in. 4 in.)19 in. 4 ft.)21 ft.

4 yd.)34 yd. 4¢)27¢ $4)$35

22. 4)18 4)25 4)22 4)29 4)36 4)39

Lesson 49

1. Take any two points less than a yard apart. Measure the distance between them with a foot-rule and also with a yardstick divided into inches.

Write your results thus:

1 ft. 8 in. = 20 in. 2 ft. 3 in. = 27 in.

Practise this measuring.

2. 1 ft. 6 in. = ? in. 1 ft. 4 in. = ? in.
2 ft. 4 in. = ? in. 2 ft. 6 in. = ? in.
3 ft. 3 in. = ? in. 4 ft. 2 in. = ? in.

3. How can you change 2 ft. 4 in. to inches without actually measuring?

4. Take any two points less than a yard apart. Measure the distance between them with a yard-stick and also with a foot-rule. Express your results thus:

17 in. = 1 ft. 5 in. 34 in. = 2 ft. 10 in.

Practise this measuring.

5. 15 in. = ? ft. ? in. 18 in. = ? ft. ? in.
26 in. = ? ft. ? in. 29 in. = ? ft. ? in.
39 in. = ? ft. ? in. 0 in. = ? ft. ? in.

6. How can you change 26 in. to feet and inches without actually measuring?

7. Measure a gallon of water with a quart measure. What number do you get? 1 gal. = ? qt.

Measure 2 gal. of water with a quart measure. What number do you get? 2 gal. = ? qt.

8. 3 gal. = ? qt. 5 gal. = ? qt. 4 gal. = ? qt.
7 gal. = ? qt. 6 gal. = ? qt. 8 gal. = ? qt.

How can you change gallons to quarts without actually measuring?

9. Measure 8 qt. of water into a pail. Measure the same water with a gallon measure. What number do you get? 8 qt. = ? gal.

10. 12 qt. = ? gal. 20 qt. = ? gal. 36 qt. = ? gal.
24 qt. = ? gal. 16 qt. = ? gal. 48 qt. = ? gal.

How can you reduce quarts to gallons without actually measuring?

11. Measure 1 gal. 3 qt. of water into a pail. Measure this again with a quart measure. What number do you get? 1 gal. 3 qt. = ? qt. Measure in a similar manner other quantities of water, and write your results as before.

12. 3 gal. 3 qt. = ? qt. 5 gal. 2 qt. = ? qt.
7 gal. 2 qt. = ? qt. 9 gal. 3 qt. = ? qt.
1 pt. 2 gi. = ? gi. 3 pt. 2 gi. = ? gi.

How do you reduce 3 gal. 2 qt. to quarts?

13. 10 qt. = ? gal. ? qt. 27 qt. = ? gal. ? qt.
9 gi. = ? pt. ? gi. 18 gi. = ? pt. ? gi.

14. 1 hr. = ? min. 2 hr. 30 min. = ? min.
3 hr. 10 min. = ? min. 4 hr. 25 min. = ? min.

15. 2 wk. 4 da. = ? da. 3 wk. 3 da. = ? da.
4 wk. 2 da. = ? da. 26 da. = ? wk. ? da.

16. 4 yd. 3 ft. = ? ft. 6 yd. 2 ft. = ? ft.

How do you reduce 5 yd. 2 ft. to feet?

16 ft. = ? yd. ? ft. 23 ft. = ? yd. ? ft.

How do you reduce 25 ft. to yards and feet?

17. A road is 6 yd. 2 ft. wide. What is the width in feet? In inches?

18. A room is 8 yd. 2 ft. long. How many steps will a boy take in walking the length of the room if he steps 2 ft. each time?

19. A man steps 30 in. at each step. How many feet and inches does he step?

20. How many times will a pail containing 2 gal. 2 qt. of water fill a quart measure?

21. How many 2-qt. jars will hold 8 gal. 2 qt. of fruit?

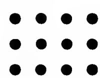
22. What will 1 gal. of cream cost at 30¢ a qt.?

23. What will 2 gal. 2 qt. of milk cost at 2¢ a pt.?

24. A milkman sold 1 qt. of milk to each of 48 customers. How many gallons did he sell?

Lesson 50

1. Draw an oblong 4 in. long and 3 in. wide. Divide it into square inches. What is its area?



2. If each dot represents 1 sq. in., how many sq. in. are represented by all the dots? What figure is represented? (An oblong 4 in. long and 3 in. wide.)

3. If each dot represents 1 sq. ft., what figure is represented? What is its area? 1 sq. yd.? 1 sq. mi.?

4. Draw an oblong 6 in. long and 4 in. wide. Represent its area by dots. What does each dot represent? What is its area?

5. What is the area of an oblong 6 ft. long and 4 ft. wide? 6 yd. long and 4 yd. wide? 6 mi. long and 4 mi. wide?

6. Draw an oblong 5 yd. long and 4 yd. wide, making 1 in. stand for 1 yd. What is its area? Could the same drawing represent an oblong 5 mi. long and 4 mi. wide? What would 1 in. then stand for? What area would it then represent?

7. What is the area of each of these oblongs?

Length	Width	Length	Width
5 in.	4 in.	8 yd.	4 yd.
7 ft.	3 ft.	10 mi.	4 mi.
9 ft.	3 ft.	12 mi.	3 mi.

8. Draw an oblong 3 in. long and 3 in. wide. What is its area?

An oblong whose length is equal to its breadth is a *square*.

9. Draw a square whose side is 4 in. What is its area? Could the same drawing represent a square whose side is 4 mi.? What area would it then represent?

10. What is the area of a 2-in. square? a 3-in. square? a 4-in. square?

11. How many square inches in an oblong 4 in. long and 3 in. wide?

12. Draw an oblong 4 2-in. long and 3 2-in. wide and divide it into 2-in. squares. How many?

13. How many 2-in. squares in an oblong 10 in. long and 8 in. wide? Draw the oblong.

14. How many 3-in. squares in an oblong 4 3-in. long and 3 3-in. wide? Draw the oblong.

15. How many 4-in. squares in an oblong 4 4-in. long and 3 4-in. wide? Draw the oblong.

16. How many 4-in. squares in an oblong 12 in. long and 8 in. wide?

17. If 6 is one factor of 24, what is the other?

An oblong is 6 in. long and contains 24 sq. in. How wide is it? What is its perimeter?

18. An oblong is 5 mi. long and contains 20 sq. mi. What is its perimeter? How many hours would it take a person to walk around it at the rate of 3 mi. an hour. How wide is it? Draw the oblong.

19. What is the side of a square which contains 4 sq. in.? 9 sq. ft.? 16 sq. yd.? 1 sq. yd.? 16 sq. mi.?

20. A blackboard is 12 ft. long and 4 ft. wide. How many square feet of surface has the board?

21. A strip of carpet is 9 ft. long and 3 ft. wide. How many square yards does it contain?

22. A strip of carpet containing 24 sq. ft. is 2 ft. wide. How long is it? How many yards?

Lesson 51

1. At 4¢ a pt., what will 5 qt. of raspberries cost?

2. At 6¢ a pt., how many quarts of raspberries will cost 24¢?

3. If 4 men can do a piece of work in 7 da., how long will it take 1 man to do it? 2 men?

4. If a man earns $4 a day, how much will he earn in 9 da.? In how many days would he earn this at $3 a day?

5. If a man earns $3 a day and spends $2, in how many days will he save $36?

6. A farmer bought 4 cows at $30 a head, and 3 sheep at $6 each. How much did they cost him?

7. A farmer sold 30 sheep at $4 a head and 6 lambs at $3 each. How much did he sell them for?

8. An express train ran 5 hr. at the rate of 40 mi. an hour. How far did it go?

9. If 4 A. of land cost $320, what did 1 A. cost?

10. A dealer bought 4 bicycles at $40 apiece and sold them at $62 apiece. What was his gain?

11. Write 4 under each of these quantities and multiply: $32, $61, $72, $208, $322, $421.

12. A man saves $32 a month. How much will he save in 3 mo.?

13. What is the value of 24 yd. of cloth at $2 a yard? At $$\frac{1}{2}$ a yard? At $$2\frac{1}{2}$ a yard?

14. If a man pays $4 a week for board, how much does he pay for board in one year of 52 wk.?

15. If 4 doz. eggs cost 84¢, what is the price per dozen?

Lesson 52

1. Divide 2¢, 4¢, 6¢, 8¢, 10¢, 12¢, 14¢, 16¢, 18¢, 20¢, 22¢, 24¢, by 2.

Take $\frac{1}{2}$ of 2¢, 4¢, 6¢, 8¢, 10¢, 12¢, 14¢, 16¢, 18¢, 20¢, 22¢, 24¢.

How do you find one-half of a quantity?

2. Divide 3¢, 6¢, 9¢, 12¢, 15¢, 18¢, 21¢, 24¢, 27¢, 30¢, 33¢, 36¢, by 3.

Take $\frac{1}{3}$ of 3¢, 6¢, 9¢, 12¢, 15¢, 18¢, 21¢, 24¢, 27¢, 30¢, 33¢, 36¢.

How do you find one-third of a quantity?

3. Divide $8, $20, $12, $32, $4, $16, $36, $28, $48, $24, $44, $40, by 4.

Take $\frac{1}{4}$ of $20, $32, $40, $36, $48, $24, $8, $16, $4, $44, $12, $28.

How do you find one-fourth of a number?

4. If a yard of cloth cost 24¢, what will $\frac{1}{2}$ yd. cost? $\frac{1}{4}$ yd.?

5. Divide 5 ft., 10 ft., 15 ft., 20 ft., by 5. Take $\frac{1}{5}$ of 5 ft., 10 ft., 15 ft., 20 ft.

How do you find one-fifth of a quantity?

6. Divide 6 yd., 18 yd., 12 yd., 24 yd., by 6. Take $\frac{1}{6}$ of 6 yd., 18 yd., 12 yd., 24 yd.

How do you find one-sixth of a quantity?

7. Divide 7 mi., 14 mi., 21 mi., 28 mi., by 7. Take $\frac{1}{7}$ of 7 mi., 14 mi., 21 mi., 28 mi.

How do you find one-seventh of a quantity?

8. Divide 8 A., 24 A., 16 A., 32 A., by 8. Take $\frac{1}{8}$ of 8 A., 24 A., 16 A., 32 A.

How do you find one-eighth of a quantity?

9. Divide 9, 18, 27, 36, of any unit by 9. Take $\frac{1}{9}$ of 9, 18, 27, 36, of any unit.

How do you find one-ninth of a quantity?

10. If I cut a piece of ribbon 36 in. long into fourths, what will be the length of each piece? If into sixths? If into ninths?

11. Divide 20 lb., 10 lb., 40 lb., 30 lb., by 10. Take $\frac{1}{10}$ of 20 lb., 10 lb., 40 lb., 30 lb.

How do you find one-tenth of a quantity?

12. Divide 11 qt., 33 qt., 44 qt., 22 qt., by 11. Take $\frac{1}{11}$ of 22 qt., 11 qt., 44 qt., 33 qt.

How do you find one-eleventh of a quantity?

13. Divide 12 gal., 24 gal., 36 gal., 48 gal., by 12. Take $\frac{1}{12}$ of 12 gal., 24 gal., 36 gal., 48 gal.

How do you find one-twelfth of a quantity?

14. In 5 hr. a man walked 20 mi. How far did he walk in 1 hr.? In 3 hr.?

15. If 6 times Helen's age is 24 yr., how many years younger is she than her sister who is 9 yr. old?

16. How much will 6 bananas cost when 4 doz. cost 48¢?

17. If 8 oranges cost 32¢, what is the price of 2 doz. oranges?

18. Divide 36¢ equally among 12 children. What does each child get?

19. If 1 yd. of ribbon costs 40¢, what will $\frac{1}{4}$ yd. cost? If 2 yd. cost 24¢, what will $\frac{1}{2}$ yd. cost?

20. If 4 cows cost $120, what is the cost of each cow? What is the gain on selling them for $36 apiece?

21. If a 3-lb. pail of lard costs 24¢, what is the price per lb.? What is saved through buying a 5-lb. pail for 39¢?

22. If 12 bars of soap cost 48¢, what will 1 bar cost? What will 6 bars cost?

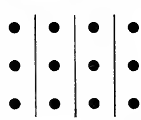
23. If one 2-lb. can of fruit costs 22¢, what will 4 cans cost?

24. If 2 5-lb. boxes of biscuits cost 64¢, what will 20 lb. of biscuits cost?

25. Make questions using the following table of prices:

Butter	22¢ per lb.	Olives	40¢ per pt.
Corn	12¢ per 2-lb. can.	Salt	7¢ per 10-lb. sack.
Fish	9¢ per $\frac{1}{2}$-lb. can.	Soap	4¢ per bar.

Lesson 53



1. In this arrangement of dots what can each dot represent?

$\frac{1}{4}$ of 12¢ = ? $\frac{2}{4}$ of 12¢ = ? $\frac{3}{4}$ of 12¢ = ?
$\frac{4}{4}$ of 12¢ = ? $\frac{1}{2}$ of 12¢ = ? $\frac{2}{2}$ of 12¢ = ?

2. Draw a line 12 in. long and divide it into 4 equal parts.

$\frac{1}{4}$ of 12 in. = ? $\frac{2}{4}$ of 12 in. = ? $\frac{3}{4}$ of 12 in. = ?
$\frac{4}{4}$ of 12 in. = ? $\frac{1}{2}$ of 12 in. = ? $\frac{2}{2}$ of 12 in. = ?

3. How do you find $\frac{1}{4}$ of a quantity? $\frac{2}{4}$ of it? $\frac{3}{4}$? $\frac{4}{4}$? How do you find $\frac{1}{2}$ of a quantity? $\frac{2}{2}$ of it?

4. A boy had 24 words in his spelling lesson and spelled correctly $\frac{3}{4}$ of them. How many did he spell correctly? Represent by dots.

5. Make 6 dots and divide them into 3 equal groups. Name units that each dot can represent.

$\frac{1}{3}$ of 6 units = ? $\frac{2}{3}$ of 6 units = ? $\frac{3}{3}$ of 6 units = ?

6. Draw a line 12 in. long and divide it into 3 equal parts.

$\frac{1}{3}$ of 12 in. = ? $\frac{2}{3}$ of 12 in. = ? $\frac{1}{3}$ of 15 in. = ?
$\frac{2}{3}$ of 15 in. = ? $\frac{1}{3}$ of 18 in. = ? $\frac{2}{3}$ of 18 in. = ?

7. How do you find $\frac{1}{3}$ of a quantity? $\frac{2}{3}$?

8. Juliette is 6 yr. old and her brother Albert $\frac{2}{3}$ as old. How old is Albert?

9. $\frac{1}{4}$ of 16 = ? $\frac{3}{4}$ of 16 = ? $\frac{1}{4}$ of 20 = ?
$\frac{3}{4}$ of 20 = ? $\frac{1}{4}$ of 24 = ? $\frac{3}{4}$ of 24 = ?

10. $\frac{1}{3}$ ft. = ? in. $\frac{2}{3}$ ft. = ? in. $\frac{1}{3}$ yd. = ? in.
$\frac{2}{3}$ yd. = ? in. $\frac{1}{4}$ ft. = ? in. $\frac{3}{4}$ ft. = ? in.
$\frac{4}{4}$ ft. = ? in. $\frac{1}{4}$ yd. = ? in. $\frac{3}{4}$ yd. = ? in.

11. $\frac{1}{3}$ hr. = ? min. $\frac{2}{3}$ hr. = ? min. $\frac{3}{3}$ hr. = ? min.
$\frac{1}{3}$ da. = ? hr. $\frac{2}{3}$ da. = ? hr. $\frac{3}{3}$ da. = ? hr.
$\frac{1}{4}$ da. = ? hr. $\frac{3}{4}$ da. = ? hr. $\frac{4}{4}$ da. = ? hr.

12. If a baby sleeps one-half of the time, how many hours a day does he sleep? How many hours a day does a man sleep who sleeps one-third of the time?

13. $\frac{2}{3}$ of 15 = ? $\frac{2}{3}$ of 18 = ? $\frac{2}{3}$ of 24 = ?
$\frac{2}{3}$ of 21 = ? $\frac{2}{3}$ of 30 = ? $\frac{2}{3}$ of 36 = ?
$\frac{3}{3}$ of 6 = ? $\frac{3}{3}$ of 9 = ? $\frac{3}{3}$ of 5 = ?

14. If I cut a yard of ribbon into halves, how many pieces will I have? How many halves in a whole?

15. If I cut a yard of silk into thirds, how many pieces will I have? How many thirds in a whole?

16. How many fourths in a whole? What is one-fourth of a gallon? How many quarts in a gallon?

17. How many fifths in a whole? What is one-fifth of a nickel? How many cents in a nickel? What is one-fifth of a dime? How many 2-cents in a dime?

18. How many sixths in a whole? Sevenths? Eighths? Ninths? Tenths? Elevenths? Twelfths?

19. What is one-seventh of a week? How many days in a week? What is one-tenth of a dime? How many cents in a dime? What is one-twelfth of a foot? How many inches in a foot? What is one-twelfth of a yard? How many 3-inches in a yard?

20. What will $\frac{3}{3}$ of a yard of cloth cost at 24¢ a yard? $\frac{4}{4}$ yd.? $\frac{6}{6}$ yd.? $\frac{8}{8}$ yd.? $\frac{9}{9}$ yd.? $\frac{12}{12}$ yd.?

21. $\frac{3}{4}$ of $8 = ?$ $\frac{3}{4}$ of $16 = ?$ $\frac{3}{4}$ of $12 = ?$ How do you find $\frac{3}{4}$ of 8? Would it be correct to multiply 8 by 3 and divide by 4? $\frac{3}{4}$ of $12 = ?$ $\frac{3}{4}$ of $32 = ?$ $\frac{3}{4}$ of $24 = ?$ $\frac{4}{4}$ of $8 = ?$ $\frac{4}{4}$ of $20 = ?$ $\frac{4}{4}$ of $6 = ?$

22. $\frac{1}{2}$ da. + $\frac{1}{4}$ da. = ? hr. $\frac{1}{3}$ da. − $\frac{1}{4}$ da. = ? hr. $\frac{2}{3}$ doz. − $\frac{1}{2}$ doz. = ? $\frac{3}{4}$ doz. − $\frac{2}{3}$ doz. = ?

23. A boy bought $\frac{3}{4}$ doz. oranges and ate $\frac{1}{4}$ doz. How many were left? If these were divided equally among 3 boys, how many did each boy get?

24. If 1 ton of coal lasts 30 da., how long will $\frac{1}{3}$ ton last? How long will $\frac{2}{3}$ ton last? If $\frac{1}{3}$ ton of coal lasts 8 da., how long will 1 ton last?

25. If 1 yd. of ribbon is worth 40¢, what is $\frac{1}{4}$ yd. worth? What is $\frac{3}{4}$ yd. worth? If $\frac{1}{4}$ yd. of ribbon is worth 6¢, what is 1 yd. worth?

26. A melon worth 40¢ was cut into 4 equal pieces. What was 1 piece worth? 3 pieces?

27. A man had $24 and spent $\frac{2}{3}$ of it for a watch. What did the watch cost him?

28. Monday, James rode 36 miles on his bicycle, and Tuesday he rode $\frac{3}{4}$ as far. How far did he ride on Tuesday?

Lesson 54

1. $8 is the quantity, $2 the unit, what is the number? 4 is often called the ratio of $8 to $2.

2. How often is the unit 8 lb. contained in 32 lb.? What is the ratio of 32 lb. to 8 lb.?

3. What will 32 lb. of flour cost, if 8 lb. cost 22¢?

4. 4 gal. is one of the 3 equal parts of 12 gal. We say the ratio of 4 gal. to 12 gal. is $\frac{1}{3}$. What is the ratio of 5 gal. to 10 gal.? Of 6 doz. to 18 doz.?

5. What is the ratio of 4 A. to 16 A.? Of the cost of 4 A. to that of 16 A.? If 16 A. cost $800, what will 4 A. cost?

6. What is the ratio of 9¢ to 27¢? 9 dimes to 27 dimes? 9 25-ct. pieces to 27 25-ct. pieces? 9 50-ct. pieces to 27 50-ct. pieces? 9 of any unit to 27 of the same unit?

7. What is the ratio of the price of 6 bu. of wheat to that of 24 bu.? If 24 bu. of wheat cost $20, what will 6 bu. cost?

8. The ratio of the value of a purse to the money in it is $\frac{1}{4}$. If there is $8 in the purse, what is the value of the purse?

9. Name as many quantities as you can of which 2 is the ratio. Of which $\frac{1}{2}$ is the ratio.

10. Name as many quantities as you can of which 3 is the ratio; $\frac{1}{3}$ the ratio; 4 the ratio; $\frac{1}{4}$ the ratio.

11. What is the ratio of 3 bu. to 12 bu.? 24 lb. to 8 lb.? 1 pt. to 1 qt.? 3 pt. to 3 qt.? 1 qt. to 1 gal.? 3 qt. to 3 gal.? 6 to 18? 12 to 3?

12. If 12 bu. of potatoes cost $8, what will 3 bu. cost?

13. If 8 boxes of candy weigh 4 lb., what will 24 boxes of candy weigh?

14. What is the cost of 18 bunches of firecrackers when 6 bunches cost 30¢?

15. If 3 boxes of berries cost 30¢, what will 18 boxes cost?

16. What is the ratio of 1 gal. to 1 qt.? Of 1 qt. to 1 gal.? Of 4 qt. to 4 gal.? Of 3 gal. to 3 qt.?

17. If 1 gal. of maple syrup is worth 80¢, what is the value of 1 qt.?

18. When butter is worth 24¢ a lb., how much can I buy for 12¢?

19. If cheese is worth 16¢ a lb., how much can I buy for 4¢? How much for 12¢?

20. When eggs are 12¢ a dozen, how many can I buy for 36¢? For 6¢?

21. If 1 qt. of milk is worth 6¢, what must I pay for 1 gal. 2 qt. 1 pt.? If 3 qt. of kerosene are worth 10¢, what are 3 gal. worth?

22. John has 2 dimes and James 7 times as much. How much have they together? James has how much more than John?

Lesson 55

1. I sold a cow for 4 ten-dollar bills; how much did I get for the cow? If I had been paid in five-dollar bills, how many would I have got?

2. I paid 3 five-dollar bills and a two-dollar bill for an overcoat. What did it cost me?

3. I paid 12 two-dollar bills and 2 one-dollar bills for a suit of clothes. What did it cost me?

4. I paid in dimes 30¢ for a book. How many dimes did I pay?

5. I paid in nickels 20¢ for a handkerchief. How many nickels did I pay? If I had paid in dimes, how many?

6. The 1 cent piece, the 5 cent piece (nickel), the ten cent piece (dime), the quarter dollar (25¢), the half dollar (50¢), and the dollar (100¢) are called *coins* of the United States.

7. I bought a yard of ribbon for 15¢, giving 3 coins in payment. What was the value of the coin?

8. I bought a yard of cloth for 60¢, giving 6 coins in payment. What was the value of the coin?

9. I paid 50¢ for a bushel of potatoes, giving 2 coins in payment. What was the value of the coin?

10. I bought a loaf of bread for 6¢, giving two coins in payment. What were the coins?

11. I paid 15¢ for a dozen bananas, giving two coins in payment. What were the coins?

12. If I buy a pound of butter for 25¢, with what coins can I pay for it?

13. I bought a pound of meat for 16¢. What three coins would pay for it?

14. I bought a dozen eggs for 22¢. What coins would pay for the eggs?

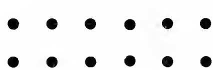
15. These coins are called *units of measure* because they measure the value of things.

16. Name all the units of measure you can, that measure the *value* of things.

17. If I paid 4 five-dollar bills, a two-dollar bill, and a one-dollar bill for an overcoat, how much did I pay in all?

18. If I paid 3 ten-dollar bills and a five-dollar bill for a suit of clothes, and received in change a two-dollar bill, how much did the suit cost me?

Lesson 56



1. $\frac{2}{3}$ doz. $-$ $\frac{1}{2}$ doz. $=$? Your answer is what part of a doz.? $\frac{1}{3}$ doz. $+$ $\frac{1}{6}$ doz. $=$? Your answer is what part of a dozen? $\frac{3}{4}$ doz. $-$ $\frac{2}{3}$ doz. $=$? Your answer is what part of a dozen?

2. $\frac{1}{2}$ ft. $-$ $\frac{1}{3}$ ft. $=$? in. $\frac{3}{4}$ ft. $-$ $\frac{1}{3}$ ft. $=$? in. $\frac{2}{3}$ ft. $-$ $\frac{1}{4}$ ft. $=$? in. Your answer is in each case what part of a foot?

3. $\frac{1}{2}$ day $-$ $\frac{1}{6}$ day $=$? hr. $\frac{1}{3}$ day $-$ $\frac{1}{6}$ day $=$? hr. $\frac{2}{3}$ day $+$ $\frac{1}{8}$ day $=$? hr. Your answer is in each case what part of a day?

4. $\frac{1}{2}$ hr. $+$ $\frac{1}{3}$ hr. $=$? min. $\frac{1}{2}$ hr. $-$ $\frac{1}{3}$ hr. $=$? min. $\frac{2}{3}$ hr. $-$ $\frac{1}{6}$ hr. $=$? min. Your last two answers are in each case what part of an hour?

5. $\frac{1}{2}$ lb. $+$ $\frac{1}{8}$ lb. $=$? oz. $\frac{1}{4}$ lb. $+$ $\frac{1}{8}$ lb. $=$? oz. $\frac{3}{4}$ lb. $-$ $\frac{1}{2}$ lb. $=$? oz. Your last answer is what part of a pound?

6. $\frac{3}{4}$ gal. $-$ $\frac{1}{2}$ gal. $=$? qt. $\frac{3}{4}$ gal. $-$ $\frac{1}{2}$ gal. $=$? qt. $\frac{1}{2}$ gal. $+$ $\frac{3}{4}$ gal. $=$? qt. Your first two answers are in each case what part of a gallon?

7. From a pail containing $\frac{3}{4}$ doz. eggs, $\frac{1}{2}$ doz. are taken. How many are left in the pail? What part of a dozen?

8. From a pitcher containing $\frac{3}{4}$ gal. of milk, $\frac{1}{2}$ gal. is poured. How many quarts are left in the pitcher? What part of a gallon?

9. What is the cost of $\frac{3}{4}$ gal. of milk at 6¢ a qt.?

10. Draw a line 1 ft. long and divide it into four equal parts.

What part of a foot is each of these parts? $\frac{1}{2}$ ft. $= \frac{\ }{4}$ ft.

11. $\frac{1}{2}$ ft. $+$ $\frac{1}{4}$ ft. $= \frac{\ }{4}$ ft. $\frac{1}{2}$ ft. $-$ $\frac{1}{4}$ ft. $=$? ft. $\frac{1}{4}$ ft. $+$ $\frac{3}{4}$ ft. $=$? ft.

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

13. Add:

$\$2\frac{1}{2}$	$\$4\frac{1}{4}$	$\$3\frac{1}{2}$	$\$3\frac{1}{4}$	$\$4\frac{3}{4}$
$3\frac{1}{4}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$4\frac{1}{4}$	$2\frac{1}{4}$

How do you add these quantities?

14. Add:

$8\frac{1}{4}$	$20\frac{3}{4}$	$6\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{1}{4}$
$2\frac{1}{2}$	$2\frac{1}{4}$	$4\frac{1}{2}$	$32\frac{1}{4}$	$33\frac{1}{4}$

15. Subtract:

$8\frac{3}{4}$	$7\frac{3}{4}$	$9\frac{3}{4}$	$5\frac{3}{4}$	$10\frac{3}{4}$
$2\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{4}$	$2\frac{1}{2}$	$3\frac{1}{4}$

How do you subtract these numbers?

