CITYTUTOR

Seventh Grade Math Lesson Materials

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Identification of the copyrighted work claimed to have been infringed, or, if multiple copyrighted works allegedly have been infringed, then a representative list of such copyrighted works;

Identification of the material that is claimed to be infringing and that is to be removed or access to which is to be disabled, and information reasonably sufficient to permit us to locate the allegedly infringing material, e.g., the specific web page address on the Platform;

Information reasonably sufficient to permit us to contact the party alleging infringement, including an email address;

A statement that the party alleging infringement has a good-faith belief that use of the copyrighted work in the manner complained of is not authorized by the copyright owner or its agent, or is not otherwise permitted under the law; and

A statement that the information in the notification is accurate, and under penalty of perjury, that the party alleging infringement is authorized to act on behalf of the copyright owner of the work that allegedly has been infringed.

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CITYTUTOR DC

G7 Unit 4:

Rational Number Arithmetic

G7 U4 Lesson 1

Interpret signed numbers in the context of temperature and elevation.

G7 U4 Lesson 1 - Students will interpret signed numbers in the context of temperature and elevation.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today is our first lesson of a new unit all about rational numbers. A rational number just means any number that can be written as a fraction. ½ and ⅔ are rational numbers, because they're fractions. Rational numbers also include decimals and whole numbers, because we know we can represent them as fractions. Today, and for most of this unit, we'll look closely at a particular kind of rational number…negative numbers!

Today, we're going to interpret signed numbers in the context of temperature and elevation. Let's get going.

Let's Talk (Slide 3): Take a moment and think about these two questions. Why do we need negative numbers? Where do we see negative numbers in the world around us? When you have an idea or two, share what comes to mind. Possible Student Answers, Key Points:

- I see negative numbers in a video game when somebody loses points.
- I see negative numbers when it's really cold outside. The temperature can be negative.
- If I spend money, my account might show a negative number.

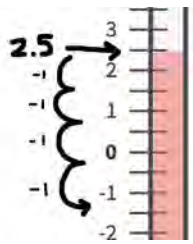
When we first learn about numbers, we tend to focus only on positive numbers, but there are times where negative numbers come in handy. Today, we'll look at two particularly common contexts: temperature and elevation.

Let's Think (Slide 4): Before we read this problem, take a look at the image of the two thermometers. What do you notice or wonder about the visual? Possible Student Answers, Key Points:

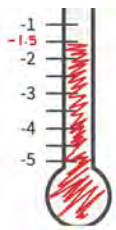
- I notice there are two thermometers labeled afternoon and night. I notice the temperature in the afternoon is between 2 and 3 degrees.I notice the second thermometer is blank.I notice some negative numbers.
- I wonder where these temperatures were take. I wonder if it was snowing, because it seems cold.

Interesting. Let's use the picture of the thermometers to help us solve these problems. *(read the problem aloud)* The first prompt wants us to figure out what the new temperature will be if the temperature drops 4 degrees. What temperature does the afternoon thermometer show? How do you know? Possible Student Answers, Key Points:

- It's halfway between the 2 and the 3. The temperature in the afternoon is 2.5 or 2 ½ degrees.

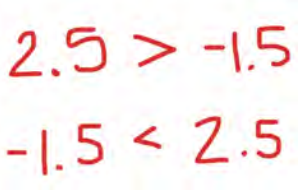


(label 2.5 with an arrow) If the temperature drops 4 degrees, I can picture the red on the thermometer going down 4 degrees. *(draw and label hops on the thermometer as -1 while you narrate the temperature decreasing)* It was 2.5 degrees. If it decreases 1 degree, I see on the thermometer it's now 1.5 degrees. If it decreases 1 degree again, I see it's 0.5 degrees. Again, it's -0.5 degrees. And if it decreases one more time, we're now at -1.5 degrees. So if the temperature starts at 2.5 degrees and drops 4 degrees, the thermometer shows us that it is now, what? (-1.5 degrees)

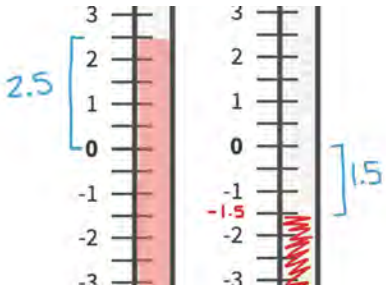


How could I show that on the blank thermometer? *(shade and label thermometer after student explains)* Possible Student Answers, Key Points:

- -1.5 is in the middle of -1 and -2. You can shade to the tick mark that is halfway between -1 and -2.



