Indicator 43 Class Notes by Mrs. Joshi

Absolute Value and Integers-(7.NS.1b/7.EE.3)

Honors Math-Red Book

1.1 Lesson

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The following numbers are **integers**.

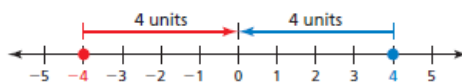$$\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots$$

Key Vocabulary
integer, p. 4
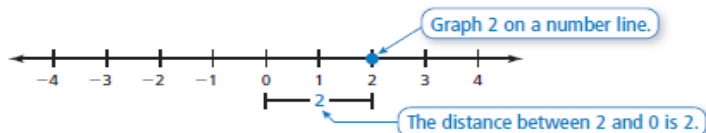absolute value, p. 4

Key Idea

Absolute Value

Words The **absolute value** of an integer is the distance between the number and 0 on a number line. The absolute value of a number a is written as $|a|$.

4 units ← → 4 units

Numbers $|-4| = 4$ $\quad$ $|4| = 4$

EXAMPLE 1 Finding Absolute Value

Find the absolute value of 2.

Graph 2 on a number line.

The distance between 2 and 0 is 2.

So, $|2| = 2$.

EXAMPLE 2 Finding Absolute Value

Find the absolute value of -3.

Graph -3 on a number line.

The distance between -3 and 0 is 3.
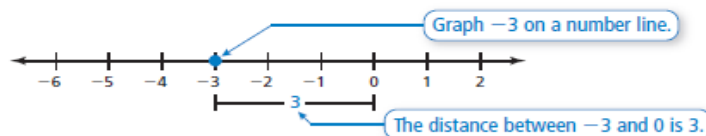
So, $|-3| = 3$.

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EXAMPLE 3 Comparing Values

Compare 1 and $\left|-4\right|$.

Remember

A number line can be used to compare and order integers. Numbers to the left are less than numbers to the right. Numbers to the right are greater than numbers to the left.

Graph 1 on a number line.

Graph $\left|-4\right| = 4$ on a number line.

$\left|-4\right|$

1 is to the left of $\left|-4\right|$.

So, $1 < \left|-4\right|$.

EXAMPLE 4 Real-Life Application

Substance	Freezing Point (°C)
Butter	35
Airplane fuel	−53
Honey	−3
Mercury	−39
Candle wax	55

The *freezing point* is the temperature at which a liquid becomes a solid.

a. Which substance in the table has the lowest freezing point?

b. Is the freezing point of mercury or butter closer to the freezing point of water, 0°C?

a. Graph each freezing point.

Airplane fuel Mercury   Honey   Butter   Candle wax
   −53   −39   −3   35   55
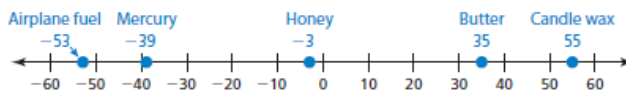
Airplane fuel has the lowest freezing point, −53°C.

b. The freezing point of water is 0°C, so you can use absolute values.

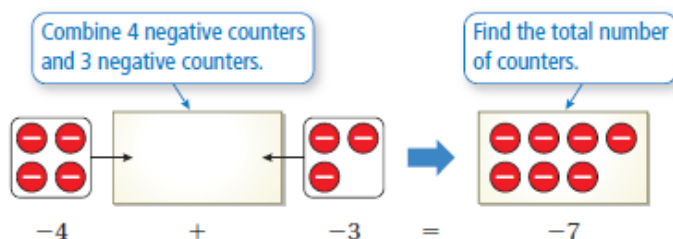Mercury: $\left|-39\right| = 39$ Butter: $\left|35\right| = 35$

Because 35 is less than 39, the freezing point of butter is closer to the freezing point of water.

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Essential Question Is the sum of two integers *positive*, *negative*, or *zero*? How can you tell?
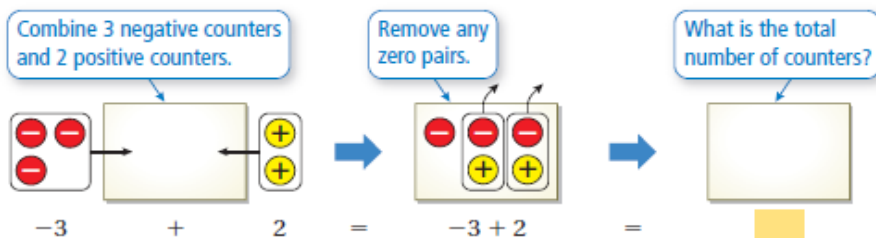
1 EXAMPLE: Adding Integers with the Same Sign

Use integer counters to find $-4 + (-3)$.