16. Copy and add:

$12\frac{1}{4}$	$82\frac{1}{4}$	$53\frac{1}{2}$	$25\frac{1}{4}$	$21\frac{1}{4}$
$23\frac{1}{4}$	$16\frac{1}{2}$	$14\frac{1}{2}$	$14\frac{1}{2}$	$33\frac{3}{4}$

Lesson 57

1. Edward is $3\frac{1}{2}$ yr. old and John $4\frac{1}{2}$. What is the sum of their ages?

2. James has $\$2\frac{1}{2}$ and Harry $\$5\frac{1}{4}$. How much have they together?

3. John has $\$6\frac{3}{4}$ and Albert $\$2\frac{1}{2}$. How much more has John than Albert?

4. A table is 4 ft. long and $2\frac{1}{2}$ ft. wide. What is the difference between its length and width?

5. A farmer planted $\frac{3}{4}$ of a field with corn and the rest with potatoes. What part of the field did he plant with potatoes? If there were 2 A. of potatoes, how many acres were planted with corn?

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

7. What is the difference between 1 and $\frac{3}{4}$? 1 and $\frac{1}{2}$? 1 and $\frac{1}{4}$? $\frac{3}{4}$ and $\frac{1}{2}$? $\frac{3}{4}$ and $\frac{1}{4}$? $\frac{1}{2}$ and $\frac{1}{4}$?

8. Draw a line 1 ft. long, and divide it into fourths. How many fourths in 1 ft.? How many fourths in $1\frac{1}{4}$ ft.? 1 ft. $= \frac{\ }{4}$ ft. $1\frac{1}{4}$ ft. $= \frac{\ }{4}$ ft.

9. Draw a line 3 ft. long and measure it with a unit one-fourth of a foot long. What number do you get? 3 ft. = ? fourths of a foot? 3 ft. $= \frac{\ }{4}$ ft.

10. How many fourths of a foot are there in 2 ft.? 3 ft.? 4 ft.? 5 ft.? 6 ft.? How do you reduce a number of feet to fourths of a foot?

11. Draw a line $4\frac{1}{4}$ ft. long, and measure it with a unit one-fourth of a foot long. What number of units do you get? $4\frac{1}{4}$ ft. = ? fourths of a foot?

12. $2\frac{1}{4}$ ft. $= \frac{\ }{4}$ ft. $3\frac{1}{4}$ ft. $= \frac{\ }{4}$ ft. $3\frac{3}{4}$ ft. $= \frac{\ }{4}$ ft. $5\frac{1}{4}$ ft. $= \frac{\ }{4}$ ft. $6\frac{3}{4}$ ft. $= \frac{\ }{4}$ ft. $8\frac{3}{4}$ ft. $= \frac{\ }{4}$ ft.
How do you reduce $5\frac{3}{4}$ ft. to fourths of a foot?

13. $\frac{5}{4}$ ft. = ? ft. $\frac{7}{4}$ ft. = ? ft. $\frac{39}{4}$ ft. = ? ft. $\frac{9}{4}$ ft. = ? ft. ? in. $\frac{25}{4}$ ft. = ? ft. ? in.

14. 1 gal. = ? qt. $\frac{1}{4}$ gal. = ? qt. $\frac{3}{4}$ gal. = ? qt. $7\frac{1}{4}$ gal. = ? qt. $10\frac{3}{4}$ gal. = ? qt. $12\frac{1}{4}$ gal. = ? qt.

15. What is the cost of $2\frac{1}{4}$ gal. of milk at 20¢ a gal.?

16. 8 qt. = ? gal. 12 qt. = ? gal. 5 qt. = ? gal. 17 qt. = ? gal. 34 qt. = ? gal. 27 qt. = ? gal.

How do you reduce quarts to gallons?

17. $\frac{5}{2}$ qt. = ? qt. ? pt. $\frac{19}{2}$ qt. = ? qt. ? pt.
$\frac{25}{4}$ gal. = ? gal. ? qt. $\frac{33}{4}$ gal. = ? gal. ? qt.

18. Multiply:

$31\frac{1}{2}$	$42\frac{1}{3}$	$62\frac{1}{4}$	$52\frac{2}{3}$	$71\frac{1}{2}$	$81\frac{3}{4}$
2	3	4	3	4	4

19. What is the cost of 2 rugs at $\$22\frac{1}{2}$ apiece?

20. Divide:

$2\overline{)26\frac{1}{2}}$ $\quad 2\overline{)65}$ $\quad 2\overline{)43}$ $\quad 4\overline{)81}$ $\quad 4\overline{)47}$ $\quad 4\overline{)89}$

21. If 4 boys divide $21, which they earn, equally among them, what does each get?

22. Julian rides 4 mi. in half-an-hour. At this rate how far will he ride in $2\frac{1}{2}$ hr.?

23. A lady paid 12¢ a yard for ribbon. If she had paid 16¢ a yard, it would have cost her 20¢ more. How many yards did she buy?

SECTION V

Lesson 58

1. Cut out of cardboard units 1 in., 2 in., 3 in., ⋯, 11 in. long.

2. Select five pairs of units which put end to end are as long as the 11-in. unit.

3. With these five pairs of units and the 11-in. unit make two triangles, each of whose sides is 11 in. long.

4. As in question three, make a square; a five-sided figure; a six-sided figure, each of whose sides is 11 in. long.

5. Memorize the sum of:

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

6. The 1 to the right in 11 in. means one unit of 1 in. The 1 to the left means 1 unit of 10 in.

What does the 1 mean in 12 in.? What does the 2 mean?

7. Select as often as you can three units which placed end to end are as long as the 11-in. unit. Write your results in columns for addition.

8. Draw lines through the above arrangement of dots to show that the sums found in question 5 are correct.

9. Draw lines through the above arrangement of dots to show that 11 is the sum of each of the following columns for addition.

3	2	4	6	2	2	2	7	2	4
5	4	4	3	5	1	3	0	7	3
3	5	3	2	4	8	6	4	2	4

10. A grocer buys pineapples at 8¢ apiece, and retails them for 11¢ each. How much does he gain on every dozen he sells?

11. Subtract:

11	11	11	11	11	11	11	11
9	2	8	3	7	4	6	5

12. Find the cost of:

$\frac{2}{3}$ doz. peaches at 9¢ a doz.
$\frac{1}{2}$ doz. apples at 6¢ a doz.
$\frac{1}{4}$ doz. figs at 8¢ a lb.

13. Add:

2	2	2	3	3	4	4	5	5
9	19	29	8	28	7	37	26	66

14. Add:

*3	4	4	2	3	1	5	4
3	2	3	2	6	2	2	4
25	15	34	37	42	48	54	63

* Add thus: 25, 28, 31.

15. Write these questions under each other and add: \$12, \$4, \$3; \$26, \$3, \$2; 3¢, 44¢, 3¢; 5¢, 1¢, 62¢.

16. I paid 23¢ for a book, 5¢ for a block of paper, and 3¢ for a lead pencil. How much did I pay in all?

17. If in question 14 I gave the clerk 3 dimes and a nickel, what change did I get back?

Lesson 59

1. 2 dimes = ?¢ 4 dimes = ?¢ 6 dimes = ?¢
2 dimes 4¢ = ?¢ 5 dimes 6¢ = ?¢
8 dimes 9¢ = ?¢ 7 dimes 2¢ = ?¢

2. 14¢ = 1 dime 4¢. 64¢ = ? dimes and cents.
25¢ = ? dimes and cents. 88¢ = ? dimes and cents.
32¢ = ? dimes and cents. 90¢ = ? dimes and cents.

3. 25 lb. is equal to 2 10-lb. (read 2 ten lb.) and 5 lb. Read in the same way each of the following: 28 lb., 34 mi., 23 sq. mi., 16 A., 52 sq. mi., 27 yr., 49 da., 15 hr., 32 min., 65 gal., 65 qt., 40 bu.

4. 23 units are equal to 2 tens and 3 units. State how many tens and units are in each of the following number of units: 18, 50, 44, 72, 97, 9, 36.

5. 2 tens = ? 4 tens = ? 8 tens = ?
3 tens 5 units = ? 7 tens 4 units = ?
2 tens 8 units = ? 6 tens 0 units = ?
6 tens 6 units = ? 9 tens 5 units = ?

6. 64 = 6 tens 4 units. 91 = ? tens and units.
24 = ? tens and units. 40 = ? tens and units.
82 = ? tens and units. 19 = ? tens and units.
57 = ? tens and units. 77 = ? tens and units.

7. 64 in. = 6 units of *ten* inches and 4 units of *one* inch.

24 in. = ? 82 ft. = ? 57 yd. = ? 91 da. = ?
15 hr. = ? 44 min. = ? 18 sec. = ? 85 lb. = ?

8. Read: $1.25, $2.50, $6.42, $7.08, $4.44, $9.25.

9. $256 is equal to 2 units of *one hundred* dollars, 5 units of *ten* dollars, and 6 units of *one* dollar.

256 yd. is equal to 2 units of *one hundred* yards, 5 units of *ten* yards, and 6 units of *one* yard.

10. Read as in question 9 each of the following: $625, 342 mi., 705 A., 432 sq. mi., 250 yd., 999 yr., 1099 yr., 365 da., 894 hr.

11. 736 = 7 hundreds, 3 tens, and 6 units.
325 = ? hundreds, tens, and units.

415, 608, 840, 927, 1027, 265, 1265, are each equal to how many *hundreds*, *tens*, and *units?*

12. How many units in ten? In 20 units how many tens? In 40 units? In 60 units? In 80 units?

13. In 18 units how many tens and units? In 37 units how many tens and units? In 65 units? In 88 units? In 96 units?

14. How many tens in one hundred? In 10 tens how many hundreds? In 20 tens? In 40 tens? In 60 tens? In 80 tens?

15. In 18 tens how many hundreds and tens? In 25 tens how many hundreds and tens? In 48 tens? In 67 tens? In 84 tens?

16. 4 hundreds 5 tens 2 units = ? number.
6 hundreds 4 tens 0 units = ? number.
7 hundreds 0 tens 8 units = ? number.
5 hundreds 3 tens 9 units = ? number.
8 hundreds 8 tens 8 units = ? number.

17. Count by 10's from 0 to 100; from 100 to 200; from 200 to 300.

18. Count by 100's from 0 to 1000; from 1000 to 2000; from 2000 to 3000.

Lesson 60

1.

3¢
28¢
31¢

Add thus: 8¢ and 3¢ are 11¢, or 1 dime and 1¢. Write down 1 and add the 1 dime to the 2 dimes, making 3 dimes. Write down 3. The sum is 31¢.

2. Add as in question 1:

3¢	5¢	6¢	2¢	8	8	2	6
48¢	66¢	54¢	49¢	83	42	99	105

In all these questions you carry 1 to the tens' column. 1 what?

Add:

3.	43	25	64	62	44	56	89	73
	38	35	27	58	77	45	30	39

4.	223	635	308	427	279	396
	474	226	443	384	641	825

5.	234	342	420	314	392	314
	523	203	135	182	204	225
	212	174	316	421	215	642

6. Add, placing the sum above the line:

68							
23	33	13	62	25	16	32	35
45	62	28	28	46	34	19	66

Subtract:

7.	68	95	*41	60	71	90	81	51
	45	62	28	28	35	42	33	16

8.	999	816	808	741	601	1051
	367	254	728	503	257	342

9. A man paid $165 for a horse and $225 for a carriage? How much did he pay for both?

10. An arithmetic costs 45¢, a reader 36¢, and a grammar 30¢. How much did they all cost?

* Subtract thus: 8 and **3** are 11; carry 1 to 2 as in addition, making it 3; 3 and **1** are 4. Write **3** under 8 and **1** under 2 thus,

$$\begin{array}{r} 41 \\ \underline{28} \\ 13 \end{array}$$

That is, fancy you are doing addition with the sum at the top.

11. A man bought a lot for $975 and sold it for $850. How much did he lose?

12. I paid $1.25 for a roast of beef and $1.10 for potatoes. What did I pay for both?

13. A farmer sold his wheat for $854 and hay for $237. How much did he get for both?

14. A merchant took in $332 on Monday, $204 on Tuesday, and $455 on Wednesday. How much did he take in on these three days?

Lesson 61

1. Memorize the sum of:

3	4	5	6
9	8	7	6

2. Find the sum of:

9	8	7	6
3	4	5	6

Add:

3.

3	9	5	6	5	4	7	3
19	13	26	36	77	48	65	38

4.

4	4	5	5	3	3	2	3
4	4	2	6	3	9	3	3
22	34	44	51	63	70	85	96

5. What is the cost of:

4 lb. raisins at 8¢ a lb.?
$\frac{1}{2}$ lb. dates at 6¢ a lb.?
$\frac{1}{2}$ lb. nuts at 12¢ a lb.?

6.	*5	*2	3	4	1	4	2	4
	4	5	3	8	3	4	2	4
	2	1	3	4	5	5	5	4
	14	56	33	70	65	43	26	84

7.	18	26	33	53	34	28	57	23
	42	36	62	74	48	92	65	88

8.	748	121	643	232	495	355	161
	234	879	586	497	307	565	768

In each of these questions you carry 1. This 1 is 1 what?

9.	426	284	294	325	272	444	111
	343	303	125	254	416	333	444
	212	241	702	411	412	222	555

10. What is the cost of:

$\frac{1}{2}$ bu. apples at 60¢ a bu.?
$2\frac{1}{2}$ lb. biscuits at 8¢ a lb.?
4 lb. sugar at $5\frac{1}{4}$¢ a lb.?

Subtract:

11.	989	†521	625	930	641	989	862
	752	263	283	615	228	457	129

* Add thus: 14, 16, 20, 25; 56, 57, 62, 64.

† Subtract thus: 3 and **8** are 11; carry 1 to 6, as in addition, making it 7; 7 and **5** are 12; carry 1 to 2 making it 3; 3 and **2** are 5. That is, fancy you are doing addition with the sum at the top.

12.	4564	7498	7594	8989	9387	7845
	2342	4288	6571	6363	8326	6043

13.	7982	9322	5745	4102	7629	1521
	2646	4218	2730	2052	1038	1432

14. A farmer has 638 sheep in one flock and 234 in another. How many has he all together?

15. I bought a house for \$4825 and sold it for \$3460. How much did I lose?

16. A man spent \$124 on Monday, \$423 on Tuesday, and \$673 on Wednesday. How much did he spend all together?

17. How many days are there in April, May, and June? How many days are there in July, August, and September?

Lesson 62

1. Memorize the sum of:

4	5	6	9	8	7
9	8	7	4	5	6

Add:

2.	5	8	4	9	5	5	3	8
	18	15	39	34	47	68	78	85

3.	4	6	3	5	9	6	4	4
	5	4	5	3	4	3	4	3
	31	23	44	65	60	72	82	96

4.

1	3	4	2	4	8	2	4
3	2	2	3	2	1	3	4
3	4	2	5	1	6	3	4
12	21	34	41	56	63	73	71

5. What is the cost of:

4 yd. of elastic at 6¢ a yd.?
10 yd. of tape at 2¢ a yd.?
$2\frac{1}{2}$ yd. lining at 10¢ a yd.?
$\frac{3}{4}$ yd. ribbon at 4¢ a yd.?

6.

28	38	27	39	25	33	56	40
33	45	54	63	78	99	82	98

7.

235	248	427	655	568	909	263	566
548	671	496	714	815	204	574	546

8. Find the cost of 2 bu. of potatoes at 40¢ a bu., and $3\frac{1}{2}$ lb. of meat at 12¢ a lb.

9.

212	141	504	141	333	333	634	232
154	320	412	453	444	111	307	260
702	168	183	138	555	666	241	318

Subtract:

10.

674	954	439	715	609	938	310	609
231	823	275	433	546	444	154	352

11.

6739	4903	6048	7354	3429	6336	7273	5128
2435	2701	2035	1321	2316	2332	3123	4128

12.

8653	9125	3522	4175	4967	2364	6001	5385
7439	4135	2140	3514	3643	1423	3453	2962

13. A farmer received $235 for his corn and $470 for his wheat. How much did he receive for both?

14. A cattle dealer had 3245 cattle and sold 1340. How many had he left?

15. A man bought a farm for $8225 and sold it for $9415. How much did he gain?

16. If a man earns $2500 a year, and his expenses are $1500, how much does he save?

17. Find the sum of 121, 121, 121, 121. Multiply 121 by 4.

18. Mr. Brown owed Mr. Smith $225. He paid the debt by giving him $160 and a horse. What was the horse worth?

Lesson 63

1. Count by 5's from 5 to 200.

2. Memorize:

Five times

1 is 5	5 is 25	9 is 45
2 is 10	6 is 30	10 is 50
3 is 15	7 is 35	11 is 55
4 is 20	8 is 40	12 is 60

3. Give two factors of each of the following numbers: 28, 45, 44, 32, 55, 27, 60, 48, 40, 35.

4. Give the two *equal* factors of each of the following numbers: 4, 9, 16, 25.

5. Give as many pairs of factors as you can for each of the following numbers:

24 (2 × 12, 3 × 8, 4 × 6), 12, 18, 20, 28, 30, 36, 40.

6. 4 is a factor of 12. What is the other factor? 4 is a factor of 20. What is the other factor?

4 is a *common factor* of 12 and 20.

Draw lines 12 in. and 20 in. long and measure them with a 4-in. unit. How many units in each?

7. What number is a common factor of 20 and 25? Of 9 and 12? Of 25 and 30? Of 10 and 14? Of 12 and 15?

8. How long is the unit that will *exactly* measure two pieces of ribbon one 12 in. long and the other 15 in. With what coin can you pay a debt of 20¢ and also of 25¢?

Multiply:

9.	21	*23	33	51	63	42
	5	5	5	5	5	5

* Multiply thus: 5 times 3 is 15; write down 5 and carry 1; 5 times 2 is 10; 10 and 1 are 11; write down 11. The *product* is 115.

In multiplying 23 by 5 you carry 1. This 1 is 1 what?

10.	262	341	424	521	203	313
	2	3	4	5	5	5

11.	6	5	5	4	5	5	5	5
	5	6	8	7	7	9	12	10

12.	41	52	42	50	53	52
	6	6	7	7	8	9

13. James rode 33 mi. on his bicycle in one week, and Henry 4 times as far all but 12 mi. How far did Henry ride?

14. Divide:

5)45   5)450   8)40   7)350   9)45   6)300

15. What number smaller than 12 has 5 for a factor? smaller than 16? 18? 22? 28? 33? 36? 39? 42? 47? 49?

Divide:

16. *5)215   5)315   5)325   5)280   5)365   5)390

On dividing 325 by 5 you have a remainder 2 on the first division. This 2 is 2 what?

* Divide thus: 5 is contained in 21 4 times with remainder 1; write down 4; 5 is contained in 15 3 times; write down 3. The *quotient* is 43.

17. $4\overline{)212}$ $3\overline{)252}$ $5\overline{)375}$ $4\overline{)304}$ $2\overline{)572}$ $3\overline{)291}$

There is a remainder on the first division each time. Is this remainder units, tens, or hundreds?

18. $6\overline{)312}$ $7\overline{)294}$ $8\overline{)416}$ $5\overline{)340}$ $9\overline{)369}$ $9\overline{)468}$

19. At \$5 a bbl. how many barrels of flour will cost \$325?

20. How many miles an hour must a train travel to go 272 mi. in 8 hr.? In 6 hr.?

21. If a train travels 26 mi. an hour, how far distant is a city which it will reach in $4\frac{1}{2}$ hr.?

22. A farmer received \$128 for a cow and some lambs. He received \$32 for the cow and \$3 for each lamb. How many lambs did he sell?

Lesson 64

1.

$1 \times 6 = 6$	$6 \times 1 = ?$	$4 \times 6 = 24$	$6 \times 4 = ?$
$2 \times 6 = 12$	$6 \times 2 = ?$	$5 \times 6 = 30$	$6 \times 5 = ?$
$3 \times 6 = 18$	$6 \times 3 = ?$	$6 \times 6 = ?$	$6 \times 6 = ?$

2. Count by 6's from 6 to 72.

3. Memorize:

Six times

1 is 6	5 is 30	9 is 54
2 is 12	6 is 36	10 is 60
3 is 18	7 is 42	11 is 66
4 is 24	8 is 48	12 is 72

4. Give two factors of each of the following numbers: 30, 21, 48, 54, 55, 72, 27, 66, 42, 60.

5. Give as many pairs of factors as you can of each of the following numbers: 18 (2 × 9, 3 × 6), 16, 36, 48, 24, 54, 60, 44.

6. What number is a common factor of 12 and 15? 15 and 25? 22 and 33? 30 and 42? 28 and 32?

7. Two logs, one 15 ft. and the other 25 ft. in length, were cut into the longest possible pieces of equal length. What is the length of each piece?

Multiply:

8.	*49	24	35	47	58	66
	6	6	6	6	6	6

In multiplying 49 by 6 you carry 5. This 5 is 5 what?

9. A dealer bought 84 sheep at $6 apiece, and sold them for $600. Find his gain.

10.	396	396	396	396	396	506
	2	3	4	5	6	6

In multiplying 396 by 3 you carry 1. This 1 is 1 what? You also carry 2. This 2 is 2 what?

11.	8	6	5	6	6	6	5	5
	6	8	9	7	9	12	12	11

* Multiply thus: 6 times 9 is 54; write down 4 and carry 5; 6 times 4 is 24; 24 and 5 are 29; write down 29. The *product* is 294.

12.

22	34	83	75	36	66
9	7	8	6	9	8

13. A farmer's barn cost him $225, and his house 9 times as much. Find the cost of both.

14. Divide:

6)426 8)400 6)546 9)549 5)505 9)369

15. What number smaller than 20 has 6 for a factor? Smaller than 15? 17? 26? 29? 34? 38? 47? 49? 52? 58?

Divide:

16.* 6)150 6)324 6)456 6)294 6)402 6)732

17. 2)576 3)576 4)576 5)650 6)864 6)834

18. 4)704 6)702 5)735 7)448 8)448 9)459

19. 6)594 9)594 8)520 7)364 8)504 9)504

20. Divide the contents of 240 bags of oats equally among three bins. How much in each?

21. How many bushels of wheat in 24 bags each containing 2 bu., and 18 bags each containing 3 bu.?

22. I paid $ 240 for a horse and bicycle. If the horse cost 5 times as much as the bicycle, find the cost of each.

* Divide thus: 6 is contained in 15 2 times with remainder 3; write down 2; 6 is contained in 30 5 times; write down 5. The *quotient* is 25.

SECTION VI

Lesson 65

1. $2.75 is read, two dollars and seventy-five cents. The **decimal point** (.) separates dollars from cents. All the figures to the left of the decimal point denote dollars, and the first two figures to the right denote cents.

2. Read the following:

$2.43	$36.10	$62.24	$169.65	$1864.86
$4.29	$64.76	$43.60	$691.80	$1759.45

3. Read the following:

$2.35, $1.35, $.35, $.25, $.15, $.05, $.08

4. Read the following:

$.05	$ .07	$ 15.17	$ 204.04
$.09	$ .30	$ 77.60	$ 300.06
$.01	$ .75	$ 20.05	$ 300.60
$.12	$2.16	$291.98	$1732.25
$.18	$3.04	$201.64	$5300.20
$.69	$5.20	$311.20	$6040.06

5. Write in figures as in question 4: Three dollars and twenty-five cents; thirty-seven dollars and fifty cents; sixteen cents; eighty-three cents; four cents; nine cents; twenty dollars and six cents.

6. Write in figures: One hundred nineteen dollars and twenty-five cents; two hundred forty-three dollars and ninety-one cents; six hundred eight dollars and eight cents; nine hundred ninety-nine dollars and ninety-nine cents.

7. How many cents in \$2? In \$.25? In \$2.25?

8. How many cents in? —

\$3.75	\$8.19	\$4.06	\$25.64	\$10.06
\$6.07	\$3.10	\$6.43	\$34.08	\$20.20

9. Write and read as dollars and cents:
16¢, 6¢, 300¢, 210¢, 625¢, 409¢, 2463¢, 1250¢, 2400¢, 1650¢, 1825¢.

10. How many cents in \$$\frac{1}{4}$, \$$\frac{1}{2}$, \$$\frac{3}{4}$, \$$\frac{1}{5}$, \$$\frac{1}{10}$?

11. Write as dollars and cents:

\$$5\frac{1}{2}$, \$$6\frac{1}{4}$, \$$8\frac{3}{4}$, \$$12\frac{1}{5}$, \$$24\frac{2}{5}$, \$$43\frac{1}{10}$, \$$64\frac{7}{10}$.

12. How many dollars, dimes, and cents in? —

\$2.45, \$6.40, \$3.08, \$4.00, \$.90.

13. How many ten-dollars, dollars, dimes, and cents in \$36.25, \$40.16, \$62.01, \$3.04, \$11.11? How many cents in 1 dime? Dimes in 1 dollar? Dollars in 1 ten-dollar?

14. Add:

\$2.14	\$13.21	\$215.42	\$1212.33
3.20	22.16	211.00	2104.12
4.53	24.00	420.06	3013.41

15. Find the sum of \$24.33, \$21.14, and \$17.22. Find the sum of \$134.25, \$243.40, and \$510.53.

16. What will it cost to settle a grocery bill of \$22.33, a meat bill of \$14.12, and a drug bill of \$2.14?

17. Subtract:

\$8.75	\$53.92	\$369.43	\$2146.56
3.42	12.60	328.12	1013.45

18. What is the difference in cost between two rocking-chairs, one costing \$27.75 and the other \$16.50?

19. I buy a chair for \$2.65; what change should I get back from a five-dollar bill?

20. Multiply:

\$5.23	\$22.15	\$31.51	\$213.42
3	4	5	6

21. What is the cost of 5 T. of coal at \$6.25 a ton, and 2 cords of wood at \$4.25 a cord?

22. Find the value of: \$48.26 ÷ 2; \$82.50 ÷ 3; \$.92 ÷ 4; \$.06 ÷ 2; \$628.75 ÷ 5; \$483.90 ÷ 6.

23. If an agent makes \$994.60 in 4 mo., what are his average monthly earnings?

24. Find the cost of:

6 cups at \$ .20 apiece.
4 knives at \$1.25 apiece.
5 plates at \$ .25 apiece.
2 spoons at \$1.50 apiece.
3 salt dishes at \$ .25 apiece.

Lesson 66

1. A pitcher holds 3 pt. How many quarts and pints does it hold? How many quarts and pints in 5 pt.? 9 pt.? 7 pt.? 11 pt.?

2. In adding pints, what unit can you always put in place of every 2 pt.?

3. In one pail there are 2 qt. 1 pt. of water; in a second pail 3 qt. 1 pt.; in a third 1 gal. 1 pt. How much water in the three pails?

4. Measure, and prove your answer to question 3 correct.

5. Make problems like question 3.

6. How many gallons and quarts are there in 6 qt.? 9 qt.? 5 qt.? 7 qt.?

7. What unit of measure can you put instead of every 4 qt. in a quantity of liquid?

8. How many quarts and pints in 3 cans, each of which holds 5 pt.? How many gallons, quarts, and pints in 3 cans, each of which holds 7 pt.?

9. If 3 pieces of ribbon of the same length cost $.15, what will 1 piece cost?

10. Draw a line three-quarters of a yard long, and divide it into pieces each one-quarter of a yard long. How many pieces? What is the cost of each piece if all costs 18¢? Of 4 such pieces? How long will 4 such pieces be?