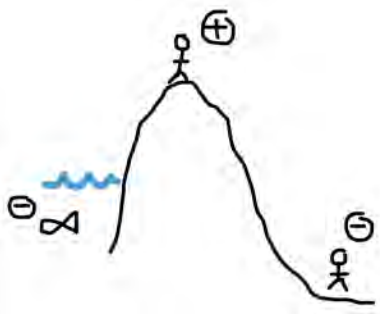
The afternoon temperature was 2.5 degrees. We just figured out that the night temperature is -1.5 degrees. The problem now asks us to write an inequality comparing the afternoon and night temperatures. We can look at the thermometer to easily see that 2.5 is greater than -1.5. *(write 2.5 > -1.5)* The afternoon thermometer's red section is higher up along the thermometer than the night's thermometer. Also, positive numbers are always greater than negative numbers. We can write this comparison another way. What would the inequality look like if we started with -1.5? (-1.5 is less than 2.5) *(write -1.5 < 2.5)* Either way we wrote this comparison is correct.



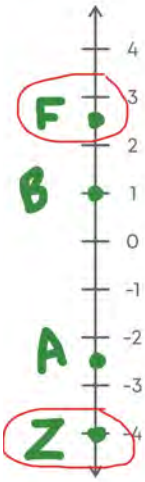
For the last question, they want us to consider how far each temperature is from freezing if zero degrees represents freezing. We can use the thermometer like a number line and mark the distance from 0 to each value. *(draw bracket from 0 to 2.5 on the first thermometer)* How far is 2.5 from 0? *(2.5)* *(write 2.5 next to bracket)* Great, now let's look at the night time temperature. *(draw bracket from 0 to -1.5)* I know the temperature is -1.5. If I look at the intervals from 0 to -1.5, I see that -1.5 is 1.5 away from 0. I might be tempted to say it is *negative* 1.5 from 0, but the question is just asking for the distance. We can say -1.5 is 1.5 degrees from 0.

We just thought about negative numbers in the context of temperature. Let's look at one more context for negative numbers.

Let's Think (Slide 5): This question involves negative numbers in the context of elevation. We'll read it in a moment.



(sketch a simple picture as you explain) Elevation refers to the height of something, usually in reference to sea level. We tend to use 0 to represent sea level. Positive elevations refer to heights *above* sea level. If I'm standing on top of a hill, I'd have a positive elevation. Negative elevations refer to heights *below* sea level. A fish swimming underwater will often be represented with a negative elevation. It's important to note that negative elevations can sometimes refer to objects or people on land too. If you're standing in a deep valley, you might be below sea level, so you'd have a negative elevation.

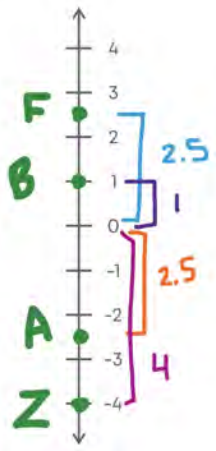


(read the problem aloud) The first question wants us to think about whose elevation is highest and lowest. Before we answer, let's mark each person's elevation on the vertical number line so we can visualize the situation. I'll mark Bailey and Zack first, since those numbers are already labeled clearly on the number line. *(mark 1 and -4 with B and Z, respectively)* Where should I mark Frank and Aya's elevations? Possible Student Answers, Key Points:

- 2.5 should go halfway between the 2 and the 3. -2.5 should go halfway between the -2 and the -3.

(label each point) The vertical number line makes it very easy to see whose elevation is highest and lowest. Frank's elevation is highest, since he's closest to the top of the number line. Zack's elevation is lowest, since he's closest to the bottom of the number line.

The next prompt wants us to consider how far each person is from sea level. Remember, elevations at sea level are typically represented as 0. This prompt is similar to the temperature problem, when it asked us to name how far each temperature was from 0. Let's look at our number line to help us.



Frank's elevation is 2.5 yards. I know that is 2.5 spaces from 0 on the number line. We can say Frank is 2.5 yards from sea level. *(draw and label bracket from 2.5 to 0)*

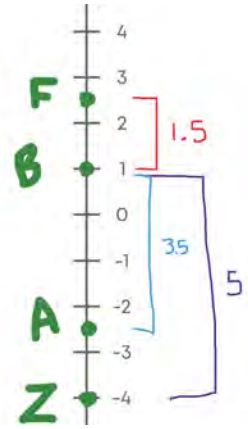
(continue drawing and labeling brackets as you narrate)

Bailey's elevation is 1 yard. How far is Bailey from sea level? (He is 1 yard from sea level)

The other two people have negative elevations. This question is just asking us how far each person is from sea level, or how far they are from 0, so we can respond simply using positive values to name how many yards away they are. How far are Aya and Zack from sea level? How do you know? Possible Student Answers, Key Points:

- Aya is 2.5 yards from sea level, because she is 2 and a half tick marks below 0.
- Zack is 4 yards from sea level, because he is 4 tick marks below 0.

When a question asks us how far people are from 0, we can use a number line to count the intervals between their location to 0.



