

# 2.1

## Use Integers and Rational Numbers

**Goal** • Graph and compare positive and negative numbers.

### Your Notes

#### VOCABULARY

Whole number are 0, 1, 2, 3, 4...

Integer are whole numbers and their opposites.  
 $-\infty \dots -3, -2, -1, 0, 1, 2, 3 \dots +\infty$

Rational number A NUMBER THAT CAN BE WRITTEN AS A FRACTION.

INTEGERS - NO FRACTIONS

#### Example 1 Graph and compare integers

Graph  $-2$  and  $-5$  on a number line. Then tell which number is less.

#### Solution



On the number line,  $-5$  is to the left of  $-2$ .

So,  $-5 < -2$  OR  $-2 > -5$

Negative integers are integers less than 0 and positive integers are integers greater than 0. The integer 0 is neither negative nor positive.

#### Example 2 Classify numbers

Tell whether each of the following numbers is a whole number, an integer, or a rational number:

Number	Whole Number?	Integer?	Rational Number?
3	Y	Y	Y (3/1)
1.7	N	N	Y (17/10)
-14	N	Y	Y (-14/1)
$-\frac{1}{2}$	N	N	Y
$-5\frac{1}{3}$	N	N	Y (-16/3)
$-\sqrt{4}$	N	Y	Y (-2)
$\pi$	N	N	N 3.14159... NO PATTERN

NOTE:  $\pi$  and  $\sqrt{2}$  are irrational numbers

2 IS NOT A PERFECT SQUARE

Perfect SQUARE

$\sqrt{2}$  N N N 1.4142... NO PATTERN

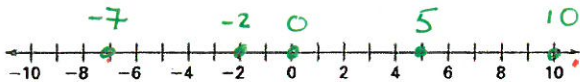
**Example 3** Order rational numbers

**Temperature** The table shows the low daily temperatures for a town over a five-day period. Order the days from warmest to coldest.

Day	1	2	3	4	5
Temperature	0°C	10°C	-2°C	5°C	-7°C

**Solution****Step 1**

Graph the numbers on a number line.

**Step 2**

Read the numbers from left to right: *small* → *big* (coldest to warmest)

-7, -2, 0, 5, 10

From warmest to coldest the days are 10, 5, 0, -2, -7

*big* → *small*  
Read **RIGHT TO LEFT**

**Your Notes****VOCABULARY**

**Opposite** Two numbers that are the same distance from ZERO. **EXAMPLE: 2 and -2**

The symbol for opposite is  **$-a$**

Take the opposite of  $a$ .

**Example 4** Find opposites of numbers

a. If  $a = -4.8$ , then  $-a = -(-4.8) = 4.8$ .

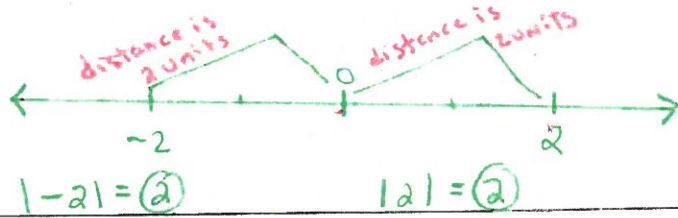
b. If  $a = \frac{5}{6}$ , then  $-a = -\left(\frac{5}{6}\right) = -\frac{5}{6}$

*show substitution*

**VOCABULARY** THINK about || symbols → mean ( )'s

Absolute value IS THE DISTANCE FROM ZERO.

The absolute value symbol is | |.



**ABSOLUTE VALUE OF A NUMBER**

Words

Numbers (EXAMPLE)

If x is a positive number, then  $|x| = x$ .

$|5| = 5$

If x is 0, then  $|x| = 0$ .

$|0| = 0$

If x is a NEGATIVE number, then  $|-x| = x$ .

$|-4| = 4$

Think! Why are these NOT EQUAL?

$$|-5| \neq -|5|$$

$$\downarrow \quad \downarrow$$

$$5 \neq -5$$

You must follow order of operations

3 RULES ①

**Example 5** Find absolute values of numbers

a. If  $a = -\frac{3}{7}$ , then  $|a| = \left| -\frac{3}{7} \right| = \frac{3}{7}$

b. If  $a = 2.9$ , then  $|a| = |2.9| = 2.9$

↑ Show substitution      ↑ "EVALUATE" EXPRESSION

✔ **Checkpoint** For the given value of a, find  $-a$  and  $|a|$ .

2. $a = 6$	3. $a = -9.5$	4. $a = -\frac{3}{8}$
$-(6) = (-6)$	$-a = (9.5)$	$-a = (\frac{3}{8})$
$ 6  = (6)$	$ a  = (9.5)$	$ a  = (\frac{3}{8})$

$-a$  →  
 $|a|$  →

$-a$  means? take the opposite of a

$|a|$  means? take the absolute value of a

## 2.2 Add Real Numbers

**Goal** • Add positive and negative numbers.

### Your Notes

#### VOCABULARY

Additive identity IS ZERO (0). THE SUM OF A NUMBER "A" AND 0 IS "A":  $A + 0 = A$

Additive inverse means the same as "OPPOSITE". THE SUM OF "A" AND ITS OPPOSITE IS 0:  $a + (-a) = 0$

↑ additive inverse

#### Example 1 Add two integers using a number line

Use the number line to find the sum.

a.  $-5 + 7 = +2 = 2$

How do you add a POSITIVE and a NEGATIVE number?