11. If three-quarters of a yard of ribbon costs 12¢, what will one-quarter of a yard cost? Four-quarters of a yard? One yard? One yard and one-quarter?

12. If $\frac{3}{4}$ yd. of cloth costs 21¢, what is the cost of 1 yd.? How do you find the cost of 1 yd. of cloth when you know the cost of $\frac{3}{4}$ yd.?

13. If $\frac{3}{4}$ lb. of butter cost 24¢, what is the price per lb.? When you know the cost of $\frac{3}{4}$ lb. of butter, how do you find the cost of 1 lb.? Of $1\frac{1}{4}$ lb.?

14. A boy sold 6 qt. of berries at 6¢ a qt. How many oranges at 3¢ each could he buy with the money he got for the berries? What unit measures the value of an orange?

15. When milk costs 24¢ a gallon, what is the cost of 1 qt.? What is the cost of 1 pt.? Of 1 gal. 3 qt. 1 pt.? What is the cost of 2 gal. 3 qt. 1 pt. at 2¢ a pt.?

16. A man spent $\frac{3}{5}$ of his salary. What part of it did he save? If he had spent $\frac{3}{4}$ of his salary, what part would he have saved? If this was \$120, what was his salary?

17. A watch cost \$50, which was five times the value of the chain. What was the cost of the chain? Of both? What is the whole quantity here? What is the number? What is the unit?

18. Draw a square whose side is 4 in. Divide it into 2-in. squares. How many? Name the whole quantity, the unit, and the number. How did you find the number?

19. How many 2-in. squares in a square whose side is 6 in.? 8 in.? 10 in.? 1 ft.?

20. How many more 3-in. squares can be cut from a square whose side is 12 in. than from one whose side is 9 in.?

21. How many 4-in. squares in an oblong 12 in. by 20 in.? 1 ft. 8 in. by 3 ft.? How many tiles, each 4 in. square, are needed for a piece of tiling 4 ft. long and 1 ft. 4 in. wide?

Lesson 67

1. A milkman has 4 gal. 1 qt. of milk in one can; in another 3 gal. 1 qt. 1 pt.; in a third 2 qt. 1 pt. How much milk has he?

2. A milkman sold 3 cans of milk, each containing 2 gal. 3 qt. How much did he sell?

3. How many quarts in 5 gal. 2 qt.? To how many customers can a milkman sell 5 gal. 2 qt. if he sells 2 qt. to each customer? Name the quantity, the unit, and the number.

4. If I divide 8 gal. 3 qt. of syrup equally among 5 persons, how much does each get? In this

question you are given the quantity and the number and are required to find the unit. State the question in which you are given the quantity and unit to find the number.

5. A man buys milk at 4¢ a qt., and sells it at 3¢ a pt. How much does he gain on each gal.? How much on 6 gal.?

6. If three-quarters of a yard of cloth cost 18¢, what will one-quarter of a yard cost? Four-quarters of a yard? One yard? One yard and one-half?

7. If $\frac{3}{4}$ yd. of ribbon costs 27¢, what will 1 yd. cost? $1\frac{1}{2}$ yd.? If $\frac{3}{4}$ lb. of raisins cost 15¢, what will 1 lb. cost? $2\frac{1}{2}$ lb.?

8. The desks in a schoolroom cost \$72 at \$2 a desk; how many desks are there in the room? How many rows of desks with 6 in a row?

9. If $\frac{3}{4}$ of the number of desks in a room are 33, how many desks are in the room? How do you find a number when you are given $\frac{3}{4}$ of it?

10. A milkman sold milk at \$.03 a pint. What was the price per gallon? What will 5 gal. sell for?

11. James paid \$$\frac{3}{4}$ for a book and \$$\frac{1}{4}$ for a slate. How much more did the book cost than the slate? How much did both cost?

12. A milkman having 25 gal. 2 qt., sold $\frac{1}{3}$ of it. How much did he sell? If he had sold $\frac{2}{3}$ of it, how much would he have sold?

13. A farmer sold 6 doz. eggs to a grocer at \$.12 a doz., 5 lb. of butter at \$.18 a lb. He took his pay in sugar at 6¢ a lb. How many pounds of sugar did he receive?

14. Florence paid \$.64 for an arithmetic and $\frac{1}{2}$ as much for a reader. What did both cost? What change should she get back from a dollar bill?

15. My hens lay 5 eggs a day. In how many weeks will they lay 140 eggs?

16. What will 2 doz. apples cost at the rate of 2 apples for 3¢? What is the unit here?

17. How many feet long is your schoolroom? How many feet wide? Now find, without measuring, the number of yards it is half-way around the room. Test your answer by measuring.

18. A boy earns \$.09 an hour, and works 8 hr. a day. How much more does he earn in 1 wk. than a boy who earns \$.10 an hour, and works 7 hr. a day?

19. In question 20, place one dot for each dollar left. How many? How many dots should you place for the money spent for groceries? How many for what was in my purse at first?

20. I spent $\frac{2}{3}$ of the money in my purse for groceries, and had \$5 left. What part of my money did I have left? How much had I at first?

21. What three different coins make \$.16?

Lesson 68

1. Monday a boy picked 5 qt. 1 pt. of berries, Tuesday 4 qt. 1 pt., and Wednesday 6 qt. 1 pt. How much did he pick on these three days?

2. The boy in question 1 sold his berries at 6¢ a quart, and bought a ball and bat with the money. What did he pay for the ball and bat?

3. What is the cost of 6 qt. 1 pt. of milk at $.24 a gallon?

4. What will $3\frac{1}{2}$ yd. of ribbon cost at 12¢ a yard? Of the three terms, quantity, unit, number, which are you given and which must you find? Using the same numbers, state a question in which you are given the quantity and unit to find the number. State a question in which you are given the quantity and number to find the unit.

5. School is in session from nine to twelve o'clock, and from a quarter after one to half-past three. This is how many hours a day? Count on the clock. How many hours a week?

6. If it takes 1 man 6 hours to cut a cord of wood, how long will it take 2 men to do it? How long will it take 3 men?

7. A man takes 6 hours to cut a cord of wood, cutting each stick into two pieces. How long will it take him if he cuts each stick into three pieces? In each case draw a stick, and mark where it is cut?

8. What number of cents can you divide into thirds and have 6¢ in each third? Test your answer by making 6 dots for each third, and then counting all your dots by 6's. How many 6's? How many dots?

9. What number can you divide into fourths and have 25 in each part? Into fifths? Into sixths?

10. If one-sixth of the distance between Chicago and Springfield is 29 mi., how far is it between these two cities?

11. How many weeks in 1 yr? $\frac{1}{2}$ yr.? $\frac{1}{4}$ yr.? $\frac{3}{4}$ yr.?

12. If a boy earns \$6 a week, how much will he earn in $\frac{3}{4}$ yr.?

13. If a boy earns \$7 a week and it costs him \$5 a week to live, how much can he save in $\frac{1}{2}$ yr.?

14. What five different coins make 91¢?

15. A lady made 6 gal. of preserves and put them up in pint cans. How many cans did she use?

16. A 5-lb. pail of butter costs 90¢. At this rate what must I pay for $2\frac{1}{2}$ lb.?

17. How many pennies will be required to form a square if there are 5 pennies on each side of the square? Place pennies so as to show how many are needed.

18. A grocer has 8 gal. 2 qt. 1 pt. of cider which he divides equally among 3 customers. What does

each receive? Name the quantity and the number. What is the unit? How did you find it?

19. To how many customers can a milkman sell 8 gal. 3 qt. of milk, if he sells 5 pt. to each customer? Name the quantity and the unit. What is the number? How did you find it?

20. A pole is $\frac{1}{4}$ in the ground and $\frac{3}{4}$ in the air. Draw the pole. If it is 4 ft. in the ground, how long is the part in the air? How long is the pole?

21. A pole is $\frac{3}{4}$ in the air and $\frac{1}{4}$ in the ground. If the height above ground is 6 ft., how long is the pole?

22. Two boys walk, one east at the rate of 3 mi. an hour, and the other west, at $\frac{2}{3}$ that rate. How far apart will they be 4 hr. after they part?

SECTION VII

Lesson 69

1. Memorize the sum of :

5	6	7	8	9
9	8	7	6	5

Add :

2.	5	9	6	8	7	7	9	6
	19	15	28	26	47	37	65	87

3.	5	3	5	6	9	6	7	5
	4	4	9	4	4	3	5	8
	22	37	30	44	51	63	72	81

4.	2	4	1	6	9	7	8	4
	2	1	3	4	1	6	4	3
	4	3	4	6	2	2	3	8
	12	25	32	14	42	58	41	60

5. I bought a coat for $12, and had left a five-dollar bill and 2 two-dollar bills. How much money had I at first?

6. I bought a carriage for $61, paid $5 for repairs, and sold it so as to gain $8. What did I sell it for?

7.	35	15	48	94	69	46	55	49
	24	77	86	39	72	38	77	80

8.	234	639	149	475	298	329	758	829
	181	70	673	328	443	872	686	555

9.	275	654	283	333	206	542	257	426
	453	513	708	325	304	129	509	328
	221	331	544	516	692	783	134	156

10. 25 years ago a young man entered the army at the age of 19. How old is he now?

11. In an orchard there are 96 apple trees and $\frac{1}{2}$ as many cherry trees. How many trees are there in the orchard?

12. A farmer has 435 sheep in one flock, 322 in a second, and 239 in a third. How many has he all together?

Subtract:

13.	784	638	743	801	417	846	931	432
	352	234	561	271	234	395	888	189

14.	6465	9039	4398	6000	3040
	2361	2127	3489	2009	1945
	1847	8666	8429	7172	5329
	1321	4888	3516	6354	1678

15. Mrs. Ellis was 24 yr. old on Feb. 19, and Caryl 8. What is the difference in their ages?

16. There are 25 pupils in the second grade, and 16 more in the first. How many are there in both grades?

17. A boy rode 75 mi. on a bicycle in two days. If he rode 49 mi. the first day, how far did he ride the second day? How many miles less than on the first day?

18. A farmer has 165 A. in oats, 124 A. in barley, and 225 A. in wheat. How many acres of grain has he?

19. A farmer sold 2 cows at \$23 each and 3 sheep at \$6.25 apiece. What did he receive altogether?

20. A farmer sold a grocer 6 T. of hay at \$12 a ton and bought \$25.50 worth of groceries. How much cash did he receive?

21. My salary is \$84 a month. I spend $\frac{1}{3}$ of this for board, $\frac{1}{6}$ for clothing, and $\frac{1}{4}$ for other expenses. How much do I spend altogether? How much do I save?

22. Alder had 24 marbles. In the morning he lost $\frac{1}{3}$ of them and in the afternoon he won $\frac{1}{2}$ as many as he had at noon. How many marbles had he at night?

Lesson 70

1. Memorize the sum of:

6	7	8	9
9	8	7	6

Add:

2.

6	6	9	9	7	7	8	8
29	49	66	86	18	38	57	77

3.

9	4	5	6	7	8	3	8
4	4	5	6	7	8	7	7
22	34	45	66	77	88	92	16

4.

1	5	9	5	6	7	5	2
2	4	2	1	7	3	6	9
3	2	2	3	8	4	6	5
13	24	32	44	56	68	77	84

5. A man had his life insured 7 years ago when he was 48 yr. of age. How old is he?

6. A man earns \$22.50 a week, his oldest son $\frac{1}{2}$ as much, and the youngest $\frac{1}{3}$ as much. What is the sum of their weekly earnings?

7. A box weighing 5 lb. contains 48 lb. of sugar, 6 lb. of coffee, and 3 lb. of tea. Find its entire weight.

8.

29	65	65	86	86	54	43	67
46	74	57	38	49	36	90	88

9.

458	29	284	777	506	364	285	789
203	843	369	666	909	859	367	412

10.

34	702	266	280	423	638	215	242
23	516	315	398	27	399	328	381
919	370	864	246	392	541	785	899

11. Two men travel, one 68 mi. east of Chicago and the other 47 mi. west. How far apart will they be when they reach their destination? Draw a line and represent the three places on this line.

12. Two men travel, one east and the other west of Chicago, the first at the rate of 36 mi. an hour and the other at the rate of 24 mi. an hour. How far apart will they be in 2 hr.?

Subtract:

13.

684	647	811	502	824	721	554	921
253	385	468	341	527	315	379	763

14.

6724	5289	6903	8000
3103	4503	4278	3574
6105	3060	8140	3435
4239	1432	2352	1547

15. One of two farms contains 384 A. and the other is $\frac{1}{3}$ as large. The first contains how many more acres than the second?

16. A man bought 6 doz. oranges at 22¢ a dozen. One dozen were spoiled, and he sold the rest at 30¢ a dozen. How much did he gain?

17. I sold a lot for \$650, losing \$275; what should I have sold it for to gain \$125?

18. James had \$.42. He spent $\frac{2}{3}$ of it for a ball, and 5¢ for an orange. How much had he left?

19. I bought a house and lot for $4250 and spent $1000 on it in repairs. I then sold it for $5925. What was my gain?

20. A laborer worked 248 days during the year. He worked how many days more than he was idle?

Lesson 71

1.

$1 \times 7 = 7$	$7 \times 1 = ?$	$5 \times 7 = 35$	$7 \times 5 = ?$
$2 \times 7 = 14$	$7 \times 2 = ?$	$6 \times 7 = 42$	$7 \times 6 = ?$
$3 \times 7 = 21$	$7 \times 3 = ?$	$42 + 7 = ?$	$7 \times 7 = ?$
$4 \times 7 = 28$	$7 \times 4 = ?$	$49 + 7 = ?$	$8 \times 7 = ?$

2. Count by 7's from 7 to 84. Count by 7's from 84 to 7.

3. Memorize:

Seven times

1 is 7	5 is 35	9 is 63
2 is 14	6 is 42	10 is 70
3 is 21	7 is 49	11 is 77
4 is 28	8 is 56	12 is 84

4. Give two factors of each of the following numbers: 32, 56, 66, 63, 35, 48, 84, 44, 27, 77.

5. What number is the greatest common factor of 24 and 32; 35 and 55; 42 and 28; 48 and 56; 72 and 84.

6. Draw two lines, one 18 in. and the other 30 in. long. What is the longest line that can be used to measure both lines? Test by measuring.

7. Find the largest can that can be used to measure the oil in each of two barrels, one of which has 20 gal. and the other 25 gal.

8. Multiply:

54	32	63	89	77	99	48
7	7	7	7	7	7	7

In multiplying 54 by 7 you carry 2. This 2 is 2 what? In multiplying 5 by 7 you get 35. This 5 is 5 what? 35 is 35 what? 35 tens + 2 tens = ?

9.

456	581	695	945	998	672
4	5	6	7	7	7

10. At the rate of 36 mi. an hour, how far will a train run in 4 hr.? Name the unit, the number, and the quantity. How did you find the quantity? With the same numbers state the question in which you have to find the unit. Another in which you have to find the number.

11. A lawyer employs in his office 7 clerks, and pays them on the average $456 a year. What is the total amount of their yearly salaries?

12. What number smaller than 20 has 7 for a factor? Smaller than 39? 52? 31? 60? 41? 43? 34? 64? 58? 55?

13. Find the value of:

294 ÷ 7 182 ÷ 7 511 ÷ 7 245 ÷ 7

14. How many weeks and days are there in a year of 366 da.?

15. A merchant buys gloves at 85¢ per pair, and sells them at 99¢ a pair. How much does he gain on 8 pairs if one pair is damaged and is sold for 50¢?

16. How many barrels of flour at $5 a barrel will cost as much as 40 bbl. of apples at $3 a bbl.? Name the quantity and the unit. How did you find the number?

17. Harry bought 7 chickens at $.25 apiece. How much had he left out of $2?

18. Find the cost of the following articles: 3 2-lb. packages cracked wheat at $.12 each, 7 lb. graham flour at $.03 a lb., and 1 lb. coffee at $.35 a lb.

Lesson 72

1. Count by 8's from 8 to 96. Count by 8's from 96 to 8.

2. Memorize:

Eight times

1 is 8	5 is 40	9 is 72
2 is 16	6 is 48	10 is 80
3 is 24	7 is 56	11 is 88
4 is 32	8 is 64	12 is 96

3. Find the value of each of the following: $8 \times \$3.05$, 8×35 A., 8×57 lb., 8×88 bu., 8×96 T.

4. What is the weight of 8 25-lb. sacks of flour and 4 50-lb. sacks?

5. Last year my coal cost \$61.50. This year I bought 8 T. at $\$6\frac{1}{2}$ a ton. How much less did my coal cost this year than last?

6. A lady bought 8 yd. of cloth at $\$3\frac{1}{4}$ a yard, a hat for \$8, and had \$16 left in her purse. How much had she at first?

7. Find the value of: $4 \times \$3.15$, $5 \times \$8.09$, $6 \times \$2.19$, $7 \times \$2.56$, $8 \times \$3.96$.

8. How many pages are there in 8 arithmetics, each of which contains 218 pages?

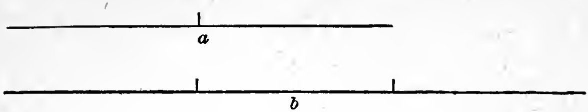
9. A drover bought 356 sheep at \$8 apiece. What did they cost him? If he sold them for \$9 apiece, what did he gain?

10. What is the value of $\$1968 \div 8$, $\$2440 \div \$8$, 2848 bu. $\div 8$ bu., 6984 bu. $\div 8$?

11. If 1408 A. is divided into 8 farms of equal size, how many acres are there in each farm? Name the quantity, number, and unit.

12. An employer distributes \$2192 among his workmen, giving \$8 to each. Find the number of workmen. What is the unit here?

13. If 3 lb. of sugar cost 16¢, what will 24 lb. cost? What is the number here?



14. How long are the lines *a* and *b*? What part of *b* is equal to *a*? *a* is equal to $\frac{2}{3}$ of *b*. The ratio of *a* to *b* is $\frac{2}{3}$. The ratio of *b* to *a* is $\frac{3}{2}$.

15. Draw lines 2 2-in. long and 3 2-in. long. What part of the line 3 2-in. is equal to the line 2 2-in.? 2 2-in. is what part of 3 2-in.? What is the ratio of 2 2-in. to 3 2-in.? Of 3 2-in. to 2 2-in.?

16. What is the ratio of 2 2-dots to 3 2-dots? Of 3 2-dots to 2 2-dots? What is the ratio of the weight of 2 2-lb. rolls of butter to that of 3 2-lb. rolls? Of the cost?

17. If 3 2-lb. rolls of butter cost 90¢, what will 2 2-lb. rolls cost?

18. What is the ratio of the cost of 3 2-lb. of butter to that of 2 2-lb.? If 2 2-lb. rolls of butter cost 48¢, what will 3 2-lb. rolls cost?

19. What is the largest unit that measures 4 in. and 6 in.? How often in each case? What is the ratio of 4 in. to 6 in.? Of 6 in. to 4 in.?

20. What is the ratio of 4 yd. to 6 yd.? Of 6 yd. to 4 yd.? Of the cost of 4 yd. of ribbon to the cost of 6 yd.? If 6 yd. of ribbon cost \$.63, what will 4 yd. cost?

21. What is the ratio of 4¢ to 6¢? Of \$4 to \$6? Of 6¢ to 4¢? Of \$6 to \$4? Of the amount \$4 will buy to that which \$6 will buy? If \$4 will buy 5 gal. of maple syrup, how many quarts will \$6 buy?

22. What is the largest unit that measures 6 in. and 8 in.? 6 in. = ? 2-in. 8 in. = ? 2-in. What is the ratio of 6 in. to 8 in.? Of 8 in. to 6 in.? Of 6 ft. to 8 ft.? Of 8 yd. to 6 yd.? Of 6¢ to 8¢? Of 8 dimes to 6 dimes?

23. At 6 boxes for 33¢, what will 8 boxes of berries cost? At 8¢ for $\frac{1}{2}$ pk. of apples, how many quarts of apples can you buy for 6¢?

24. James caught a ball 6 times out of 8. How many times did he miss it in 96 chances?

Lesson 73

1. Fill a peck measure with a quart measure. How many quarts in one peck? 1 pk. = ? qt.

2. Fill a bushel measure with a peck measure. How many pecks in one bushel? How many quarts in one bushel? ? pt. = 1 qt. ? qt. = 1 pk. ? pk. = 1 bu. 1 bu. = ? qt.

3. 3 pk. = ? qt. 6 pk. = ? qt. 4 pk. = ? qt.
5 pk. = ? qt. 8 pk. = ? qt. 9 pk. = ? qt.

How can you reduce pecks to quarts without actually measuring?

4. Reduce to quarts: 2 pk. 3 qt.; 5 pk. 6 qt.; 7 pk. 4 qt.; 1 bu.; 3 bu.; 5 bu. 4 qt.

How do you reduce bushels to quarts?

5. $1\frac{1}{2}$ bu. = ? qt. $3\frac{1}{2}$ bu. = ? qt. $2\frac{1}{4}$ bu. = ? qt.
$2\frac{1}{2}$ pk. = ? qt. $3\frac{3}{4}$ pk. = ? qt.

6. 2 bu. 3 pk. = ? pk. 2 bu. 3 pk. 4 qt. = ? qt. 3 bu. 2 pk. 4 qt = ? qt. 4 bu. 3 qt. = ? qt.

7. A bushel of oats weighs 32 lb. What does 1 qt. of oats weigh? 1 pk.?

What is the weight of 2 bu. 3 pk. 6 qt. of oats?

8. What part of a bushel is 2 pk.?

A bushel of beans weighs 60 lb. What is the weight of 3 bu. 2 pk.?

9. 15 pk. = ? bu. pk. 25 pk. = ? bu. pk.
30 qt. = ? pk. qt. 18 qt. = ? pk. qt.

10. 36 qt. = ? bu. 18 pk. = ? bu. 48 qt. = ? bu.

What is the cost of 48 qt. of potatoes at 60¢ a bu.?

11. What is the weight of 40 qt. of wheat if 1 bu. weighs 60 lb.?

12. How many ounces are there in 1 lb. of butter? Name other articles, one pound of which contains 16 oz. How could such an expression as 2 lb. 6 oz. arise?

13. $1\frac{1}{2}$ lb. = ? oz. $2\frac{3}{4}$ lb. = ? oz. $3\frac{5}{8}$ lb. = ? oz
4 oz. = ? lb. 8 oz. = ? lb. 12 oz. = ? lb
1 oz. = ? lb. 2 oz. = ? lb. 5 oz. = ? lb.

14. What is the price of pepper per oz. when $\frac{1}{8}$ lb. costs 8¢?

15. What is the weight in ounces of 5 $\frac{1}{4}$-lb. cans of mustard, 3 $\frac{1}{2}$-lb. cans, and 2 1-lb. cans?

16. 3 lb. 4 oz. = ? oz. 4 lb. 6 oz. = ? oz. At $.16 a lb. what is the cost of 5 lb. 8 oz. of butter?

Lesson 74

1. Place cubic inches, making a pile 4 in. long, 3 in. wide, 2 in. thick. Count their number thus: One 3-cu. in, two 3-cu. in., *i.e.* 6 cu. in. $(2 \times 3 = 6)$. One 6-cu. in., two 6-cu. in., three 6-cu. in., four 6-cu. in., *i.e.* 24 cu. in. $(4 \times 6 = 24)$. The volume = 24 cu. in.

2. How can you get the number 24 in question 1 without counting? What is the unit?

3. How many cubic inches in a prism 2 in. long, 1 in. wide, and 1 in. thick? Make this prism.

4. Find the number of cubic inches in each of the following prisms, the dimensions being given in inches:

Length	Width	Thickness	Length	Width	Thickness
3	1	1	6	4	2
3	2	1	6	3	3
4	3	2	8	4	3
6	5	3	8	6	4

How do you find the number of cubic inches in a prism?

5. What is the volume of a 1-in. cube? 2-in. cube? 3-in. cube? 4-in. cube? 5-in. cube? 6-in. cube? 7-in. cube? 8-in. cube?

6. A 2-in. cube can be cut into how many 1-in. cubes? A 4-in. cube can be cut into how many 2-in. cubes? What is the unit of length here? The unit of volume?

7. An 8-in. cube can be cut into how many 4-in. cubes? How many 2-in. cubes? What is the unit of volume here?

8. A 6-in. cube can be cut into how many 3-in. cubes? How many 2-in. cubes?

9. Measure and find the volume of as many prisms as you can find.

10. Mark off and build up in the corner of the room *one cubic foot.*

11. What is the volume of a prism 8 in. long, 4 in. wide, and 4 in. high?

12. What is the volume of a pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high? How do you find the number of units of volume in any prism?

13. A pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high is called *a cord.* Mark off a cord in the corner of the room? What is sold by the cord?

14. How many cubic feet are there in a box 3 ft. long, 1 ft. wide, and 1 ft. deep?

15. How many cubic feet are there in a box 3 ft. long, 3 ft. wide, and 2 ft. deep? 4 ft. long, 3 ft. wide, and $2\frac{1}{2}$ ft. deep?

16. How many 3-in. cubes could be placed in a box 3 ft. long, 2 ft. 6 in. wide, and 1 ft. 6 in. deep?

17. How many cubic inches in a tin box 11 in. long, 7 in. wide, and 3 in. deep? Such a box will hold exactly a gallon. Pour a gallon of water into such a box and prove this. 1 gal. = ? cu. in.

18. A cubic foot of water weighs 1000 oz. A tank 4 ft. long, 2 ft. wide, and 1 ft. deep is full of water. How many ounces does it weigh?

19. What is the weight of a block of stone 6 in. long, 4 in. wide, and 2 in. thick, if 8 cu. in. weigh 1 lb.?

20. How many square inches are there on the surface of a cube whose edge is 4 in.?

21. Measure the dimensions of several boxes and find their volumes.

SECTION VIII

Lesson 75

1. In the Roman notation numbers are expressed by means of seven capital letters. These letters are used to denote numbers, and their values are written in question 2. This is called the Roman notation because the Romans were the first to use these letters for this purpose.

2.

I.	V.	X.	L.	C.	D.	M.
1.	5.	10.	50.	100.	500.	1000.

3. VI (V + I) = 6 VIII (V + III) = 8
XV (X + V) = 15 XX (X + X) = 20.

4. Write in Roman notation 6, 7, 8; 15, 16, 17, 18.

5. Write in Roman notation 20, 21, 22, 23; 25, 26, 27, 28.

6. Write in Roman notation 30, 31, 32, 33; 35, 36, 37, 38.

7. Write in Roman notation 50, 51, 52, 53; 55, 56, 57, 58.

8. IV (V – I) = 4 IX (X – I) = 9
XL (L – X) = 40 XC (C – X) = 90.

9. Write in Roman notation 4, 14; 20, 24; 30, 34; 40, 44; 50, 54.

10. Write in Roman notation 9, 19, 29, 39, 49, 59, 69, 79, 89.

11. Write in Roman notation 90, 91, 94, 95, 97, 99, 100.

12. Look at the clock face, in the prefaces of books, at the beginning of chapters or sections of books, and find out where Roman numerals are used.

Study the following carefully:

13.

I = 1	XI = 11	? = 21
II = 2	XII = 12	? = 22
III = 3	XIII = 13	? = 23
IV = 4	XIV = 14	? = 24
V = 5	XV = 15	? = 25
VI = 6	XVI = 16	? = 26
VII = 7	XVII = 17	? = 27
VIII = 8	XVIII = 18	? = 28
IX = 9	XIX = 19	? = 29
X = 10	XX = 20	? = 30

14.