Combine 4 negative counters and 3 negative counters.

Find the total number of counters.

$$-4 \qquad + \qquad -3 \qquad = \qquad -7$$

∴ So, $-4 + (-3) = -7$.

2 ACTIVITY: Adding Integers with Different Signs

Work with a partner. Use integer counters to find $-3 + 2$.

Combine 3 negative counters and 2 positive counters.

Remove any zero pairs.

What is the total number of counters?

$$-3 \qquad + \qquad 2 \qquad = \qquad -3 + 2 \qquad =$$

∴ So, $-3 + 2 = \boxed{}$.

3 EXAMPLE: Adding Integers with Different Signs

Use a number line to find $5 + (-3)$.

Start at 0. Move 5 units to the right.

Add -3.

Then move 3 units left to end at 2.

5

−8 −6 −4 −2   0   2   4   6   8
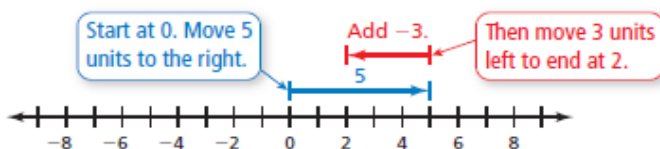
∴ So, $5 + (-3) = 2$.

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🔑 Key Idea

Key Vocabulary 🔊
opposites, *p. 10*
additive inverse, *p. 10*

Adding Integers with the Same Sign

Words   Add the absolute values of the integers. Then use the common sign.

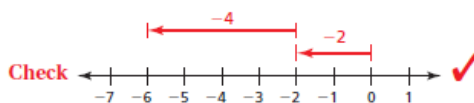**Numbers** $2 + 5 = 7$ $-2 + (-5) = -7$

EXAMPLE 1 — Adding Integers with the Same Sign

Find $-2 + (-4)$. Use a number line to check your answer.

$-2 + (-4) = -6$ Add $\left|-2\right|$ and $\left|-4\right|$.

Use the common sign.

∴ The sum is -6.

Check

Two numbers that are the same distance from 0, but on opposite sides of 0, are called **opposites**. For example, -3 and 3 are opposites.

🔑 Key Ideas

Adding Integers with Different Signs

Words   Subtract the lesser absolute value from the greater absolute value. Then use the sign of the integer with the greater absolute value.

Numbers $8 + (-10) = -2$ $-13 + 17 = 4$

Additive Inverse Property

Words   The sum of an integer and its **additive inverse**, or opposite, is 0.

Numbers $6 + (-6) = 0$ $-25 + 25 = 0$

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EXAMPLE 2 — **Adding Integers with Different Signs**

a. Find $5 + (-10)$.

$$5 + (-10) = -5$$

$|-10| > |5|$. So, subtract $|5|$ from $|-10|$.

Use the sign of -10.

∴ The sum is -5.

b. Find $-3 + 7$.

$$-3 + 7 = 4$$

$|7| > |-3|$. So, subtract $|-3|$ from $|7|$.

Use the sign of 7.

∴ The sum is 4.

c. Find $-12 + 12$.

$$-12 + 12 = 0$$

The sum is 0 by the Additive Inverse Property.

-12 and 12 are opposites.

∴ The sum is 0.

EXAMPLE 3 — **Adding More than Two Integers**

The list shows four bank account transactions in July. Find the change C in the account balance.

JULY TRANSACTIONS	
Deposit	$50
Withdrawal	-$40
Deposit	$75
Withdrawal	-$50

Find the sum of the four transactions.

$$C = 50 + (-40) + 75 + (-50)$$ Write the sum.
$$= 10 + 75 + (-50)$$ Add 50 and -40.
$$= 85 + (-50)$$ Add 10 and 75.
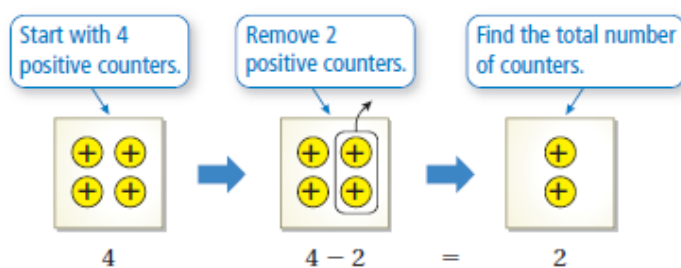$$= 35$$ Add 85 and -50.

∴ Because $C = 35$, the account balance increased $35 in July.

