STRAYER-UPTON
PRACTICAL ARITHMETICS
SECOND BOOK
PART 2

BY

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PREFACE

This series of books aims to give the child the ability to compute easily and accurately, and to enable him to interpret and solve the quantitative situations which he will meet in everyday life. In the achievement of this aim, these books incorporate the most valuable findings of modern experimentation in the teaching of arithmetic, including the results of important researches conducted by the authors themselves. These books present only those methods and materials which have been thoroughly tested in the classroom by many experienced teachers.

It is an established principle of teaching that nothing stimulates a pupil's interest so much as the satisfaction he gets from his ability to do things successfully. If he finds himself steadily perfecting new skills in arithmetic, he will look forward to his arithmetic period and will approach each new problem with intelligent interest. In accordance with this principle, these texts require the pupil to take only one new step at a time and supply him with enough exercises to assure mastery of that step before proceeding to the next one. Thus the constant stimulus of success is made possible for the pupil.

In this book the following features are worthy of note:

1. This book is written for children, in language with which they are familiar. The greatest care has been taken in the selection of vocabulary.

2. The problems relate to the life and interests of the pupils. They are *real problems* in every sense of the word.

3. Motivation is the keynote of successful work in arithmetic. When a new topic is being presented, the pupils should know why the topic is important and how it is used in life. This fundamental principle of teaching is

applied throughout this series of books by presenting every new operation or detail of a process in connection with an interesting motivating problem that treats of some situation with which the child is familiar.

4. The explanations of new principles and processes have been made as simple and clear as possible.

5. All the abstract exercises have been scientifically constructed so as to provide drill on all the fundamental number combinations, with ample repetition of those recognized as most difficult. The pupil thereby acquires that automatic mastery of the basic computations which is so essential to rapid and accurate computation.

6. The total number of abstract exercises in this book is far greater than that usually found in elementary school texts. All these exercises have been graded with extreme care with reference to the difficulty of the steps involved.

7. The checking of computations is one of the most important habits that a child can form. Throughout this book checking is taught early in the presentation of each new operation and is constantly required in connection with all exercises.

8. A series of 84 Improvement Tests covering whole numbers, fractions, and decimals is included. These tests provide the most efficient and interesting means yet devised for keeping alive skills already learned while the pupil is studying new topics. For example, when the pupil is studying the addition and subtraction of fractions, the Improvement Tests provide the drill on whole numbers that is necessary to keep these skills active. These tests have the further advantage that the total time required to give and score them is less than 30 minutes a week thus leaving ample time to be devoted to the new work of the grade. For further information concerning these tests, see pages 16-20 of Part 1 of this book.

9. This book provides an exceptionally full and generous program of diagnostic and remedial work. Frequent diagnostic tests are given throughout the book, with keyed references to remedial exercises.

10. The carefully planned instruction in problem solving, which was given in the First Book of this series, is continued in this book. In addition to a large number of one-step problems in which the technical language expressions of arithmetic are frequently reviewed, special attention is now given to the solution of problems of two or more steps, with emphasis upon those types of two-step and three-step problems that occur most frequently in everyday life.

There are very few pages in the book on which all the problems may be worked by using the same operation, such as addition only. There are, on the other hand, many pages containing problems of different kinds, each of which the pupil has to study carefully before selecting the operation to be performed. By developing the pupil's initiative in this way and also by centering attention on the more common types of problems, as stated above, the pupil's ability in problem solving is developed as systematically as his skill in computation.

11. A series of tests on problem solving is also provided throughout the book. These tests cover types of problem situations with which every pupil should be familiar. An important feature of these tests is that they not only measure the pupil's mastery of types of thinking frequently employed in problem solving, but they also check his ability to interpret important language expressions and technical phrases peculiar to arithmetic. These tests are arranged in groups known as Groups A, B, and C. Each group consists of three tests; thus Group A consists of Tests A1, A2, and A3. The problems on Test A1 cover the same variety and types of problem situations and the same range of difficulty as those found on Tests A2 and A3. A pupil, therefore, should do better on the second and third tests of any group than on the first test. Thus the pupil has the satisfaction of seeing himself grow in problem-solving ability. The problems on the tests of Groups B and C cover, in similar manner, other sets of type problems.

12. This book contains many interesting projects and units of work involving quantitative relationships.

13. Full provision has been made for pupils of varying levels of ability. For those of average and below-average ability a large number of well-graded exercises is provided. For pupils of superior ability more difficult exercises marked with a star (*), are furnished. The diagnostic tests indicate the needs of each pupil and give references to suitable remedial work.

George Drayton Strayer

Clifford Brewster Upton

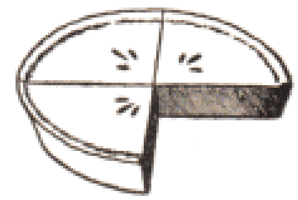
CONTENTS

Chapter II

CHAPTER II

DIVIDING FRACTIONS

1. Alma has $\frac{3}{4}$ of a pie. She divides it into 3 equal pieces. Then each piece is what part of the pie?



Just as 3 *apples* $\div$ 3 = 1 *apple*, so 3 *fourths* $\div$ 3 = 1 *fourth;* that is, $\frac{3}{4} \div 3 = \frac{1}{4}$. You see that you divide the numerator of $\frac{3}{4}$ by 3 to get $\frac{1}{4}$.