Let's wrap this up by now finding how far Bailey is from each friend. We know Bailey is at an elevation of +1 yard. Instead of finding the friends' distances from 0, we can now just count how far they are away from 1 on the number line. *(draw and label brackets as you count intervals during the next sequence of dialogue)*

Frank is at positive 2.5 yards. I can move my finger from 1 to 2.5, and see that Bailey is 1.5 yards from Frank. Aya is at negative 2.5 yards. I can move my finger from 1 to -2.5. I see that Bailey is *(whisper count as you move your finger 1, 2, 3, 3.5…)* 3.5 yards from Aya. How far is Bailey from Zack? How do you know? Possible Student Answers, Key Points:

- Bailey is 5 yards from Zack. If I count the intervals from 1 to -4 on the number line, she is 5 spaces away from Zack.

Our answers just now were all positive values, because we were just asked to name how far they are from Bailey. When asked for a distance, it's most common to respond with a positive value, regardless of an object or person's position.

Nice job! We just answered questions involving negative values related to elevation.

Let's Try it (Slides 6 - 7): Now let's work with some more problems where we have to interpret signed numbers in the context of temperature and elevation. As we work, it will be helpful to visualize the position of values by using a vertical number line. We'll also want to keep in mind whether it makes more sense to answer the given question using a negative value or a positive value. Depending on what is being asked, one type of signed number may be more appropriate than another. I know you're going to do great!

WARM WELCOME

Today we will interpret signed numbers in the context of temperature and elevation.

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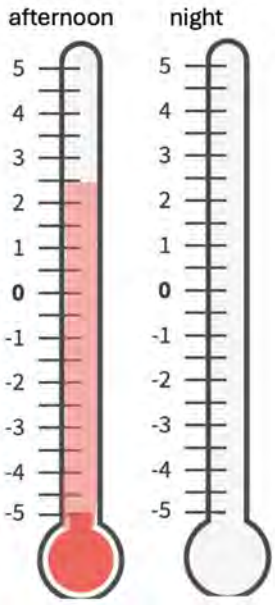
Let's Talk:

Why do we need negative numbers?

Where do we see negative numbers in the world around us?

Let's Think:

The temperature in the afternoon is shown in the first thermometer.



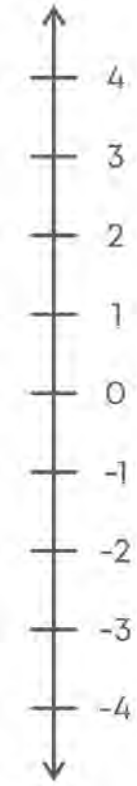
a. At night, the temperature drops 4 degrees. Shade the thermometer. What is the new temperature?

b. Write an inequality to compare the afternoon and night temperatures.

c. Zero degrees is considered freezing. How far is each temperature from freezing?

Let's Think:

NAME	ELEVATION (yards)
Frank	2.5
Aya	-2.5
Bailey	1
Zack	-4



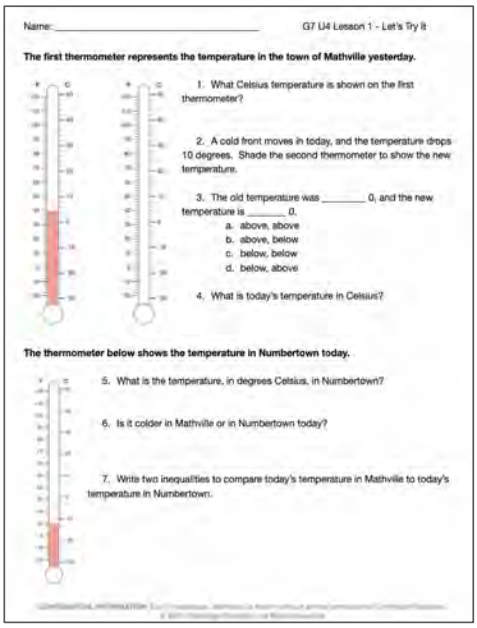
a. Whose elevation is highest? Lowest?

b. How far is each person from sea level?

c. How far is Bailey from each of her friends?

Let's Try It:

Let's explore interpreting signed numbers in the context of temperature and elevation together.



Name:_____ G7 U4 Lesson 1 - Let's Try It

The first thermometer represents the temperature in the town of Mathville yesterday.

1. What Celsius temperature is shown on the first thermometer?

2. A cold front moves in today, and the temperature drops 10 degrees. Shade the second thermometer to show the new temperature.

