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Name _____ Date _____

Identify all the sets to which each of the following numbers belong: *natural numbers*, *whole numbers*, *integers*, *rational numbers*, and *real numbers*.

a	b	c	d
1. -6	4	$\frac{5}{8}$	0.3

Find the absolute value of each number.

a	b	c	d
2. $ -26 $	$ 126 $	$ -1.2 $	$ \frac{-1}{2} $

Place the following numbers in order from least to greatest.

a	b	c	d
3. $-1, -3, 0$	$-9, 8, 4$	$-17, -4, 7$	$-1.3, -1, -14$

Simplify.

a	b	c	d
4. $63 \div (7 - 4) \times 2 =$	$4^2 \div 2 - 3 \times 2 =$	$(10 + 8) \div 9 + 30 =$	$(7 - 5) \times (2 + 4) =$

Write an algebraic expression for each verbal expression.

a	b
5. y multiplied by 6 _____	8 decreased by z _____

Evaluate each expression if $a = 8$, $b = 4$, and $c = 2$.

a	b	c	d
6. $ac + b =$	$\frac{a+b}{c} =$	$3b - 2c =$	$a + b - c =$

Solve.

a	b	c	d
7. $n = 4(3 + 2)$	$2s = 10$	$x = 3(2) + 4(1)$	$6 + y = 18$

Solve.

8. In the formula $A = lw$, find A when l is 5 inches and w is 25 inches.

9. In the formula $A = \pi r^2$, find A when r is 14 centimeters.

10. In the formula $I = prt$, find p when I is \$300, r is 4%, and t is 1 year.

11. In the formula $V = lwh$, find w when V is 120 cubic inches, l is 8 inches, and h is 5 inches.

12. In the formula $C = (F - 32)\frac{5}{9}$, find C when F is 59° .

13. In the formula $F = (C \cdot \frac{9}{5}) + 32$, find F when C is 45° .

Simplify.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
14. $6 + (-16) =$	$-8 + (-10) =$	$14 - (-7) =$	$(-4)(-8)$
15. $-5(-7)(-2)$	$-35 \div (-7) =$	$\frac{-18}{6} =$	$4a + 7a =$
16. $27xy - 15xy =$	$-3x + x + (-7x) =$	$7cd - (-15cd) =$	$3t(1.5r) =$
17. $\frac{9z}{3} =$	$3(8 + 6p) =$	$\frac{b}{3}(\frac{a}{6}) =$	$\frac{1}{4}(8a - a) =$

Solve.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
18. $8a - 5 = 3a + 15$	$2b + 6 = b - 4$	$3x - 2 = 2(x + 3)$	$4y - (2y + 6) = 10$
19. $\frac{x}{3} + 5 = \frac{x}{6} + 2$	$\frac{a}{2} + 3 = \frac{2a}{8}$	$\frac{9}{t} = \frac{3}{5}$	$\frac{s}{4} = \frac{6}{8}$

Write an equation. Solve.

20. Three times a number increased by 15 is equal to 30. What is the number?

21. The length of a rectangle is 3 times the width. The area is 48 square inches. Find the length and width.

Answer _____

Answer _____

Change each number from scientific notation to standard form.

<i>a</i>	<i>b</i>	<i>c</i>
22. $2.1 \times 10^3 =$	$0.8 \times 10^4 =$	$1.7 \times 10^{-2} =$

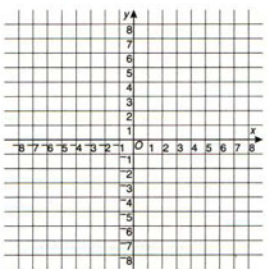
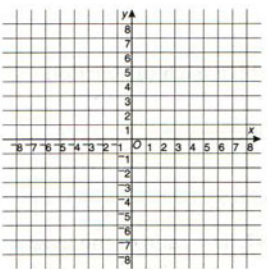
Simplify.

<i>a</i>	<i>b</i>	<i>c</i>
23. $(-3)^2(2)^3 =$	$2ab^2(3c) =$	$(2x^2y)(-3xy^3) =$
24. $(ab^2)^3 =$	$\frac{2x^3}{x^2} =$	$\frac{-8a^3b}{4ab^3} =$
25. $(3a - 3b) + (-a + 5b) =$	$(4a + 2b) - (a + 3b) =$	$4a^2 - 5b^3 + 3a^2 =$
26. $\frac{x}{3y} \cdot \frac{3y}{x} =$	$\frac{a}{b^2} \div \frac{a}{b} =$	$\frac{8ab + 10a^2b}{2ab} =$

Multiply.

