Section 1.4   Applications of Multiplication and Division

Objectives In this section you will learn to:

- Solve problems using multiplication.
- Find the area of a rectangle.
- Solve problems using division.
- Find the area of a geometric figure.

INTRODUCTION

This section introduces you to some ways in which we can apply multiplication and division. Just as in the problems of addition and subtraction, there are key words or phrases that indicate whether multiplication or division should be used.

APPLICATIONS INVOLVING MULTIPLICATION

There are many situations to which multiplication can apply. Since multiplication is an abbreviation for repeated addition, we use it whenever the same number is added over and over a certain number of times.

For each of these word problems:

- Read the problem through carefully (maybe two or three times).

- Think about the situation (imagine yourself in the situation).

- Remember that in multiplication, there are two numbers:

  ➤ One number that will be repeated, and

  ➤ another number that indicates the number of times it is repeated.

- Multiply appropriately.

- Write a sentence answering the question.

Example 1:	Bindee just completed her associate's degree and is now looking for a job. Searching the internet, she found a job as an entry level secretary that pays $1,783 per month. If she is hired for that job, how much would she earn in 12 months?
Procedure:	The monthly wage is the same each month—and Bindee would earn that wage 12 *times*—so multiplication is the operation to use.
	Multiply the monthly wage ($1,783) by the number of months (12).

Answer:

$$\begin{array}{r} \text{Bindee monthly wage:} \rightarrow \quad 1783 \\ \text{Times 12 months:} \quad \rightarrow \quad \underline{\times \quad 12} \\ 3566 \\ \underline{17830} \\ 21,396 \end{array}$$

Sentence: If Bindee gets the job, she will earn $21,396 in 12 months.

YTI #1 George sells sports cards. In each Upper Deck *Stars* box there   Show your
are 24 packs of cards. If George has 6 of these boxes, how many   work over here:
packs of Upper Deck *Stars* does he have?

Sentence: _____

YTI #2 At the restaurant where Leilani is a waitress, there is a buffet
special for $9 per person. A group of 15 patrons came in one
afternoon and they all ordered the buffet special. Before tax and
tip, what was the total amount of their bill?

Sentence: _____

YTI #3 Sam, a truck driver, is asked to pick up 93 boxes, each weighing
38 pounds. What is the total weight of this load?

Sentence: _____

THE AREA OF A RECTANGLE

In geometry, **area** is the amount of surface in an enclosed region. Area is always measured in square units, such as square feet (*sq ft*) and square centimeters (*sq cm*).

We can use the area of a rectangle to illustrate the idea that multiplication is repeated addition. This illustration will also develop the formula for the area of a rectangle.
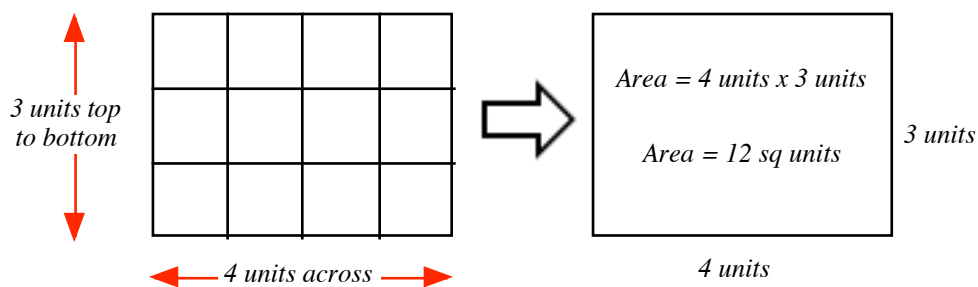
First, consider the single unit square, at right.   (It has no specific measure, such as an inch, so we say that each side length is one *unit*.)
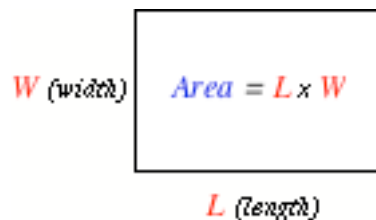

1 unit square

We can put 12 of these small squares together to form a *3 by 4* rectangle.

