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## Algebra • Properties

Properties of operations are characteristics of the operations that are always true.

Property	Examples
<b>Commutative Property of Addition or Multiplication</b>	Addition: $3 + 4 = 4 + 3$ Multiplication: $8 \times 2 = 2 \times 8$
<b>Associative Property of Addition or Multiplication</b>	Addition: $(1 + 2) + 3 = 1 + (2 + 3)$ Multiplication: $6 \times (7 \times 2) = (6 \times 7) \times 2$
<b>Distributive Property</b>	$8 \times (2 + 3) = (8 \times 2) + (8 \times 3)$
<b>Identity Property of Addition</b>	$9 + 0 = 9$ $0 + 3 = 3$
<b>Identity Property of Multiplication</b>	$54 \times 1 = 54$ $1 \times 16 = 16$

Use properties to find  $37 + 24 + 43$ .

$$\begin{aligned}
 37 + 24 + 43 &= 24 + \underline{37} + 43 \\
 &= 24 + (37 + 43) \\
 &= 24 + \underline{80} \\
 &= \underline{104}
 \end{aligned}$$

Use the Commutative Property of Addition to reorder the addends.

Use the Associative Property of Addition to group the addends.

Use mental math to add.

Grouping 37 and 43 makes the problem easier to solve because their sum, 80, is a multiple of 10.

Use properties to find the sum or product.

1.  $31 + 27 + 29$

2.  $41 \times 0 \times 3$

3.  $4 + (6 + 21)$

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Complete the equation, and tell which property you used.

4.  $(2 \times \underline{\quad}) + (2 \times 2) = 2 \times (5 + 2)$

5.  $\underline{\quad} \times 1 = 15$

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## Algebra • Powers of 10 and Exponents

You can represent repeated factors with a base and an exponent.

Write  $10 \times 10 \times 10 \times 10 \times 10 \times 10$  in exponent form.

10 is the repeated factor, so 10 is the **base**.

The base is repeated 6 times, so 6 is the **exponent**.

$$10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^6$$

$10^6$  ← exponent  
↑  
base

A base with an exponent can be written in words.

Write  $10^6$  in words.

The exponent 6 means "the sixth power."

$10^6$  in words is "the sixth power of ten."

You can read  $10^2$  in two ways: "ten squared" or "the second power of ten."

You can also read  $10^3$  in two ways: "ten cubed" or "the third power of ten."

Write in exponent form and in word form.

1.  $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

exponent form: \_\_\_\_\_ word form: \_\_\_\_\_

2.  $10 \times 10 \times 10$

exponent form: \_\_\_\_\_ word form: \_\_\_\_\_

3.  $10 \times 10 \times 10 \times 10 \times 10$

exponent form: \_\_\_\_\_ word form: \_\_\_\_\_

Find the value.

4.  $10^4$

5.  $2 \times 10^3$

6.  $6 \times 10^2$

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## Algebra • Multiplication Patterns

You can use basic facts, patterns, and powers of 10 to help you multiply whole numbers by multiples of 10, 100, and 1,000.

**Use mental math and a pattern to find  $90 \times 6,000$ .**

- $9 \times 6$  is a basic fact.  $9 \times 6 = 54$
- Use basic facts, patterns, and powers of 10 to find  $90 \times 6,000$ .

$$\begin{aligned} 9 \times 60 &= (9 \times 6) \times 10^1 \\ &= 54 \times 10^1 \\ &= 54 \times 10 \\ &= 540 \end{aligned}$$

$$\begin{aligned} 9 \times 600 &= (9 \times 6) \times 10^2 \\ &= 54 \times 10^2 \\ &= 54 \times 100 \\ &= 5,400 \end{aligned}$$

$$\begin{aligned} 9 \times 6,000 &= (9 \times 6) \times 10^3 \\ &= 54 \times 10^3 \\ &= 54 \times 1,000 \\ &= 54,000 \end{aligned}$$

$$\begin{aligned} 90 \times 6,000 &= (9 \times 6) \times (10 \times 1,000) \\ &= 54 \times 10^4 \\ &= 54 \times 10,000 \\ &= 540,000 \end{aligned}$$

So,  $90 \times 6,000 = 540,000$ .