2. If Mary divides $\frac{4}{5}$ of a pie equally between 2 boys, what part of the pie does each boy get?

To divide $\frac{4}{5}$ by 2, you divide the numerator of $\frac{4}{5}$ by 2 and get $\frac{2}{5}$. Each boy gets $\frac{2}{5}$ of a pie.

In these problems you see that the numerator of the fraction is exactly divisible by the whole number.

To divide a fraction by a whole number, divide the numerator, if it is exactly divisible, by the whole number.

Exercises

1. Mother divided $\frac{6}{8}$ of a cake among 3 girls. What part of a cake did each girl get? What is $\frac{6}{8} \div 3$?

Divide the following fractions mentally:

2. $\frac{3}{4} \div 3$	**6.** $\frac{4}{5} \div 4$	**10.** $\frac{15}{16} \div 5$	**14.** $\frac{8}{5} \div 2$
3. $\frac{5}{6} \div 5$	**7.** $\frac{3}{5} \div 3$	**11.** $\frac{14}{15} \div 2$	**15.** $\frac{9}{8} \div 3$
4. $\frac{8}{9} \div 8$	**8.** $\frac{4}{7} \div 2$	**12.** $\frac{9}{12} \div 3$	**16.** $\frac{8}{15} \div 4$
5. $\frac{10}{12} \div 2$	**9.** $\frac{6}{7} \div 2$	**13.** $\frac{9}{16} \div 9$	**17.** $\frac{15}{16} \div 3$

INVERTING A FRACTION

1. When you are asked to *invert* a fraction, such as $\frac{2}{3}$, turn it upside down like this: $\frac{3}{2}$. *To invert* means *to turn upside down.* What do you get if you invert $\frac{3}{4}$?

2. When you invert $\frac{1}{3}$ you get $\frac{3}{1}$, which equals 3. To invert 5, think of 5 as $\frac{5}{1}$, then turn $\frac{5}{1}$ upside down and get $\frac{1}{5}$. In the same way 17, or $\frac{17}{1}$, is $\frac{1}{17}$ when inverted.

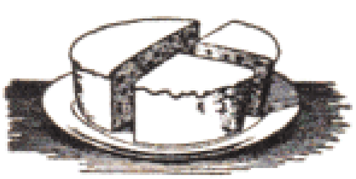
Invert each of the following:

3. $\frac{3}{8}$ $\quad\frac{1}{5}$ $\quad 3$ $\quad\frac{7}{8}$ $\quad\frac{8}{1}$ $\quad 16$ $\quad\frac{5}{6}$ $\quad\frac{6}{1}$ $\quad 7$ $\quad\frac{1}{6}$

DIVIDING A FRACTION BY A WHOLE NUMBER

The rule on page 145 tells you how to work an example like $\frac{3}{4} \div 3$. You will now learn how to divide a fraction by a whole number when the numerator of the fraction is not exactly divisible by the whole number.

1. Uncle Fred divides $\frac{1}{2}$ of a cake between Anna and John. What part of a cake does each get? What is $\frac{1}{2} \div 2$?



If you invert the divisor, 2, you get $\frac{1}{2}$. What is $\frac{1}{2} \times \frac{1}{2}$? Is $\frac{1}{2} \div 2$ the same as $\frac{1}{2} \times \frac{1}{2}$?

2. If Uncle Fred divides $\frac{1}{2}$ of a cake among 3 girls, what part of a cake does each get? What is $\frac{1}{2} \div 3$?

Invert 3 and find $\frac{1}{2} \times \frac{1}{3}$. Is $\frac{1}{2} \div 3$ the same as $\frac{1}{2} \times \frac{1}{3}$?

To divide a fraction by a whole number, invert the divisor and multiply.

This rule may be used for all problems. When the numerator of the fraction is exactly divisible by the whole number, it is quicker, however, to do the work mentally by using the rule on page 145.

DIVIDING A FRACTION BY A WHOLE NUMBER

Tell what fractions should be put in place of the dots:

1. $\frac{1}{3} \div 4 = \frac{1}{3} \times \frac{1}{4} = \ldots$

2. $\frac{1}{2} \div 3 = \frac{1}{2} \times \frac{1}{3} = \ldots$

3. $\frac{1}{5} \div 2 = \frac{1}{5} \times \ldots = \ldots$

4. $\frac{1}{4} \div 4 = \frac{1}{4} \times \ldots = \ldots$

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

6. $\frac{1}{3} \div 3 = \frac{1}{3} \times \ldots = \ldots$

7. $\frac{2}{3} \div 3 = \frac{2}{3} \times \ldots = \ldots$

8. $\frac{3}{4} \div 4 = \frac{3}{4} \times \ldots = \ldots$

9. Fay used $\frac{3}{4}$ lb. of flour for 2 cakes of equal size. What part of a pound of flour was there in each cake?

Since the numerator of $\frac{3}{4}$ is not divisible by 2, invert 2, which gives $\frac{1}{2}$; then multiply $\frac{3}{4}$ by $\frac{1}{2}$.

