Place Value and Patterns

You can use a place-value chart and patterns to write numbers that are 10 times as much as or $\frac{1}{10}$ of any given number.

Each place to the right is $\frac{1}{10}$ of the value of the place to its left.

	$\frac{1}{10}$ of the hundred thousands place	$\frac{1}{10}$ of the ten thousands place	$\frac{1}{10}$ of the thousands place	$\frac{1}{10}$ of the hundreds place	$\frac{1}{10}$ of the tens place
Hundred Thousands	**Ten Thousands**	**Thousands**	**Hundreds**	**Tens**	**Ones**
10 times the ten thousands place	10 times the thousands place	10 times the hundreds place	10 times the tens place	10 times the ones place	

Each place to the left is 10 times the value of the place to its right.

Find $\frac{1}{10}$ of 600.

$\frac{1}{10}$ of 6 hundreds is 6 tens .

So, $\frac{1}{10}$ of 600 is 60 .

Find 10 times as much as 600.

10 times as much as 6 hundreds is 6 thousands.

So, 10 times as much as 600 is 6,000 .

Use place-value patterns to complete the table.

Number	10 times as much as	$\frac{1}{10}$ of
1. 200		
2. 10		
3. 700		
4. 5,000		

Number	10 times as much as	$\frac{1}{10}$ of
5. 900		
6. 80,000		
7. 3,000		
8. 40		

Name _____

Place Value of Whole Numbers

You can use a place-value chart to help you understand whole numbers and the value of each digit. A **period** is a group of three digits within a number separated by a comma.

Millions Period			Thousands Period			Ones Period		
Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones
		2,	3	6	7,	0	8	9

Standard form: 2,367,089

Expanded Form: Multiply each digit by its place value, and then write an addition expression.

$(2 \times 1{,}000{,}000) + (3 \times 100{,}000) + (6 \times 10{,}000) + (7 \times 1{,}000) + (8 \times 10) + (9 \times 1)$

Word Form: Write the number in words. Notice that the millions and the thousands periods are followed by the period name and a comma.

two million, three hundred sixty-seven thousand, eighty-nine

To find the value of an underlined digit, multiply the digit by its place value. In 2,367,089, the value of 2 is $2 \times 1{,}000{,}000$, or 2,000,000.

Write the value of the underlined digit.

1. 153,732,991

_____

2. 236,143,802

_____

3. 264,807

_____

4. 78,209,146

_____

Write the number in two other forms.

5. 701,245

_____

_____

6. 40,023,032

_____

_____

Algebra • Properties

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

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

Use properties to find 37 + 24 + 43.

$37 + 24 + 43 = 24 + \underline{37} + 43$ Use the Commutative Property of Addition to reorder the addends.

$= 24 + (37 + 43)$ Use the Associative Property of Addition to group the addends.

$= 24 + \underline{80}$ Use mental math to add.

$= \underline{104}$

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.** $4 + (6 + 21)$

_____ _____ _____

Complete the equation, and tell which property you used.

4. $(2 \times \_\_\_\_) + (2 \times 2) = 2 \times (5 + 2)$ **5.** $\_\_\_\_ \times 1 = 15$

_____ _____

_____ _____

Algebra • Powers of 10 and Exponents

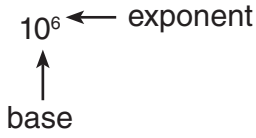
You can represent repeated factors with a base and an exponent.

Write 10 × 10 × 10 × 10 × 10 × 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**.

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



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. 2×10^3 _____

6. 6×10^2 _____

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 × 6,000.

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

$9 \times 60 = (9 \times 6) \times 10^1$
$= 54 \times 10^1$
$= 54 \times 10$
$= 540$

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

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

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

So, 90 × 6,000 = 540,000.

Use mental math to complete the pattern.

1. 3 × 1 = 3

3 × 10^1 = _____

3 × 10^2 = _____

3 × 10^3 = _____

2. 8 × 2 = 16

(8 × 2) × 10^1 = _____

(8 × 2) × 10^2 = _____

(8 × 2) × 10^3 = _____

3. 4 × 5 = 20

(4 × 5) × _____ = 200

(4 × 5) × _____ = 2,000

(4 × 5) × _____ = 20,000

4. 7 × 6 = _____

(7 × 6) × _____ = 420

(7 × 6) × _____ = 4,200

(7 × 6) × _____ = 42,000

Multiply by 1-Digit Numbers

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

Estimate. Then find the product. 378 × 6

Estimate: 400 × 6 = **2,400**

Step 1 Multiply the ones.

	Thousands	Hundreds	Tens	Ones
		3	^{4}7	**8**
×				**6**
				8

Step 2 Multiply the tens.

	Thousands	Hundreds	Tens	Ones
		^{4}3	^{4}**7**	8
×				**6**
			6	8

Step 3 Multiply the hundreds.

	Thousands	Hundreds	Tens	Ones
		^{4}**3**	^{4}7	8
×				**6**
	2,	**2**	6	8

So, 378 × 6 = **2,268**.

Complete to find the product.

1. 7 × 472 Estimate: 7 × _____ = _____

Multiply the ones.

472
× 7

Multiply the tens.

^{1}
472
× 7

Multiply the hundreds.

^{51}
472
× 7

Estimate. Then find the product.

2. Estimate: _____

863
× 8

3. Estimate: _____

809
× 8

4. Estimate: _____

932
× 7

5. Estimate: _____

2,767
× 7

Multiply by 2-Digit Numbers

You can use place value and regrouping to multiply.

Find 29 × 63.

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

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

Step 2 Multiply by the tens.

