

## • Multiplying by Two-Digit Numbers

### Power Up

#### facts

Power Up G

#### count aloud

Count by 12s from 12 to 120.

#### mental math

- a. **Measurement:** From shoulder to fingertips, Autumn's arm was 2 feet 2 inches long. How many inches is this?
- b. **Geometry:** A hexagon has six sides. If each side of a hexagon is 34 millimeters long, what is the distance around the hexagon?
- c. **Fractional Parts:** Wendy has traveled in  $\frac{6}{10}$  of the 50 states. How many states is this?
- d. **Number Sense:**  $3\frac{1}{4} - 1\frac{1}{4}$
- e. **Fractional Parts:** How many years is  $\frac{1}{4}$  of a century?
- f. **Percent:** 25% of 24
- g. **Percent:** 10% of 20
- h. **Calculation:**  $\frac{1}{2}$  of 20, + 2,  $\div$  2, + 2,  $\div$  2, + 2,  $\div$  2

#### problem solving

In the first 6 games of the season, the Rio Vista football team won 4 games and lost 2 games. They won their seventh game by 8 points. Altogether, the team played 10 games during the season. What is the greatest number of games the Rio Vista team could have won during the season? Is it certain that the Rio Vista team won more than half their games during the season?

#### Focus Strategy: Use Logical Reasoning

**Understand** We are told the football team played 10 games during the season. In the first 6 games, they won 4 and lost 2. The team won the next game (the seventh game) by 8 points. We are asked to find how many games the team could have won and whether it is certain the team won more than half their games.

In this problem we are given *irrelevant information*, that is, information that does not help us solve the problem. We ignore irrelevant information when carrying out our solution. While we need to know that the football team won the seventh game, the number of points that the team won by is irrelevant.

**Plan** We use *logical reasoning* to solve the problem.

**Solve** The team won 4 of the first 6 games, and we know they won the seventh game. So the team won 5 games out of its first 7. This leaves 3 more games that the team could have won. If we assume the team won all 3 of those games, they would have  $5 + 3 = 8$  wins, which is the most wins they could have during the season.

To find whether it is certain the team won more than half their games, we must assume that the team lost their last 3 games. This would give the team a record of 5 wins and 5 losses. Five wins is exactly half of the games in the season. Thus, **it is not certain the team won more than half their games.**

**Check** We found the team could win 8 games at most during the season, but it is not certain they would win more than half their games. We know our answers are reasonable because the team could win all 3 of their final games, or they could lose all 3 games. We first found the team's record assuming they won their final 3 games. Then we found the team's record assuming they lost their final 3 games.

## New Concept

When we multiply by a two-digit number, we really multiply twice. We multiply by the tens, and we multiply by the ones. Here we multiply 43 by 12. Since 12 is  $10 + 2$ , we may multiply 43 by 10 and 43 by 2. Then we add the products.

$$\begin{array}{r} 43 \\ \times 12 \\ \hline \end{array} \text{ is the same as } \begin{array}{r} 43 \quad 43 \\ \times 10 \text{ plus } \times 2 \\ \hline 430 \quad 86 \\ \hline 430 + 86 = 516 \end{array}$$

When we multiply by a two-digit number, we do not need to separate the problem into two problems before we start.

### Example 1

$$\begin{array}{r} \text{Multiply: } 43 \\ \times 12 \\ \hline \end{array}$$

First we multiply 43 by the 2 of 12. We get 86 and we write the 86 so the 6 is in the ones column under the 2.

$$\begin{array}{r} 43 \\ \times 12 \\ \hline 86 \end{array}$$

Next, we multiply 43 by the 10 of 12. We get 430, which we may write below the 86. Then we add 86 to 430 and find that  $43 \times 12$  equals **516**. The numbers 86 and 430 are called **partial products**. The number 516 is the final product. Below are two ways we may show our work:

$$\begin{array}{r} 43 \\ \times 12 \\ \hline 86 \\ 430 \\ \hline 516 \end{array} \quad \text{or} \quad \begin{array}{r} 43 \\ \times 12 \\ \hline 86 \\ 43 \\ \hline 516 \end{array}$$

If we move one place to the left, we do not need to write the zero.

#### Reading Math

Use the steps below to multiply by a two-digit number:

1. Multiply by the ones.
2. Multiply by the tens.
3. Add the partial products.

Some people do not write the trailing zero in the second partial product. In the method on the right, the 0 of 430 is omitted from the second partial product. We begin writing the partial product one place to the left. The 43 means “43 tens.”