10. Aunt Susan divides $\frac{3}{4}$ lb. of candy equally among 6 girls. What part of a pound of candy does each get?

$$\frac{3}{4} \div 6 = \frac{\overset{1}{\cancel{3}}}{4} \times \frac{1}{\underset{2}{\cancel{6}}} = \frac{1}{8}$$

Always cancel when you can.
Each girl gets $\frac{1}{8}$ lb. of candy.

11. Anna has a whole pie and $\frac{1}{5}$ of another pie to divide among 3 girls. What is $\frac{6}{5} \div 3$? What part of a pie does each girl receive?

Divide. Do the work mentally when possible:

12. $\frac{2}{5} \div 4$	**20.** $\frac{2}{3} \div 8$	**28.** $\frac{4}{5} \div 6$	**36.** $\frac{4}{3} \div 2$
13. $\frac{3}{5} \div 6$	**21.** $\frac{3}{4} \div 3$	**29.** $\frac{14}{15} \div 4$	**37.** $\frac{8}{3} \div 2$
14. $\frac{2}{3} \div 6$	**22.** $\frac{4}{5} \div 8$	**30.** $\frac{9}{10} \div 6$	**38.** $\frac{3}{8} \div 9$
15. $\frac{5}{6} \div 10$	**23.** $\frac{3}{4} \div 9$	**31.** $\frac{4}{5} \div 10$	**39.** $\frac{8}{3} \div 4$
16. $\frac{3}{5} \div 3$	**24.** $\frac{8}{9} \div 6$	**32.** $\frac{5}{6} \div 15$	**40.** $\frac{8}{5} \div 4$
17. $\frac{8}{9} \div 2$	**25.** $\frac{8}{15} \div 2$	**33.** $\frac{2}{3} \div 18$	**41.** $\frac{15}{14} \div 5$
18. $\frac{8}{9} \div 3$	**26.** $\frac{7}{10} \div 7$	**34.** $\frac{4}{5} \div 16$	**42.** $\frac{18}{5} \div 6$
19. $\frac{15}{16} \div 5$	**27.** $\frac{15}{16} \div 6$	**35.** $\frac{15}{8} \div 3$	**43.** $\frac{21}{4} \div 7$

DIVIDING MIXED NUMBERS

Mrs. Smith used $9\frac{3}{4}$ yd. of narrow silk to make scarfs of equal length for 6 girls. How many yards long was each scarf?

$$9\frac{3}{4} \div 6 = \frac{\overset{13}{\cancel{39}}}{4} \times \frac{1}{\underset{2}{\cancel{6}}} = \frac{13}{8} = 1\frac{5}{8}$$

Change $9\frac{3}{4}$ to the improper fraction $\frac{39}{4}$. Invert the divisor, 6, to $\frac{1}{6}$ and then multiply. Check the work by going over it again.

Each scarf was $1\frac{5}{8}$ yd. long.

To divide a mixed number by a whole number, change the mixed number to an improper fraction and proceed as in dividing fractions.

Exercises

Divide. Check the work by going over it again:

1. $3\frac{1}{2} \div 3$	**10.** $2\frac{1}{4} \div 2$	**19.** $3\frac{2}{5} \div 3$	**28.** $5\frac{3}{4} \div 2$
2. $3\frac{2}{3} \div 4$	**11.** $5\frac{2}{3} \div 6$	**20.** $9\frac{1}{2} \div 4$	**29.** $1\frac{2}{3} \div 2$
3. $1\frac{1}{5} \div 4$	**12.** $4\frac{1}{2} \div 3$	**21.** $3\frac{1}{8} \div 5$	**30.** $3\frac{1}{3} \div 5$
4. $3\frac{3}{5} \div 6$	**13.** $1\frac{1}{6} \div 14$	**22.** $5\frac{1}{3} \div 4$	**31.** $4\frac{2}{3} \div 7$
5. $3\frac{1}{3} \div 4$	**14.** $7\frac{1}{2} \div 10$	**23.** $4\frac{7}{8} \div 6$	**32.** $2\frac{1}{5} \div 11$
6. $5\frac{1}{5} \div 13$	**15.** $1\frac{3}{5} \div 10$	**24.** $3\frac{3}{4} \div 6$	**33.** $2\frac{1}{4} \div 12$
7. $4\frac{4}{5} \div 16$	**16.** $7\frac{1}{2} \div 20$	**25.** $7\frac{1}{2} \div 18$	**34.** $6\frac{2}{3} \div 15$
8. $1\frac{1}{5} \div 12$	**17.** $2\frac{2}{3} \div 16$	**26.** $3\frac{1}{2} \div 42$	**35.** $1\frac{1}{4} \div 15$
9. $1\frac{2}{3} \div 10$	**18.** $11\frac{1}{5} \div 7$	**27.** $4\frac{2}{3} \div 14$	**36.** $17\frac{1}{2} \div 15$

37. Mary has $43\frac{1}{2}$ ft. of rope. She uses it to make 4 equal ropes for jumping. How long is each rope?

38. Arthur has picked $11\frac{1}{4}$ bu. of apples. If he puts them into 15 bags, each holding the same amount, what part of a bushel does he put into each bag?