XL = 40	XC = 90	D = 500
L = 50	C = 100	DC = 600
LX = 60	CXXX = 130	DCC = 700
LXX = 70	CCC = 300	M = 1000

15. Write in Roman numerals the numbers from 30 to 100.

16. Write in Roman numerals 110, 140, 149, 150, 154, 182, 190, 194.

17. Write in Roman numerals 300, 15, 315; 200, 84, 284; 500, 99, 599; 614, 739, 827, 934.

18. Write in Roman numerals 1000, 250, 1250; 344, 1344, 1898, 1492.

19. Read, and write the numbers in figures:

(*a*) Henry Hudson discovered the Hudson River in MDCIX.

(*b*) The Pilgrims landed in MDCXX.

(*c*) Georgia was settled in MDCCXXXII.

(*d*) The battle of Bunker Hill was fought in MDCCLXXV.

(*e*) The World's Fair was held in Chicago in MDCCCXCIII.

Lesson 76

1. Review the multiplication tables of 7 and 8.

2. Write down one-seventh of \$14, \$28, \$35, \$56, \$70. Write down three-sevenths of \$14, \$28, \$35, \$56, \$70. How do you find one-seventh of a quantity? Three-sevenths?

3. A man's salary was \$42 a week, and his expenses $\frac{4}{7}$ of his salary. How much did he save each week?

4. Write down one-eighth of \$16, \$24, \$32, \$64, \$96. Write down five-eighths of \$16, \$24, \$32,

\$64, \$96. How do you find one-eighth of a quantity? Five-eighths?

5. A lady had \$40, and spent $\frac{5}{8}$ of it for groceries. With the remainder she bought a wrap. What did the wrap cost?

6. My expenses in one month were \$56; I spent $\frac{3}{8}$ of it for board, $\frac{3}{7}$ of it for a suit of clothes, and the remainder for an overcoat. What did I spend for each item?

7. A grocer paid \$.60 a bu. for potatoes, and sold them for 20¢ a pk. What did he gain per bu.?

8. Which will cost more, $\frac{3}{8}$ pk. of apples at 24¢ a pk. or $\frac{2}{3}$ pk. of potatoes at 15¢ a pk.? How much?

9. A man saved $\frac{4}{7}$ of his salary. What part of his salary did he spend? If he had spent $\frac{5}{8}$ of his salary, what part of it would he have saved?

10. A watch cost 7 times as much as the chain. The cost of both was how many times the cost of the chain? What do you take as the unit of measure?

11. If the watch and chain in question 10 together cost \$80, what was the cost of the chain? Of the watch?

12.	$\frac{2}{3}$ of \$24 = ?	$\frac{3}{4}$ of \$20 = ?	$\frac{3}{4}$ of \$32 = ?
	$\frac{2}{5}$ of 20 lb. = ?	$\frac{3}{5}$ of 10 lb. = ?	$\frac{4}{5}$ of 30 lb. = ?
13.	$\frac{5}{6}$ of 18 gal. = ?	$\frac{4}{7}$ of 28 gal. = ?	$\frac{6}{7}$ of 21 gal. = ?
	$\frac{3}{8}$ of 40 yd. = ?	$\frac{5}{8}$ of 56 yd. = ?	$\frac{7}{8}$ of 24 yd. = ?

14. A lady bought a piece of cloth containing 18 yd. She required $\frac{2}{3}$ of it for a dress for herself and $\frac{1}{2}$ as much for her daughter. How many yards were in each dress? How much was left over?

15. What is the ratio of 4 ft. to 8 ft.? Of 8 ft. to 4 ft.? 1 yd. 1 ft. = ? ft. 2 yd. 2 ft. = ? ft. What is the ratio of 1 yd. 1 ft. to 2 yd. 2 ft.? Of 2 yd. 2 ft. to 1 yd. 1 ft.? Draw lines 1 yd. 1 ft. long and 2 yd. 2 ft. long and prove your result correct.

16. If 2 yd. 2 ft. of cloth cost 96 ¢, what part of 96 ¢ will a piece 1 yd. 1 ft. long cost? How much?

17. How many ft. in 2 yd. 1 ft.? In 7 yd.? What is the ratio of 2 yd. 1 ft. to 7 yd.? Of the cost of 2 yd. 1 ft. to that of 7 yd.?

18. If 7 yd. of ribbon cost 84 ¢, what will 2 yd. 1 ft. cost?

19. How many pints in 2 qt. 1 pt.? In 7 qt. 1 pt.? What is the ratio of 2 qt. 1 pt. to 7 qt. 1 pt.? Of 7 qt. 1 pt. to 2 qt. 1 pt.?

20. If 2 qt. 1 pt. of milk cost $.15, what will 7 qt. 1 pt. cost?

A milkman sells 2 qt. 1 pt. of milk to each of three customers. How much do they all buy?

21. How many quarts in 2 gal. 1 qt.? If 2 gal. 1 qt. of oil cost 18 ¢, what will 9 gal. cost? If 6 gal.

3 qt. of maple syrup cost \$6, what will 2 gal. 1 qt. cost?

22. What is the ratio of 2 bu. 1 pk. to 11 bu. 1 pk.? Of 11 bu. 1 pk. to 2 bu. 1 pk.? If 2 bu. 1 pk. of barley weigh 108 lb., what will 11 bu. 1 pk. weigh?

23. If 2 bu. 1 pk. of oats weigh 72 lb., what will 11 bu. 1 pk. cost at 1¢ a lb.?

24. If an express train runs 45 mi. in 1 hr. 30 min., how far will it run in 3 hr. at the same rate?

Lesson 77

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1. Let each dot represent 1¢. 1¢ is what part of 6¢? 2¢ is what part? 3¢? 4¢? 5¢?

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2. Let each dot represent 1 lb. 2 lb. is what part of 8 lb.? 4 lb.? 6 lb.? 7 lb.? 8 lb.?

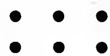
3. 1 lb. + 3 lb. = ? lb. The sum of 1 lb. and 3 lb. is what part of 8 lb.? The sum of 2 lb. and 4 lb. is what part of 8 lb.?

4. From a piece of ribbon 8 yd. long were sold 2 yd. to each of 2 customers. The part sold was what part of the original piece?

5. $\frac{1}{4}$ ft. + $\frac{2}{4}$ ft. = ? $\frac{1}{6}$ ft. + $\frac{2}{6}$ ft. = ? $\frac{3}{6}$ ft. + $\frac{2}{6}$ ft. = ?
$\frac{1}{5}$ ft. + $\frac{2}{5}$ ft. = ? $\frac{2}{5}$ ft. + $\frac{3}{5}$ ft. = ? $\frac{3}{8}$ ft. + $\frac{4}{8}$ ft. = ?

6. Find the sum of $\frac{1}{2}$ ft. and $\frac{1}{3}$ ft. Why can you not find the sum of $\frac{1}{2}$ ft. and $\frac{1}{3}$ ft. as you found the sum of $\frac{1}{4}$ ft. and $\frac{2}{4}$ ft.? How can you find their sum?

7. Draw a line 1 ft. long, and divide it into 6 equal parts. Mark off on this line parts $\frac{1}{2}$ ft. and $\frac{1}{3}$ ft. long. Their sum is what part of 1 ft.? Their difference is what part? Into how many units was 1 ft. divided?



8. If these 6 dots represent 1 ft., what part of a foot is represented by 2 dots, by 3 dots, by 4 dots, by 5 dots, by 6 dots?

9. If these 6 dots represent 1 ft., how many dots represent $\frac{1}{2}$ ft? $\frac{1}{3}$ ft.? Their sum? This is what part of a foot? How many dots represent their difference? This is what part of a foot? $\frac{1}{2}$ ft. + $\frac{1}{3}$ ft. = $\frac{5}{6}$ ft. $\frac{1}{3}$ ft. + $\frac{1}{2}$ ft. = ? $\frac{1}{2}$ ft. − $\frac{1}{3}$ ft. = $\frac{1}{6}$ ft.

10. What is the sum of $\frac{1}{2}$ yd. and $\frac{1}{3}$ yd.? What is their difference? Draw a line 1 yd. long, mark it off into parts as in question 7, and prove your answers correct. Into how many units was 1 yd. divided?

11. $\frac{1}{2}$ da. − $\frac{1}{3}$ da. = ? $\frac{1}{2}$ da. + $\frac{1}{3}$ da. = ?
$\frac{1}{2}$ hr. − $\frac{1}{3}$ hr. = ? $\frac{1}{2}$ hr. + $\frac{1}{3}$ hr. = ?
$\frac{1}{2}$ bu. + $\frac{1}{3}$ bu. = ? $\frac{1}{2}$ bu. − $\frac{1}{3}$ bu. = ?
$\frac{1}{3}$ mi. + $\frac{1}{2}$ mi. = ? $\frac{1}{2}$ yr. + $\frac{1}{3}$ yr. = ?
$\frac{1}{3}$ A. + $\frac{1}{2}$ A. = ?

12. What is the sum of one-half of a quantity and one-third of it? Of one-third of a quantity and one-half of it? What is the difference between one-half of a quantity and one-third of it?

13. A young man spent $\frac{1}{2}$ of his weekly salary for board, $\frac{1}{3}$ of it for clothing, and the rest he saved. What part of his salary did he spend? What part did he save? If he saved \$2, what was his weekly salary?

14. A man left $\frac{1}{2}$ his money to his wife, and $\frac{1}{3}$ to his oldest son. What was the difference between their shares? If this was \$3000, how much money was left?

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15. If these 8 dots represent 1 gal., mark off by a line the number of dots that represent $\frac{3}{8}$ gal. and $\frac{1}{4}$ gal. How many represent their sum? This is what part of a gallon? Their difference? This is what part of a gallon?

$\frac{3}{8}$ gal. $-$ $\frac{1}{4}$ gal. $=$? gal. $\frac{3}{8}$ gal. $+$ $\frac{1}{4}$ gal. $=$? gal.

16. How many pints in 1 gal.? In $\frac{3}{8}$ gal.? In $\frac{1}{4}$ gal.? In the difference between $\frac{3}{8}$ gal. and $\frac{1}{4}$ gal.? This is what part of a gallon? How many pints in their sum? This is what part of a gallon?

17. Into a pitcher containing $\frac{3}{8}$ gal. of water there is poured $\frac{1}{4}$ gal. How many pints are there in the pitcher? There is what part of a gallon?

18. What is the sum of $\frac{3}{8}$ of a man's salary and $\frac{1}{4}$ of it? The difference?

What part of a year is gone when $\frac{1}{4}$ and $\frac{3}{8}$ of it are gone? What is the sum of one-fourth and three-eighths of a quantity? What is the difference?

19. Using the 8 dots in question 15 to represent \$1, find the sum of $\$\frac{1}{2}$, $\$\frac{1}{4}$, $\$\frac{1}{8}$.

$\$\frac{5}{8} - \$\frac{1}{2} = ?$ $\quad$ $\$\frac{7}{8} - \$\frac{3}{4} = ?$ $\quad$ $\$\frac{1}{2} - \$\frac{3}{8} = ?$

$\$\frac{5}{8} - \$\frac{1}{4} = ?$ $\quad$ $\$\frac{3}{8} + \$\frac{1}{4} = ?$ $\quad$ $\$\frac{5}{8} + \$\frac{1}{4} = ?$

Place 8 dots in each case, and mark off the dots that represent the fractions in each question.

20. By how many dots or units will you represent one dollar in the following questions?

$\$\frac{1}{2} + \$\frac{1}{4} - \$\frac{5}{8} = ?$ $\quad$ $\$\frac{3}{4} - \$\frac{5}{8} + \$\frac{1}{2} = ?$

21. What is the weight of a parcel containing $\frac{1}{2}$ lb. of candy and $\frac{3}{8}$ lb. of figs?

22. James is $\frac{1}{4}$ and his brother Arthur $\frac{1}{8}$ of their father's age. If the difference in their ages is 5 yr., how old is their father?

23. When you found in question 9 the sum of $\frac{1}{2}$ ft. and $\frac{1}{3}$ ft., by how many dots or units did you represent 1 ft.? How is 6 related to 2 and 3? If you were adding $\frac{1}{3}$ ft. and $\frac{1}{4}$ ft., into how many parts or units would you represent 1 ft. as being divided? How is this number related to 3 and 4?

24. Place 12 dots to represent 1 ft., and mark off the number representing $\frac{1}{2}$ ft. and $\frac{1}{4}$ ft. $\frac{1}{3}$ ft. = ? dots. $\frac{1}{4}$ ft. = ? dots. $\frac{1}{3}$ ft. + $\frac{1}{4}$ ft. = ? dots. This is what part of a foot?

Lesson 78

1. In each of the following cases, into how many parts do you think of \$1, 1 lb., etc., as being divided?

When you add $\$\frac{1}{2}$ and $\$\frac{1}{5}$; $\frac{1}{2}$ lb. and $\frac{2}{5}$ lb.; $\$\frac{1}{2}$ and $\$\frac{3}{10}$; $\frac{2}{5}$ lb. and $\frac{3}{10}$ lb.; $\frac{1}{4}$ yd. and $\frac{1}{5}$ yd.; $\frac{3}{4}$ yd. and $\frac{1}{5}$ yd.; $\frac{2}{5}$ gal. and $\frac{1}{3}$ gal.; $\frac{1}{2}$ A. and $\frac{1}{6}$ A.?

2. In each of the following questions represent 1 lb. by dots, and mark off the number of dots that represent the parts of 1 lb.:

$\frac{1}{2}$ lb. + $\frac{1}{5}$ lb. = ? $\frac{1}{2}$ lb. − $\frac{1}{5}$ lb. = ? $\frac{1}{2}$ lb. + $\frac{2}{5}$ lb. = ?
$\frac{1}{2}$ lb. − $\frac{2}{5}$ lb. = ? $\frac{4}{5}$ lb. − $\frac{1}{2}$ lb. = ? $\frac{3}{5}$ lb. − $\frac{1}{2}$ lb. = ?

3. If Caryl had $\frac{4}{5}$ lb. of candy, and gave $\frac{1}{2}$ lb. away, how much did she keep for herself? What did her candy cost at 25¢ a lb.?

4. $\frac{1}{4}$ gal. + $\frac{1}{5}$ gal. = ? $\frac{1}{4}$ gal. − $\frac{1}{5}$ gal. = ?
$\frac{2}{5}$ gal. + $\frac{1}{4}$ gal. = ? $\frac{1}{4}+\frac{1}{5}+\frac{3}{10}=?$ $\frac{3}{10}-\frac{1}{4}+\frac{1}{5}=?$

5. What is the cost of 1 lb. of baking powder at $\$\frac{2}{5}$ a lb., and 2 lb. butter at $\$\frac{1}{4}$ a lb.? How many cents? What change should be given back out of a dollar bill?

6. In terms of what unit do you express 3 nickels and 2 dimes before you can add them? 1 yd. and 1 ft.? 2 ft. 4 in. and $\frac{1}{2}$ ft.? 3 gal. and 2 qt.? One-quarter dollar and 3 dimes?

7. In terms of what unit do you express $\frac{1}{2}$ ft. and $\frac{1}{3}$ ft. before you can add them?

(This unit is one-sixth of a foot.)

$\frac{1}{2}$ ft. = ? sixths of a foot. $\frac{1}{3}$ = how many sixths of a foot? $\frac{1}{2}$ ft. + $\frac{1}{3}$ ft. =? $\frac{1}{2}$ ft. − $\frac{1}{3}$ ft. = ?

8. In terms of what unit do you express $\frac{1}{3}$ yd. and $\frac{1}{4}$ yd. before you can add them? $\frac{2}{3}$ yd. = ? twelfths of a yard. $\frac{1}{4}$ yd. = ? twelfths of a yard.

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

9. Why can you not add two fractions without changing them to the same unit? Reduce $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{6}$ to sixths?

10. Reduce these fractions to 12ths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{6}$, $\frac{5}{6}$. How did you reduce $\frac{1}{2}$ to 12ths? $\frac{2}{3}$? $\frac{3}{4}$?

11. Reduce these fractions to 10ths: $\frac{1}{2}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{5}{5}$. How did you reduce $\frac{1}{2}$ to 10ths? $\frac{1}{5}$? $\frac{4}{5}$? $\frac{5}{5}$?

12. A piece of land containing $\frac{4}{5}$ A. is divided into lots each containing $\frac{1}{10}$ A. Find the number of lots.

13. Reduce these fractions to 8ths: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{4}{4}$.

14. A piece of ribbon $\frac{3}{4}$ yd. long is divided into pieces each $\frac{1}{8}$ yd. long. How many pieces?

15. What is meant by the sum of $\frac{1}{2}$ and $\frac{1}{4}$? Find the sum of:

$\frac{1}{2}$ and $\frac{1}{4}$	$\frac{2}{3}$ and $\frac{4}{9}$	$\frac{3}{5}$ and $\frac{3}{4}$
$\frac{2}{3}$ and $\frac{1}{6}$	$2\frac{1}{5}$ and $\frac{1}{3}$	$\frac{3}{4}$ and $\frac{3}{8}$
$\frac{1}{2}$ and $\frac{2}{3}$	$\frac{3}{5}$ and $1\frac{2}{3}$	$3\frac{1}{2}$ and $4\frac{5}{12}$
$\frac{3}{4}$ and $\frac{1}{3}$	$2\frac{1}{4}$ and $3\frac{2}{5}$	$1\frac{3}{4}$ and $\frac{7}{10}$

16. What is meant by the difference between $\frac{3}{4}$ and $\frac{1}{2}$? Find the difference between:

$\frac{3}{4}$ and $\frac{1}{2}$	$\frac{7}{9}$ and $\frac{2}{3}$	$3\frac{4}{5}$ and $1\frac{3}{4}$
$\frac{5}{6}$ and $\frac{2}{3}$	$\frac{1}{3}$ and $\frac{1}{5}$	$5\frac{7}{12}$ and $2\frac{1}{3}$
$\frac{2}{3}$ and $\frac{1}{4}$	$\frac{4}{5}$ and $\frac{2}{3}$	$4\frac{3}{10}$ and $2\frac{1}{4}$
$\frac{3}{4}$ and $\frac{2}{3}$	$2\frac{3}{5}$ and $\frac{1}{4}$	$3\frac{9}{10}$ and $1\frac{1}{3}$

17. How do you find the sum of two fractions? The difference?

18. From a piece of land containing $3\frac{4}{5}$ A., the owner sells $2\frac{1}{2}$ A. How much has he left?

19. Mr. Ellis gave Alder a five-dollar bill with which to buy a hat that cost $\$2\frac{1}{4}$. How much change should Alder return to his father?

20. Daisy gave $\$5\frac{1}{4}$ for a pair of shoes, and $\$16\frac{1}{2}$ for a jacket. How much had she left from $25?

21. Draw three lines each 1 ft. long. Divide the first into 2 equal parts, the second into 4 equal parts, and the third into 6 equal parts.

$\frac{1}{2}$ ft. = ? in. $\frac{2}{4}$ ft. = ? in. $\frac{3}{6}$ ft. = ? in.

Which is greater, $\frac{1}{2}$ ft., $\frac{2}{4}$ ft., or $\frac{3}{6}$ ft.?

22. Find the number of inches in $\frac{1}{2}$ yd., $\frac{2}{4}$ yd., and $\frac{3}{6}$ yd. Which is greater, $\frac{1}{2}$ yd., $\frac{2}{4}$ yd., or $\frac{3}{6}$ yd.

Find the number of hours in $\frac{1}{2}$ da., $\frac{2}{4}$ da., $\frac{3}{6}$ da., and $\frac{4}{8}$ da. Which is greater, $\frac{1}{2}$ da., $\frac{2}{4}$ da., $\frac{3}{6}$ da., or $\frac{4}{8}$ da.

23. What is meant by saying that $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{6}$, and $\frac{4}{8}$ are equal?

24. Is $\frac{1}{2}$ also equal to $\frac{5}{10}$ or $\frac{6}{12}$? Test by finding the number of minutes in $\frac{1}{2}$ hr., $\frac{5}{10}$ hr., and $\frac{6}{12}$ hr.

25. Show that $\frac{1}{2}$ bu. of oats is equal to $\frac{2}{4}$ or $\frac{4}{8}$ or $\frac{8}{16}$ or $\frac{16}{32}$ of it. (1 bu. oats weighs 32 lb.)

$\frac{1}{2}=\frac{2}{4}=\frac{4}{8}=\frac{8}{16}=\frac{16}{32}$. $\qquad$ $\frac{1}{2}=\frac{3}{6}=\frac{5}{10}=\frac{6}{12}$.

26. Show that $\frac{1}{3}=\frac{2}{6}=\frac{3}{9}$ and that $\frac{1}{4}=\frac{2}{8}=\frac{4}{16}$.

Lesson 79

1. A young man spent $\frac{1}{2}$ of his weekly salary for board and $\frac{1}{3}$ of it to meet other expenses. What part of his salary did he spend? What part did he save? If this was \$1.50, what was his salary?

2. What is the difference between $\frac{1}{2}$ of a quantity and $\frac{1}{3}$ of it? If the difference between $\frac{1}{2}$ of my age and $\frac{1}{3}$ of it is 2 years, how old am I?

3. If three-fourths of a yard of ribbon cost 15¢, what will one-fourth of a yard cost? What will a yard cost?

If $\frac{3}{4}$ yd. of cloth cost 24¢, what will $\frac{1}{4}$ yd. cost? 1 yd.?

4. $\frac{1}{2}$ a field is planted with potatoes and $\frac{1}{4}$ of it with carrots. What part of the field is planted with these two vegetables? Draw the field.

5. I invest $\frac{1}{2}$ of my money in a house and lot and $\frac{2}{5}$ of it in business. This is what part of my money? What part is left? If I have \$600 left, how much had I at first?

6. Draw the farm in question 7; divide it into 15 equal parts; mark off the parts sold to each, and also the remainder. Then mark the number of acres in each part sold.

7. The owner of a farm sells $\frac{3}{5}$ of it to one man and $\frac{1}{3}$ of it to another. What part of it does he sell? What part does he keep? If this is 10 A., how large was his farm?

8. What is the difference between $\frac{2}{3}$ of a school term and $\frac{1}{2}$ of it? If the difference is 10 da., how many days are there in the school term?

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9. If 5 of these dots represent 40¢, what will 1 dot represent? What will 6 dots represent? If these 6 dots represent the cost of 1 yd. of cloth, what will 5 dots represent? 1 dot? 6 dots?

10. $\frac{5}{6}$ yd. of cloth costs 40¢.
$\frac{1}{6}$ yd. of cloth costs ?
$\frac{6}{6}$ yd. of cloth costs ?
1 yd. of cloth costs ?

11. $\frac{4}{5}$ A. of land costs \$80.
$\frac{1}{5}$ A. of land costs ?
$\frac{5}{5}$ A. of land costs ?
1 A. costs ?

12. If $\frac{4}{5}$ of my weekly salary is \$20, what is my salary?

13. A cask that is $\frac{2}{3}$ full contains 24 gal.; find the number of gallons it holds. Draw the cask, and mark off the parts.

14. A man divided his farm among his three sons. The oldest got $\frac{3}{8}$ of it, and the second $\frac{1}{4}$. What part of the farm did these two get? What was the share of the youngest?

15. If the youngest son got 90 A., what was the size of the farm? How many acres did each son get?

16. A gallon measure is half full. If I pour out $\frac{1}{5}$ gal., what part of a gallon is left in the measure?

17. A boy gave $\frac{1}{4}$ of his marbles to one boy and $\frac{1}{5}$ to another. What part of them did he give away? What part did he keep?

18. A man spent $\frac{3}{5}$ of his money for clothes and $\frac{1}{10}$ for a hat. What part of it did he spend? What part did he have left? If this is \$9, how much had he at first?

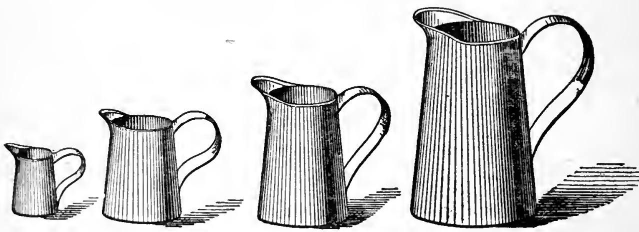
SECTION IX

Lesson 80

Units of Value

United States Money

10 cents (ct. or ¢)	= 1 dime (d.)
10 dimes	= 1 dollar ($)



Units of Capacity

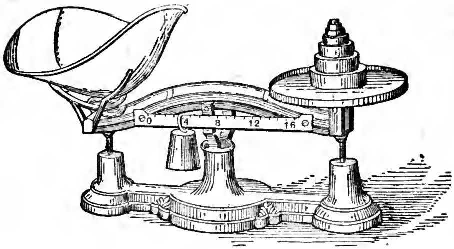
Liquid Measure

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)

Dry Measure

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks, or 32 quarts	= 1 bushel (bu.)

Units of Weight



Avoirdupois Weight

16 ounces (oz.)	= 1 pound (lb.)
100 pounds	= 1 hundredweight (cwt.)
2000 pounds, or 20 hundredweight	= 1 ton (T.)

Units of Length

Long Measure

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 / 1760 yards / 5280 feet	= 1 mile (mi.)

Measure in the schoolroom two points one rod apart.

Name two places one mile apart.

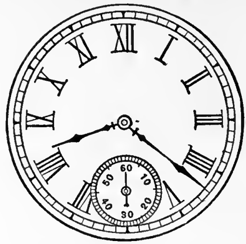
Units of Surface

Surface, or Square Measure

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (A.)
640 acres	= 1 square mile (sq. mi.)

A township is 6 mi. square and contains 36 sq. mi.

UNITS OF TIME



Measure of Time

60 seconds (sec.)	=	1 minute (min.)
60 minutes	=	1 hour (hr.)
24 hours	=	1 day (da.)
7 days	=	1 week (wk.)
12 months (mo.)	=	1 year (yr.)
365 days	=	1 common year
366 days	=	1 leap year

MISCELLANEOUS UNITS

12 units	=	1 dozen (doz.)
20 units	=	1 score
24 sheets	=	1 quire
20 quires	=	1 ream

1. Commit these tables to memory.

2. A man ran 100 yd. in 10 sec. What is the unit of length? Of time? Give instances in which 1 min. is the unit of time. 1 hr. 1 da. 1 wk. 1 mo. 1 yr.

3. Name things that are bought and sold by the quart, liquid measure; by the gallon; by the pint; by the gill. Of what use is the gill?

4. Red raspberries are sold in boxes of what size? Why? Strawberries are measured by units of what size? Why?

5. Name articles that are sold by the peck; by the bushel.

6. Why is the quart measure generally used by milkmen to measure their milk? Why is the quart measure not a convenient measure to use in selling kerosene?

7. Why is pepper put up in $\frac{1}{8}$-lb. or $\frac{1}{4}$-lb. bottles instead of in larger quantities?

8. Why is the price of eggs quoted at so much a dozen instead of at so much each? Name other articles, the price of which is quoted by the dozen.

9. Flour is sold in sacks containing $\frac{1}{8}$ bbl. ($24\frac{1}{2}$ lb.), $\frac{1}{4}$ bbl. (49 lb.), and by the barrel (196 lb.). Why are these convenient quantities?

10. Butter is put up for sale in 1-lb., 2-lb. rolls and in 5-lb. pails. Why are these convenient quantities?

11. Name things sold by the ton; measured by the acre; by the square mile.

12. Why are spices sold by the ounce? Give instances in which one dozen, one score, one quire, and one ream are used as units of measure.