3. The old temperature was _____ 0, and the new temperature is _____ 0.
   a. above, above
   b. above, below
   c. below, below
   d. below, above

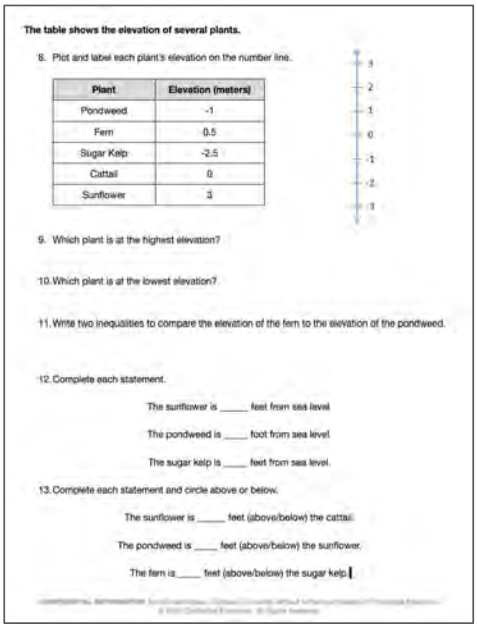
4. What is today's temperature in Celsius?

The thermometer below shows the temperature in Numbertown today.

5. What is the temperature, in degrees Celsius, in Numbertown?

6. Is it colder in Mathville or in Numbertown today?

7. Write two inequalities to compare today's temperature in Mathville to today's temperature in Numbertown.



The table shows the elevation of several plants.

8. Plot and label each plant's elevation on the number line.

Plant	Elevation (meters)
Pondweed	-1
Fern	0.5
Sugar Kelp	-2.5
Cattail	0
Sunflower	3

9. Which plant is at the highest elevation?

10. Which plant is at the lowest elevation?

11. Write two inequalities to compare the elevation of the fern to the elevation of the pondweed.

12. Complete each statement.

The sunflower is _____ feet from sea level.

The pondweed is _____ foot from sea level.

The sugar kelp is _____ feet from sea level.

13. Complete each statement and circle above or below.

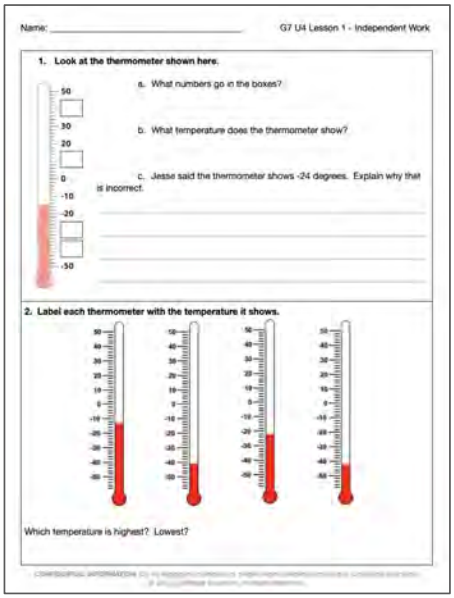
The sunflower is _____ feet (above/below) the cattail.

The pondweed is _____ feet (above/below) the sunflower.

The fern is _____ feet (above/below) the sugar kelp.

On your Own:

Now it's time to explore interpreting signed numbers in the context of temperature and elevation on your own.



Name: _____ G7 U4 Lesson 1 - Independent Work

1. Look at the thermometer shown here.

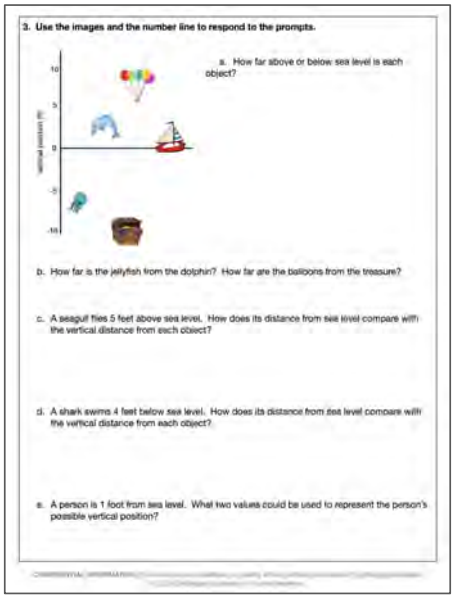
a. What numbers go in the boxes?

b. What temperature does the thermometer show?

c. Jesse said the thermometer shows -24 degrees. Explain why that is incorrect.

2. Label each thermometer with the temperature it shows.

Which temperature is highest? Lowest?



3. Use the images and the number line to respond to the prompts.

a. How far above or below sea level is each object?

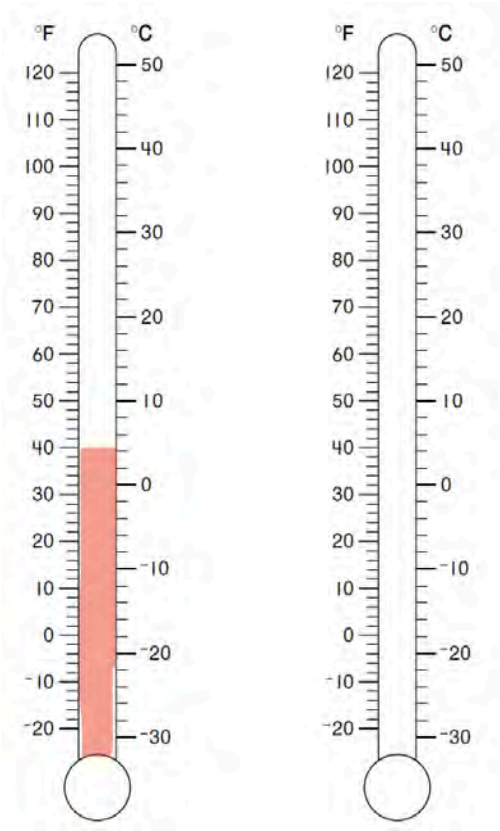
b. How far is the jellyfish from the dolphin? How far are the balloons from the treasure?