39. It takes Carl 30 min. to go $3\frac{3}{4}$ mi. on his bicycle. What part of a mile does he average per minute?

IMPROVEMENT TEST No. 8

Test 8 A — Addition (Time 4 min.)

1.	2.	3.	4.	5.
5496	5769	9740	3585	4681
1237	4671	1912	1021	1047
8305	6944	6469	3925	6862
9458	3100	2900	1320	9765
1797	4366	9746	4893	8900
2608	5775	8088	5543	4092
3770	8828	3839	3709	2271

Test 8 B — Subtraction (Time 4 min.)

1. \$7830.73	2. \$9861.91	3. \$4967.20
564.17	264.20	648.12
4. \$8482.16	5. \$6529.04	6. \$5209.35
237.56	1294.80	2477.39
7. \$9675.39	8. \$7540.33	9. \$8317.12
3307.45	5183.31	4435.87
10. \$9697.09	11. \$2097.15	12. \$8214.65
2883.59	1968.67	1383.48

Test 8 C — Multiplication (Time 4 min. after copying)

1.	2.	3.	4.	5.
795	819	486	367	547
825	634	927	170	496

Test 8 D — Division (Time 4 min. after copying)

1. 73)34894 2. 31)24583 3. 59)48354

4. 56)14224 5. 69)49664

★WHAT IS YOUR AVERAGE?

1. Last week George kept a record of the time it took him to walk to school each day. It took him $10\frac{1}{2}$ min. on Monday, $9\frac{1}{4}$ min. on Tuesday, $9\frac{3}{4}$ min. on Wednesday, $10\frac{3}{4}$ min. on Thursday, and 11 min. on Friday. How many minutes a day, on the average, did it take him?

To find the average, add the 5 numbers and then divide the sum by 5. In doing this you will get a sum of $51\frac{1}{4}$, which must be changed to $\frac{205}{4}$ before you divide by 5.

2. Keep a record of the time it takes you to walk to school each day for a week. Find your average time.

3. Last September Jack weighed $72\frac{3}{4}$ lb. In 7 months his weight increased to 78 lb. How many pounds a month, on the average, did he gain?

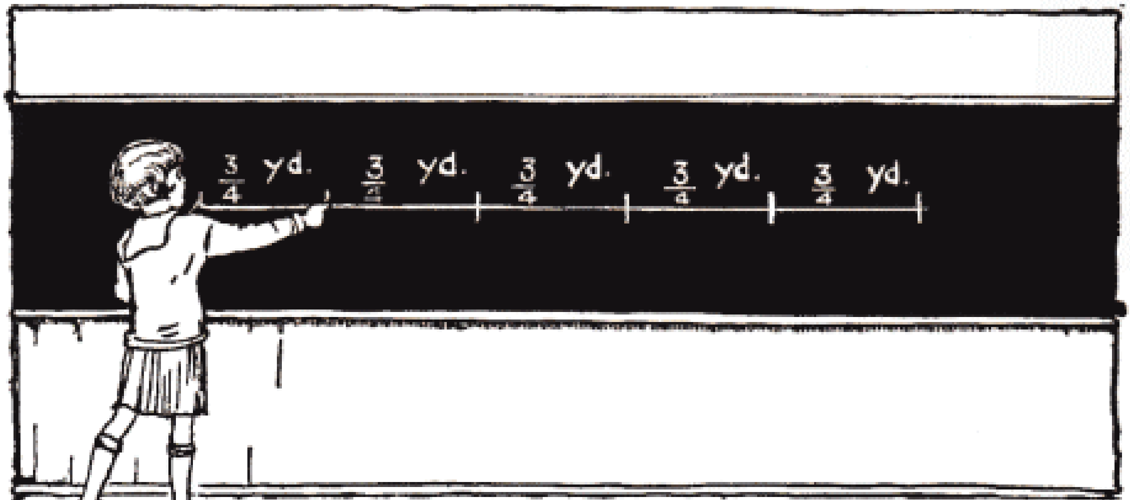
4. Jane gained $1\frac{1}{8}$ in. in height in 9 months. Find her average gain per month.

5. Fred has a pedometer, which shows how far he walks. On a trip to Echo Lake he walked $3\frac{7}{8}$ mi. the first hour, $3\frac{3}{4}$ mi. the second hour, and $3\frac{1}{4}$ mi. the third hour. How many miles an hour did he average?

6. In 5 days last week John spent $\frac{1}{3}$ hr., $\frac{1}{2}$ hr., $\frac{2}{3}$ hr., $\frac{1}{2}$ hr., and $1\frac{1}{3}$ hr. on his homework. Find the average time per day he spent on it.

7. Nell should practice on the piano $1\frac{1}{4}$ hr. each day except Sunday. Last week she practiced $\frac{5}{6}$ hr. on Monday, $1\frac{1}{4}$ hr. on Tuesday, $1\frac{1}{6}$ hr. on Wednesday, $\frac{3}{4}$ hr. on Thursday, $1\frac{3}{4}$ hr. on Friday, and $1\frac{1}{4}$ hr. on Saturday. Was her average time per day enough?