13. How might such expressions as the following arise by acts of measurement: 2 yd. 1 ft. 6 in.; 1 gal. 2 qt. 1 pt.; 8 bu. 2 pk.; 2 lb. 8 oz.; 4 T. 500 lb.; 6 yr. 4 mo.; 2 hr. 20 min.?

14. How might such statements as the following arise by acts of measurement:

$24 \text{ in.} = 12 \times 2 \text{ in.}$ $24 \text{ in.} = 8 \times 3 \text{ in.}$ $24 \text{ in.} = 6 \times 4 \text{ in.}$
$24 \text{ in.} = 4 \times 6 \text{ in.}$ $24 \text{ in.} = 3 \times 8 \text{ in.}$ $24 \text{ in.} = 2 \times 12 \text{ in.}$

What is the ratio of 24 in. to 2 in.? Of 24 in. to 3 in.? To 4 in.? To 6 in.? To 8 in.? To 12 in.?

15. In question 14, name the different units that have been used to measure the quantity, 24 in. Name the numbers.

As the unit becomes larger, what change takes place in the number? What is their product?

16. What two things are necessary to express the measurement of a quantity? How can you obtain the quantity from the number and the unit?

17. In the following examples what are the quantities measured by the given numbers and units?

Number	Unit	Number	Unit
4	2 qt.	3	7 da.
3	2 in.	6	3 doz.
4	$5	5	5 sq. in.
3	$10	8	10 A.

18. If the quantity 36 in. is measured by a 4-in. unit, what number expresses the measurement?

19. In the following examples what numbers express the measurements?

Quantity	Unit	Quantity	Unit
24 hr.	8 hr.	3 bu.	1 pk.
30¢	6¢	6 bu.	4 pk.
2 da.	6 hr.	48	1 doz.
$20	$5	4-in. sq.	2 sq. in.
$1	1 dime	1 qt.	1 gal.
4 gal.	2 qt.	1 ft.	1 yd.

20. If the number 8 expresses the measurement of the quantity 40 in., what is the unit? How can you obtain the unit from the number and the quantity?

21. In the following examples what units have been used to measure the quantities?

Quantity	Number	Quantity	Number
$12	6	$200	10
30 da.	5	$200	20
2 bu.	4	6 gal.	12
15 doz.	5	35¢	5

22. How do you obtain the quantity from the number and unit? The unit from the quantity and number? The number from the quantity and unit?

Lesson 81

1. What is the quantity measured by the number 6 when the unit is 3 gal. 2 qt. of milk?

2. Find the weight of the unit that measures the quantity 9 lb. 8 oz. 4 times.

3. To what unit must 2 yd. 1 ft. 6 in. be reduced in order to find the number of times it is measured by the unit 3 in.? Find this number. This number is often called the *ratio* of 2 yd. 1 ft. 6 in. to 3 in. If you actually measured a line 2 yd. 1 ft. 6 in. long by the unit 3 in. to find this number, would it be necessary to reduce 2 yd. 1 ft. 6 in. to inches?

4. Find the ratio of 5 bu. 1 pk. to 3 pk. Find the cost of 5 bu. 1 pk. of potatoes at the rate of 3 pk. for 50 ¢.

5. Make a drawing to represent a field 120 yd. long and 80 yd. wide. How long must a wire be to go around it? What would be its cost at 6 ¢ a yard? What would 4 rows of wire fencing cost?

6. What would 4 rows of wire fencing cost for a chicken coop 6 yd. long and 4 yd. wide at 6 ¢ a yd.?

7. If a yard measure is $\frac{1}{2}$ in. too long, what is the actual distance between two points which are found by this measure to be 6 yd. apart?

8. A 200-acre farm is sown with grain as follows: barley 25 A., oats 46 A., wheat 75 A. The buildings, garden, and orchard occupy 12 A., and the rest is pasture. How many acres of pasture are there?

9. A map is drawn so that half an inch represents 1 mi. What will 1 in. represent? How many square miles will 1 sq. in. represent?

10. Find the weight of an iron bar 1 ft. long if 1 yd. weighs 18 lb.

Find the weight of an iron bar 4 yd. 2 ft. long, of which 1 yd. weighs 15 lb.

11. Find the cost of fencing a piece of railway (both sides), 7 rd. long, at $5.50 a rod?

12. A block of stone is 8 in. long, 6 in. wide, and 4 in. thick. Find its weight if 6 cu. in. weigh 1 lb.

13. A merchant buys 28 yd. of cheese cloth at 6¢ a yd. He uses a certain number of yards in his store and sells the remainder for the total cost price at 7¢ a yard. How many yards does he sell? How many does he use?

14. What does a bushel of wheat weigh? If 3 lb. of wheat makes 2 lb. of flour, how many pounds of flour will 1 bu. of wheat make?

15. Find the cost of cementing the floor of a cellar 6 yd. long and 5 yd. wide at 12¢ per sq. yd.

16. Find the cost of digging a cellar 4 yd. long, 3 yd. wide, and 2 yd. deep, at 20¢ per cu. yd.

17. A certain map is drawn so that 2 mi. is represented by 1 in. On this map the township of Scott is a square whose side is 3 in. What is the length of the township? What is its area?

18. Find the number of strips of paper in the wall of a room 24 ft. long and 20 ft. wide, the paper being 2 ft. wide. What is the unit here?

19. A farmer sowed 3 pk. of wheat in a small field and raised 14 bu. 1 pk. of seed. What is the average yield per peck of seed?

20. An express train takes 8 hr. 20 min. to travel 320 mi. If stops of 5 min. each are made at 4 different places, find the average rate at which the train is travelling.

21. A railway train travels at the rate of 1 mi. in 2 min. What is its speed per hour?

Lesson 82

1. What is the sum of:

7	8	8	9	9
9	8	9	9	10

Add:

2.

7	9	8	8	9	9	10	9
19	27	39	48	59	30	8	28

3.

9	9	8	9	9	6	7	4
5	6	7	3	9	2	8	3
32	53	60	45	80	98	90	91

4.

4	1	2	3	4	8	7	9
2	4	8	9	8	4	5	6
9	8	5	5	5	3	2	3
19	27	22	45	63	71	83	90

Add:

5.	$39.46	$45.49	$38.94	$97.56
	86.74	23.87	59.36	36.79

$352.69	$388.14	$6243.80	$1873.45
176.29	279.56	2597.80	2794.63

6.	$165.95	$229.69	$370.80	$179.79
	258.71	141.65	156.93	324.67
	147.58	299.57	881.79	250.60

7. A merchant sold goods on Monday to the value of $187.91, Tuesday $254.82, and Wednesday $181.79. What were the total sales on these three days?

8. A farmer sold 23 bu. wheat for $24.84, 34 bu. for $33.31, and 15 bu. barley for $14.70. How many bushels of grain did he sell and for how much?

Subtract:

9.	$37.33	$28.77	$427.97	$626.78
	29.38	19.89	368.48	349.79
10.	$356.71	$3026.69	$2281.79	$6006.25
	248.24	1456.84	1584.82	3750.82

11. A real estate agent bought a lot for $1880 and sold it for $2375. Find his gain.

12. A man paid $137 for one horse and $89 for another. They cost him for feed $24.75. He sold them for $275. Find his gain.

13. Find the amount of the following bill:

6 pairs of stockings at 3 for \$1.00.
24 handkerchiefs at \$1.75 per doz.
6 yd. cloth at \$.48 a yd.
3 yd. muslin at \$.15 a yd.

14. A farmer's wife sold 20 lb. of butter at 15¢ a pound. She then bought 16 lb. of sugar at $5\frac{1}{4}$¢ a pound, and 2 lb. of tea at 60¢ a pound. How many pounds of raisins at 8¢ a pound can she buy with the rest of her money?

Lesson 83

1. Count by 9's from 9 to 108.
Count by 9's from 108 to 9.

2. Memorize:

Nine times

1 is 9	5 is 45	9 is 81
2 is 18	6 is 54	10 is 90
3 is 27	7 is 63	11 is 99
4 is 36	8 is 72	12 is 108

3. In the table of 9's what is the sum of the two digits in each product?

4. Name the numbers less than 100 of which 9 is a factor. What number is the greatest common factor of 18 and 24; 18 and 45; 35 and 56; 63 and 81; 40 and 55; 99 and 72?

5. What is the largest unit that will divide 45 A. and 63 A.? Two farms contain, respectively, 45 A. and 63 A. If these two farms are divided into fields of equal size, containing as many acres as possible, how many acres will there be in each field? How many fields?

Multiply:

6.	\$514.02	\$1180.66	\$26.55	\$97.22
	7	8	9	9
7.	\$851.02	\$738.75	\$243.44	\$1097.47
	9	9	9	9

8. What number smaller than 20 has 9 for a factor? Smaller than 25? 61? 33? 70? 80? 82? 74? 26? 44?

9. Give the quotient and remainder on dividing \$231 by 9; \$868 by \$9; 798 mi. by 9; 676 of any unit by 9; 319 of any unit by 9 of the same unit.

10. A speculator gave his check for the price of 9 city lots at \$2450 apiece, and after this was cashed he still had \$1250 in the bank. How much had he at first?

11. A farmer got 315 bu. of oats off a nine-acre field. How many bushels to the acre?

State the corresponding question in which you are required to find the number. The quantity.

12. In how many days would a man walk 216 mi., at the rate of 3 mi. an hour for 9 hr. a day?

● ●

● ●

13. What is the ratio of 3 dots to 4 dots? Of 4 dots to 3 dots? If each dot represents 6¢, what will 3 dots represent? 4 dots? What is the ratio of 18¢ to 24¢? Of 24¢ to 18¢?

14. If 24¢ will buy a peck of peas, what part of a peck will 18¢ buy? How many quarts?

● ● ●

● ● ●

15. What is the ratio of 4 dots to 6 dots? If each dot represents 9 yd., what will 4 dots represent? 6 dots? What is the ratio of 36 yd. to 54 yd.? Of 54 yd. to 36 yd.?

16. If 54 yd. of cloth cost $67.50, what will 36 yd. of the same kind cost?

If 54 men can do a piece of work in 6 da., how long will it take 36 men to do it?

17. Refer to the dots in question 15 and give the value of 1 dot, 2 dots, 3 dots, 4 dots, 5 dots, and 6 dots, when each dot represents 9 lb.

18. What is the ratio of 9 lb. to 36 lb.? Of 36 lb. to 9 lb.? Of 18 lb. to 45 lb.? Of 45 lb. to 18 lb.? Of 27 lb. to 54 lb.? Of 54 lb. to 27 lb.?

19. If 18 lb. of coffee cost $5.40, what will 45 lb. cost at the same rate?

20. 54 T. of coal cost $310.50. What will 27 T. cost at the same rate?

21. What is the ratio of 4 5-cd. of wood to 9 5-cd. of wood? Of 20 cd. to 45 cd.? Of 45 cd. to 20 cd.? If 45 cd. of wood cost $144, what will 20 cd. cost?

22. If 36 T. of hay cost $320, what will 27 T. cost?

23. The value of a purse and the money within it is $12. If the ratio of the money to the value of the purse is 3, find the value of each.

Lesson 84

1. Memorize:

Ten times

1 is 10	5 is 50	9 is 90
2 is 20	6 is 60	10 is 100
3 is 30	7 is 70	11 is 110
4 is 40	8 is 80	12 is 120

2. In what figure do all these products of 10 end?

3. Multiply:

35	62	288	164	2164	3256
10	10	10	10	10	10

In what figure do all these products of 10 end?

4. What is the easiest way of multiplying a number by 10? Write the product of these numbers multiplied by 10:

16, 21, 24, 43, 72, 245, 631, 725.

5. Multiply 16 by 10 and the product by 10. How can you multiply a number by 10 twice in succession without actually multiplying? How can you multiply a number by 100 without actually multiplying?

6. Write the product of these numbers when multiplied by 100:

5, 8, 12, 24, 35, 68, 215, 625.

7.	$1 \times 11 = 11$	$11 \times 1 = ?$	8. $1 \times 12 = 12$	$12 \times 1 = ?$
	$2 \times 11 = 22$	$11 \times 2 = ?$	$2 \times 12 = 24$	$12 \times 2 = ?$
	$3 \times 11 = 33$	$11 \times 3 = ?$	$3 \times 12 = 36$	$12 \times 3 = ?$
	$4 \times 11 = 44$	$11 \times 4 = ?$	$4 \times 12 = 48$	$12 \times 4 = ?$
	$5 \times 11 = 55$	$11 \times 5 = ?$	$5 \times 12 = 60$	$12 \times 5 = ?$
	$6 \times 11 = 66$	$11 \times 6 = ?$	$6 \times 12 = 72$	$12 \times 6 = ?$
	$7 \times 11 = 77$	$11 \times 7 = ?$	$7 \times 12 = 84$	$12 \times 7 = ?$
	$8 \times 11 = 88$	$11 \times 8 = ?$	$8 \times 12 = 96$	$12 \times 8 = ?$
	$9 \times 11 = 99$	$11 \times 9 = ?$	$9 \times 12 = 108$	$12 \times 9 = ?$
	$10 \times 11 = 110$	$11 \times 10 = ?$	$10 \times 12 = 120$	$12 \times 10 = ?$
	$11 \times 11 = ?$	$11 \times 11 = ?$	$11 \times 12 = 132$	$12 \times 11 = ?$
	$12 \times 11 = ?$	$11 \times 12 = ?$	$12 \times 12 = 144$	$12 \times 12 = ?$

9. Write out and memorize the multiplication tables of 11 and 12.

10. What is the area of a square whose side is 12 in.? How many square inches in a square foot?

11. In a garden there are 12 rows of potatoes with 11 hills in a row; how many hills of potatoes are there in the garden? Name the number, unit, and quantity. State the corresponding question in which you are required to find the number. The unit.

12. If $\frac{1}{2}$ pk. of potatoes is obtained from each hill on the average, what is the yield in bushels?

13. Review the Multiplication Table:

Two times	Three times	Four times	Five times	Six times	Seven times
1 is 2	1 is 3	1 is 4	1 is 5	1 is 6	1 is 7
2 " 4	2 " 6	2 " 8	2 " 10	2 " 12	2 " 14
3 " 6	3 " 9	3 " 12	3 " 15	3 " 18	3 " 21
4 " 8	4 " 12	4 " 16	4 " 20	4 " 24	4 " 28
5 " 10	5 " 15	5 " 20	5 " 25	5 " 30	5 " 35
6 " 12	6 " 18	6 " 24	6 " 30	6 " 36	6 " 42
7 " 14	7 " 21	7 " 28	7 " 35	7 " 42	7 " 49
8 " 16	8 " 24	8 " 32	8 " 40	8 " 48	8 " 56
9 " 18	9 " 27	9 " 36	9 " 45	9 " 54	9 " 63
10 " 20	10 " 30	10 " 40	10 " 50	10 " 60	10 " 70
11 " 22	11 " 33	11 " 44	11 " 55	11 " 66	11 " 77
12 " 24	12 " 36	12 " 48	12 " 60	12 " 72	12 " 84

Eight times	Nine times	Ten times	Eleven times	Twelve times
1 is 8	1 is 9	1 is 10	1 is 11	1 is 12
2 " 16	2 " 18	2 " 20	2 " 22	2 " 24
3 " 24	3 " 27	3 " 30	3 " 33	3 " 36
4 " 32	4 " 36	4 " 40	4 " 44	4 " 48
5 " 40	5 " 45	5 " 50	5 " 55	5 " 60
6 " 48	6 " 54	6 " 60	6 " 66	6 " 72
7 " 56	7 " 63	7 " 70	7 " 77	7 " 84
8 " 64	8 " 72	8 " 80	8 " 88	8 " 96
9 " 72	9 " 81	9 " 90	9 " 99	9 " 108
10 " 80	10 " 90	10 " 100	10 " 110	10 " 120
11 " 88	11 " 99	11 " 110	11 " 121	11 " 132
12 " 96	12 " 108	12 " 120	12 " 132	12 " 144

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SECTION X

Lesson 85

Read the following quantities:

1.	$1000	$2000	$6000	$8000	$625
	$1625	$4625	$6645	$8314	$9276

2.	$12,000	$18,000	$46,000	$90,000
	$423	$12,423	$25,428	$36,250
	$58,736	$60,235	$60,035	$80,005

3.	$438	$438,000	$649,000
	$625,346	$549,763	$245,084
	$333,333	$325,040	$520,006
4.	$1,000,000	$4,000,000	$6,000,000
	$1,250,000	$4,645,000	$6,236,124
	$2,825,127	$2,478,042	$4,048,026
5.	$312.83	$2678.28	$1052.47
	$45,624.25	$17,322.50	$30,420.08
	$70,055.04	$841,762.50	$123,750.65

Write in figures:

6. Six hundred twenty-five; eight hundred sixty; five hundred seventy-six; one thousand two hundred forty-six; two thousand sixty; three thousand eighty; six thousand eight; nine thousand nine.

7. Fifteen thousand three hundred fifty-four; seventy-five thousand two hundred forty-nine; ten thousand two hundred fifty; twenty thousand four hundred five; sixty-four thousand twenty-six; eighty thousand seven.

8. Three hundred twenty-four dollars and twenty-five cents; two thousand six hundred fifty dollars and four cents; forty-five thousand nine hundred ninety-eight dollars and twenty-three cents; two hundred seventy-six thousand five hundred four dollars and seventeen cents.

9. Review these addition tables:

1	2	1	2	3	1	2	3
4	3	5	4	3	6	5	4

1	2	3	4	1	2	3	4
7	6	5	4	8	7	6	5

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

3	4	5	6	4	5	6	5	6	7
9	8	7	6	9	8	7	9	8	7

6	7	7	8	8	9	9
9	8	9	8	9	9	10

Add:

10.	$811.04	$360.00	$ 26.55	$851.02
	650.12	215.17	418.60	312.60
	19.25	12.50	20.63	147.22
	32.50	311.20	105.24	568.35
	113.56	235.32	222.42	116.02

11.	$ 636.99	$ 859.69	$ 97.22	$1180.66
	1850.14	2223.42	8148.60	342.65
	311.20	1097.47	3839.25	1237.50
	1201.64	1214.03	694.62	2678.28

12. New Hampshire contains 9305 sq. mi., Vermont 9565, Massachusetts 8315, Rhode Island 1256, Connecticut 4990. What is the total area of these five states?

13. This total area is how many square miles greater than that of Maine, the area of which is 33,040 sq. mi.?

Subtract:

14.	$403.59	$875.13	$6168.37	$1035.42
	94.63	694.73	467.89	559.83

15.	$3839.25	$5300.20	$7357.51	$36,501.28
	3661.09	1214.03	1777.60	21,420.64

16. Vermont contains 9565 sq. mi. and Massachusetts 8315; what is the difference in their areas?

17. Lake Erie contains 7750 sq. mi., Ontario 6950, and Michigan 22,000. How much larger is

Lake Michigan than the united area of Lake Erie and Lake Huron?

18. A, B, and C engaged in trade; A put in \$2450, B, \$3275, and C as much as A and B together. How much money did C put into the business? What was the total capital?

Multiply:

19.	\$34.71 8	\$28.79 6	\$33.72 9	\$24.95 5
20.	\$134.36 4	\$364.76 7	\$1763.29 8	\$2678.28 9

21. A is worth \$3275, and B 4 times as much. What is B worth?

22. Divide:

6)\$5876.40 7)\$4956.35 8)\$3008.96 9)\$5842.35

23. A dealer bought sheep at the average rate of \$6 each; how many did he buy for \$3816? What are you given? What are you required to find?

24. A furniture dealer gains \$1296 buying sofas for \$18.75 each and selling them for \$27.75. How many did he sell? What is the unit here?

Lesson 86

1. 64,395 is equal to 5 units, 9 tens, 3 hundreds, 4 thousands, 6 ten-thousands.

2. Give, as in question 1, the *place value* of each figure: 25; 37; 272; 582; 6548; 2094; 42,965; 37,048.

3. What is the units' place, the tens' place, the hundreds', the thousands', the ten-thousands'?

4. Multiply 2 tens by 3, how many tens? Multiply 2 by 3 tens, how many tens? Multiply 4 tens by 5, by 6, by 7, by 8; how many tens in each case? Multiply 4 by 5 tens, by 6 tens, by 7 tens, by 8 tens? How many tens in each case?

5. 25 units = ? units tens.
24 tens = ? tens hundreds.
58 tens = ? tens hundreds.
32 units = ? units tens.
64 tens = ? tens hundreds.
16 tens = ? tens hundreds.

6. 3 tens multiplied by 2 equals 6 tens.
3 tens multiplied by 2 tens equals 6 what?
6 tens multiplied by 4 tens equals what?
6 tens multiplied by 2 tens equals what?

7. $$\begin{array}{r} 68 \\ \underline{24} \\ 272 \\ \underline{136} \\ 1632 \end{array}$$

Multiply 68 by 4, and the product is 272. The 7 is 7 what? The 2 in 24 is 2 what? Multiply 8 by 2 tens and the product is 16 tens or 1 hundred 6 tens. Place 6 tens under 7 tens, and carry the 1 to the hundreds' place. Multiply 6 tens by 2 tens, and the product is 12 hundreds. To this add 1 hundred, and the sum is 13 hundreds. Add, and the complete product is 1632.

8. Study question 7, then place 24 under 68 and multiply without looking at the book. Do this until you can work quickly and *accurately*.

9. Multiply:

38	58	36	76	$64	$47
24	24	24	32	25	.16

10. A bushel of oats weighs 32 lb.; how many pounds in 48 bu.?

11. A page of a book contains 39 lines, averaging 13 words to a line. Find the number of words on the page.

12. A speculator buys 25 A. of land at $65 an acre and sells it for $88 an acre. Find his gain.

13. Multiply:

(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(*f*)
$35	$17	32 lb.	27 mi.	19 mi.	$48
28	13	68	38	16	24

14. Question 13 shows the multiplications that must be done for simple practical examples like questions 10, 11, 12.

Write out these examples:

(*a*) About the cost of 28 cows at $35 each.

(*b*) About the gain on selling 13 horses.

(*c*) About the number of pounds in 68 bu. of oats.

(*d*) About the distance a boy rides on his bicycle in 38 days.

(*e*) About the distance apart two boats will be, one going down stream at 11 mi. an hr., the other up stream at 8 mi. an hr.

(*f*) About a man's savings in 2 yr.

Multiply:

15.	42	79	89	93	75	86
	39	67	99	58	94	86
16.	231	176	224	168	365	893
	24	32	13	43	64	75
17.	\$22.13	\$43.07	\$29.04	\$34.45	\$54.39	\$47.81
	24	27	16	82	18	29
18.	\$39.17	\$94.26	\$87.91	\$60.86	\$68.77	\$74.93
	45	66	89	19	95	68

19. A business man pays in wages \$96.75 each week; what wages does he pay in 1 yr. (1 yr. = 52 wk.)?

20. How far will a bicyclist travel in 36 da., if he travels 8 hr. a day at the rate of 9 mi. an hour?

Lesson 87

1. Divide 714 by 21.

```
21)714(34
   63
   --
    84
    84
    --
```

2 is called the *trial divisor.*

2 is contained in 7 3 times. Multiply 21 by 3. The product is 63. Place 63 under 71, subtract, and bring down 4.

2 is contained in 8 4 times. Multiply 21 by 4, and write the product 84 under 84.

The *quotient* is 34. How would you prove 34 the correct answer?

2. What is the *trial divisor* when the divisor is 21? 31? 41? 51?

Find the quotients:

903 ÷ 21	992 ÷ 31	2542 ÷ 41	3162 ÷ 51
	$1344 ÷ 21	$1488 ÷ $31	

3. What is the trial divisor when the divisor is 22? 42? 62? 72?

Find the quotients:

726 ÷ 22	2352 ÷ 42	4650 ÷ 62	5188 ÷ 72
$726 ÷ 22 = ?	$2352 ÷ $42 = ?	$4650 ÷ 62 = ?	

4. A cattle dealer paid $682 for 22 head of cattle. What was the average price? Name the quantity, number, and unit.

5. If a train travels 32 mi. an hour, how long will it take to travel 1152 mi., there being stops amounting to one hour?

6. How many cows at $31 apiece can a man buy with the money he receives for 9 horses sold at an average price of $124?

7. What is the cost of 1472 lb. of oats at $\$\frac{1}{2}$ a bu.? (1 bu. oats weighs 32 lb.)

8. What is the trial divisor when the divisor is 23, 24, 33, 44, 54, 63, 84?

	Divisor Dividend Quotient	Divisor Dividend Quotient
9.	(*a*) 23)6285(273	(*b*) 24)3877(161
	46	24
	168	147
	161	144
	75	37
	69	24
	6 Remainder	13 Remainder

(*a*) The trial divisor 2 is contained in the trial dividend 6 3 times. On multiplying 23 by 3, the product 69 is seen to be too large. Why? Try 2 in the quotient. Again, 2 is contained in 16 8 times. On multiplying 23 by 8, the product 184 is seen to be too large. Why? Try 7 in the quotient. 2 is contained in 7 3 times. The remainder is 6.

(*b*) On the second division 2 is contained in 14 7 times. Why is 7 too large?

(*c*) When 23, 24; 33, 34; 43, 44; and so on, are the divisors, the quotient obtained by using the trial divisor is frequently too large. If so, try in the quotient the number next smaller.

10. Study question 9 carefully, then copy the examples, and divide. Do this until you can divide *accurately* and quickly without looking at the book.

11. Find the quotients:

$3197 \div 23$ $\quad 5940 \div 44$ $\quad 5355 \div 63$ $\quad 12{,}936 \div 84$

12. Find the quotients and remainders:

1527 ÷ 34	2632 ÷ 54	46,798 ÷ 64	2954 ÷ 14
7549 ÷ 13	6493 ÷ 84	26,495 ÷ 94	3823 ÷ 44

13. How many days are there in 1728 hr.? 4008 hr.? 21,768 hr.?

14. How many sheets of paper in 1 quire? If a business man uses 7488 sheets of paper in a year, how many quires does he use?

15. A man whose salary is $40 a week spends $26 a week. In how many weeks can he save $686? What is the unit that measures his savings?

16. A speculator paid $6654 for 64 horses and 85 sheep. If the sheep cost $6 apiece, what was the average cost of each horse?

Lesson 88

	Divisor Dividend Quotient		Divisor Dividend Quotient
1.	(*a*) 29)7948(274		(*b*) 57)8898(156
	58		57
	214	118	319
	203	87	285
	118	31	348
	116		342
	2 Remainder		6 Remainder

(*a*) As 29 is nearly equal to 30, the trial divisor is 3. 3 is contained in 7, 2 times, in 21, 7 times, and in

11, 3 times. On multiplying 29 by 3 the product is 87. On placing 87 under 118 and subtracting, the remainder is 31. This is larger than 29, and therefore the quotient is 1 larger than 3, or 4.

(*b*) On the last division the trial divisor 6 is contained in 34 5 times. Why is 5 too small?

(*c*) When 27, 28, 29 are the divisors, the trial divisor is 3. What is the trial divisor when the divisors are 37, 38, or 39? 47, 48, or 49? 57, 58, or 59? 67? 88? 99?

2. Name the trial divisors. Find the quotients and remainders:

$5842 \div 29$	$9843 \div 25$	$3134 \div 44$
$9546 \div 59$	$4554 \div 36$	$8967 \div 79$
$8113 \div 67$	$3580 \div 64$	$17{,}988 \div 34$
$8572 \div 98$	$3679 \div 47$	$97{,}445 \div 67$

Prove your answers correct by multiplying and adding in the remainder. If correct, this sum will equal the dividend.