c. A seagull flies 5 feet above sea level. How does its distance from sea level compare with the vertical distance from each object?

d. A shark swims 4 feet below sea level. How does its distance from sea level compare with the vertical distance from each object?

e. A person is 1 foot from sea level. What two values could be used to represent the person's possible vertical position?

The first thermometer represents the temperature in the town of Mathville yesterday.



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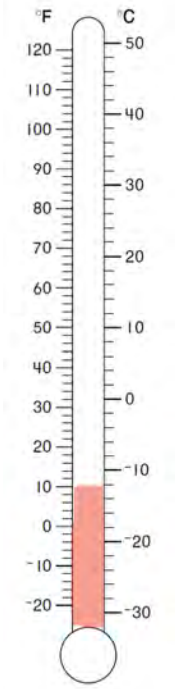

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The table shows the elevation of several plants.

8. Plot and label each plant's elevation on the number line.

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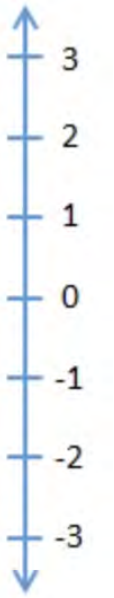

9. Which plant is at the highest elevation?

10. Which plant is at the lowest elevation?

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12. Complete each statement.

The sunflower is _____ feet from sea level.

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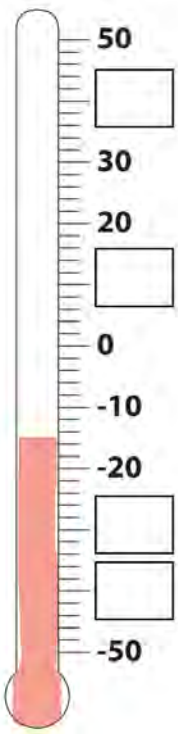
1. Look at the thermometer shown here.

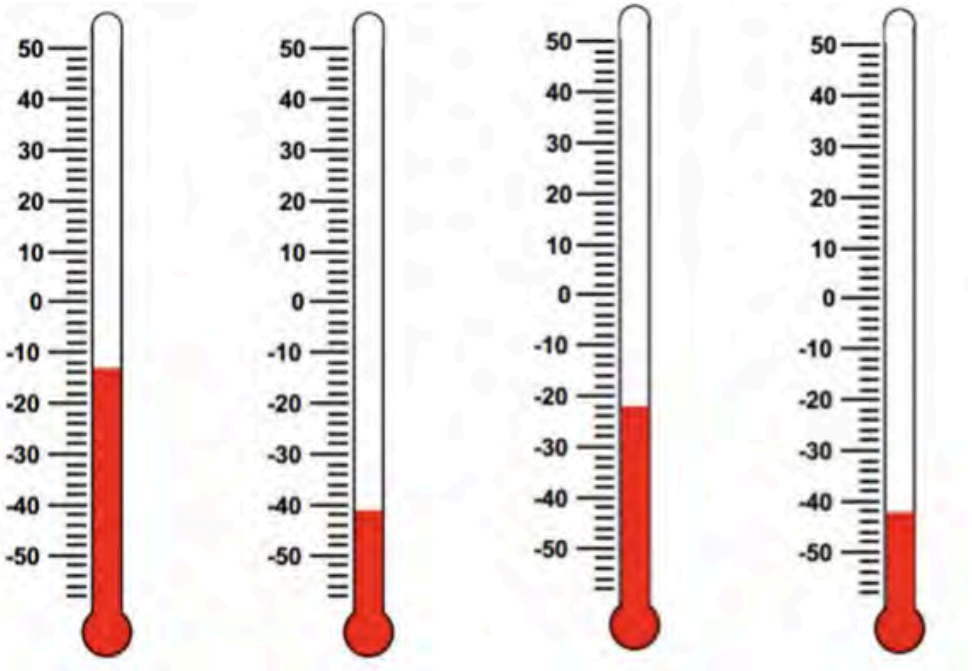


a. What numbers go in the boxes?

b. What temperature does the thermometer show?