WHAT DIVIDING BY A FRACTION MEANS



The whole line on the blackboard is $3\frac{3}{4}$ yd. long.

1. Laura has a piece of ribbon 6 yd. long. To find how many pieces each 2 yd. long she can cut from it, she divides 6 by 2.

2. Suppose that Laura has a piece of ribbon $3\frac{3}{4}$ yd. long and wants to find how many pieces each $\frac{3}{4}$ yd. long she can cut from it. She must find how many times $\frac{3}{4}$ yd. is contained in $3\frac{3}{4}$ yd.; that is, she must divide $3\frac{3}{4}$ by $\frac{3}{4}$. To do this she draws a line $3\frac{3}{4}$ yd. long and measures off $\frac{3}{4}$ yd. on it as many times as she can, as shown in the picture. She measures 5 spaces, hence $3\frac{3}{4}$ yd. $\div \frac{3}{4}$ yd. $= 5$.

3. Draw a line $3\frac{3}{4}$ in. long and mark it off into spaces each $\frac{3}{4}$ in. long. Do you get 5 spaces?

4. Bert says that he can get the same answer another way. He thinks of $3\frac{3}{4}$ in. as $\frac{15}{4}$ in. Then he thinks: 15 *fourths* $\div$ 3 *fourths* $= 15 \div 3$, or 5, just as 15 *feet* $\div$ 3 *feet* $= 5$. So Bert also shows that $\frac{15}{4} \div \frac{3}{4} = 5$.

5. You can divide by a fraction by measuring as Laura did or by thinking of the numbers as Bert did. On the next page you will learn a still shorter way to get the answer.

HOW TO DIVIDE BY A FRACTION

You have learned to divide a fraction by a *whole number* by inverting the divisor and multiplying. Now you will try this rule to divide *by a fraction.*

1. On page 151 Bert found that $\frac{15}{4} \div \frac{3}{4} = \frac{15}{3} = 5$. See if you can get the same answer by inverting $\frac{3}{4}$ to $\frac{4}{3}$ and multiplying, thus:

$$\frac{15}{4} \div \frac{3}{4} = \frac{15}{\underset{1}{\cancel{4}}} \times \frac{\overset{1}{\cancel{4}}}{3} = \frac{15}{3} = 5$$

You see that you get the same result as before. This shows that the rule for dividing by inverting the divisor may be used also when you divide by a fraction.

2. Try the rule on a harder problem like $\frac{3}{4} \div \frac{2}{3}$.

You cannot divide 3 *fourths* by 2 *thirds* because they have *different names.* But if you change both fractions to *twelfths,* then they both have the *same name* and you can divide like this:

$$\frac{3}{4} \div \frac{2}{3} = \frac{9}{12} \div \frac{8}{12} = \frac{9}{8} = 1\tfrac{1}{8}$$

Now do the problem by inverting the divisor and multiplying *without changing the fractions to twelfths.* Invert $\frac{2}{3}$ and get $\frac{3}{2}$. Then multiply like this:

$$\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8} = 1\tfrac{1}{8}$$

You get the same answer as you did before, and the second way to divide is *much quicker.*

To divide a fraction by a fraction, invert the divisor and multiply. Cancel, if possible, before multiplying.

DIVIDING BY A FRACTION

Study these examples carefully. Show how the divisor in each example is inverted.

$$\frac{7}{12} \div \frac{5}{8} = \frac{7}{\underset{3}{\cancel{12}}} \times \frac{\overset{2}{\cancel{8}}}{5} = \frac{14}{15} \qquad \frac{5}{12} \div \frac{5}{6} = \frac{\overset{1}{\cancel{5}}}{\underset{2}{\cancel{12}}} \times \frac{\overset{1}{\cancel{6}}}{\underset{1}{\cancel{5}}} = \frac{1}{2}$$