<i>a</i>	<i>b</i>	<i>c</i>
27. $3(2x - y) =$	$(r + s)(2r + s) =$	$2a(a^2 - 3b) =$
28. $2x^2(x^2 + 3x + 7) =$	$(x + y)^2 =$	$(x + y)(2x - 3y) =$

Make a table of solutions. Graph the equation. Draw a straight line through the points.

<i>a</i>	<i>b</i>																
29. $3x - 5y = 15$ <table border="1" style="display: inline-table; vertical-align: middle;"> <thead> <tr><th><i>x</i></th><th><i>y</i></th></tr> </thead> <tbody> <tr><td>-5</td><td></td></tr> <tr><td>0</td><td></td></tr> <tr><td>5</td><td></td></tr> </tbody> </table> 	<i>x</i>	<i>y</i>	-5		0		5		$2x + 3y = 6$ <table border="1" style="display: inline-table; vertical-align: middle;"> <thead> <tr><th><i>x</i></th><th><i>y</i></th></tr> </thead> <tbody> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> </tbody> </table> 	<i>x</i>	<i>y</i>						
<i>x</i>	<i>y</i>																
-5																	
0																	
5																	
<i>x</i>	<i>y</i>																

Find the slope of the line that passes through the given points.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
30. (2, 3) and (4, 5)	(1, -3) and (-5, 1)	(1, -2) and (2, -4)	(0, 6) and (5, 7)

What Is Algebra?

Study the following number sentences to find a pattern.

$$1 \times 3 = 3 \quad 1 \times 5.7 = 5.7 \quad 1 \times 12 = 12$$

You can write a general statement about the three number sentences: if a number is multiplied by 1, the product is the number. Here is a way to describe the pattern using a **variable**. Variables are letters or symbols used to represent numbers. The number is represented by the variable n .

$$1 \times n = n \quad \text{where } n \text{ represents any number}$$

Algebra is the study of variables and the operations of arithmetic with variables. Sometimes more than one variable is needed to describe a pattern.

EXAMPLE 1

Study the three number sentences. Describe the pattern using two variables, a and b .

$$22 + 8 = 8 + 22$$

$$3 + 5 = 5 + 3$$

$$10 + 2 = 2 + 10$$

The pattern is $a + b = b + a$.

EXAMPLE 2

Write three number sentences that fit the pattern $\frac{d}{d} = 1$.

Choose any number for d . Here are three possible number sentences.

$$\frac{4}{4} = 1 \quad \frac{1.2}{1.2} = 1 \quad \frac{99}{99} = 1$$

PRACTICE

Describe the pattern using one or two variables.

$$1. \quad \begin{array}{l} 5 \times 6 = 6 \times 5 \\ 7 \times 10 = 10 \times 7 \end{array}$$

$$\begin{array}{l} 4 \times 8 = 8 \times 4 \\ a \times b = b \times a \end{array}$$

$$\begin{array}{l} 3 - 3 = 0 \\ 8 - 8 = 0 \end{array}$$

$$\begin{array}{l} 99 - 99 = 0 \\ \end{array}$$

$$\begin{array}{l} 6 + 6 = 2 \times 6 \\ 10 + 10 = 2 \times 10 \end{array}$$

$$\begin{array}{l} 3 + 3 = 2 \times 3 \\ \end{array}$$

$$\begin{array}{l} 0 \times 7 = 0 \\ 0 \times 10 = 0 \end{array}$$

$$\begin{array}{l} 0 \times 25 = 0 \\ \end{array}$$

Write two number sentences that fit the pattern.

$$2. \quad n + 0 = n$$

$$3 \times a = a + a + a$$

$$3. \quad r + 2 = s$$

$$4 \times m = n$$

Sets of Numbers

Every number belongs to a **set** of numbers. Some numbers belong to more than one set. It is helpful to compare the following sets of numbers by using number lines.

Natural Numbers

{1, 2, 3, 4, ...}

Whole Numbers

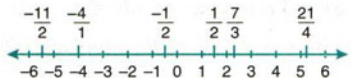
{0, 1, 2, 3, 4, ...}

Integers

{... -3, -2, -1, 0, 1, 2, 3, ...}

Rational Numbers

{all numbers that can be written in the form $\frac{a}{b}$, where a and b are integers and $b \neq 0$ }



Several rational numbers are shown on the number line. Between any two rational numbers, you can always find another rational number.

EXAMPLE 1

Name all the sets to which each of the following numbers belong.

5 Natural Numbers, Whole Numbers, Integers, Rational Numbers

$\frac{1}{3}$ Rational Numbers

EXAMPLE 2

Write three numbers that belong to each of the following sets.

Whole Numbers 0, 2, 7

Integers -8, 0, 5

PRACTICE

Name all the sets to which each of the following numbers belong.