### Example 2

**A restaurant chain purchased 95 pounds of potatoes for each of its 26 locations. About how many pounds of potatoes were purchased altogether?**

We are not asked for an exact number, so we can estimate. If we round 95 pounds up to 100 pounds and round 26 pounds to 30, then we estimate that the total number of pounds of potatoes is 3000 pounds.

**Analyze** Write the estimated amount of potatoes as a fractional part of a ton. (*Hint*: 2000 pounds equals 1 ton.)

### Example 3



Visit [www.SaxonMath.com/Int5Activities](http://www.SaxonMath.com/Int5Activities) for a calculator activity.

**At \$0.35 each, what is the cost of two dozen pencils?**

We multiply \$0.35 by 24. We ignore the dollar sign and the decimal point until we have a final product.

$$\begin{array}{r} \$0.35 \\ \times 24 \\ \hline 140 \\ 700 \\ \hline \$8.40 \end{array} \quad \text{or} \quad \begin{array}{r} \$0.35 \\ \times 24 \\ \hline 140 \\ 70 \\ \hline \$8.40 \end{array}$$

After multiplying, we place the decimal point. Since we multiplied cents, we show cents in the final product by placing the decimal point so that there are two digits to the right of the decimal point. The cost is **\$8.40**.

The multiplication algorithm presented in this lesson is based on the **Distributive Property**. The Distributive Property applies to situations in which a sum is multiplied, such as

$$25 \times (10 + 2)$$

According to the Distributive Property, we have two choices when multiplying a sum:

**Choice 1:** Find the sum; then multiply.

**Choice 2:** Multiply each addend; then add the products.

Here we illustrate these choices:

$$\begin{array}{c} 25 \times (10 + 2) \\ \swarrow \quad \searrow \\ 25 \times 12 \quad \text{or} \quad (25 \times 10) + (25 \times 2) \end{array}$$

Both choices result in the same answer (which in this case is 300).

### Example 4

**Benito wants to multiply 35 by (20 + 4). Using the Distributive Property, show his two choices. Then find each answer.**

Here are Benito's two choices:

$$\begin{array}{c} 35 \times (20 + 4) \\ \swarrow \quad \searrow \\ 35 \times 24 \quad \text{or} \quad (35 \times 20) + (35 \times 4) \end{array}$$

Now we find each answer:

$$\begin{array}{r} 35 \\ \times 24 \\ \hline 140 \\ 700 \\ \hline 840 \end{array} \quad (35 \times 20) + (35 \times 4)$$
$$700 + 140$$
$$840$$

Notice that 700 and 140 appear as partial products in both methods.

## Lesson Practice

Multiply:

a.  $\begin{array}{r} 32 \\ \times 12 \\ \hline \end{array}$

b.  $\begin{array}{r} \$0.62 \\ \times 23 \\ \hline \end{array}$

c.  $\begin{array}{r} 48 \\ \times 64 \\ \hline \end{array}$

d.  $\begin{array}{r} 246 \\ \times 22 \\ \hline \end{array}$

e.  $\begin{array}{r} \$1.47 \\ \times 34 \\ \hline \end{array}$

f.  $\begin{array}{r} 87 \\ \times 63 \\ \hline \end{array}$

g. Musoke wants to multiply 12 by  $(20 + 3)$ . Show her two choices for multiplying. Find each answer.

h. **Estimate** Early one morning, a bakery shipped 11 boxes of bagels to local supermarkets. Each box contained 24 bagels. Show two different ways to estimate the number of bagels that were shipped that morning. Then choose one of the ways and explain why it represents a better estimate.

## Written Practice

*Distributed and Integrated*

1. The numbers of visitors to the school science fair are shown in the table:  
(49)

Science Fair

Day	Number of Visitors
Wednesday	47
Thursday	76
Friday	68
Saturday	

The total attendance for the four days was 320 visitors. How many visitors attended the science fair on Saturday?

\*2. To mail the letter, Yai-Jun used one 39-cent stamp and three 23-cent stamps. How many cents did it cost to mail the letter?  
(11)

- \* 3. Represent** Draw a diagram to illustrate and solve this problem:  
(Inv. 2, 46) Arthur ate  $\frac{3}{4}$  of the 60 raisins. How many raisins did he eat?  
 What percent of the raisins did he eat?