Exercises in Dividing Fractions

Group				
A′.	**1.** $\frac{3}{5} \div \frac{1}{2}$	**2.** $\frac{3}{4} \div \frac{2}{3}$	**3.** $\frac{1}{4} \div \frac{1}{3}$	**4.** $\frac{3}{10} \div \frac{2}{3}$
A.	**5.** $\frac{5}{8} \div \frac{3}{4}$	**6.** $\frac{9}{10} \div \frac{4}{5}$	**7.** $\frac{7}{16} \div \frac{3}{8}$	**8.** $\frac{11}{16} \div \frac{3}{4}$
B.	**9.** $\frac{3}{4} \div \frac{7}{8}$	**10.** $\frac{2}{3} \div \frac{5}{6}$	**11.** $\frac{5}{6} \div \frac{11}{12}$	**12.** $\frac{5}{8} \div \frac{7}{16}$
C.	**13.** $\frac{5}{6} \div \frac{5}{7}$	**14.** $\frac{7}{8} \div \frac{1}{4}$	**15.** $\frac{1}{5} \div \frac{3}{10}$	**16.** $\frac{1}{3} \div \frac{5}{12}$
D.	**17.** $\frac{8}{9} \div \frac{5}{6}$	**18.** $\frac{7}{8} \div \frac{5}{6}$	**19.** $\frac{5}{8} \div \frac{3}{10}$	**20.** $\frac{3}{8} \div \frac{5}{12}$
E.	**21.** $\frac{3}{4} \div \frac{1}{8}$	**22.** $\frac{3}{8} \div \frac{1}{16}$	**23.** $\frac{1}{5} \div \frac{1}{10}$	**24.** $\frac{1}{3} \div \frac{1}{15}$
F.	**25.** $\frac{2}{3} \div \frac{4}{9}$	**26.** $\frac{3}{4} \div \frac{9}{16}$	**27.** $\frac{5}{8} \div \frac{15}{16}$	**28.** $\frac{3}{10} \div \frac{9}{20}$
G.	**29.** $\frac{3}{8} \div \frac{9}{10}$	**30.** $\frac{8}{9} \div \frac{4}{15}$	**31.** $\frac{16}{25} \div \frac{14}{15}$	**32.** $\frac{5}{12} \div \frac{5}{8}$
H.	**33.** $\frac{1}{6} \div \frac{5}{6}$	**34.** $\frac{1}{8} \div \frac{3}{4}$	**35.** $\frac{1}{6} \div \frac{2}{3}$	**36.** $\frac{1}{8} \div \frac{7}{8}$
J.	**37.** $\frac{3}{8} \div \frac{3}{4}$	**38.** $\frac{2}{9} \div \frac{2}{3}$	**39.** $\frac{5}{12} \div \frac{5}{6}$	**40.** $\frac{7}{16} \div \frac{7}{8}$
K.	**41.** $\frac{3}{4} \div \frac{3}{8}$	**42.** $\frac{7}{8} \div \frac{7}{16}$	**43.** $\frac{5}{6} \div \frac{5}{12}$	**44.** $\frac{4}{5} \div \frac{4}{15}$

45. May has $\frac{3}{4}$ yd. of ribbon. How many badges each $\frac{1}{8}$ yd. long can she make from it?

46. Susan is making lemonade. She needs $\frac{3}{16}$ lb. of sugar for every quart of lemonade. She has 15 oz. ($\frac{15}{16}$ lb.) of sugar. How many quarts can she make?

NOTE. Each group above presents the same difficulty as is found in the corresponding group in multiplication on pages 131, 133, 136.

HOW LONG DOES JOHN WALK?

1. John can walk $3\frac{1}{4}$ mi. an hour. How long does it take him to walk 13 mi.?

Write 13 as $\frac{13}{1}$ and $3\frac{1}{4}$ as $\frac{13}{4}$. Then invert $\frac{13}{4}$ to $\frac{4}{13}$ and multiply. The quotient is 4.

Hence it takes John 4 hr.

$$13 \div 3\frac{1}{4} = \frac{13}{1} \div \frac{13}{4} = \frac{\overset{1}{\cancel{13}}}{1} \times \frac{4}{\underset{1}{\cancel{13}}} = 4$$

2. At $2\frac{1}{2}$ mi. an hour, how long would it take John to walk $13\frac{3}{4}$ mi.?

To divide a whole number or a mixed number by a fraction or by a mixed number, change all mixed numbers to improper fractions; then proceed as in dividing fractions.

TESTING THE RULE FOR DIVIDING

1. Alice made $7\frac{1}{2}$ lb. of candy for the school fair. How many boxes holding $\frac{3}{4}$ lb. each can she fill?

First invert the divisor and multiply, as shown here.

Alice can fill 10 boxes.

$$7\frac{1}{2} \div \frac{3}{4} = \frac{\overset{5}{\cancel{15}}}{\underset{1}{\cancel{2}}} \times \frac{\overset{2}{\cancel{4}}}{\underset{1}{\cancel{3}}} = 10$$

To test the rule and check the answer, work the problem by changing pounds to ounces, as shown at the right. You get the same answer as before. Hence you know that the rule is right.

1 lb. = 16 oz.
$7\frac{1}{2}$ lb. = $7\frac{1}{2} \times 16$ oz. = 120 oz.
$\frac{3}{4}$ lb. = $\frac{3}{4} \times 16$ oz. = 12 oz.
120 oz. ÷ 12 oz. = 10

Divide by inverting the divisor and multiplying. Then test the rule by working each problem another way, changing yards to inches, pounds to ounces, and hours to minutes:

2. $2\frac{1}{2}$ yd. ÷ $\frac{1}{4}$ yd.	**5.** $5\frac{1}{3}$ yd. ÷ $\frac{2}{3}$ yd.	**8.** $6\frac{3}{4}$ yd. ÷ $\frac{3}{4}$ yd.
3. $3\frac{1}{4}$ hr. ÷ $\frac{1}{2}$ hr.	**6.** $3\frac{3}{8}$ lb. ÷ $\frac{3}{4}$ lb.	**9.** $3\frac{1}{2}$ hr. ÷ $\frac{3}{4}$ hr.
4. $6\frac{2}{3}$ hr. ÷ $\frac{5}{6}$ hr.	**7.** $5\frac{1}{4}$ lb. ÷ $\frac{7}{16}$ lb.	**10.** $3\frac{3}{4}$ lb. ÷ $\frac{5}{8}$ lb.