3. How many pounds of sugar are there in 3600 oz.? (1 lb. = ? oz.) What would it cost at 5¢ a lb.?

4. A farmer sells 2160 lb. of wheat at 80¢ a bushel. Find the number of bushels and the total selling price. (1 bu. of wheat weighs 60 lb.)

5. Find the value of 12,288 lb. barley at $.50 a bu. (1 bu. barley weighs 48 lb.)

6. A farm of 85 A. cost $6375; what is the price per acre? If the owner of this farm wishes to increase it to 100 A., how many acres must he buy, and what will they cost at the same rate?

7. If 25 wagons cost $1375, what will 1 cost? What will 45 cost at $3 apiece less?

8. A bicycle dealer bought 3 doz. bicycles for $1620; how many could he have bought for $2160?

9. Find the quotients and remainders:

23,487 ÷ 31	58,049 ÷ 28	44,555 ÷ 63
84,287 ÷ 59	13,947 ÷ 16	65,287 ÷ 17
86,777 ÷ 92	30,049 ÷ 19	99,498 ÷ 43
38,695 ÷ 67	78,243 ÷ 99	84,827 ÷ 15

10. A wholesale merchant paid $13,625 to a manufacturer for rugs at $25 apiece. How many did he buy?

11. Divide:

4)$29.64	5)$37.50	6)$17.64	8)$2.64
9)$1.98	4)$.24	7)$.98	2)$.08

12. Find the quotients:

$38.13 ÷ 31	$22.68 ÷ 42	$743.50 ÷ 25
$64.68 ÷ 22	$84.42 ÷ 63	$369.84 ÷ 67
$42.68 ÷ 22	$13.50 ÷ 18	$854.37 ÷ 99

13. If 25 T. of coal cost $121.25, find the price per ton.

14. If a dozen and a half boxes of soap cost $56.70, what is the price of one box?

Lesson 89

1. Divide \$.72 by \$.06.

$$\$.06\overline{)\$.72}$$

$$6¢\overline{)72¢}$$
$$12$$

Change \$.06 to 6¢ and \$.72 to 72¢ and divide 6¢ into 72¢.

2. Divide \$36.25 by \$.25.

\$.25)\$36.25(

25¢)3625¢(145
25
112
100
125
125

Change \$.25 to 25¢ and \$36.25 to 3625¢, and divide 25¢ into 3625¢.

3. \$ .75 ÷ \$.05 = ? \$.84 ÷ \$.12 = ? \$.08 ÷ \$.04 = ?
\$1.80 ÷ \$.30 = ? \$3.25 ÷ 25¢ = ? \$3.60 ÷ \$.90 = ?

4. At \$.06 a quart, how many quarts of milk can you buy for \$.48? How many gallons?

5. At 7¢ a cake, how many cakes of soap can you buy for \$.63? How many boxes, there being 3 in a box?

6. At \$.30 a dozen, how many dozen lemons will cost \$1.80?

7. How many pecks of potatoes can you buy for \$.45 at 15¢ a peck? What part of a bushel?

8. At \$.24 a lb., how many pounds of butter will cost \$1.92?

9. At 8¢ a lb., how many 2-lb. boxes of biscuits can you buy for \$.64?

10. At \$.10 a gal., how many 5-gal. cans of oil can you have filled for \$1.50?

11. A lady pays \$.96 for dimity at \$.12 a yard. How many dresses can she make from it for her little girl, if each dress takes 4 yd.?

12. How many collars can you buy for \$2.00 at the rate of 3 for 50¢?

13. A merchant bought cloth at \$.36 a yard and sold it for \$.45 a yard. His gain was \$22.50; how many yards did he sell?

14. \$8.32 ÷ \$.16 = ? \$9.45 ÷ \$.35 = ?
\$2.52 ÷ \$.18 = ? \$15.84 ÷ \$.44 = ?
\$3.60 ÷ \$.24 = ? \$14.25 ÷ \$.57 = ?

15. At \$.35 a basket, how many baskets of peaches can you buy for \$25.20? How many dozen baskets?

16. At 28¢ each, how many hammers can you buy for \$4.48?

17. How many bushels of potatoes, at \$.65 a bushel, can you buy for \$11.05?

18. At \$.54 a bushel, how many bushels of corn can you buy for \$176.04? If you sell the corn at 58¢ a bushel, what is your gain?

19. A grocer bought potatoes in the fall at \$.45 a bu., and sold them in the spring for \$.68 a bu.

His gain was $57.50; how many bushels did he buy? What is the unit that measures his gain?

20. Bought apples at 55¢ a bu. and sold them at 20¢ a pk. If my gain was $37.50, how many bushels did I buy?

Lesson 90

1. Write in figures: Two hundred twenty-five dollars and seventy-five cents; one thousand forty dollars and six cents; six thousand three hundred dollars sixty-seven cents.

2. Reduce to dollars and cents: 341¢; 2159¢; 7804¢; 25425¢; 25039¢.

3. Reduce to cents: $4; $6.25; $27.03; $30.14; $50.20; $254.27; $360.02.

4. A farmer receives $29.25 for wheat, $19.02 for corn, $7.25 for vegetables, and $8.46 for turkeys. What does he receive in all?

5. A lady bought a bookcase for $9.98, a chair for $5.35, a hat-rack for $11.50, and a lounge for $12.88. Find the amount of her bill.

6. Find the amount of these bills: meat $12.63, daily paper 65¢, laundry $2.36, gas $3.25, and plumber $1.70.

7. Ice cream salt is sold at 1¢ a lb., or for 85¢ per 100 lb. sack. Find what is saved by buying 100 lb. at a time.

8. A man had \$5000 in the bank. He withdrew \$3496.75; how much remained in the bank?

9. I bought a horse for \$150 and a cow for \$32.75, and paid cash \$126.49. How much is still due?

10. A lady paid 64¢ for cotton, 75¢ for ribbon, \$4.25 for a pair of shoes, and \$3.73 for cloth. What change should she have left from a ten-dollar bill?

11. Find the amount of this bill:

3 cans peaches at 32¢ each
2 packages gelatine at 17¢ each
57 lb. sugar at 19 lb. for \$1
3 packages cracked wheat at 11¢ each.

12. Find the amount of this bill:

2 lb. cheese at \$.16 a lb.
5 lb. butter at \$.22 a lb.
10 lb. ham at $12\frac{1}{2}$¢ a lb.
2 bottles pickles at 29¢ each
$\frac{1}{2}$ doz. glasses jelly at \$4.40 a doz.

13. If 25 lb. coffee cost \$8.25, what is the cost of 1 lb.?

14. A merchant received \$86.70 for cloth sold at \$.34 a yard. How many yards were sold?

15. Paid \$317.52 for wheat at \$.98 a bushel. Find the number of bushels bought.

16. A merchant bought cloth at 36¢ a yard, and sold it for \$56.25 at a profit of 9¢ a yard. How many yards did he buy?

SECTION XI

Lesson 91

1. In the expression $2.34 the 3 is 3 what? What part of a dollar? The 4 is 4 what? What part of a dollar? The 34 is 34 what? What part of a dollar?

2. In the expression $4.73 what part of a dollar is the 7? The 3? The 73?

3. Read as dollars and hundredths of a dollar: $2.31, $4.65, $7.60, $6.05, $6.46, $6.09, $.35, $.06, $.43, $.09.

4. Measure with a metric stick and count the number of meters (m.) in the length of the room. In the width.

5. Measure different lengths with the metric stick.

6. Guess at two points on the blackboard one meter apart. Test by measuring with a metric stick.

7. Count the number of decimeters (dm.) in a meter. How many?

8. One decimeter is what part of a meter? 2 decimeters is what part of a meter? 3 dm.? 6 dm.?

9. Measure the width of the door and state its width in decimeters.

10. Similarly measure the width of your desk; its length; the height of the blackboard above the floor, etc.

11. Cut a strip of cardboard 1 decimeter long. Use it to measure the metric stick. How many decimeters in a meter?

12. 1 meter 1 decimeter is written 1.1 meters, meaning by that one meter and *one-tenth* of a meter. 1 meter 2 decimeters is written 1.2 meters, meaning one meter and two-tenths of a meter.

1 m. 1 dm. = 1.1 m.   1 m. 2 dm. = 1.2 m.

The dot between the 1 and 1, and between the 1 and 2, is called the *decimal point.* It separates *units* from *tenths.*

13. 2.5 m. is read two and five-tenths meters. Read similarly:

1.3 m., 2.4 m., 3.6 m., 4.2 m., 6.8 m., .8 m., .2 m., .1 m.

14. Measure the length of the room and express your result in meters. (Thus, 8.4 m.)

15. Measure and express the results in meters: The width of the room; points taken at random on the blackboard; the heights of different pupils, etc.

16. Draw an oblong .2 m. long and .1 m. wide. Take points 1.4 m. apart; 3.4 m. apart; 4.6 m. apart.

17. 2.5 lb. is read two and five-tenths pounds. Read similarly: 2.5 da., 2.7 hr., 1.6 mi., 4.8 yd., .8 yd., 8.4 gal., .6 qt.

18. Write in figures, using contractions: Three and four-tenths meters, five and six-tenths pounds, four and seven-tenths dollars, two-tenths of a mile.

19. Count the number of centimeters (cm.) in a decimeter; of centimeters in a meter.

20. Find the number of centimeters in the height of this book; in the width.

21. Measure the number of centimeters in the length of a line of this book; in the length and width of a sheet of paper, length of a lead pencil, and of other things.

22. Draw an oblong 12 cm. long and 8 cm. wide.

23. ? cm. = 1 dm. ? dm. = 1 m. ? cm. = 1 m. 1 cm. is what part of 1 dm.? 1 dm. is what part of 1 m.? 1 cm. is what part of 1 m.?

24. What part of 1 m. is 2 cm.? 4 cm.? 8 cm.? 15 cm.? 25 cm.? 36 cm.?

25. 1 dm. 2 cm. = ? cm. What part of a meter? 2 dm. 4 cm. = ? cm. What part of a meter?

26. 1 m. 1 dm. 1 cm. is written 1.11 m., meaning by that one meter, one-tenth of a meter, one-hundredth of a meter, or one and eleven-hundredths meters.

27. 4.68 m. is read four and sixty-eight hundredths meters. Read similarly:

2.56 m., 4.29 m., 3.64 m., .45 m., .06 m., 3.07 m., 5.60 m.

28. 4.65 lb. is read four and sixty-five hundredths pounds. Read similarly:

2.25 lb., 3.17 mi., 6.43 A., 5.89 yr., .23 da., .64 hr., .04 hr., .06 gal., 2.09 gal., 4.06 bu., 4.60 bu., 3.49, .75, 2.09, .06.

29. Take two points 4.62 m. apart; 3.12 m. apart; 2.40 m.; 3.07 m.

30. In the expression 4.62 m. the *place value* of each figure is given thus: 4 is four meters, 6 is six-tenths of a meter, and 2 is two-hundredths of a meter.

Give the place value of each figure in the following: 2.31 m., 4.59 m., 7.35 m., 2.09 m., 4.30 m., 2.07 m.

31. Give the place value of each figure in the following: 2.15 lb., 3.74 mi., 3.66 A., 2.09 yr., .32 da., .64 hr., .06 yr., 2.60 gal., 4.65, 7.23, .41, 2.04, .04.

Lesson 92

1. Count the number of millimeters (mm.) in a centimeter; of centimeters in a decimeter; of decimeters in a meter; of millimeters in a meter.

2. Find the number of millimeters in the width of the margins of this book; in the thickness of this book; in the length of the printed word *millimeter;* in the distance between the lines on ruled paper; and in other short distances.

3. Draw and cut a slit 2 mm. wide and 3 cm. long in a sheet of paper.

4. ? mm. = 1 cm. ? cm. = 1 dm. ? dm = 1 m. ? mm. = 1 m. 1 mm. is what part of 1 cm.? 1 cm. is what part of 1 dm.? 1 dm. is what part of 1 m.? 1 mm. is what part of 1 m.?

5. What part of 1 m. is 2 mm.? 8 mm.? 25 mm.? 84 mm.? 264 mm.? 625 mm.?

6. 1 dm. 2 cm. 5 mm. = ? mm. What part of a meter? 3 dm. 4 cm. 6 mm. = ? mm. What part of a meter?

7. 1 m. 1 dm. 1 cm. 1 mm. is written 1.111 m., meaning one meter, one-tenth of a meter, one-hundredth of a meter, one-thousandth of a meter, or one and one hundred eleven thousandths meters.

8. 4.685 m. is read four and six hundred eighty-five thousandths meters. Read similarly:

2.346 m., 6.275 m., 3.204 m., 4.250 m., 4.016 m., 4.006 m., 7.005 m., .214 m., .015 m., .006 m., .004 m., 3.146 m.

9. 4.625 lb. is read four and six hundred twenty-five thousandths pounds. Read similarly:

2.245 lb., 2.145 T., 7.543 A., 5.019 A., 7.016 yr., 2.005 da., .243 da., .075 hr., .009 bu., .004 gal., 3.468 mi., 4.248, .329, .024, .082, .002, .005.

10. Write in figures, using contractions:

One and three hundred sixty-eight thousandths pounds; nine and six hundred four thousandths tons; three hundred thirty-five thousandths of a mile; forty-nine thousandths of a day; six thousandths of a year; seventeen thousandths of a year.

11. Take two points 1.245 m. apart; 2.436 m. apart; 3.104 m.; 2.005 m.

12. What is the place value of each figure in question 11?

13. Give the place value of each figure in the following:

3.764 m., 8.157 lb., 2.829 T., 4.666 mi., 8.095 A., 1.906 A., 3.008 yr., .247 yr., .016 yr., .009 mi., 3.980 mi., 5.823, 7.048, .042, .248, .009.

14. Read the following:

2.15	2.356	80.004	666.016
9.08	32.356	311.25	850.14
73.25	432.356	636.09	189.1
96.03	80.4	357.512	914.019
245.2	80.04	201.001	10.011

15. What is the place value of each figure in the last column of question 14?

16. Show on a metric stick the following, and note carefully, by comparing the part cut off with the meter, what part of a meter each quantity seems to be:

.25 m., .15 m., .356 m., .4 m., .246 m., .14 m.

Lesson 93

Copy and add:

1.	2345	234.5	23.45	2.345
	3482	348.2	34.82	3.482
	6134	613.4	61.34	6.134
	8753	875.3	87.53	8.753

2.	64.215	16.43	222.342
	28.528	24.213	530.030
	21.835	5.342	112.458
	17.652	44.653	738.754

3. Write in columns and add:

2.174 + 5.073 + 4.256 + 3.543.

.214 bu. + .876 bu. + .371 bu. + .444 bu.

4. Show on a metric stick .214 m., .876 m., .371 m., .444 m.

5. Find the number of acres in a farm that is divided into four fields, containing, respectively, 23.875 A., 15.18 A., 12.316 A., and 16.245 A.

6. In the following question draw the road and mark the distances:

Four towns, A, B, C, D, lie on a road running north and south. The distance from A to B is 4.186 mi., from B to C 6.56 mi., and from C to D 8.514 mi. Find the distance from A to D.

Copy and subtract:

7.	3.426	6.539	38.492	62.073
	1.312	2.153	25.861	44.444
8.	3.42	8.4	6.	796.873
	1.204	3.156	4.251	636.134

9. From a piece of cloth containing 16.5 yd. I cut 12.375 yd. How much was left in the piece?

10. From a farm containing 100 A. the owner sold 32.875 A. How much did he still own?

11. A man bought a house and lot with .125 of his money and invested the remainder in business. What part of his money went into business?

12. Draw a line and mark off on it 7 parts, each .5 ft. long. Measure the whole part cut off. What is its length? $7 \times .5$ ft. = ? ft.

13. Add:

.2 yd.	.3 bu.	.32 gal.	2.64 A.	.428 da.
.2 "	.3 "	.32 "	2.64 "	.428 "
.2 "	.3 "	.32 "	2.64 "	.428 "
.2 "	.3 "	.32 "	2.64 "	.428 "

Copy and multiply:

14.	.2 yd.	.3 bu.	.32 gal.	2.64 A.	.428 da.
	4	4	4	4	4

How many figures are there to the right of the decimal point in the multiplicands? In the products?

15.	.141	1.98	3.452	8.234	26.019
	6	3	7	8	7

As you multiply give the place value of each partial product.

16.	2.13	4.25	87.1	.642	.057
	16	24	36	44	64
17.	1.75	2.034	3.506	23.5	3.006
	99	27	81	69	72

18. Look at the metric stick and find out the number of inches in one meter. If 1 meter is equal to 39.371 in., how many inches long is a line that measures 3 meters?

19. Measure a line 3 meters long on the blackboard, find the number of inches in it by measuring, and test the correctness of the answer to question 18.

20. What will 25 loads of wheat weigh, the average weight being 1.135 T.?

21. A merchant sold 45 yd. of cloth a day at a gain of $.125 a yd. Find his gain on a week's sales.

22. Find the cost of 48 thousand feet of lumber at $43.875 per thousand.

23. Multiply .36 by 24; 24 by .36; .256 by 6; 6 by .256; 8 by .53. Find .53 of $8; .64 of 96 yd.; 2.54 of 26; .26 of 254; 3.18 of 42; .42 of 350 sheep.

24. A drover sold .24 of his flock of 250 sheep. How many did he sell?

25. Monday a merchant sold .924 of a piece of cloth containing 36 yd. How many did he sell? If the rest went to the remnant counter, how many yards went to the remnant counter?

Lesson 94

1. Divide 34.458 by 6.

$$\begin{array}{r} 6\overline{)34.458} \\ 5.743 \end{array}$$

6 is contained in 34 5 times, in 44 tenths 7 tenths, in 25 hundredths 4 hundredths, and in 18 thousandths 3 thousandths.

2. Find the value of:

$8.652 \div 4$	$23.191 \div 7$	$8.992 \div 4$
$17.664 \div 6$	$4.996 \div 2$	$8.253 \div 9$
$84.708 \div 9$	$6.336 \div 8$	$4.995 \div 5$
$.897 \div 3$	$2.457 \div 7$	$25.938 \div 3$
$98.475 \div 5$	$.544 \div 8$	$86.824 \div 8$

3. If a vessel travels 64.688 mi. in 4 hr., what is the rate per hr.?

4. I paid \$4.375 for 5 yd. of cloth. What was the price per yd.?

5. If 1 bu. contains 2150.42 cu. in., how many cubic inches will 1 qt. dry measure hold?

6. If 1 gal. holds 231 cu. in., how many cubic inches will 1 qt. liquid measure hold?

7. Divide 357.84 by 42.

```
42)357.84(8.52
   336
   ---
    218
    210
    ---
      84
      84
      --
```

42 is contained in 357 8 times, in 218 tenths 5 tenths, in 84 hundredths 2 hundredths.

8. Find the value of:

$35.289 \div 27$	$120.93 \div 29$
$106.08 \div 34$	$66.317 \div 47$
$3.266 \div 23$	$2629.8 \div 54$
$6.544 \div 16$	$124.5 \div 75$

As you divide give the place value of each figure in the quotient.

9. I paid \$2031.75 for 63 A. of farm land. Find the cost per acre.

10. A merchant paid \$65.625 for a chest of tea containing 75 lbs. Find the cost per pound. What would be the total gain on selling it at \$1 a lb.?

11. Divide 2.574 by .6.

$$.6\overline{)2.574}$$

$$6\overline{)25.74}$$

$$4.29$$

Place the decimal point one place to the right in both divisor and dividend and divide as in the example. Why can you do this?

12. Copy and divide:

$.3\overline{)3.45}$	$.4\overline{).196}$	$.5\overline{)2.25}$	$.6\overline{)31.2}$
$.4\overline{)3.508}$	$.5\overline{)4.75}$	$.6\overline{)25.2}$	$.7\overline{)8.764}$
$.8\overline{)289.2}$	$.8\overline{)8.92}$	$.9\overline{)7.569}$	$.9\overline{).3483}$
$.5\overline{).3625}$	$.4\overline{).0812}$	$.6\overline{)3.144}$	$.8\overline{)4.504}$
$.4\overline{)24}$	$.6\overline{)15}$	$.8\overline{)960}$	$.9\overline{)10.8}$

Give the place value of each figure in the quotient.

13. Find the number of steps in a stairs between two floors, one of which is 14.5 ft. higher than the other, if each step is .5 ft. high. Name the unit of measure and the quantity. How do you find the number when the unit and quantity are known?

14. A drover sold .6 of his flock of sheep and had 240 left. Find the number of sheep in the flock at first.

15. A merchant sold cloth so as to gain .3 of the cost. If the gain on each yard was 27¢, find the cost price. Find the selling price.

16. Divide .435 by .06 and 9.112 by 3.4.

(*a*)

.06).435
6)43.50
7.25

(*b*)

3.4)9.112(
34)91.12(2.68
68
231
204
272

(*a*) Since in this division 6 is contained in 15 twice with remainder 3, annex a zero. 6 is contained in 30 5 times.

(*b*) 34 is contained in 91 units two times. Write down two and continue the division.

17. Divide 15.288 by .42.

.42)15.288(
42)1528.8(36.4
126
268
252
168
168

Move the decimal point two places to the right in both divisor and dividend before dividing. Why can you do this?

18. Find the value of :

$.264 \div .04$	$33.76 \div 1.3$	$8 \div .4$
$3.78 \div .03$	$29.97 \div .37$	$12 \div .06$
$14.35 \div .05$	$2.808 \div .45$	$3 \div .25$
$4.062 \div .06$	$59.636 \div 1.7$	$18 \div .45$
$3.4 \div .05$	$37.625 \div 43$	$450 \div .75$
$12.6 \div 6$	$29.664 \div .24$	$36 \div .09$

19. When do you move the decimal point one place to the right before dividing? When two places? When do you put the decimal point in your quotient? When do you annex zeros to the dividend?

20. If 39 bu. of wheat cost $34.125, what is the price per bushel?

21. At $.12 a gallon, how many gallons of kerosene can you buy for $2.76?

22. A merchant pays $240 for cloth at $.75 a yard. How many yards does he buy?

23. A drover lost .045 of his flock of sheep by wolves, .125 by disease, and .16 by theft. What part of his flock did he lose? If he sold the remainder, what part of his flock did he sell?

24. If in question 23 there were sold 201 sheep, how many were in the flock at first?

25. If a man earns $4.75 a day, and his average daily expenses are $3.40, in how many days will he save $81? What is the unit here?

SECTION XII

Lesson 95

1. The term *per cent* (%) is used constantly in business. The merchant gains 20% on selling cloth, meaning by this that he gains \$20 on every \$100 that the cloth cost him. The insurance company charges 2% for insuring furniture, meaning that \$2 is charged for every \$100 worth of furniture insured. A man pays 5% for the use of money, meaning that he pays \$5 a year on every \$100 borrowed. Per cent means hundredths. 50% of a quantity is 50 hundredths of it.

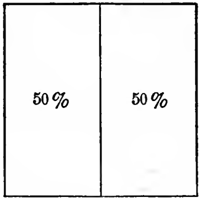
2. A quantity divided into fourths is measured by 4 units; a quantity divided into fifths is measured by 5 units.

3. By how many units is a quantity measured that is divided into sixths? Into eighths? Tenths? Twentieths? Fiftieths? Hundredths?

4. Quantities considered in percentage are measured by 100 units.

By how many units is $\frac{1}{4}$ of a quantity, considered in percentage, measured? $\frac{1}{2}$? $\frac{3}{4}$? $\frac{4}{4}$?

5. $\frac{1}{4}$ of a quantity equals what per cent of it? $\frac{1}{2}$? $\frac{3}{4}$? $\frac{4}{4}$?



6. What part of 1 sq. in. is 50% of it?

7. Draw lines 1 in., 2 in., 4 in., 6 in., 7 in. long, and so on. Mark off 50% of each line. This is what part of each line? How many inches? What is 50% of 6 in.? 9 in.? 12 in.? 6 ft.? 18 yd.? 80 yd.? 60 mi.? 120 mi.?

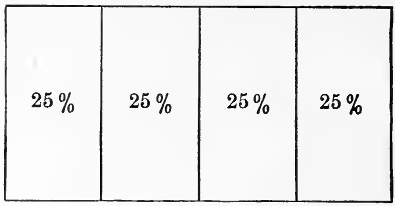
8. What part of a quantity is 50% of it? How many yards of carpet in 50% of 120 yd.? What is the cost at 50¢ a yd.?

9. Draw a 2-in. square and mark off 50% of it. Draw an oblong 4 in. by 2 in. and mark off 50% of it. How many square inches in 50% of the square? Of the oblong?

10. A farmer gave his son 50% of his farm of 160 A. How many acres did he receive?

11. How many inches in 50% of 1 ft.? In 50% of 1 yd.? How many quarts in 50% of 1 gal.? Pints in 50% of 1 qt.? Quarts in 50% of 1 bu.? Quarts in 50% of 1 pk.? Ounces in 50% of 1 lb.?

Months in 50% of 1 yr.? Hours in 50% of 1 da.? Minutes in 50% of 1 hr.? Sheets in 50% of 1 quire? Units in 50% of 1 score?



12. 25% of 2 sq. in. is what part of it? 50% is what part? 75%? 100%? How many square inches in each case?

13. A quantity considered in percentage is measured by how many units? $\frac{1}{4}$ of the quantity? By what per cent? 75% is what part of the quantity?

14. Draw a line 1 ft. long and divide it into parts each of which is 25% of 1 ft. Show 75% of 1 ft. What part of 1 ft. is 25% of it? 75% of it? How many inches?

15. Draw a square inch and divide it into parts each of which is 25% of it. What part of 1 sq. in. is 25% of it? 50% of it? 75% of it? 100% of it? What part of a quantity is 25% of it? 75% of it? 100% of it?

16. A farmer sold 25% of his flock of 240 sheep. How many sheep did he sell? What per cent of his flock did he keep? How many sheep?

17. A man paid 75% of $160 for a horse. What did the horse cost?

18. How many inches in 25% of 1 ft.? Inches in 25% of 1 yd.? Quarts in 25% of 1 gal.? Gills in 25% of 1 qt.? Quarts in 25% of 1 bu.? Quarts in 25% of 1 pk.? Ounces in 25% of 1 lb.? Months in 25% of 1 yr.? Hours in 25% of 1 da.? Cents in 25% of $1? Units in 25% of 1 score? Sheets in 25% of 1 quire?

How do you find 25% of a quantity?

19. Find 75% of each quantity in question 18. How do you find 75% of a quantity?

20. What per cent of a quantity is $\frac{1}{2}$ of it? $\frac{1}{4}$? $\frac{3}{4}$? 5¢ is what part of 10¢? What per cent?

21. A grocer paid 60¢ a lb. for tea and sold it so as to gain 25%; find the gain. Find the selling price.

22. I paid 36¢ a yd. for cloth and sold it at a gain of 9¢ a yd. What part of the cost do I gain? What per cent?

23. If 25% of the cost of a cow is $8, what did it cost?

24. Land was bought at $20 an acre and sold so as to gain 25%. Find the selling price.

25. A horse that cost $80 was sold at a gain of 25%. Find the selling price.

26. If I take off $\frac{1}{4}$ of the marked price on selling a book, what per cent of the marked price is left?

27. Cecil had 80¢. He spent 50% of it to have his bicycle mended, and 25% of the remainder for oranges. How much had he left?