1 TAKE THE DIFFERENCE OF THE NUMBERS

2 KEEP THE SIGN OF THE LARGER ABSOLUTE VALUE

b.  $-3 + (-4) = -7$

How do you add numbers with the same signs?

1 ADD THE NUMBERS

2 KEEP THE SIGN

$$5 + (-7) = -2$$

Remember: To add a positive number, move to the right on a number line. To add a negative number, move to the left.

Your Notes

**RULES OF ADDITION**

To add two numbers with the same sign:

1. Add their ABSOLUTE VALUES
2. The sum has the same sign as the numbers added.

Example:  $-5 + (-7) = -12$

To add two numbers with different signs:

1. Subtract the lesser absolute value.
2. The sum has the same sign as the number with the GREATER absolute value.

Example:  $-10 + 4 = -6$

**Example 2** Add real numbers

Find the sum.

a.  $-2.5 + (-4.2) =$

$=$  *Mental STEP*  
 $= -6.7$

**Rule of same signs**  
 Take absolute values.  
 Add.

b.  $10.5 + (-15.0) =$

$=$  *MENTAL STEP*  
 $= -4.5$

**Rule of different signs**  
 Take absolute values.  
 Subtract and take sign from greater absolute value.

✓ **Checkpoint** Find the sum.

1.  $-7 + (-3)$

$-10$

2.  $9.6 + (-2.1)$

$+7.5$

③  $5 + (-9) + (-12) + 6$

Tip • Add -'s  
 • Then add +'s

$-21 + 11 =$   
 $-10$

**Your Notes**

IN FINAL ANSWERS

$$\begin{array}{c} \boxed{N0 + -} \rightarrow +(-1) \\ \text{X} \\ \text{NO} \\ \text{NO} \end{array}$$

**PROPERTIES OF ADDITION**

**Commutative Property** The order in which you add two numbers does not change the sum.

$$a + b = b + a$$

NOTICE: THE VARIABLES SWITCH. REVERSE THE TERMS. THE RESULTS ARE EQUAL.

Example:  $-1 + 3 = 3 + (-1)$

**Associative Property** The way you group three numbers in a sum does not change the sum.

$$(a + b) + c = a + (b + c)$$

ASSOCIATE MEANS GROUPING SYMBOLS.

Example:  $(1 + 2) + 3 = 1 + (2 + 3)$

NOTICE TERM STAY IN SAME ORDER

**Identity Property** The sum of a number and 0 is the number.

$$a + 0 = a$$

"ANYTHING PLUS 0" IS ITSELF

Example:  $4 + 0 = 4$

**Inverse Property** The sum of a number and its opposite is 0.

$$a + (-a) = 0$$

ADD OPPOSITES EQUALS ZERO

Example:  $-9 + 9 = 0$

\* what is the difference between terms and factors?

\*\* TERMS are separated by +, - signs.

\*\* FACTORS are separated by MULT. SIGNS.

IMPORTANT DEFINITIONS

EXAMPLES

3 TERMS:

$$-2x - 5 + 10 \rightarrow 2x, -5, 10$$

Checkpoint Identify the property being illustrated.

Commutative  
Associative  
IDENTITY  
INVERSE

3.  $-5 + 5 = 0$

INVERSE

4.  $(-5 + 2) + 3 = -5 + (2 + 3)$

ASSOCIATIVE

5.  $x + 5 = 5 + x$

COMMUTATIVE COMMUTATIVE

6.  $y + 0 = y$

Additive IDENTITY

7.  $(5 + 6) + 7 = (6 + 5) + 7$

COMMUTATIVE

3 FACTORS

$$-5 \times y \rightarrow -5, x, y$$

# 2.3

## Subtract Real Numbers

Goal • Subtract real numbers.

Your Notes

**SUBTRACTION RULE**

Words: To subtract  $b$  from  $a$ , add the OPPOSITE of  $b$  to  $a$ .

Algebra:  $a - b = a + (-b)$

Numbers:  $15 - 7 = 15 + (-7)$

→ "ADD THE OPPOSITE"

THERE IS NO SUCH THING AS SUBTRACTION NOW!

We simply add positive and negative #'s.

**Example 1 Subtract real numbers**

Find the difference. *Write as an addition problem*

a.  $-10 - 4 = -10 + (-4) = -14$

b.  $13 - (-11) = 13 + 11 = 24$

**Example 2 Evaluate a variable expression**

Evaluate the expression  $a - b + 5.3$  when  $a = 6.5$  and  $b = -3$ .

**Solution**

$a - b + 5.3 = 6.5 - (-3) + 5.3$  **Substitute values.**

$= 6.5 + 3 + 5.3$  **Add the opposite of -3.**

$= 14.8$  **Add.**

ALWAYS use ( )'s when substituting **NEGATIVE** #'s to make sure you do order operations correctly.

✓ **Checkpoint** Find the difference.

<p>1. <math>-4 - 8 = -4 + (-8) = -12</math></p>	<p>2. <math>9 - 18 = 9 + (-18) = -9</math></p>
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Write as an addition problem →

Then evaluate →

✓ **Checkpoint** Evaluate the expression when  $m = 3.2$  and  $t = -4$ . Show substitution

<p>3. <math>m - t + 2 = 3.2 - (-4) + 2 = 3.2 + 4 + 2 = 9.2</math></p>	<p>4. <math>(m - 3) - t = [(3.2) - 3] - (-4) = .2 + 4 = 4.2</math></p>
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Show substitution →

Write as Add problem →

EVALUATE →