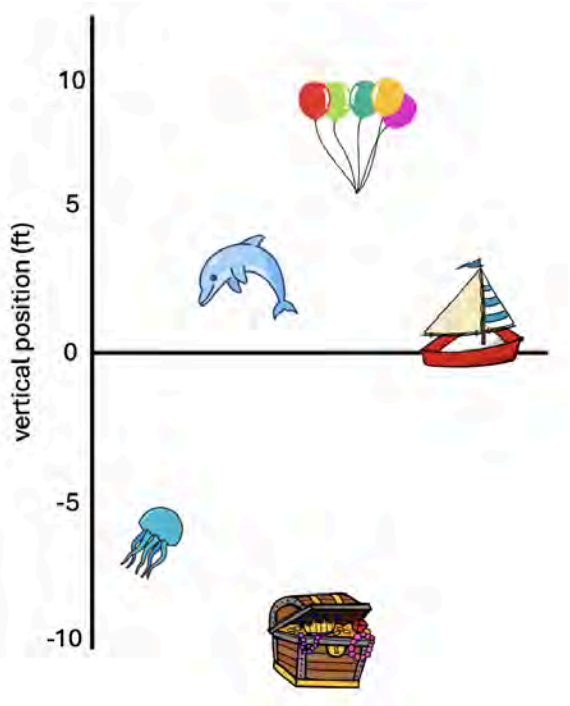
c. Jesse said the thermometer shows -24 degrees. Explain why that is incorrect.

2. Label each thermometer with the temperature it shows.



Which temperature is highest? Lowest?

3. Use the images and the number line to respond to the prompts.



a. How far above or below sea level is each object?

b. How far is the jellyfish from the dolphin? How far are the balloons from the treasure?

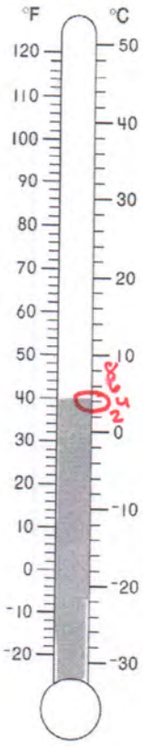
c. A seagull flies 5 feet above sea level. How does its distance from sea level compare with the vertical distance from each object?

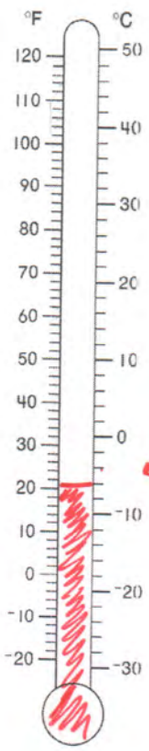
d. A shark swims 4 feet below sea level. How does its distance from sea level compare with the vertical distance from each object?

e. A person is 1 foot from sea level. What two values could be used to represent the person's possible vertical position?

Name: KEY

The first thermometer represents the temperature in the town of Mathville yesterday.





1. What Celsius temperature is shown on the first thermometer?

4°C

2. A cold front moves in today, and the temperature drops 10 degrees. Shade the second thermometer to show the new temperature.

-6°C

3. The old temperature was _____ 0, and the new temperature is _____ 0.

   a. above, above
   b. above, below
   c. below, below
   d. below, above

4. What is today's temperature in Celsius?

-6°C

The thermometer below shows the temperature in Numbertown today.

5. What is the temperature, in degrees Celsius, in Numbertown?

-12°C

6. Is it colder in Mathville or in Numbertown today?

It is colder in Numbertown.

I know because $-12 < -6$.

7. Write two inequalities to compare today's temperature in Mathville to today's temperature in Numbertown.

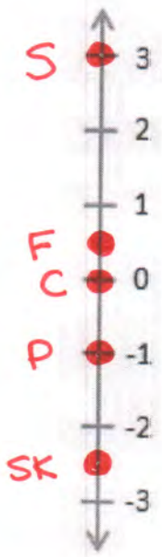
$-12 < -6$

$-6 > -12$

The table shows the elevation of several plants.

8. Plot and label each plant's elevation on the number line.

Plant	Elevation (meters)
Pondweed (P)	-1
Fern (F)	0.5
Sugar Kelp (SK)	-2.5
Cattail (C)	0
Sunflower (S)	3



9. Which plant is at the highest elevation?

The sunflower is at the highest elevation.

10. Which plant is at the lowest elevation?

The sugar kelp is at the lowest elevation.

11. Write two inequalities to compare the elevation of the fern (0.5) to the elevation of the pondweed (-1).

$0.5 > -1$

$-1 < 0.5$

12. Complete each statement.

The sunflower is 3 feet from sea level.

The pondweed is 1 foot from sea level.

The sugar kelp is 2.5 feet from sea level.

13. Complete each statement and circle above or below.

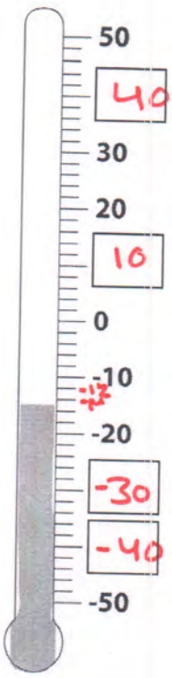
The sunflower is 3 feet (above/below) the cattail.