Write *natural numbers*, *whole numbers*, *integers*, or *rational numbers*.

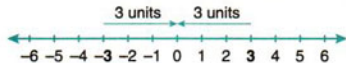
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1. 13 <i>natural numbers,</i> <i>whole numbers,</i> <i>integers, rational</i> <i>numbers</i>	-5	$\frac{1}{5}$	0
_____	_____	_____	_____

Write three numbers that belong to each of the following sets.

2. integers	whole numbers	natural numbers	rational numbers
_____	_____	_____	_____

Understanding Numbers and Absolute Value

The **absolute value** of a number is its distance from 0 on a number line. Look at 3 and -3 . They are both 3 units away from 0.



3 is 3 units from 0. The absolute value of 3 is 3.

-3 is 3 units from 0. The absolute value of -3 is 3.

$|3| = 3$ is read as *the absolute value of 3 equals 3*.

$|-3| = 3$ is read as *the absolute value of -3 equals 3*.

EXAMPLE 1

$$|2| = 2$$

EXAMPLE 2

$$|-30| = 30$$

EXAMPLE 3

$$|9| = 9$$

EXAMPLE 4

$$|-4| = 4$$

PRACTICE

Find the absolute value of each number.

a

b

c

d

1. $|-7| = 7$ $|0| = \underline{\hspace{2cm}}$ $|-17| = \underline{\hspace{2cm}}$ $|22| = \underline{\hspace{2cm}}$

2. $|6| = \underline{\hspace{2cm}}$ $|-9| = \underline{\hspace{2cm}}$ $|-8| = \underline{\hspace{2cm}}$ $|13| = \underline{\hspace{2cm}}$

3. $|-12| = \underline{\hspace{2cm}}$ $|-19| = \underline{\hspace{2cm}}$ $|-11| = \underline{\hspace{2cm}}$ $|26| = \underline{\hspace{2cm}}$

4. $|18| = \underline{\hspace{2cm}}$ $|-3| = \underline{\hspace{2cm}}$ $|10| = \underline{\hspace{2cm}}$ $|-15| = \underline{\hspace{2cm}}$

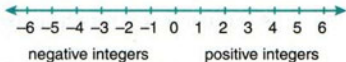
Name the two numbers that have the given absolute value.

5. 23 23, -23 14 32 29

6. 21 40 12 99

Comparing and Ordering Integers

You can use a number line to compare two or more integers.
 An integer is **less than** ($<$) any integer to its right on the number line. An integer is **greater than** ($>$) any integer to its left.
 An integer is **greater than or equal to** (\geq) itself and any integer to its left. An integer is **less than or equal to** (\leq) itself and any integer to its right.



EXAMPLE 1

6 is to the right of 3.
 $3 < 6$ and $6 > 3$
 -2 is to the right of -4 .
 $-4 < -2$ and $-2 > -4$

EXAMPLE 2

3 is to the left of 5.
 $5 > 3$ and $3 < 5$
 -4 is to the left of -3 .
 $-3 > -4$ and $-4 < -3$

PRACTICE

Compare. Write $<$, $>$, or $=$.

1. -9 ^a $<$ 7	-6 ^b $\underline{\hspace{1cm}}$ 1	8 ^c $\underline{\hspace{1cm}}$ 8	0 ^d $\underline{\hspace{1cm}}$ -4
2. 31 $\underline{\hspace{1cm}}$ 18	-5 $\underline{\hspace{1cm}}$ -8	-12 $\underline{\hspace{1cm}}$ -12	0 $\underline{\hspace{1cm}}$ 17
3. -13 $\underline{\hspace{1cm}}$ -9	-11 $\underline{\hspace{1cm}}$ -11	-3 $\underline{\hspace{1cm}}$ 2	-6 $\underline{\hspace{1cm}}$ -2
4. 45 $\underline{\hspace{1cm}}$ 54	-2 $\underline{\hspace{1cm}}$ -19	6 $\underline{\hspace{1cm}}$ -6	0 $\underline{\hspace{1cm}}$ 0
5. -1 $\underline{\hspace{1cm}}$ -1	9 $\underline{\hspace{1cm}}$ -16	0 $\underline{\hspace{1cm}}$ -5	-3 $\underline{\hspace{1cm}}$ -3

Write in order from least to greatest. Use $<$.

6. $5, 0, -6$ $-6 < 0 < 5$	$17, 18, -20$	$0, -47, 74$	$-4, 4, -6$
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Write in order from greatest to least. Use $>$.

7. $1, -6, 8$ $8 > 1 > -6$	$-13, -31, 44$	$-2, -9, 0$	$7, -5, 0$
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