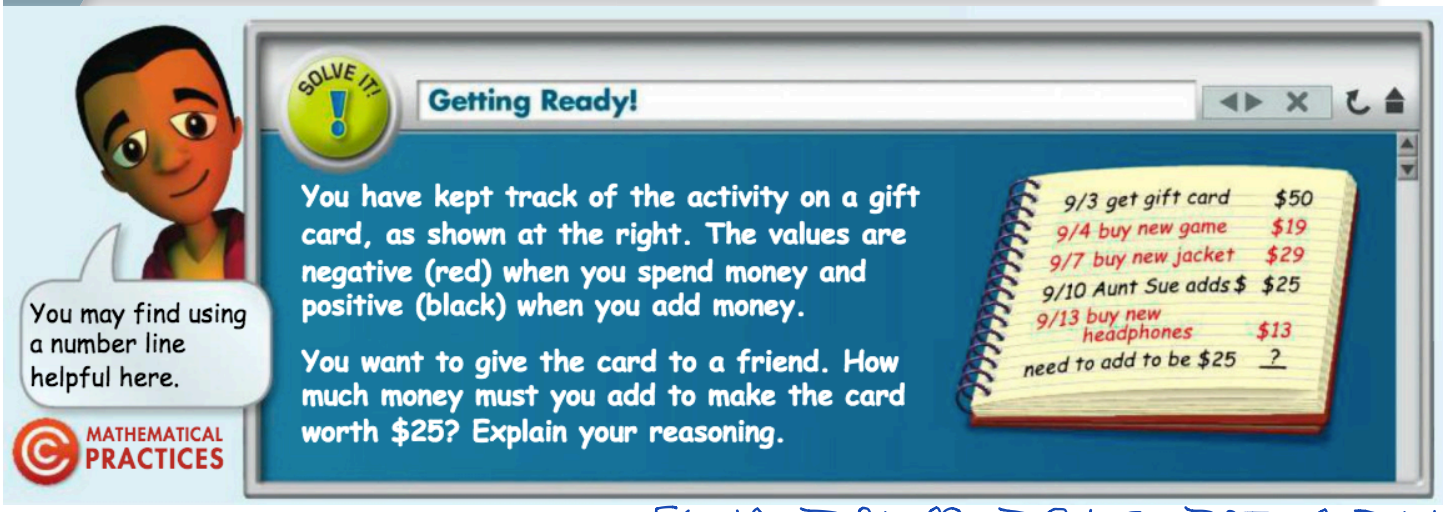
1-5 Adding and Subtracting Real Numbers



50−19 ⇒ 31−29 ⇒ 2+25 ⇒ 27−13 ⇒ 14

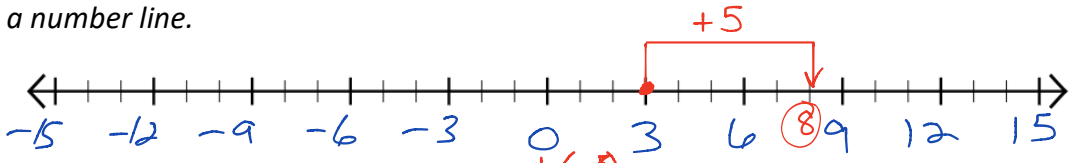
+11

25

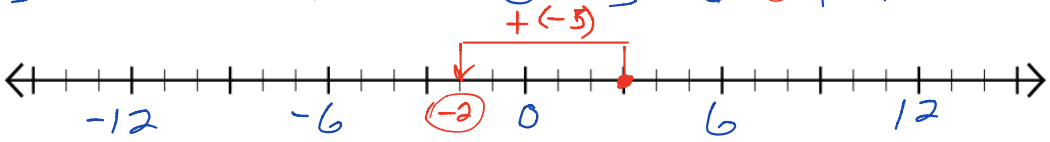
PROBLEM 1: USING NUMBER LINE MODELS

What is each sum? Use a number line.