DIVIDING MIXED NUMBERS

Divide, and check. If you get any example wrong, practice all the examples in that group again.

Group			
A′.	**1.** $\frac{3}{5} \div 3\frac{1}{2}$	**2.** $7 \div \frac{2}{5}$	**3.** $8 \div 1\frac{1}{2}$
	4. $3\frac{1}{3} \div \frac{3}{4}$	**5.** $4\frac{1}{2} \div 1\frac{2}{3}$	**6.** $11 \div \frac{3}{4}$
A.	**7.** $\frac{5}{6} \div 4\frac{1}{2}$	**8.** $\frac{2}{3} \div 3\frac{1}{5}$	**9.** $\frac{3}{4} \div 1\frac{4}{5}$
	10. $1\frac{5}{8} \div \frac{3}{4}$	**11.** $5\frac{1}{4} \div 2\frac{1}{2}$	**12.** $1\frac{7}{8} \div 1\frac{3}{4}$
B.	**13.** $\frac{15}{16} \div 1\frac{2}{3}$	**14.** $4\frac{1}{5} \div \frac{3}{4}$	**15.** $5\frac{1}{3} \div 1\frac{3}{5}$
	16. $4\frac{3}{8} \div \frac{3}{16}$	**17.** $2\frac{5}{8} \div \frac{3}{5}$	**18.** $3\frac{1}{5} \div 2\frac{2}{3}$
C.	**19.** $\frac{3}{4} \div 1\frac{3}{4}$	**20.** $5 \div 7\frac{1}{2}$	**21.** $4 \div \frac{8}{9}$
	22. $6 \div 2\frac{2}{5}$	**23.** $1\frac{7}{8} \div \frac{7}{8}$	**24.** $2\frac{3}{4} \div 2\frac{1}{4}$
D.	**25.** $\frac{3}{4} \div 1\frac{1}{6}$	**26.** $6 \div 1\frac{3}{5}$	**27.** $15 \div \frac{6}{7}$
	28. $2\frac{1}{8} \div \frac{5}{12}$	**29.** $1\frac{5}{8} \div \frac{5}{12}$	**30.** $12\frac{1}{2} \div 3\frac{1}{3}$
E.	**31.** $21 \div 3\frac{1}{2}$	**32.** $35 \div \frac{5}{6}$	**33.** $18 \div 2\frac{1}{4}$
	34. $27 \div \frac{9}{10}$	**35.** $3\frac{3}{4} \div \frac{1}{8}$	**36.** $48 \div 9\frac{3}{5}$
F.	**37.** $\frac{3}{8} \div 1\frac{5}{16}$	**38.** $\frac{5}{9} \div 1\frac{7}{18}$	**39.** $1\frac{1}{2} \div \frac{15}{16}$
	40. $1\frac{9}{16} \div 1\frac{1}{4}$	**41.** $2\frac{1}{5} \div 1\frac{7}{15}$	**42.** $3\frac{1}{3} \div 2\frac{2}{9}$
G.	**43.** $\frac{14}{15} \div 5\frac{5}{6}$	**44.** $\frac{15}{16} \div 2\frac{11}{12}$	**45.** $2\frac{3}{16} \div \frac{5}{12}$
	46. $9\frac{1}{6} \div 1\frac{7}{15}$	**47.** $9\frac{3}{5} \div 1\frac{7}{25}$	**48.** $16\frac{1}{4} \div 3\frac{3}{4}$
H.	**49.** $\frac{1}{5} \div 3\frac{1}{5}$	**50.** $\frac{1}{6} \div 2\frac{2}{3}$	**51.** $\frac{1}{8} \div 6\frac{1}{4}$
	52. $\frac{1}{7} \div 1\frac{3}{7}$	**53.** $\frac{1}{9} \div 1\frac{2}{3}$	**54.** $\frac{1}{4} \div 1\frac{1}{2}$
J.	**55.** $\frac{4}{9} \div 5\frac{1}{3}$	**56.** $\frac{2}{3} \div 3\frac{1}{3}$	**57.** $\frac{7}{8} \div 5\frac{1}{4}$
	58. $1\frac{1}{3} \div 6\frac{2}{3}$	**59.** $2\frac{2}{3} \div 5\frac{1}{3}$	**60.** $4\frac{1}{5} \div 8\frac{2}{5}$
K.	**61.** $3\frac{3}{4} \div \frac{3}{16}$	**62.** $8\frac{1}{3} \div \frac{5}{6}$	**63.** $6\frac{3}{10} \div \frac{9}{10}$
L.	**64.** $3\frac{1}{4} \div \frac{13}{4}$	**65.** $1\frac{2}{3} \div \frac{5}{3}$	**66.** $1\frac{1}{4} \div \frac{5}{4}$

DIVISION OF FRACTIONS

If you miss exercises in any row, you need more practice. The Help Pages tell you where to find it.