**Use mental math to complete the pattern.**

1.  $3 \times 1 = 3$

$3 \times 10^1 = \underline{\hspace{2cm}}$

$3 \times 10^2 = \underline{\hspace{2cm}}$

$3 \times 10^3 = \underline{\hspace{2cm}}$

2.  $8 \times 2 = 16$

$(8 \times 2) \times 10^1 = \underline{\hspace{2cm}}$

$(8 \times 2) \times 10^2 = \underline{\hspace{2cm}}$

$(8 \times 2) \times 10^3 = \underline{\hspace{2cm}}$

3.  $4 \times 5 = 20$

$(4 \times 5) \times \underline{\hspace{2cm}} = 200$

$(4 \times 5) \times \underline{\hspace{2cm}} = 2,000$

$(4 \times 5) \times \underline{\hspace{2cm}} = 20,000$

4.  $7 \times 6 = \underline{\hspace{2cm}}$

$(7 \times 6) \times \underline{\hspace{2cm}} = 420$

$(7 \times 6) \times \underline{\hspace{2cm}} = 4,200$

$(7 \times 6) \times \underline{\hspace{2cm}} = 42,000$

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# Multiply by 1-Digit Numbers

You can use place value to help you multiply by 1-digit numbers.

**Estimate. Then find the product.**  $378 \times 6$

**Estimate:**  $400 \times 6 = 2,400$

**Step 1** Multiply the ones.

Thousands	Hundreds	Tens	Ones
	3	<sup>4</sup> 7	8
			6
			8

**Step 2** Multiply the tens.

Thousands	Hundreds	Tens	Ones
	<sup>4</sup> 3	<sup>4</sup> 7	8
			6
		6	8

**Step 3** Multiply the hundreds.

Thousands	Hundreds	Tens	Ones
	<sup>4</sup> 3	<sup>4</sup> 7	8
			6
2,	2	6	8

So,  $378 \times 6 = 2,268$ .

**Complete to find the product.**

1.  $7 \times 472$

Estimate:  $7 \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

Multiply the ones.

$$\begin{array}{r} 472 \\ \times 7 \\ \hline \end{array}$$

Multiply the tens.

$$\begin{array}{r} \phantom{1} \\ 472 \\ \times 7 \\ \hline \end{array}$$

Multiply the hundreds.

$$\begin{array}{r} \phantom{51} \\ 472 \\ \times 7 \\ \hline \end{array}$$

**Estimate. Then find the product.**

2. Estimate:

$$\begin{array}{r} \underline{\hspace{2cm}} \\ 863 \\ \times 8 \\ \hline \end{array}$$

3. Estimate:

$$\begin{array}{r} \underline{\hspace{2cm}} \\ 809 \\ \times 8 \\ \hline \end{array}$$

4. Estimate:

$$\begin{array}{r} \underline{\hspace{2cm}} \\ 932 \\ \times 7 \\ \hline \end{array}$$

5. Estimate:

$$\begin{array}{r} \underline{\hspace{2cm}} \\ 2,767 \\ \times 7 \\ \hline \end{array}$$

# Multiply by 2-Digit Numbers

You can use place value and regrouping to multiply.

**Find  $29 \times 63$ .**

**Step 1** Write the problem vertically.  
Multiply by the ones.

$$\begin{array}{r} 2 \\ 63 \\ \times 29 \\ \hline 567 \end{array} \leftarrow 63 \times 9 = (\underline{60} \times 9) + (\underline{3} \times 9) \\ = \underline{540} + \underline{27}, \text{ or } \underline{567}$$

**Step 2** Multiply by the tens.

$$\begin{array}{r} 2 \\ 63 \\ \times 29 \\ \hline 567 \\ 1,260 \end{array} \leftarrow 63 \times 20 = (\underline{60} \times 20) + (\underline{3} \times 20) \\ = \underline{1,200} + \underline{60}, \text{ or } \underline{1,260}$$

**Step 3** Add the partial products.

$$\begin{array}{r} 63 \\ \times 29 \\ \hline 567 \\ + 1,260 \\ \hline 1,827 \end{array}$$

So,  $63 \times 29 = 1,827$ .