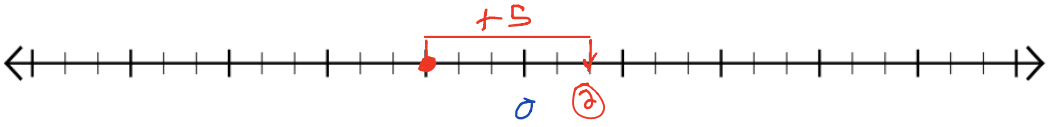
a) 3 + 5 = 8



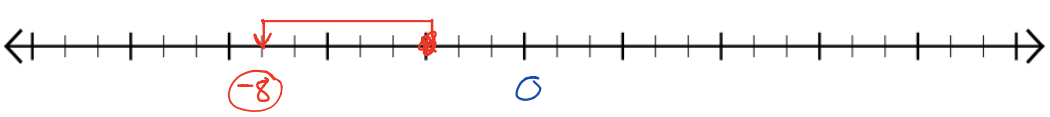
b) 3 + (-5) = -2



c) -3 + 5 = 2



d) -3 + (-5) = -8



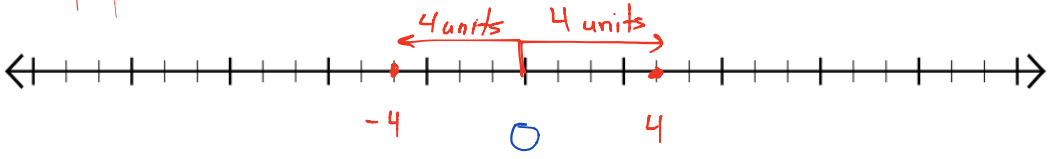
The ***absolute value*** *of a number is its distance from zero on the number line*. Absolute value is always nonnegative since distance is a measurement.

For example, the absolute value of 4 is 4 and the absolute vale of -4 is 4. You can write this as:

|4|

|4|

$$|4| = 4 \text{ and } |-4| = 4.$$



You can use absolute value when you find the sums of real numbers.

KEY CONCEPT: ADDING REAL NUMBERS

Adding Numbers With the Same Sign

To add two numbers with the same sign, add their absolute values. The sum has the same sign as the addends.

Examples: $|3| + |4| = 7$ $\qquad$ $|-3| + |-4| = -7$

Adding Numbers With Different Signs

To add two numbers with different signs, subtract their absolute values. The sum has the same sign as the addend with the greater absolute value.

Examples: $|-3| + |4| = 1$ $\qquad$ $|3| + |-4| = -1$

PROBLEM 2: ADDING REAL NUMBERS

What is each sum?

a) $|-12| + |7|$ $\quad -5$

b). $|-18| + (-2)$ $\quad -20$

c). $|-4.8| + |9.5|$ $\quad 4.7$

d). $\frac{3}{4} + \left(-\frac{5}{6}\right)$ $\quad -\frac{1}{12}$

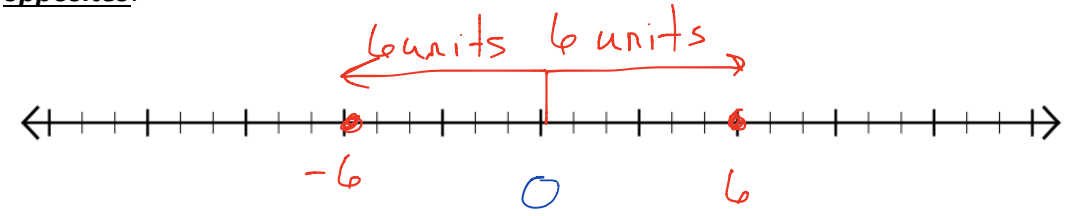
e) $|-16| + |-8|$ $\quad -24$

f). $|-11| + |9|$ $\quad -2$

g). $|9| + |-12|$ $\quad -3$

h). $|-6| + |-2|$ $\quad -8$

Two numbers that are the same distance from zero on a number line but lie in opposite directions are ***opposites***.



-6 $\qquad$ $-(-(-2))$

-2

the opposite of

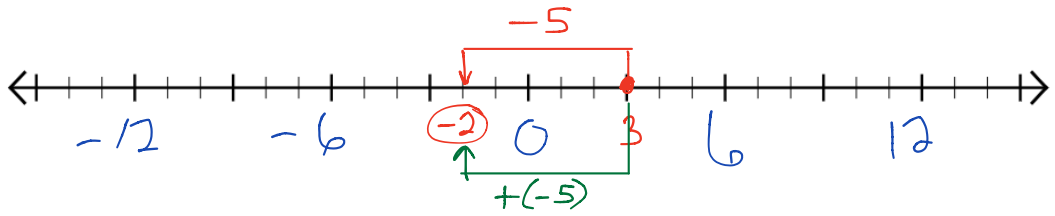
A number and its opposite are called ***additive inverses***. To find the sum of a number and its opposite, you can use the ***Inverse Property of Addition***.