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

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

← 57 × ____

\+ ____ ← 57 × ____

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

← 76 × ____

\+ ____ ← 76 × ____

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

← 139 × ____

\+ ____ ← 139 × ____

4. Find 26×69. Estimate first. $\begin{array}{r} 69 \\ \times\ 26 \end{array}$

Estimate: _____

Relate Multiplication to Division

Use the Distributive Property to find the quotient of 56 ÷ 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.

$(40 + 16) = 56$
$(4 \times \mathbf{10}) + (4 \times \mathbf{4}) = 56$
$4 \times (\mathbf{10} + \mathbf{4}) = 56$

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.

$4 \times \mathbf{14} = 56$
$56 \div 4 = \mathbf{14}$

Use multiplication and the Distributive Property to find the quotient.

1. $68 \div 4 =$ _____

2. $75 \div 3 =$ _____

3. $96 \div 6 =$ _____

4. $80 \div 5 =$ _____

5. $54 \div 3 =$ _____

6. $105 \div 7 =$ _____

Name _____

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
What do I need to find? I need to find how many players are on each team in Brett's town. **What information do I need to use?** There are 8 teams with a total of 128 players. **How will I use the information?** I can divide the total number of players by the number of teams. I can use a simpler problem to divide.	• First, I use the total number of players. 128 players • To find the number of players on each team, I will need to solve this problem. 128 ÷ 8 = ? • To find the quotient, I break 128 into two simpler numbers that are easier to divide. 128 ÷ 8 = (80 + 48) ÷ 8 = (80 ÷ 8) + (48 ÷ 8) = 10 + 6 = 16 So, there are 16 players on each team.

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 ÷ 5 = (100 + _____) ÷ 5

= (100 ÷ 5) + (_____ ÷ 5)

= _____ + 5

= _____

_____

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 ÷ 8 = (80 + _____) ÷ 8

= (_____ ÷ 8) + (_____ ÷ 8)

= _____ + 4

= _____

_____

Name _____

Algebra • Numerical Expressions

Write words to match the expression.

$$6 \times (12 - 4)$$

Think: Many word problems involve finding the cost of a store purchase.

Step 1 Examine the expression.

• What operations are in the expression? multiplication and subtraction

Step 2 Describe what each part of the expression can represent when finding the cost of a store purchase.

• What can multiplying by 6 represent? buying 6 of the same item

Step 3 Write the words.

• Joe buys 6 DVDs. Each DVD costs $12. If Joe receives a $4 discount on each DVD, what is the total amount of money Joe spends?

1. What is multiplied and what is subtracted?

_____

2. What part of the expression is the price of the item?

_____

3. What can subtracting 4 from 12 represent?

_____

Write words to match the expression.

4. $4 \times (10 - 2)$

_____

_____

_____

_____

5. $3 \times (6 - 1)$

_____

_____

_____

_____

Name _____

Algebra • Evaluate Numerical Expressions

A **numerical expression** is a mathematical phrase that includes only numbers and operation symbols.

You **evaluate** the expression when you perform all the computations to find its value.

Order of Operations
1. Parentheses
2. Multiply and Divide
3. Add and Subtract

To evaluate an expression, use the **order of operations.**

Evaluate the expression $(10 + 6 \times 6) - 4 \times 10$.

Step 1 Start with computations inside the parentheses.

$10 + 6 \times 6$

Step 2 Perform the order of operations inside the *parentheses*.

Multiply and divide from left to right.

$10 + 6 \times 6 = 10 + \underline{36}$

Add and subtract from left to right.

$10 + 36 = \underline{46}$

Step 3 Rewrite the expression with the parentheses evaluated.

$46 - 4 \times 10$

Step 4 *Multiply and divide* from left to right.

$46 - 4 \times 10 = 46 - \underline{40}$

Step 5 *Add and subtract* from left to right.

$46 - 40 = \underline{6}$

So, $(10 + 6 \times 6) - 4 \times 10 = 6$.

Evaluate the numerical expression.

1. $8 - (7 \times 1)$ _____

2. $5 - 2 + 12 \div 4$ _____

3. $8 \times (16 \div 2)$ _____

4. $4 \times (28 - 20 \div 2)$ _____

5. $(30 - 9 \div 3) \div 9$ _____

6. $(6 \times 6 - 9) - 9 \div 3$ _____

7. $11 \div (8 + 9 \div 3)$ _____

8. $13 \times 4 - 65 \div 13$ _____

9. $9 + 4 \times 6 - 65 \div 13$ _____

Name _____

Algebra • Grouping Symbols

Parentheses ( ), *brackets* [ ], and *braces* { }, are different grouping symbols used in expressions. To evaluate an expression with different grouping symbols, perform the operation in the innermost set of grouping symbols first. Then evaluate the expression from the inside out.

Evaluate the expression $2 \times [(9 \times 4) - (17 - 6)]$.

Step 1 Perform the operations in the *parentheses* first.

$2 \times [(9 \times 4) - (17 - 6)]$

$2 \times [\ 36 \ - \ 11\ ]$

Step 2 Next perform the operations in the *brackets*.

$2 \times [\ 36 - 11\ ]$

$2 \times \ 25$

Step 3 Then multiply.

$2 \times 25 = 50$

So, $2 \times [(9 \times 4) - (17 - 6)] = 50$

Evaluate the numerical expression.

1. $4 \times [(15 - 6) \times (7 - 3)]$

$4 \times [9 \times$ _____ $]$

$4 \times [$ _____ $]$

_____

2. $40 - [(8 \times 7) - (5 \times 6)]$

_____

3. $60 \div [(20 - 6) + (14 - 8)]$

_____

4. $5 + [(10 - 2) + (4 - 1)]$

_____

5. $3 \times [(9 + 4) - (2 \times 6)]$

_____

6. $32 \div [(7 \times 2) - (2 \times 5)]$

_____