The pondweed is 4 feet (above/below) the sunflower.

The fern is 3 feet (above/below) the sugar kelp.

Name: KEY

1. Look at the thermometer shown here.



a. What numbers go in the boxes?

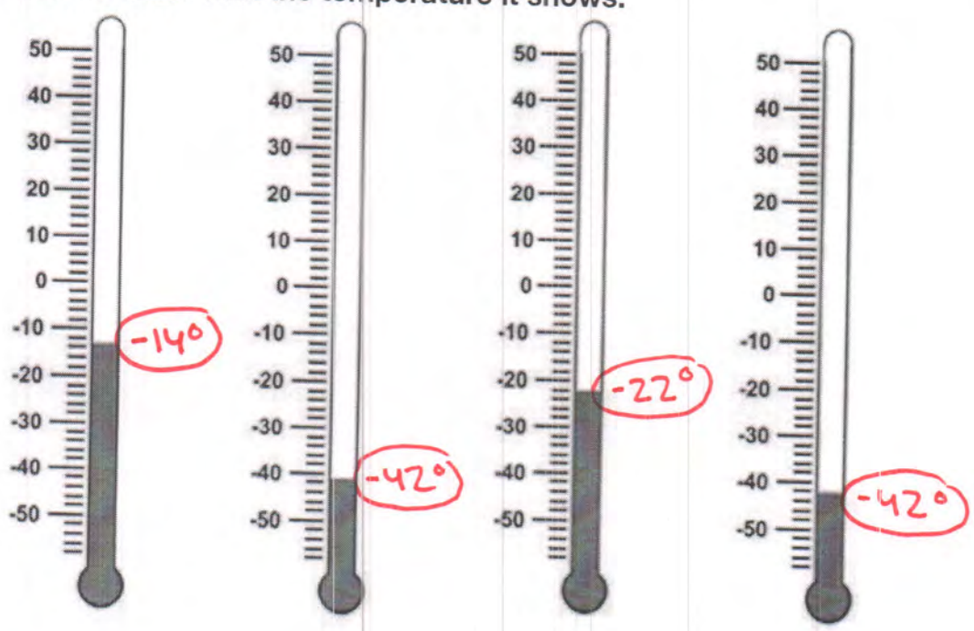
b. What temperature does the thermometer show?

about -15° (or -14 / -16)

c. Jesse said the thermometer shows -24 degrees. Explain why that is incorrect.

That is incorrect, because the temperature is between -10 and -20. -24° would be between -20 and -30.

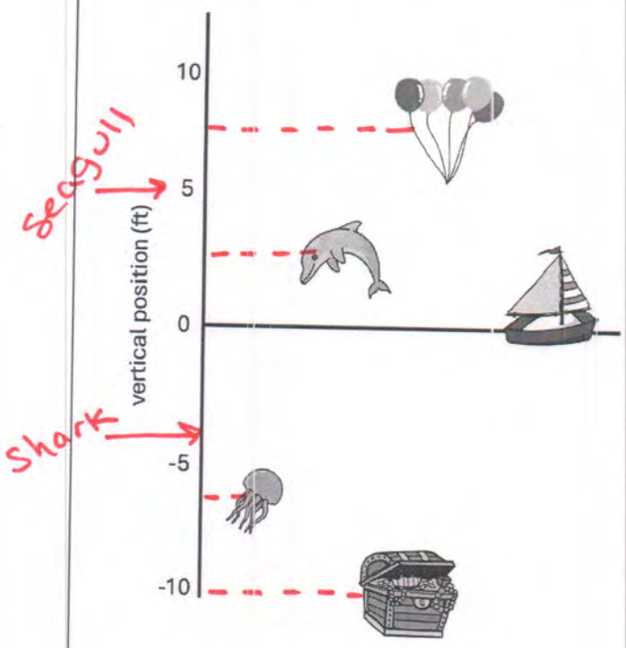
2. Label each thermometer with the temperature it shows.



Which temperature is highest? Lowest?

The highest is -14°, and the lowest is -42°.

3. Use the images and the number line to respond to the prompts.



a. How far above or below sea level is each object?

(answers may vary slightly)

balloons: 8 feet above
dolphin: 2 feet above
boat: 0 feet above/below
jellyfish: 6 feet below
treasure: 10 feet below

b. How far is the jellyfish from the dolphin? How far are the balloons from the treasure?

8 feet

18 feet

c. A seagull flies 5 feet above sea level. How does its distance from sea level compare with the vertical distance from each object?

- It's 3 feet below the balloons.
- It's 3 feet above the dolphin.
- It's 5 feet above the boat.
- It's 11 feet above the jellyfish.
- It's 15 feet above the treasure.

d. A shark swims 4 feet below sea level. How does its distance from sea level compare with the vertical distance from each object?