Divide the following and check the work:

					HELP PAGES
1.	$\frac{5}{8} \div 5$	$\frac{3}{16} \div 3$	$\frac{4}{5} \div 2$	$\frac{9}{10} \div 3$	**145**
2.	$\frac{3}{4} \div 9$	$\frac{2}{3} \div 4$	$\frac{15}{16} \div 9$	$\frac{9}{16} \div 12$	**147**
3.	$2\frac{1}{2} \div 3$	$3\frac{1}{8} \div 5$	$3\frac{3}{4} \div 6$	$8\frac{3}{4} \div 10$	**148**
4.	$6\frac{3}{4} \div 6$	$2\frac{4}{5} \div 7$	$7\frac{1}{2} \div 9$	$9\frac{1}{3} \div 7$	**148**
5.	$\frac{5}{8} \div \frac{1}{2}$	$\frac{3}{4} \div \frac{5}{6}$	$\frac{1}{4} \div \frac{1}{8}$	$\frac{7}{16} \div \frac{7}{8}$	**153**
6.	$\frac{3}{4} \div \frac{3}{5}$	$\frac{1}{5} \div \frac{3}{10}$	$\frac{9}{10} \div \frac{3}{5}$	$\frac{5}{8} \div \frac{2}{3}$	**153**
7.	$\frac{4}{5} \div \frac{3}{10}$	$\frac{1}{3} \div \frac{2}{3}$	$\frac{7}{8} \div \frac{3}{4}$	$\frac{1}{4} \div \frac{3}{8}$	**153**
8.	$\frac{3}{8} \div \frac{3}{5}$	$\frac{3}{10} \div \frac{3}{5}$	$\frac{3}{4} \div \frac{5}{8}$	$\frac{7}{8} \div \frac{3}{16}$	**153**
9.	$\frac{1}{2} \div \frac{3}{4}$	$\frac{9}{16} \div \frac{3}{16}$	$\frac{4}{5} \div \frac{1}{3}$	$\frac{1}{3} \div \frac{1}{6}$	**153**
10.	$6\frac{1}{2} \div 3\frac{1}{3}$	$15 \div 2\frac{1}{2}$	$2\frac{1}{3} \div 4\frac{2}{3}$	$4\frac{1}{2} \div \frac{3}{4}$	**155**
11.	$1\frac{1}{6} \div 5\frac{5}{6}$	$12 \div 1\frac{3}{4}$	$8\frac{3}{4} \div 2\frac{1}{10}$	$3\frac{1}{3} \div \frac{5}{8}$	**155**
12.	$2\frac{1}{3} \div 1\frac{1}{4}$	$25 \div 1\frac{2}{3}$	$2\frac{1}{2} \div 3\frac{1}{8}$	$2\frac{1}{8} \div \frac{7}{8}$	**155**
13.	$4\frac{1}{6} \div 1\frac{2}{3}$	$27 \div 1\frac{4}{5}$	$1\frac{3}{5} \div 1\frac{1}{5}$	$1\frac{5}{16} \div \frac{7}{10}$	**155**
14.	$4\frac{1}{2} \div 1\frac{1}{5}$	$24 \div 5\frac{1}{3}$	$4\frac{1}{6} \div 1\frac{7}{8}$	$1\frac{3}{4} \div \frac{7}{4}$	**155**

USING FRACTIONS IN PROBLEMS

1. For a candy sale Mary and Helen made candy together. They made $6\frac{1}{4}$ lb. of fudge and $4\frac{1}{4}$ lb. of taffy. They mixed the candy and packed it in boxes each holding $\frac{3}{4}$ lb. How many boxes did they have?

2. Dick weighs $68\frac{1}{4}$ lb. The normal weight of a boy Dick's age and height is 75 lb. How many pounds should Dick gain?

3. Mrs. Cross bought $4\frac{1}{2}$ yd. of silk at $1.12 a yard. Later she bought $2\frac{1}{4}$ yd. more at the same price. How much did all the silk cost her?

★**4.** Miss King's speedometer registered 1487 mi. when she started to camp and 1622 mi. when she arrived. She drove $4\frac{1}{2}$ hr. to make the trip. What was her average speed per hour?

5. Tom ordered from a catalogue some radio equipment with these weights: $1\frac{1}{4}$ lb., $2\frac{1}{2}$ lb., $\frac{1}{4}$ lb., 2 lb., 9 lb., $1\frac{1}{2}$ lb. What was the weight of Tom's whole order?

6. Doris bought some things for a party. She got $4\frac{1}{2}$ doz. cup cakes at $.30 a dozen, and $6\frac{1}{2}$ doz. rolls at $.24 a dozen. How much in all did she pay for them?

7. Ned weighs $72\frac{1}{2}$ lb. and his father weighs $181\frac{1}{4}$ lb. Ned's father weighs how many times as much as Ned?

★**8.** John earns $4.75 a week helping in a store and $1.55 a week doing errands. He puts $\frac{1}{3}$ of all he earns in the school bank. How much does he put in the bank in 8 wk.?

9. Mrs. Smith bought a remnant of curtain material containing 24 yd. She made 10 curtains and used $2\frac{1}{3}$ yd. for each one. How many yards of material did she have left over?