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Essential Question How are adding integers and subtracting integers related?
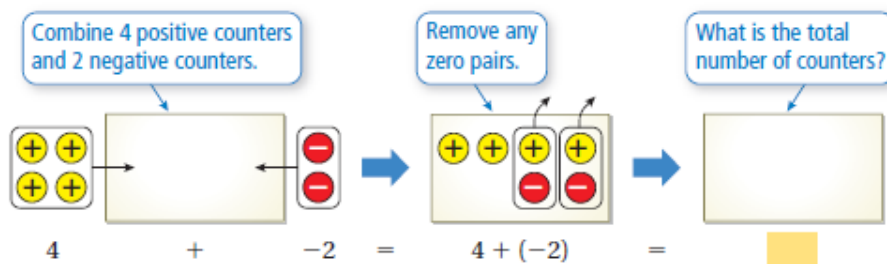
1 EXAMPLE: Subtracting Integers
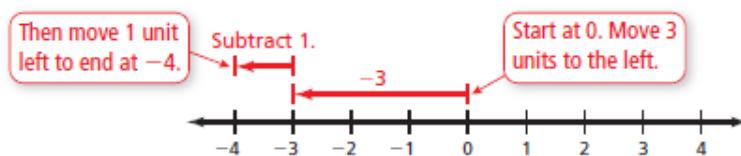
Use integer counters to find $4 - 2$.

Start with 4 positive counters.

Remove 2 positive counters.

Find the total number of counters.

| 4 | | $4 - 2$ | $=$ | 2 |

So, $4 - 2 = 2$.

2 ACTIVITY: Adding Integers

Work with a partner. Use integer counters to find $4 + (-2)$.

Combine 4 positive counters and 2 negative counters.

Remove any zero pairs.

What is the total number of counters?

| 4 | $+$ | -2 | $=$ | $4 + (-2)$ | $=$ | |

3 EXAMPLE: Subtracting Integers

Use a number line to find $-3 - 1$.

Then move 1 unit left to end at -4.

Subtract 1.

Start at 0. Move 3 units to the left.

-3

$-4 \quad -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4$

So, $-3 - 1 = -4$.

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1.3 Lesson

🔴 Key Idea

Subtracting Integers

Words To subtract an integer, add its opposite.

Numbers $3 - 4 = 3 + (-4) = -1$
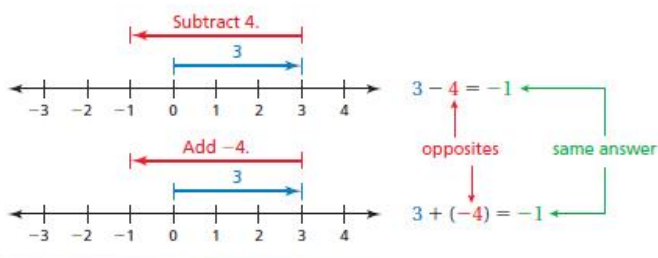
EXAMPLE 1 — Subtracting Integers

a. Find $3 - 12$.

$$3 - 12 = 3 + (-12) \qquad \text{Add the opposite of 12.}$$
$$= -9 \qquad \text{Add.}$$

⋮· The difference is -9.

b. Find $-8 - (-13)$.

$$-8 - (-13) = -8 + 13 \qquad \text{Add the opposite of } -13.$$
$$= 5 \qquad \text{Add.}$$

⋮· The difference is 5.

c. Find $5 - (-4)$.

$$5 - (-4) = 5 + 4 \qquad \text{Add the opposite of } -4.$$
$$= 9 \qquad \text{Add.}$$

⋮· The difference is 9.

EXAMPLE 2   Subtracting Integers

Evaluate $-7 - (-12) - 14$.

$$-7 - (-12) - 14 = -7 + 12 - 14 \qquad \text{Add the opposite of } -12.$$
$$= 5 - 14 \qquad \text{Add } -7 \text{ and } 12.$$
$$= 5 + (-14) \qquad \text{Add the opposite of } 14.$$
$$= -9 \qquad \text{Add.}$$

So, $-7 - (-12) - 14 = -9$.

EXAMPLE 3   Real-Life Application

Which continent has the greater range of elevations?

	North America	Africa
Highest Elevation	6198 m	5895 m
Lowest Elevation	-86 m	-155 m

To find the range of elevations for each continent, subtract the lowest elevation from the highest elevation.

North America

$$\text{range} = 6198 - (-86)$$
$$= 6198 + 86$$
$$= 6284 \text{ m}$$

Africa

$$\text{range} = 5895 - (-155)$$
$$= 5895 + 155$$
$$= 6050 \text{ m}$$

Because 6284 is greater than 6050, North America has the greater range of elevations.