PROPERTY: INVERSE PROPERTY OF ADDITION

For every real number *a*, there is an additive inverse *-a*, such that $a + (-a) = (-a) + a = 0$.

Examples: 14 + (-14) = 0 -14 + 14 = 0

You can use opposites (additive inverses) to subtract real numbers. To see how, use the number line below to model 3-5 and 3+(-5).



KEY CONCEPT: SUBTRACTING REAL NUMBERS

To subtract a real number, add its opposite: $a - b = a + (-b)$.

ADD THE OPPOSITE! (2 changes)

Examples: 3 – (5) = 3 + (-5) = -2 3 – (-5) = 3 + 5 = 8

PROBLEM 3: SUBTRACTING REAL NUMBERS

What is each difference?

16 (16) 32, 48
2: 2, 4, 6, 8, 10, 12, 14, (16)
1 2 3 4 5 6 7 8

a) - 8 + (+13)

|-8| + |13|

13 − 8 = 5

b). 3.5 + (-12.4)

|3.5| + (-12.4|

12.4 − 3.5 = 8.9

-8.9

c). -2.1 – [2.3 + (+1.9)]

-2.1 - [2.3 + 1.9]

2.3 + 1.9 = 4.2

-2.1 + -4.2

-2.1 + (-4.2)

2.1 + 4.2 = 6.3

-6.3

d). $\frac{7}{16} - \left(-\frac{1}{2}\right)$ $\frac{8}{8}$

$\frac{7}{16} - \left(-\frac{8}{16}\right)$

$\frac{7}{16} + \frac{8}{16}$

$\frac{15}{16}$

e) 36 – (-12)

36 + 12

36 + 12 = 48

48

f). -7 – (-5)

-7 + 5

7 − 5 = 2

-2

g). -13 – 7

-13 + (-7)

13 + 7 = 20

-20

h). $\frac{1}{8} - \frac{3}{4}$ $\frac{2}{2}$

$\frac{1}{8} - \frac{6}{8}$

$\frac{1}{8} + \left(-\frac{6}{8}\right)$

6 − 1 = 5

$-\frac{5}{8}$

All of the addition properties of real numbers that you learned in Lesson 1-4 apply to both positive and negative numbers. You can use these properties to reorder and simplify expressions.

PROBLEM 4: ADDING AND SUBTRACTING REAL NUMBERS

a) A reef explorer dives 25 ft to photograph brain coral and then rises 16 ft to travel over a ridge before diving 47 ft so survey the base of the reef. Then the diver rises 29 ft to see an underwater cavern. What is the location of the cavern in relation to sea level?

$0 - 25 + 16 - 47 + 29$

$0 + (-25) + 16 + (-47) + 29$

$-72 + 45$

-27

$25 + 47 = 72$

$16 + 29 = 45$

$72 - 45 = 27$

27 ft below sea level

b) A robot submarine dives 803 ft to the ocean floor. It rises 215 ft as the water gets shallower. Then the submarine dives 2619 ft into a deep crevice. Next, it rises 734 ft to photograph a crack in the wall of the crevice. What is the location of the crack in relation to sea level?

$0 - 803 + 215 - 2619 + 734$

$0 + (-803) + 215 + (-2619) + 734$

$-3422 + 949$

-2473

$803 + 2619 = 3422$

$215 + 734 = 949$

$3422 - 949 = 2473$

2473 ft below sea level

Lesson Check • Do you UNDERSTAND?

Error Analysis **Your friend says that since $-a$ is the opposite of a, the opposite of a number is always negative. Describe and correct the error.**

30. Use a counterexample to describe and correct your friend's error.

The opposite of -2 is $+2$.

Math Success

Check off the vocabulary words that you understand.

☐ absolute value ☐ opposites ☐ additive inverses

Rate how well you can *add and subtract real numbers.*

Need to review 0 2 4 6 8 10 Now I get it!