28. What per cent of 20¢ is 5¢? Of 16¢ is 8¢? Of 1 ft. is 6 in.? Of 1 da. is 6 hr.? Of 1 gal. is 1 qt.?

29. A merchant sold an overcoat at a gain of $3, which was 25% of the cost. What was the cost price? The selling price?

30. Roy's age is 25% of his father's. If Roy is 9 yr. of age, how old is his father?

31. A man who earns $240 a month spends 75% of it. How much does he save a month? How much a year?

Lesson 96

1. $\frac{1}{3}$ of 100 units = ? $\frac{2}{3}$ of 100 units = ? $\frac{1}{3}$ of a quantity is what per cent of it? $\frac{2}{3}$ of a quantity is what per cent of it?

2. What part of a line is $33\frac{1}{3}\%$ of it? Draw lines 3 in., 6 in., 9 in., and 12 in. long. Divide each line into parts each of which is $33\frac{1}{3}\%$ of the whole line. How many inches in $33\frac{1}{3}\%$ of each line? Show $66\frac{2}{3}\%$ of each line. How many inches in $66\frac{2}{3}\%$ of each line?

3. What part of a quantity is $33\frac{1}{3}\%$ of it? $66\frac{2}{3}\%$ of it? What is $33\frac{1}{3}\%$ of 6 ft.? 18 yd.? 45 mi.? \$75? 90 T.? What is $66\frac{2}{3}\%$ of each of these quantities? 100% of each?

4. How many months in $33\frac{1}{3}\%$ of 1 yr.? Hours in $33\frac{1}{3}\%$ of 1 da.? Minutes in $33\frac{1}{3}\%$ of 1 hr.? Seconds in $33\frac{1}{3}\%$ of 1 min.? Find $66\frac{2}{3}\%$ of each of these quantities. 100% of each.

5. $33\frac{1}{3}\%$ of 1 ft. = ? $33\frac{1}{3}\%$ of 1 yd. = ? $33\frac{1}{3}\%$ of 1 doz. = ? $33\frac{1}{3}\%$ of 1 quire = ? Find $66\frac{2}{3}\%$ of each of these quantities. 100% of each.

6. Draw a 3-in. square and a 6-in. square. Show $33\frac{1}{3}\%$ and also $66\frac{2}{3}\%$ of each. $33\frac{1}{3}\%$ of 1 sq. yd. = ? sq. ft. $66\frac{2}{3}\%$ of 1 sq. yd. = ? sq. ft.

7. What part of a quantity is equal to 25% of it? $66\frac{2}{3}\%$? 75%? $33\frac{1}{3}\%$? 100%? 50%?

8. What per cent of a quantity is equal to $\frac{3}{4}$ of it? $\frac{1}{3}$? $\frac{3}{3}$? $\frac{1}{4}$? $\frac{2}{2}$? $\frac{2}{3}$? $\frac{4}{4}$?

9. Cloth which cost \$.75 a yard was sold at a loss of $33\frac{1}{3}\%$. Find the selling price.

10. If $33\frac{1}{3}\%$ of a cargo of flour consisting of 6300 bbl. was damaged, how many barrels were damaged?

11. A grain dealer invested \$4500 in wheat, and $66\frac{2}{3}\%$ of that amount in oats. How much did he invest in oats? In both?

12. A merchant bought apples at 60¢ a bushel, and sold them at a gain of $33\frac{1}{3}\%$. Find the selling price per bushel. Per peck.

13. A person gave $80 for one horse and $75 for another. He sold the first at a gain of 25% and the second at a gain of $33\frac{1}{3}\%$. Find his gain on both.

14. A merchant bought goods for $120. He sold half of them at a gain of $33\frac{1}{3}\%$ and the remainder at a gain of 25%. Find his total gain.

15. One village has a population of 2000 and another 75% of that number. Find the population of the second village.

16. What part of $6 is $2? What per cent? What per cent of $24 is $6? Of $24 is $18? Of 16 bu. is 8 bu.? Of 16 bu. is 12 bu.? Of $15 is $10? Of $36 is $24?

17. What per cent of 1 ft. is 4 in.? Of 1 yd. is 2 ft.? Of 1 sq. yd. is 6 sq. ft.? Of 1 gal. is 1 qt.? Of 1 qt. is 1 pt.? Of 1 bu. is 3 pk.? Of 1 pk. is 6 qt.? Of 1 lb. is 4 oz.? Of 1 yr. is 8 mo.? Of 1 da. is 12 hr.? Of 1 dime is 2 nickels? Of 1 quire is 18 sheets?

18. I bought a rug for $24, and sold it at an advance of $8. Find the gain per cent. To find the gain per cent, you always compare the gain with what?

19. I bought a cow for $28 and sold her for $35. Find the gain per cent.

20. A dealer bought a bicycle for $60, and sold it for $40. Find his loss per cent.

21. A merchant gains $33\frac{1}{3}\%$ by selling cloth at an advance of 25¢ a yard. Find the cost price per yard.

22. A speculator lost $800 by selling a house at 25% below cost. Find what he paid for it.

23. If $66\frac{2}{3}\%$ of the population of a certain town is 1800, find the population.

24. If 75% of the cost of a farm is $3600, find the cost.

Lesson 97

1. $\frac{1}{5}$ of 100 units = ? $\frac{2}{5}$ of 100 units = ? $\frac{3}{5}$ of 100 units = ? $\frac{4}{5}$ of 100 units = ? $\frac{5}{5}$ of 100 units = ?

What per cent of a quantity is $\frac{1}{5}$ of it? $\frac{2}{5}$? $\frac{3}{5}$? $\frac{4}{5}$? $\frac{5}{5}$?

2. Draw an oblong 5 in. long and 1 in. wide, and divide it into five equal parts. What per cent of the oblong is each part? Mark this per cent in each part. What per cent of the oblong is 2 parts? 3 parts? 4 parts? 5 parts?

3. What part of a quantity is 20% of it? 40%? $33\frac{1}{3}\%$? 60%? 75%? 80%? 100%?

What per cent of a quantity is $\frac{1}{5}$ of it? $\frac{2}{5}$? $\frac{3}{4}$? $\frac{3}{5}$? $\frac{2}{3}$? $\frac{4}{5}$? $\frac{1}{2}$? $\frac{3}{3}$?

4. How many cents in 20% of 1 dime? In 40% of 1 nickel? In 80% of half a dollar? In 60% of a 25-ct. piece? How many minutes in 40% of 1 hr.? Seconds in 60% of 1 min.? Sheets in 75% of 1 quire? Units in 40% of 1 score?

5. If I have 5 5-ct. pieces and buy a lead pencil for 5¢, what per cent of my money do I spend? If I spend 15¢, what per cent do I spend?

6. A lady has a piece of cloth containing 16 yd. She cuts off 12 yd. to make a dress. What per cent of the entire piece is required for the dress?

7. Romney lost $33\frac{1}{3}$% of his marbles and then had 16 left. How many had he at first?

8. Blanche is 18 yr. old, and Violet 10. The difference between their ages is what per cent of Violet's age?

9. A grocer bought tea at 75¢ a lb., and sold it for 90¢ a lb. Find his gain per cent. What would have been the selling price to lose 20%?

10. A man sold a horse for $\frac{3}{4}$ of the cost price. Find his loss per cent.

11. A merchant put 2 yd. of cloth, which sold at $2.50 a yd., on the remnant counter, and reduced the price 40%. Find the selling price.

12. Pencils bought at 48¢ a doz. were sold at a gain of 25%. Find the selling price of each pencil.

13. A grocer bought coffee so that he could sell it for 36¢ a lb. and make a profit of $33\frac{1}{3}\%$. Find the cost per lb.

14. A drover bought 40 sheep at $6 apiece, and sold them at a gain of 20%. Find his gain.

15. I paid $60 for one bicycle and $75 for another. I sold the first at a gain of $33\frac{1}{3}\%$ and the second at a loss of 20%. Find my gain on the whole transaction.

16. What is the gain per cent when the selling price is $1\frac{1}{4}$ times the cost?

17. What is the loss per cent when the selling price is $\frac{2}{3}$ of the cost?

18. A merchant bought 12 overcoats for $180 and sold them at a gain of 20%. Find the selling price of each coat.

19. Bought pencils at 24¢ a dozen and sold them at 3¢ each. Find the gain per cent.

20. A wholesale dealer marks bicycles at $60, subject to a discount of $33\frac{1}{3}\%$. Find the actual selling price.

21. If I buy 600 sheep at $5 apiece, and pay $66\frac{2}{3}\%$ of the cost price, how much do I still owe?

22. A library has 800 volumes, of which 25% are history. If 50% of the remainder are fiction, how many volumes of fiction are there in the library?

23. A man spent $\frac{1}{3}$ of his money for a suit of clothes and $\frac{1}{4}$ of it for an overcoat. What per cent of his money did he spend?

Lesson 98

1. $\frac{1}{10}$ of 100 units = ? $\frac{3}{10}$ of 100 units = ? $\frac{6}{10}$ of 100 units = ? $\frac{7}{10}$ of 100 units = ? $\frac{8}{10}$ of 100 units = ? $\frac{10}{10}$ of 100 units = ? What per cent of a quantity is $\frac{2}{10}$ of it? $\frac{4}{10}$? $\frac{5}{10}$? $\frac{8}{10}$? $\frac{10}{10}$?

10%	10%	10%	10%	10%
10%	10%	10%	10%	10%

2. What part of this oblong is 10% of it? 20%? 30%? 40%? 50%? 60%? 70%? 80%? 90%? 100%?

3. What per cent of this oblong is $\frac{1}{2}$ of it? $\frac{1}{5}$ of it? $\frac{1}{10}$? $\frac{3}{5}$? $\frac{7}{10}$? $\frac{9}{10}$? $\frac{2}{5}$?

4. How many cents in 10% of 1 dime? In 30% of $1? In 30% of half a dollar? How many days in 10% of the month of June? Seconds in 30% of 1 min.? Units in 90% of 1 score?

5. A farmer raised 360 bu. of wheat, and kept 10% of this for flour for his own family. How many did he sell?

6. A man saves each month 10% of his salary. If this is \$22, what is his salary?

7. If 10% of a boy's rate of walking is $\frac{1}{5}$ mi. per hr., what is his rate per hr.?

8. A boy saved \$40 in one year, and the next year he saved 10% more than that. How much did he save in 2 yr.?

9. A house rents at \$300 a year, which is 10% of its value. What is the house worth?

10. $\frac{1}{8}$ of 100 units = ? $\frac{1}{4}$ of 100 units = ? $\frac{8}{8}$ of 100 units = ? What per cent of a quantity is $\frac{1}{8}$ of it? $\frac{8}{8}$?

$12\frac{1}{2}$%	$12\frac{1}{2}$%	$12\frac{1}{2}$%	$12\frac{1}{2}$%
$12\frac{1}{2}$%	$12\frac{1}{2}$%	$12\frac{1}{2}$%	$12\frac{1}{2}$%

11. What part of this oblong is $12\frac{1}{2}$% of it? What per cent of this oblong is $\frac{1}{8}$ of it? $\frac{1}{4}$? $\frac{1}{2}$? $\frac{3}{4}$? $\frac{8}{8}$?

12. What part of any quantity is $12\frac{1}{2}$% of it? What per cent of any quantity is $\frac{1}{8}$ of it?

13. How many inches in $12\frac{1}{2}$% of 1 ft.? Square inches in $12\frac{1}{2}$% of 1 sq. ft.? Pints in $12\frac{1}{2}$% of 1 gal.? Quarts in $12\frac{1}{2}$% of 1 bu.? Ounces in

$12\frac{1}{2}\%$ of 1 lb.? Hours in $12\frac{1}{2}\%$ of 1 da.? Sheets in $12\frac{1}{2}\%$ of 1 quire?

14. Four pupils of the first grade were absent Monday. If this was $12\frac{1}{2}\%$ of the whole number, how many are in the first grade?

15. One-eighth of a box of oranges was found to be decayed on opening the box. What per cent of the oranges was good?

16. A laboring man is idle 2 da. out of 8. What per cent of the time is he idle?

17. A fruit dealer buys pineapples at 8¢ apiece, and sells them at 9¢ apiece. Find his gain per cent.

18. What is $\frac{1}{6}$ of 100%? $\frac{6}{6}$ of 100?

$16\frac{2}{3}\%$	$16\frac{2}{3}\%$	$16\frac{2}{3}\%$
$16\frac{2}{3}\%$	$16\frac{2}{3}\%$	$16\frac{2}{3}\%$

19. What part of this oblong is $16\frac{2}{3}\%$ of it? What per cent of this oblong is $\frac{1}{6}$ of it? $\frac{1}{3}$? $\frac{2}{3}$? $\frac{6}{6}$?

20. How many inches in $16\frac{2}{3}\%$ of 1 ft.? Inches in $16\frac{2}{3}\%$ of 1 yd.? Square inches in $16\frac{2}{3}\%$ of 1 sq. ft.? Hours in $16\frac{2}{3}\%$ of 1 da.? Minutes in $16\frac{2}{3}\%$ of 1 hr.? Months in $16\frac{2}{3}\%$ of 1 yr.? Sheets in $16\frac{2}{3}\%$ of 1 quire?

21. What is the difference in hours between $16\frac{2}{3}\%$ and $12\frac{1}{2}\%$ of one day?

22. What per cent of 1 gal. is 1 pt.? Of 1 qt. is $\frac{1}{2}$ pt.? Of 1 da. is 4 hr.? Of 1 yr. is 8 mo.? Of 1 quire is 18 sheets? Of 1 score is 8 units?

23. Mrs. Hume spent \$4 for a chair and \$28 for a rug. What per cent of the whole sum did the chair cost?

24. If the price of flour advances from \$5 to \$5.50 a bbl., what is the per cent of increase?

25. A fruit dealer buys oranges at 8¢ a doz., and sells them at 1¢ apiece. Find his gain per cent.

Lesson 99

1. Find the quantity of which \$2 is $12\frac{1}{2}\%$. \$.08 is 50%. \$2.50 is $16\frac{2}{3}\%$. $\frac{1}{2}$ pt. is 25%. 6 bu. is $66\frac{2}{3}\%$. 12 mi. is 75%. 12 mi. is 60%.

2. What is meant by saying that $12\frac{1}{2}\% = \frac{1}{8}$? $16\frac{2}{3}\% = \frac{1}{6}$? $\frac{1}{3} = 33\frac{1}{3}\%$? $66\frac{2}{3}\% = \frac{2}{3}$? $\frac{3}{4} = 75\%$? $100\% = 1$?

3. What per cent of 1 lb. Avoir. is 12 oz.? Of 1 quire is 18 sheets? Of 1 da. is 8 hr.? Of 1 yr. is 6 mo.? Of \$1 is 20¢?

4. What is the ratio of 25% of a quantity to 75% of it? Of 75% to 25 ? Of $33\frac{1}{3}\%$ to $66\frac{2}{3}\%$? Of 80% to 20%? Of 20% to 80%? Of $16\frac{2}{3}\%$ to

$33\frac{1}{3}\%$? Of $33\frac{1}{3}\%$ to $16\frac{2}{3}\%$? Of 60% to 40%? Of 40% to 60%?

5. In a certain school $33\frac{1}{3}\%$ of the pupils are boys, and there are 28 girls. Find the number of boys.

6. A young man spends 40% of his salary; what per cent does he save? If he spends $24 a month, what does he save?

7. A kitchen range burns 50% of 1 T. of coal a month. How many tons does it burn in one year?

8. A man sold a cow that cost $36 at a loss of 25%. Find the selling price.

9. A young man put $64 in a savings bank and soon after drew out $12\frac{1}{2}\%$ of it. How much still remained in the bank?

10. From a 5-gal. can of oil 2 gal. are drawn out. What per cent still remains in the can?

11. What per cent is lost by selling goods at $\frac{3}{4}$ of the cost? At $\frac{2}{3}$ of the cost?

12. What per cent is gained by selling goods at $\frac{5}{4}$ of the cost? At $\frac{4}{3}$ of the cost?

13. 25% of the number of bushels of grain raised by a farmer are oats and 50% wheat. If he raises 320 bu. of oats, how many bushels of wheat does he raise?

14. A young man in the High School studies at home $12\frac{1}{2}\%$ of the entire day. How many hours does he study at home each day?

15. A merchant buys 60 yd. of silk for \$180 and sells it at an advance of 20%. Find the selling price per yd.

16. A man paid \$150 for a horse and 50% more for a carriage. Find the cost of both.

17. What per cent is gained if cloth costing 30 ¢ a yard is sold for 40 ¢? 36 ¢? 42 ¢? 35 ¢? 50 ¢?

18. What per cent is lost if cloth bought at 36 ¢ is sold for 27 ¢? 30 ¢? 24 ¢?

19. If hats are bought at \$2.50 and sold for \$3 apiece, find the gain per cent.

20. Eggs bought at \$3 a crate of 30 doz. are sold at 12 ¢ a dozen. Find the gain per cent.

SECTION XIII

Lesson 100

1. Name five different units of length that will exactly measure a line 12 in. long. What is the ratio of the line to the 6-in. unit?

2. I owe a debt measured by the number 8 and the unit \$5. How many ten-dollar bills will pay the debt? What is the ratio of the debt to \$10?

3. A fruit dealer arranges his apples in piles of 4 for 5¢. If he sells 1 pile to each of 6 customers, how many apples does he sell? For how much?

4. If the measuring unit is a line 3 in. long, draw the line made up of three parts, the first being 3 times, the second 4 times, and the third 5 times the measuring unit? How many inches in the line?

5. What is the quantity which is equal to the sum of 5, 3, and 6 times the measuring unit?

6. A fruit dealer sells his apples at the rate of 6 for 5¢. He sold five cents' worth to each of 9 customers. How many apples did he sell?

7. A horse which travels at the rate of 6 mi. an hour goes from A to B in 2 hr., and from B to C in 3 hr. How long is the road from A to C?

8. Find the number of times that a clock strikes from 8.30 A.M. until 2.30 P.M., if the clock strikes every hour.

9. A man left to his widow $8350, to his son $6425, and to his daughter $5725. Find the value of his property.

10. Find the capacity of four bins, the first of which will contain 65.223 bu., the second 34.542 bu., the third 20.112 bu., and the fourth 19.123 bu. If these four bins are full of wheat, what is it worth at $1 a bushel?

11. A merchant sold 122 yd. of cloth from a piece containing 150 yd. What is the remainder worth at $.50 a yd.?

12. What quantity is the difference between the numbers 6 and 2, the unit being $5? $10? $20?

13. How much greater are 6 units of $9 than 5 units of $10? What is the ratio of this difference to the unit $2?

14. A car containing 24 T. of coal was divided between two families. If the first got 11.25 T., how many did the second get?

15. Find the number of square feet in an oblong garden 12 yd. long and 9 yd. wide.

16. Two vessels start from the same point and travel down stream, the first at the rate of 12 mi. an hr. and the second at the rate of 8 mi. an hr. How far apart will they be in 6 hr.?

17. If these two vessels travel in opposite directions at the same rate, how far apart will they be in 6 hr.? Mark off a line to represent this distance?

18. A speculator bought 5 lots at $600 each, and 4 lots at $500 each. He sold them for $575 apiece. Find his gain.

19. Find the weight of a block of wood 3 ft. long, 2 ft. wide, and 1 ft. thick, weighing 32.5 lb. per cu. ft.

20. A drover bought 8 sheep at $5.35 per head, and 17 at $4.25. Find the total cost. Find his gain on selling them for $150.

Lesson 101

1. A string 36 in. long has a piece 4 in. long cut off, and then another piece of the same length, and so on. How often can this be done? What is the unit here?

2. In question 1, what is the ratio of the length of the string to that of the unit? Of the length of the unit to that of the string?

3. Divide $24 between A and B, giving B 3 times as much as A. What is the unit here?

4. Divide \$30 between A, B, and C, giving B twice as much as C, and A $1\frac{1}{2}$ times as much as B. What is the unit here?

5. A merchant sold cloth at \$1 a yd., and an equal quantity at \$2 a yd. What did 1 yd. of each sell for? If all the cloth sold for \$24, how many yards of each did he sell? What is the unit here?

6. A merchant sold silk at \$2 a yd., and an equal quantity at \$3 a yd. If all the silk sold for \$80, how many yards of each did he sell? What is the unit here?

7. A township is 6 mi. square. Draw a township, making 1 in. for 1 mi. What is its area?

8. A township is divided into 36 sections, each 1 mi. square. Divide the township you have drawn into 36 sections. How many square inches in your drawing represent one section?

9. Each section of one square mile contains 640 A. Divide one section into 4 farms of 160 A.

10. What is the difference in area between a 6 in. square and an oblong containing 6 sq. in.?

11. Into how many townships can a tract of land 12 mi. square be divided?

12. What is the ratio of 20 min. to 1 hr.? A train runs 15 mi. in 20 min. At the same rate how far would it go in 1 hr.?

13. Soap that cost 4¢ a cake is sold for 5¢. The gain is what part of the cost? What per cent of the cost?

14. If 3 ft. is the unit of length, what is the unit of area?

15. Divide $48 between Julian and Alder so that Julian may get $3 for every $1 Alder gets. What is the unit here?

16. Roy has 24 marbles, and Cecil 6. They play together, and Roy loses $\frac{1}{4}$ of his. How many has Cecil now?

17. Draw a line 10 in. long. Measure it with a unit $\frac{1}{6}$ ft. long. How many times did you measure? 10. in. is equal to $\frac{5}{6}$ ft. What is the unit here? What is the number?

18. Draw a line 9 in. long. Measure it with a unit $\frac{1}{4}$ ft. long. How many times did you measure? 9 in. is equal to $\frac{3}{4}$ ft. What is the unit here? What is the number?

19. Name the units that measure the following quantities and give the number of units: $\frac{2}{3}$ ft., $\frac{3}{4}$ yd., $\frac{8}{9}$ yd., $\$\frac{3}{4}$, $\frac{7}{8}$ lb., $\frac{11}{12}$ da., $\frac{5}{6}$ hr., $\frac{3}{8}$ bu., $\frac{6}{7}$ wk., $\frac{5}{12}$ quire, and $\frac{7}{10}$ score.

20. What part of a dollar is needed to give $\frac{1}{5}$ of a dollar to each of 4 persons? What is the number here? The unit? The quantity?

21. What quantity is measured by the number 12 and the unit $\frac{1}{4}$ ft.?

22. What quantity is measured 4 times by the unit $\frac{1}{7}$ wk.?

23. How often does the unit $\frac{1}{6}$ bu. measure the quantity $\frac{5}{6}$ bu.?

24. What is the unit that measures the quantity $\frac{3}{8}$ lb. 3 times?

Lesson 102

1. George gives away $\frac{1}{3}$ of his marbles and has 16 left. How many had he at first?

2. A paid \$40 an acre for a farm. This was $\frac{1}{2}$ of what B paid an acre for his farm. What did B pay for his farm of 60 A.?

3. A man earns \$$3\frac{1}{2}$ a day, and his daily expenses are \$$1\frac{1}{2}$. In how many days will he save enough to buy a bicycle costing \$60?

4. Bought tea at 75¢ a lb. and sold it at a gain of $33\frac{1}{3}\%$. Find the selling price.

5. James received a present of \$24. He gave $\frac{1}{3}$ of it to his sister, and $\frac{1}{2}$ of the remainder to his brother, and kept the rest himself. How much did each receive?

6. How many pounds of butter, worth \$.21 a lb., will cost \$20.58?

7. If a man eats 32 oz. of bread in one day, how many pounds will he eat in one week?

8. Two farmers go to market. The first has 36 bu. of wheat weighing 60 lb. a bu., and the second 48 bu. of oats weighing 32 lb. a bu. Which load is heavier and how much?

9. What will 12 bu. 30 lb. of wheat cost at \$.84 a bu.? What will 15 bu. 8 lb. of oats cost at \$.36 a bu.?

10. A farmer sold 6 loads of wheat, each containing 32 bu., at \$.94 a bu. Find the total selling price.

11. Find the cost of laying a cement sidewalk 30 yd. long and 4 ft. wide, at 16¢ a square foot.

12. A house worth \$4800 is insured for 75% of its value. For what is it insured?

13. A manufacturer employed 25 men, paying on the average \$1.50. What will it cost him a day to increase their wages 10%?

14. Of 30 pupils in a grade 3 were not promoted. What per cent of the class failed to be promoted?

15. A lady is 27 years of age. If her age is 75% of her husband's, how old is he?

16. A lady spent $66\frac{2}{3}$% of the money in her purse for furniture, $16\frac{2}{3}$% for carpet, and the rest for a jacket. What per cent did she spend for a jacket? If this was \$25, how much had she at first?

17. A dressmaker has 12 dresses to make. If she makes $33\frac{1}{3}\%$ of them in 12 da., how many days will she take to make them all?

18. I bought 6 doz. lemons at \$.20 a doz., and sold them for 2¢ each. What was my gain per cent?

19. A man had \$6000 in the bank. He drew out 50% of it and bought a house with 75% of the sum drawn out. Find the cost of the house.

20. In a school there are 42 pupils, the ratio of the number of boys to the number of girls is 3 to 4. How many of each?

Lesson 103

1. Write down neatly the following statement of six weeks' cash receipts; add the amounts vertically and find the sum of the totals:

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.
1st	\$26.53	\$32.15	\$36.21	\$28.06	\$25.84	\$45.63
2d	21.78	28.28	31.43	32.60	27.97	44.55
3d	18.66	24.12	26.55	27.13	24.95	41.16
4th	26.94	35.92	32.19	36.08	22.31	48.29
5th	16.23	31.14	35.56	32.23	29.99	54.93
6th	19.20	25.05	24.97	29.67	24.15	60.03
Total						

2. Add as in question 1:

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.
1st	$ 54.73	$ 35.71	$ 68.68	$ 37.69	$ 53.44	$ 67.41
2d	46.17	65.41	34.76	62.07	61.16	52.61
3d	45.80	57.29	42.63	71.28	68.72	67.43
4th	47.47	60.50	78.25	63.36	45.76	43.80
5th	64.52	39.65	45.38	15.75	32.74	74.45
6th	52.41	43.77	58.97	42.57	41.78	65.28
Total						

3. Add as in question 1:

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.
1st	$ 86.93	$ 76.19	$ 67.60	$ 74.61	$ 69.65	$ 68.29
2d	93.47	68.37	86.43	64.62	57.42	74.95
3d	64.55	76.04	53.86	65.02	69.38	78.54
4th	97.98	93.57	64.36	59.41	23.45	96.71
5th	62.67	86.21	68.15	62.39	46.29	76.58
6th	49.78	46.53	76.28	78.35	95.43	93.75
Total						

Add:

4.	6134	9268	3257	2168
	8497	5769	7931	8394
	4758	3275	4528	5486
	2738	4623	2832	9034
	4243	2752	4654	9657

5.

25146	67125	92745
9829	878	35924
58797	4572	57436
6543	27639	25372
462	44444	31819

6.

34	58	52	78	39	69
15	47	93	73	86	93
75	29	35	28	64	82
62	97	67	89	26	45
28	32	63	83	97	37
99	49	68	44	36	66
95	78	81	60	99	58
32	52	39	33	78	87
57	91	42	56	64	62
43	47	55	78	76	63

7.