- 4. Represent** Write  $(1 \times 1000) + (1 \times 1)$  in standard form.  
(48)

- 5. Represent** Use words to name 1760.  
(7)

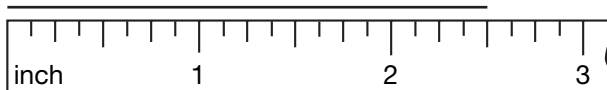
- \* 6. Represent** Draw a circle. Shade all but one sixth of it. What percent of the circle is *not* shaded?  
(37, 43)

- 7. Represent** Use digits to write sixty-two thousand, four hundred ninety.  
(7)

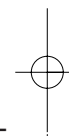
- \* 8. Multiple Choice** The perimeter of the Khafne Pyramid in Egypt is 2835 feet. When we count by hundreds, we find that 2835 is closest to which number?

**A** 2000      **B** 2700      **C** 2800      **D** 2900

- 9.** How long is the line segment below?  
(44)



- \* 10. Analyze** Below are two stacks of coins. If some coins were taken from the taller stack and added to the shorter stack until the stacks were even, how many coins would be in each stack?  
(50)



- 11.** Compare:  $\frac{1}{2}$  of 10  $\bigcirc$   $\frac{1}{3}$  of 12  
(Inv. 2, Inv. 3)

**12.**  $(1 + 2 + 3 + 4 + 5) \div 5$   
(24)

**13.** 
$$\begin{array}{r} 43 \\ \times 12 \\ \hline \end{array}$$
  
(51)

**14.** 
$$\begin{array}{r} \$0.72 \\ \times \quad 31 \\ \hline \end{array}$$
  
(51)

**15.** 
$$\begin{array}{r} 248 \\ \times 24 \\ \hline \end{array}$$
  
(51)

**16.** 
$$\begin{array}{r} \$1.96 \\ \times \quad 53 \\ \hline \end{array}$$
  
(51)

**17.** 
$$\begin{array}{r} 8762 \\ 3624 \\ 4795 \\ + 8473 \\ \hline \end{array}$$
  
(6)

**18.** 
$$\begin{array}{r} \$10.00 \\ - \$ 9.92 \\ \hline \end{array}$$
  
(13)

**19.** 
$$\begin{array}{r} 600 \\ \times 50 \\ \hline \end{array}$$
  
(29)

**20.** 
$$\begin{array}{r} \$6.00 \\ \quad 8 \\ \hline \end{array}$$
  
(26)

21.  $\$41.36 \div 4$   
(34)

22.  $9x = 4275$   
(26)

23.  $3 + \frac{1}{4} + 2\frac{2}{4}$   
(43)

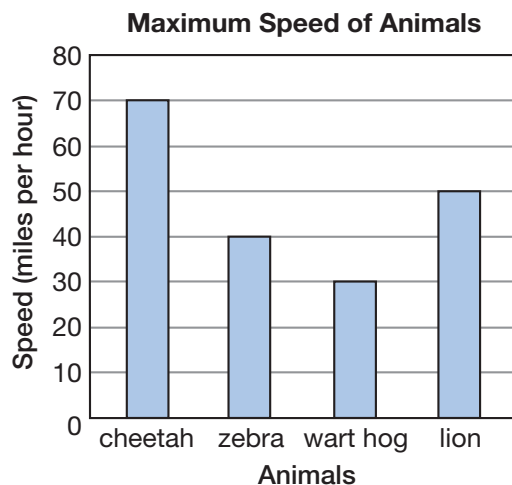
24.  $\left(5\frac{5}{8} - 3\frac{3}{8}\right) - 1\frac{1}{8}$   
(24, 41)

25. In the running long jump, S'Mira jumped 16 feet 9 inches. How many inches did she jump? (One foot equals 12 inches.)  
(47)

26. Ajani needs to multiply 15 by  $(20 + 4)$ . Using the Distributive Property, show his two choices and the final product.  
(51)


27. This table shows how fast some animals can run:  
(Inv. 5)

- Which two speeds are used to find the range of the data?
- What is the median speed of the animals?
- Which animal has a maximum speed that is closest to the average speed of all of the animals shown in the graph?



\* 28. **Represent** Write 205,000 in expanded notation.  
(48)

\* 29. **Estimate** The math book was  $11\frac{1}{4}$  inches long. Round  $11\frac{1}{4}$  inches to the nearest inch.  
(44)

30.  **Justify** The distance between Kenley's and Bernardo's house is 24 miles. Last month, Kenley drove from his house to Bernardo's house, and back again, 9 different times. What is a reasonable estimate of the number of miles Kenley drove? Explain your answer.  
(51)