The illustration below also shows the area formula for a rectangle:

3 units top
to bottom

4 units across

Area = 4 units x 3 units

Area = 12 sq units

3 units

4 units

In general, **Area of a rectangle = Length x Width**.

W (width) $Area = L \times W$

L (length)

Example 2:   Find the area of the rectangle at right.

Answer: Area = Length x Width

Area = 8 feet x 5 feet

Area = 40 sq ft

5 feet

8 feet
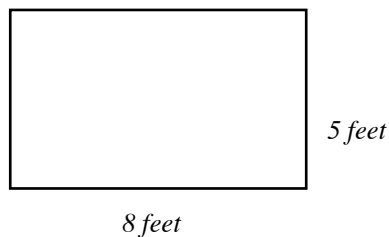
YTI #4   Find the area of each rectangle. Use Example 2 as a guide.

a)

7 inches

16 inches

b)

95 meters

45 meters
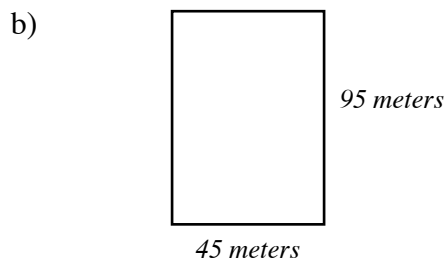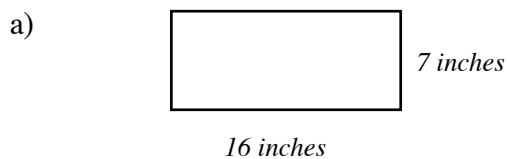
APPLICATIONS INVOLVING DIVISION

Applications that involve division often require that a number of items be divided equally among individuals of a group. A key word meaning division is *each*. It is often found in the last sentence.

Example 3: Kayla is making arrangements for 93 basketball fans to attend an out-of-town high school basketball game. She needs to know how many vans to rent so that everyone has a ride. If each van seats 6, how many vans are needed so that everyone has a seat?

Procedure: Here we want to divide the 93 people up into groups of 6 so that each group can fit into a van. Notice that the last sentence includes the word *each*. We will divide to find the answer.

Answer:

$$\begin{array}{r} 15 \text{ r } 3 \\ 6\overline{)93} \\ -6 \\ \hline 33 \\ -30 \\ \hline 3 \end{array}$$

Notice that 6 did not divide evenly into 93. What should be done with the remainder of 3?

The answer suggests that the 15 vans will be full with 6 people each, and there will be one more van needed to carry the remaining 3 people, so 16 vans are needed in all.

Sentence: 16 vans are needed so that everyone has a seat.

YTI #5 Ruben took 8 children from the Boys and Girls Club to the county fair. He purchased 120 ride tickets for the children. How many ride tickets will each child receive?

Show work here:

Sentence: _____

YTI #6 Three neighbors decided to have common garage sale and split the proceeds evenly. If they earned a total of $1,728, how much will each neighbor get?

Sentence: _____

YTI #7 Uh oh. Guy used his credit card too much and now owes $4,536. To avoid more interest charges, he agreed to cut up his card and pay all $4,536 back in 24 months. How much must Guy pay each month?

Sentence: _____

YTI #8   Taiyana is purchasing wooden boxes with pre-made mail slots for the employees at her office. Each box contains mail slots for 12 employees. If the office has 163 employees, how many of these boxes must she purchase?

Sentence: _____

You Try It Answers: Section 1.4

YTI #1:   George has 144 packs of Upper Deck *Stars*.

YTI #2:   The total amount of the bill, before tax and tip, was $135.

YTI #3:   The total weight of the load is 3,534 pounds.

YTI #4:   a)   112 square inches   b)   4,275 square meters

YTI #5:   Each child will receive 15 ride tickets.

YTI #6:   They will each get $576.