6958.994	7936.042	6683.145
8772.343	7721.358	948.03
5822.962	2546.563	7364.207
7319.526	7864.289	4563.09
8393.751	7325.004	7825.4

Subtract:

8.	\$3862.93	\$6760.68	\$1696.65
	1391.76	1098.91	43.68
9.	\$3976.98	\$2035.68	\$1948.39
	1678.63	364.76	1754.46

10.	$3559.83 1932.57	$4264.15 1268.34	$1763.29 685.38
11.	$5436.29 4963.19	$2678.28 312.83	$1180.66 119.25
12.	$2016.72 1215.17	$8416.60 1542.24	$5300.20 2223.42
13.	$1732.25 1214.03	$4656.20 738.75	$1097.47 1024.74
14.	$3661.00 1139.67	$1201.60 311.20	$1850.14 196.17
15.	24375 14692	95657 6478	16125 5765
16.	84329 59761	49328 1760	29845 14008
17.	819634 497256	205639 174593	726998 395432
18.	337.877 199.601	698.206 587.964	279.345 158.709
19.	56.979 28.034	34.702 15.96	632.194 576.4
20.	84.67 19.483	49.107 28.315	56.5 26.548
21.	158. 36.427	223. 1.89	599.78 64.532
22.	382.635 13.284	32.808 12.08	77.065 49.17

23.	392. / 1.473	45.652 / 18.654	445.2 / 159.304
24.	171.8 / 25.631	672.39 / 43.1	239.76 / 173.291

Lesson 104

Multiply:

1.	456 32	439 25	862 85	676 68	864 96
2.	\$55.76 28	\$62.24 48	\$34.36 43	\$76.82 15	\$46.29 75
3.	\$57.06 13	\$67.82 26	\$43.85 58	\$60.09 88	\$39.95 63
4.	57261 38	89437 15	65435 48	23826 73	16436 84
5.	653 231	429 324	384 256	629 125	439 121
6.	307 268	255 199	460 121	720 340	840 350
7.	907 359	707 660	796 263	129 888	930 725
8.	1495 236	1598 426	2716 287	3948 635	5048 650

9.	3526 819	1521 637	6432 568	9780 876	1946 621
10.	$64.32 321	$32.34 125	$18.64 253	$84.50 212	$13.67 631
11.	$17.01 784	$83.95 214	$22.35 523	$38.26 350	$63.51 208
12.	$68.91 141	$11.51 189	$14.93 276	$26.57 801	$39.03 168
13.	$90.75 324	$34.26 275	$64.29 343	$35.28 653	$42.86 797
14.	42.57 375	8.764 423	1.534 264	.295 147	.375 294
15.	6.293 435	.826 131	9.12 258	6.293 219	2.03 145
16.	115.5 818	3.064 513	48.18 155	585.3 306	4.659 314

In the following questions name the trial divisors and find the quotients and remainders:

17. 32)4985 52)2735 61)6751 43)8668

18. 49)3548 66)5675 54)2085 19)5921

19. 36)6772 87)5439 73)9106 99)6487

20. 212)2524 314)7768 425)3467 512)5394

21.	108)5695	219)9488	706)9983	822)7786
22.	198)9897	299)3428	384)7534	795)2857
23.	346)67894	578)17639	289)33333	684)46999
24.	563)26407	662)40640	147)68952	365)41707
25.	839)17788	777)18810	556)79964	319)68795

ANSWERS

Lesson 58

12. 11¢. **15.** $19, $31, 50¢, 68¢. **16.** 31¢. **17.** 4¢.

Lesson 60

3. 81, 60, 91, 110, 121, 101, 119, 112. **4.** 697, 861, 751, 811, 920, 1221. **5.** 969, 719, 871, 917, 811, 1181. **6.** 68, 95, 41, 90, 71, 50, 51, 101. **7.** 23, 33, 13, 32, 36, 48, 48, 35. **8.** 632, 562, 80, 238, 344, 709. **9.** $390. **10.** $1.11. **11.** $125. **12.** $2.35. **13.** $1091. **14.** $991.

Lesson 61

5. 41¢. **7.** 60, 62, 95, 127, 82, 120, 122, 111. **8.** 982, 1000, 1229, 729, 802, 920, 929. **9.** 981, 828, 1121, 990, 1100, 999, 1110. **10.** 71¢. **11.** 237, 258, 342, 315, 413, 532, 733. **12.** 2222, 3210, 1023, 2626, 1061, 1802. **13.** 5336, 5104, 3015, 2050, 6591, 89. **14.** 872. **15.** $1365. **16.** $1220. **17.** 91 da., 92 da.

Lesson 62

5. 72¢. **6.** 61, 83, 81, 102, 103, 132, 138, 138. **7.** 783, 919, 923, 1369, 1383, 1113, 837, 1112. **8.** $1.22. **9.** 1068, 629, 1099, 732, 1332, 1110, 1182, 810. **10.** 443, 131, 164, 282, 63, 494, 156, 257. **11.** 4304, 2202, 4013, 6033, 1113, 4004, 4150, 1000. **12**. 1214, 4990, 1382, 661, 1324, 941, 2548, 2423. **13**. $705. **14**. 1905. **15**. $1190. **16**. $1000. **18**. $65.

Lesson 63

10. 524, 1023, 1696, 2605, 1015, 1565. **13**. 120 mi. **22**. 32.

Lesson 64

10. 792, 1188, 1584, 1980, 2376, 3036. **13**. $2250. **16**. 25, 54, 76, 49, 67, 122. **17**. 288, 192, 144, 130, 144, 139. **18**. 176, 117, 147, 64, 56, 51. **19**. 99, 66, 65, 52, 63, 56. **21**. 102 bu. **22**. $200, $40.

Lesson 65

14. $9.87, $59.37, $846.48, $6329.86. **15**. $62.69, $888.18. **16**. $38.59. **17**. $5.33, $41.32, $41.31, $1133.11. **18**. $11.25. **19**. $2.35. **20**. $15.69, $88.60, $157.55, $1280.52. **21**. $39.75. **22**. $24.13, $27.50, $.23, $.03, $125.75, $80.65. **23**. $248.65. **24**. $11.20.

Lesson 66

3. 2 gal. 2 qt. 1 pt. **15**. 6¢, 3¢, 45¢, 69¢.

Lesson 67

1. 8 gal. 1 qt. **4**. 1 gal. 3 qt. **5**. 8¢, 48¢. **12**. 8 gal. 2 qt., 17 gal. **13**. 27 lb. **14**. 96¢, 4¢. **15**. 4 wk. **16**. 36¢. **18**. 12¢. **20**. $15. **21**. Dime, nickel, and penny.

Lesson 68

1. 16 qt. 1 pt. **2.** 99¢. **3.** 39¢. **5.** $5\frac{1}{4}$ hr., $26\frac{1}{4}$ hr. **10.** 174 mi. **12.** $ 234. **13.** $ 52. **16.** 45¢. **18.** 2 gal. 3 qt. 1 pt. **19.** 14. **22.** 20 mi.

Lesson 69

5. $ 21. **6.** $ 74. **7.** 59, 92, 134, 133, 141, 84, 132, 129. **8.** 415, 709, 822, 803, 741, 1201, 1444, 1384. **9.** 949, 1498, 1535, 1174, 1202, 1454, 900, 910. **11.** 144. **12.** 996. **13.** 432, 404, 182, 530, 183, 451, 43, 243. **14.** 4104, 6912, 909, 3991, 1095, 526, 3778, 4913, 818, 3651. **16.** 66. **17.** 26 mi.; 23 mi. **18.** 514 A. **19.** $ 64.75. **20.** $ 46.50. **21.** $ 63, $ 21. **22.** 24.

Lesson 70

6. $ 41.25. **7.** 62 lb. **8.** 75, 139, 122, 124, 135, 90, 133, 155. **9.** 661, 872, 653, 1443, 1415, 1223, 652, 1201. **10.** 976, 1588, 1445, 924, 842, 1578, 1328, 1522. **11.** 115 mi. **12.** 120 mi. **13.** 431, 262, 343, 161, 297, 406, 175, 158. **14.** 3621, 786, 2625, 4426, 1866, 1628, 5788, 1888. **15.** 256 A. **16.** 18¢. **17.** $ 1050. **18.** 9¢. **19.** $ 675. **20.** 131 days.

Lesson 71

5. 8; 5; 14; 8; 12. **6.** 6 in. **7.** 5 gal. **9.** 1824, 2905, 4170, 6615, 6986, 4704. **11.** $ 3192. **13.** 42, 26, 73, 35. **15.** 63¢. **16.** 24 bbl. **17.** 25¢. **18.** 92¢.

Lesson 72

5. $ 9.50. **6.** $ 50. **7.** $ 12.60, $ 40.45, $ 13.14, $ 17.92, $ 31.68. **8.** 1744. **9.** $ 2848, $ 356.

10. \$246, 305, 356, 873 bu. **11**. 176 A. **12**. 274. **13**. \$1.28. **17**. 60¢. **23**. 44¢, 3 qt. **24**. 24 times.

Lesson 73

4. 19 qt., 46 qt., 60 qt., 32 qt., 96 qt., 164 qt. **5**. 48 qt., 112 qt., 72 qt., 20 qt., 30 qt. **6**. 11 pk., 92 qt., 116 qt., 131 qt. **7**. 1 lb., 8 lb., 94 lb. **8**. $\frac{1}{2}$ bu., 210 lb. **10**. $1\frac{1}{8}$ bu., $4\frac{1}{2}$ bu., $1\frac{1}{2}$ bu., 90¢. **11**. 75 lb. **13**. 24 oz., 44 oz., 58 oz., $\frac{1}{4}$ lb., $\frac{1}{2}$ lb., $\frac{3}{4}$ lb., $\frac{1}{16}$ lb., $\frac{1}{8}$ lb., $\frac{5}{16}$ lb. **14**. 4¢. **15**. 76 oz. **16**. 52 oz., 70 oz., 88¢.

Lesson 74

16. 720. **17**. 231 cu. in. **18**. 8000 oz. **19**. 6 lb. **20**. 96 sq. in.

Lesson 75

16. CX, CXL, CXLIX, CL, CLIV, CLXXXII, CXC, CXCIV. **17**. CCC, XV, CCCXV; CC, LXXXIV, CCLXXXIV; D, XCIX, DXCIX; DCXIV, DCCXXXIX, DCCCXXVII, DCCCCXXXIV. **18**. M, CCL, MCCL; CCCXLIV, MCCCXLIV; MDCCCXCVIII, MCCCCXCII.

Lesson 76

3. \$18. **5**. \$15. **6**. \$21, \$24, \$11. **7**. 20¢. **8**. The latter, 1¢. **11**. \$10, \$70. **12**. \$16, \$15, \$24, 8 lb., 6 lb., 24 lb. **13**. 15 gal., 16 gal., 18 gal., 15 yd., 35 yd., 21 yd. **14**. 12 yd., 6 yd., none. **16**. $\frac{1}{2}$, 48¢. **18**. 28¢. **19**. $\frac{1}{3}$, 3. **22**. $\frac{1}{5}$; 5; 540 lb. **23**. \$3.60. **24**. 90 mi.

Lesson 77

16. 64 pt., 24 pt., 16 pt., 8 pt., $\frac{1}{8}$ gal., 40 pt., $\frac{5}{8}$ gal. **17**. 40 pt., $\frac{5}{8}$ gal. **22**. 40 yr.

Lesson 78

2. $\frac{7}{10}$, $\frac{3}{10}$, $\frac{9}{10}$, $\frac{1}{10}$, $\frac{3}{10}$, $\frac{1}{10}$ lb. **3.** $\frac{3}{10}$ lb., 20 ¢. **5.** \$ $\frac{9}{10}$, 90 ¢, 10 ¢. **6.** 1 cent, 1 nickel, or 1 dime. **15.** $\frac{3}{4}$, $\frac{5}{6}$, $1\frac{1}{6}$, $1\frac{1}{12}$, $1\frac{1}{9}$, $2\frac{8}{15}$, $2\frac{4}{15}$, $5\frac{13}{20}$, $1\frac{7}{20}$, $1\frac{1}{8}$, $7\frac{11}{12}$, $2\frac{9}{20}$. **16.** $\frac{1}{4}$, $\frac{1}{6}$, $\frac{5}{12}$, $\frac{1}{12}$, $\frac{1}{9}$, $\frac{2}{15}$, $\frac{2}{15}$, $2\frac{7}{20}$, $2\frac{1}{15}$, $3\frac{1}{4}$, $2\frac{1}{20}$, $2\frac{17}{30}$. **18.** $1\frac{3}{10}$ A. **19.** \$ $2\frac{3}{4}$. **20.** \$ $3\frac{1}{4}$.

Lesson 79

1. \$ 9. **5.** $\frac{9}{10}$, $\frac{1}{10}$, \$ 6000. **7.** $\frac{14}{15}$, $\frac{1}{15}$, 150 A. **8.** 60 da. **14.** $\frac{5}{8}$, $\frac{3}{8}$. **15.** 240 A., 90 A., 60 A., 90 A. **18.** $\frac{7}{10}$, $\frac{3}{10}$, \$ 30.

Lesson 81

1. 21 gal. **2.** 2 lb. 6 oz. **3.** 1 in., 30, No. **4.** 7, \$ 3.50. **5.** 400 yd., \$ 24, \$ 96. **6.** \$ 4.80. **7.** 6 yd. 3 in. **8.** 42 A. **9.** 2 mi., 4 sq. mi. **10.** 6 lb., 70 lb. **11.** \$ 77. **12.** 32 lb. **13.** 24 yd., 4 yd. **14.** 60 lb., 40 lb. **15.** \$ 3.60. **16.** \$ 4.80. **17.** 6 mi., 36 sq. mi. **18.** 44 strips, 2 ft. **19.** 4 bu. 3 pk. **20.** 40 mi. an hr. **21.** 30 mi.

Lesson 82

4. 34, 40, 37, 62, 80, 86, 97, 108. **5.** \$ 126.20, \$ 69.36, \$ 98.30, \$ 134.35, \$ 528.98, \$ 667.70, \$ 8841.60, \$ 4668.08. **6.** \$ 572.24, \$ 670.91, \$ 1409.52, \$ 755.06. **7.** \$ 624.52. **8.** 72 bu., \$ 72.85. **9.** \$ 7.95, \$ 8.88, \$ 59.49, \$ 276.99. **10.** \$ 108.47, \$ 1569.85, \$ 696.97, \$ 2255.43. **11.** \$ 495. **12.** \$ 24.25. **13.** \$ 8.83. **14.** 12 lb.

Lesson 83

5. 9 A., 12 fields of 9 A. each. **6.** \$ 3598.14, \$ 9445.28, \$ 238.95, \$ 874.98. **7.** \$ 7659.18, \$ 6648.75, \$ 2190.96,

$ 9877.23. **9.** $ 25, $ 6; $ 96, $ 4; 88 mi., 6 mi.; 75 of the unit, 1 of the unit; 35 of the unit, 4 of the unit. **10.** $ 23,300. **11.** 35 bu. **12.** 8 da. **16.** $ 45, 9 da. **19.** $ 13.50. **20.** $ 155.25. **22.** $ 240. **23.** $ 3, $ 9.

Lesson 84

4. Add zero. **5.** Add two zeros. **12.** 16 bu. 2 pk.

Lesson 85

10. $ 1626.47, $ 1134.19, $ 793.44, $ 1995.21. **11.** $ 3999.97, $ 5394.61, $ 12,779.69, $ 5439.09. **12.** 33,431 sq. mi. **13.** 391 sq. mi. **14.** $ 308.96, $ 180.40, $ 5700.48, $ 475.59. **15.** $ 178.16, $ 4086.17, $ 5579.91, $ 15,080.64. **16.** 1250 sq. mi. **17.** 7300 sq. mi. **18.** $ 5725, $ 11,450. **19.** $ 277.68, $ 172.74, $ 303.48, $ 124.75. **20.** $ 537.44, $ 2553.32, $ 14,106.32, $ 24,104.52. **21.** $ 13,100. **22.** $ 979.40, $ 708.05, $ 376.12, $ 649.15. **23.** 636 sheep. The quantity and the unit. The number. **24.** 144.

Lesson 86

9. 912, 1392, 864, 2432, $ 1600, $ 752. **10.** 1536 lb. **11.** 507. **12.** $ 575. **13.** $ 980, $ 221, 2176 lb., 1026 mi., 304 mi., $ 1152. **15.** 1638, 5293, 8811, 5394, 7050, 7396. **16.** 5544, 5632, 2912, 7224, 23,360, 66,975. **17.** $ 531.12, $ 1162.89, $ 464.64, $ 2824.90, $ 979.02, $ 1386.49. **18.** $ 1762.65, $ 6221.16, $ 7823.99, $ 1156.34, $ 6533.15, $ 5095.24. **19.** $ 5031. **20.** 2592 mi.

Lesson 87

2. 43, 32, 62, 62, $ 64, 48. **3.** 33, 56, 75, 72–4, 33, $ 56, $ 75. **4.** $ 31. **5.** 37 hr. **6.** 36 cows. **7.** $ 23. **11.** 139, 135, 85, 154. **12.** 44, 31; 48, 40; 731, 14; 211; 580, 9; 77, 25; 281, 81; 86, 39. **13.** 72 da., 167 da., 907 da. **14.** 312 q. **15.** 49 wk., $ 14. **16.** $ 96.

Lesson 88

2. 201, 13; 161, 47; 121, 6; 87, 46; 393, 18; 126, 18; 55, 60; 78, 13; 71, 10; 113, 40; 529, 2; 1454, 27. **3.** 225 lb., $ 12.25. **4.** 36 bu., $ 28.80. **5.** $ 128. **6.** $ 75, 15 A., $ 1125. **7.** $ 55, $ 2340. **8.** 4 doz. **9.** 757, 20; 1428, 35; 943, 21; 577, 36; 2073, 5; 871, 11; 1581, 10; 790, 33; 707, 14; 3840, 7; 2313, 39; 5655, 2. **10.** 545 rugs. **11.** $ 7.41, $ 7.50, $ 2.94, $ .33, $ .22, $ .06, $ .14, $ .04. **12.** $ 1.23, $ 2.94, $ 1.94, $ .54, $ 1.34, $ .75, $ 29.74, $ 5.52, $ 8.63. **13.** $ 4.85. **14.** $ 3.15.

Lesson 89

8. 8 lb. **9.** 4. **10.** 3. **11.** 2. **12.** 12. **13.** 250. **14.** 52, 14, 15, 27, 36, 25. **15.** 72, 6 doz. **16.** 16. **17.** 17. **18.** 326, $ 13.04. **19.** 250 bu., 23¢. **20.** 150 bu.

Lesson 90

4. $ 63.98. **5.** $ 39.71. **6.** $ 20.59. **7.** 15¢ per 100 lb. **8.** $ 1503.25. **9.** $ 56.26. **10.** 63¢. **11.** $ 4.63. **12.** $ 5.45. **13.** 33¢. **14.** 226. **15.** 324. **16.** 125.

Lesson 93

1. 20,714, 2071.4, 207.14, 20.714. **2**. 132.23, 90.638, 1603.584. **3**. 15.046, 1.905 bu. **5**. 67.616 A. **6**. 19.26 mi. **7**. 2.114, 4.386, 12.631, 17.629. **8**. 2.216, 5.244, 1.749, 160.739. **9**. 4.125 yd. **10**. 67.125 A. **11**. .875. **13**. 10.56 A., 1.712 da. **14**. 10.56 A., 1.712 da. **15**. .846, 5.94, 24.164, 65.872, 182.133. **16**. 34.08, 102, 3135.6, 28.248, 3.648. **17**. 173.25, 54.918, 283.986, 1621.5, 216.432. **18**. 196.855. **20**. 28.375. **21**. $33.75. **22**. $2106. **23**. 8.64; 8.64; 1.536; 1.536; 4.24; $4.24; $61.44; 66.04; 66.04; 133.56; 133.56. **24**. 60. **25**. 33.264 yd., 2.736 yd.

Lesson 94

2. 2.163, 2.944, 9.412, .299, 19.695, 3.313, 2.498, .792, .351, .068, 2.248, .917, .999, 8.646, 10.853. **3**. 16.172 mi. **4**. $.875. **5**. 67.2 cu. in. **6**. 57.75 cu. in. **8**. 1.307, 3.12, .142, .409, 4.17, 1.411, 48.7, 1.66. **9**. $32.25. **10**. $.875; $9.375. **12**. 11.5, 8.77, 361.5, .725, 60, .049, 9.5, 11.15, .203, 25, 4.5, 42, 8.41, 5.24, 1200, 52, 12.52, .387, 5.63, 12. **13**. 29. **14**. 600. **15**. 90¢; $1.17. **18**. 6.6, 126, 287, 67.7, 68, 2.1, 25.96+, 81, 6.24, 35.08, .875, 123.6, 20, 200, 12, 40, 600, 400. **20**. .875. **21**. 23. **22**. 320. **23**. .33; .67. **24**. 300. **25**. 60 da.

Lesson 95

23. $32. **24**. $25. **25**. $100. **27**. 30¢. **29**. $12, $15. **30**. 36 yr. **31**. $60, $720.

Lesson 96

9. 50¢. **10.** 2100. **11.** \$3000, \$7500. **12.** 80¢, 20¢. **13.** \$45. **14.** \$35. **15.** 1500. **18.** $33\frac{1}{3}\%$. **19.** 25%. **20.** $33\frac{1}{3}\%$. **21.** 75¢. **22.** \$3200. **23.** 2700. **24.** \$4800.

Lesson 97

5. 20%, 60%. **6.** 75%. **7.** 24. **8.** 80%. **9.** 20%, 60¢. **10.** 25%. **11.** \$3. **12.** 5¢. **13.** 27¢. **14.** \$48. **15.** \$5. **16.** 25%. **17.** $33\frac{1}{3}\%$. **18.** \$18. **19.** 50%. **20.** \$40. **21.** \$1000. **22.** 300. **23.** $58\frac{1}{3}\%$.

Lesson 98

6. \$220. **7.** 2 mi. **8.** \$84. **9.** \$3000. **23.** $12\frac{1}{2}\%$. **24.** 10%. **25.** 50%.

Lesson 99

5. 14. **6.** 60%, \$36. **7.** 6 T. **8.** \$27. **9.** \$56. **10.** 60%. **11.** 25%, $33\frac{1}{3}\%$. **12.** 25%, $33\frac{1}{3}\%$. **13.** 640 bu. **14.** 3 hr. **15.** \$3.60. **16.** \$375. **17.** $33\frac{1}{3}\%$, 20%, 40%, $16\frac{2}{3}\%$, $66\frac{2}{3}\%$. **18.** 25%, $16\frac{2}{3}\%$, $33\frac{1}{3}\%$. **19.** 20%. **20.** 20%.

Lesson 100

1. 1, 2, 3, 4, and 6 in.; 2. **2.** 4; 4. **3.** 24 apples; 30¢. **4.** 36 in. **5.** 14 times the unit. **6.** 54 apples. **7.** 30 mi. **8.** 45 times. **9.** \$20,500. **10.** 139 bu.; \$139. **11.** \$14. **12.** \$20; \$40; \$80. **13.** \$4; 2. **14.** 12.75 T. **15.** 972 sq. ft. **16.** 24 mi. **17.** 120 mi. **18.** \$175. **19.** 195 lb. **20.** \$115.05; \$34.95.

Lesson 101

1. 9 times, 4 in. **2.** 9, $\frac{1}{9}$. **3.** $6, $18; A's share. **4.** A $15, B $10, C $5; C's share. **5.** $3; 8 yd.; $3, *i.e.* the selling price of 1 yd. of each. **10.** 30 sq. in. **11.** 4. **12.** $\frac{1}{3}$; 45 mi. **13.** $\frac{1}{4}$, 25%. **14.** 9 sq. ft. **15.** $36; $12; $4. **16.** 12. **17.** 5 times; $\frac{1}{6}$ ft.; 5. **18.** 3 times, $\frac{1}{4}$ ft.; 3. **19.** $\frac{1}{3}$ ft., 2; $\frac{1}{4}$ yd., 3, etc. **20.** $ $\frac{4}{5}$, 4, $ $\frac{1}{5}$, $ $\frac{4}{5}$. **21.** 3 ft. **22.** $\frac{4}{7}$ wk. or 4 da. **23.** 5 times.

Lesson 102

1. 24. **2.** $4800. **3.** 30 da. **4.** $1. **5.** $8 each. **6.** 98 lb. **7.** 14 lb. **8.** Load of wheat; 624 lb. **9.** $10.50; $5.49. **10.** $180.48. **11.** $57.60. **12.** $3600. **13.** $3.75. **14.** 10%. **15.** 36 yr. **16.** $16\frac{2}{3}$%; $150. **17.** 36 da. **18.** 20%. **19.** $2250. **20.** 18, 24.

Lesson 103

1. $129.34, $176.66, $186.91, $185.77, $155.21, $294.59; $1128.48. **2.** $311.10, $302.33, $328.67, $292.72, $303.60, $370.98; $1909.40. **3.** $455.38, $446.91, $416.68, $404.40, $361.62, $488.82; $2573.81. **4.** 26,370; 25,687; 23,202; 34,739. **5.** 100,777; $144,658; 243,296. **6.** 540, 580, 595, 622, 665, 662. **7.** 37267.576; 33393.256; 27383.872. **8.** $2471.17; $5661.77; $1652.97. **9.** $2298.35; $1670.92; $193.93. **10.** $1627.26; $2995.81; $1077.91. **11.** $473.10; $2365.45; $1061.41. **12.** $801.55; $6874.36; $3076.78. **13.** $518.22; $3917.45; $72.73. **14.** $2521.33; $890.40; $1653.97. **15.** 9683; 89,169; 10,360. **16.** 24,568; 47,568; 15,837. **17.** 322,378;

31,046; 331,566. **18.** 138.276; 110.242; 120.636. **19.** 28.945; 18.742; 55.794. **20.** 65.187; 20.792; 29.952. **21.** 121.573; 221.11; 535.248. **22.** 369.351; 20.728; 27.895. **23.** 390.527; 26.998; 285.896. **24.** 146.169; 629.29; 66.469.

Lesson 104

1. 14,592; 10,975; 73,270; 45,968; 82,944. **2.** $ 1561.28; $ 2987.52; $ 1477.48; $ 1152.30; $ 3471.75. **3.** $ 741.78; $ 1763.32; $ 2543.30; $ 5287.92; $ 2516.85. **4.** 2,175,918; 1,341,555; 3,140,880; 1,739,298; 1,380,624. **5.** 150,843; 138,996; 98,304; 78,625; 53,119. **6.** 82,276; 50,745; 55,660; 244,800; 294,000. **7.** 325,613; 466,620; 209,348; 114,552; 674,250. **8.** 352,820; 680,748; 779,492; 2,506,980; 3,281,200. **9.** 2,887,794; 968,877; 3,653,376; 8,567,280; 1,208,466. **10.** $ 20,646.72; $ 4042.50; $ 4715.92; $ 17,914; $ 8625.77. **11.** $ 13,335.84; $ 17,965.30; $ 11,689.05; $ 13,391; $ 13,210.08. **12.** $ 9716.31; $ 2175.39; $ 4120.68; $ 21,282.57; $ 6557.04. **13.** $ 29,403; $ 9421.50; $ 22,051.47; $ 23,037.84; $ 34,159.42. **14.** 15,963.75; 3707.172; 404.976; 43.365; 110.25. **15.** 2737.455; 108.206; 2352.96; 1378.167; 294.35. **16.** 94,479; 1571.832; 7467.9; 179,101.8; 1462.926. **17.** 155, 25; 52, 31; 110, 41; 201, 25. **18.** 72, 20; 85, 65; 38, 33; 311, 12. **19.** 188, 4; 62, 45; 124, 54; 65, 52. **20.** 11, 192; 24, 232; 8, 67; 10, 274. **21.** 52, 79; 43, 71; 14, 99; 9, 388. **22.** 49, 195; 11, 139; 19, 238; 3, 472. **23.** 196, 78; 30, 299; 115, 98; 68, 487. **24.** 46, 509; 61, 258; 469, 9; 114, 97. **25.** 21, 169; 24, 162; 143, 456; 215, 210.

COMMENTS.

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