**Complete to find the product.**

**1.** 
$$\begin{array}{r} 57 \\ \times 14 \\ \hline \end{array}$$

$\leftarrow 57 \times \underline{\quad}$

$+$   $\leftarrow 57 \times \underline{\quad}$

**2.** 
$$\begin{array}{r} 76 \\ \times 45 \\ \hline \end{array}$$

$\leftarrow 76 \times \underline{\quad}$

$+$   $\leftarrow 76 \times \underline{\quad}$

**3.** 
$$\begin{array}{r} 139 \\ \times 12 \\ \hline \end{array}$$

$\leftarrow 139 \times \underline{\quad}$

$+$   $\leftarrow 139 \times \underline{\quad}$

**4.** Find  $26 \times 69$ . Estimate first.

$$\begin{array}{r} 69 \\ \times 26 \\ \hline \end{array}$$

Estimate: \_\_\_\_\_

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## Relate Multiplication to Division

Use the Distributive Property to find the quotient of  $56 \div 4$ .

### Step 1

Write a related multiplication sentence for the division problem.

$$56 \div 4 = \square$$

$$4 \times \square = 56$$

### Step 2

Use the Distributive Property to break apart the product into lesser numbers that are multiples of the divisor in the division problem. Use a multiple of 10 for one of the multiples.

$$(40 + 16) = 56$$

$$(4 \times 10) + (4 \times 4) = 56$$

$$4 \times (10 + 4) = 56$$

### Step 3

To find the unknown factor, find the sum of the numbers inside the parentheses.

$$10 + 4 = 14$$

### Step 4

Write the multiplication sentence with the unknown factor you found. Then, use the multiplication sentence to complete the division sentence.

$$4 \times 14 = 56$$

$$56 \div 4 = 14$$

Use multiplication and the Distributive Property to find the quotient.

1.  $68 \div 4 =$  \_\_\_\_\_

2.  $75 \div 3 =$  \_\_\_\_\_

3.  $96 \div 6 =$  \_\_\_\_\_

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4.  $80 \div 5 =$  \_\_\_\_\_

5.  $54 \div 3 =$  \_\_\_\_\_

6.  $105 \div 7 =$  \_\_\_\_\_

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## Problem Solving • Multiplication and Division

In Brett's town, there are 128 baseball players on 8 different teams. Each team has an equal number of players. How many players are on each team?

Read the Problem	Solve the Problem
<p><b>What do I need to find?</b> I need to find <u>how many players are on each team in Brett's town</u>.</p> <p><b>What information do I need to use?</b> There are <u>8 teams</u> with a total of <u>128 players</u>.</p> <p><b>How will I use the information?</b> I can <u>divide</u> the total number of players by the number of teams. I can use a simpler problem to <u>divide</u>.</p>	<ul style="list-style-type: none"> <li>First, I use the total number of players. <b>128 players</b></li> <li>To find the number of players on each team, I will need to solve this problem. <math>128 \div 8 = \underline{\quad?}</math></li> <li>To find the quotient, I break 128 into two simpler numbers that are easier to divide. <math>128 \div 8 = (80 + \underline{48}) \div 8</math> <math>= (\underline{80} \div 8) + (\underline{48} \div 8)</math> <math>= \underline{10} + 6</math> <math>= \underline{16}</math></li> </ul> <p>So, there are <u>16</u> players on each team.</p>

1. Susan makes clay pots. She sells 125 pots per month to 5 stores. Each store buys the same number of pots. How many pots does each store buy?

$$125 \div 5 = (100 + \underline{\quad}) \div 5$$

$$= (100 \div 5) + (\underline{\quad} \div 5)$$

$$= \underline{\quad} + 5$$

$$= \underline{\quad}$$

2. Lou grows 112 rosemary plants. He ships an equal number of plants to customers in 8 states. How many rosemary plants does he ship to each customer?

$$112 \div 8 = (80 + \underline{\quad}) \div 8$$

$$= (\underline{\quad} \div 8) + (\underline{\quad} \div 8)$$

$$= \underline{\quad} + 4$$

$$= \underline{\quad}$$