YTI #7:   Guy must pay $189 each month.

YTI #8:   Taiyana must purchase 14 boxes. (13 of the boxes will be full, and 1 box will hold mail for the 7 remaining employees.)

Focus Exercises: Section 1.4

Work each application and answer the question with a complete sentence.

1. The parking lot at the Hillside Christmas Craft Fair has 14 rows of parking with 12 parking spaces in each row. How many cars can fit in the parking lot?

2. Monica has a one year lease on her apartment and pays a monthly rent of $835. How much rent will Monica pay for the entire year (12 months)?

3. Ignacio's truck gets 13 miles per gallon of gas. He just filled the gas tank to a total of 28 gallons. How many miles can Ignacio's truck go before it runs out of gas?

4. Sandy is counting inventory at The Office Station. In the pen and pencil section, there are 33 boxes of Script Magic gel pens. If each box holds 18 pens, how many Script Magic gel pens does The Office Station have in its inventory?

5. A jumbo jet is flying from San Francisco to Australia and is averaging 492 miles per hour. How many miles will the jet travel in 16 hours?

6. Rico spends $25 every week on lottery tickets. How much does Rico spend in a year (52 weeks) on lottery tickets?

7. Diane is a massage therapist. During her first week working at Dr. Kent's chiropractic office, she saw 33 patients. If she earns $18 for every patient, how much did Diane earn that first week?

8. Toby is preparing a 23-pound turkey for his family's Thanksgiving gathering. The recipe he's using says to roast the turkey 12 minutes per pound. For how many minutes should Toby roast the turkey?

9. There are 306 families in the Magnolia Elementary PTA. Each family must contribute $18 this year to support the PTA's field trip program. What will the total income for the PTA's field trip program be this year?

10. Soo works for the purchasing department of a mid-sized company. Last week she bought 12 computers for the new West Valley office, which opens in two months. Each computer is priced at $1,289. What is the total price for the 12 computers?

11. A youth soccer field is in the shape of a rectangle. The length is 60 yards and the width is 28 yards. What is the area of this soccer field?

12. An official college basketball court is 94 feet long and 50 feet wide. What is the area of this basketball court?

13. The state of Wyoming is in the shape of a rectangle. It is 357 miles long and 274 miles wide. Round each of these dimensions to the nearest ten. Use the rounded numbers to approximate the area of Wyoming.

14. The state of Colorado is in the shape of a rectangle. It is 376 miles long and 282 miles wide. Round each of these dimensions to the nearest ten. Use the rounded numbers to approximate the area of Colorado.

15. The Lazy *W* Summer Camp has 238 campers and 17 counselors. The campers were divided evenly into "family" groups. If each counselor was in charge of one family group, how many campers were in each group?

16. Jorge is in charge of scheduling trash pick up in Timonium, Maryland. He has 18 trash trucks to cover 5,310 homes. If he divides the homes equally among his drivers, to how many homes will each driver be assigned?

17. 96 people attended a concert in Memorial Park. Each person paid the same amount for a ticket. If the total of the receipts was $2,208, how much did each person pay to attend the concert?

18. Alicia ordered 54 new computers for the teachers at her school. If the total bill (before tax and shipping) came to $53,082, what was the price of each computer?

19. A Harley Davidson distributor needs to ship 365 new motorcycles by train. If each boxcar holds 16 motorcycles, how many boxcars are needed to ship the motorcycles?

20. In planning for the next semester, Mr. Tom anticipates 900 students will want to take Elementary Algebra. If each section can contain up to 42 students, how many sections of Elementary Algebra should he schedule?

21. Priority Express printed 1,350 booklets for a large company. It's Kari's job to box them all. If she can fit 24 booklets into each box, how many boxes will she need for all of the booklets?

22. A running club is planning to raise money to help preserve an historic part of Yosemite National Forest. The 27 runners in the club will take turns—relay style—running the entire length of California, from Oregon to Mexico, 783 miles in all. If the distance is divided equally among all of the runners, how many miles will each run?