- It's 12 feet below the balloons.
- It's 6 feet below the dolphin.
- It's 4 feet below the boat.
- It's 2 feet above the jellyfish.
- It's 6 feet above the treasure

e. A person is 1 foot from sea level. What two values could be used to represent the person's possible vertical position?

+1 (above sea level) -1 (below sea level)

G7 U4 Lesson 2

Use a number line to add positive and negative numbers, generalize how to add positive and negative numbers

G7 U4 Lesson 2 - Students will use a number line to add positive and negative numbers, and generalize how to add positive and negative numbers.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson, we spent time thinking about negative values in the contexts of temperature and elevation. What are some things that come to mind when you think about negative numbers in those contexts? Possible Student Answers, Key Points:

- We see negative numbers on thermometers. 0 degrees Celsius is freezing, and negative numbers are below freezing.
- Negative numbers in elevation mean you're below sea level. Sea level is often thought of as having an elevation of 0. Sometimes you can have a negative elevation, but not actually be under water.

Today, those contexts will come in handy as we learn about how to add with positive and negative numbers.

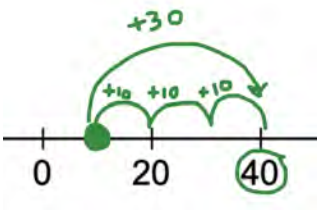
Let's Talk (Slide 3): Take a look at the two images here. What is similar? What is different? Possible Student Answers, Key Points:

- They both have positive and negative numbers. They both count by intervals of 20. They both show -20.
- One is a thermometer, and the other is a number line. One is oriented horizontally and the other is vertical. One uses a point to show the value, and the other uses a shaded scale.

You noticed a lot of important things. In our previous lesson we saw how a thermometer can help us think about positive and negative values. Since a thermometer is very similar to a number line, we can also use number lines to think about negative values. Whether they're horizontal or vertical, number lines can help us easily visualize negative numbers. Today, we'll number lines to help us think about adding with positive and negative numbers.

Let's Think (Slide 4): Picture a thermometer in your mind. What happens to the thermometer when the temperature rises? (the red line goes up) What happens to the thermometer when the temperature falls? (the red line goes down) In this series of problems, we'll see how we can use a horizontal number line to to represent the rise and fall of temperatures, including some values that are negative.

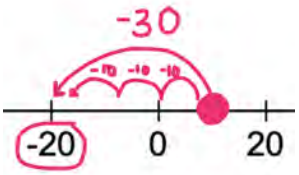
(read the problem aloud)



(sketch on number line as you narrate) Part As says the temperature is 10 degrees, so I'll mark a point on 10. It's not labeled on the number line, but I know 10 is halfway between 0 and 20. Since the temperature is *increasing* 30 degrees, I'll move up my number line 10, then 10, then 10. I know the temperature will be 40 degrees. I can also show that using one big hop of 30, if that's easier for me.

What equation could I write to represent this change in temperature, and how do you know? *(write equation as student shares)* Possible Student Answers, Key Points:

- We can write 10 + 30 = 40. We started at 10 degrees, it went up 30 degrees, and we ended up at 40 degrees on the number line.

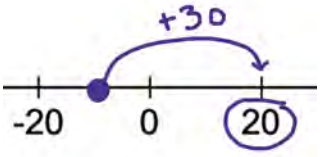


Part B has a similar starting temperature, but the problem says the temperature decreased 30 degrees. This means I'll still mark the starting temperature at 10 degrees on my number line, but I'll move 30 degrees in the other direction. I can show my change in temperature in hops of 10 or one big hop of 30. What temperature is it now? (-20 degrees)

10 - 30 = -20

10 + (-30) = -20

(write equations as you narrate) We can write two equations to represent this change. We can think of this as 10 - 30 = -20, because we started at 10 degrees and went down 30 degrees, ending up at -20 on the number line. We can also think about this as 10 + (-30) = -20. We can think of subtracting as adding a negative quantity. Both equations are equivalent, and depending on the situation, one might be more helpful to think about than the other.

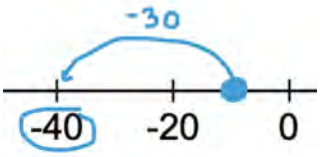


Using what we just did in Part A and Part B, how would you represent Part C on the number line? *(draw as student shares, supporting as needed)* Possible Student Answers, Key Points:

- I would start at -10, between 0 and -20. Then I would draw a hop of 30 to the right, since the temperature is increasing. My answer would be 20 degrees.

-10 + 30 = 20

(write equation) We can represent that change in temperature with the equation -10 + 30 = 20. The starting temperature was -10. We increased, or added, 30 degrees. We ended up at 20 degrees.



Lastly, Part D wants us show the temperature decreasing 30 degrees from -10 degrees. I'll start at -10 like before, but this time I'll move left 30 to show that the temperature is going down. It would be -40 degrees.

-10 - 30 = -40

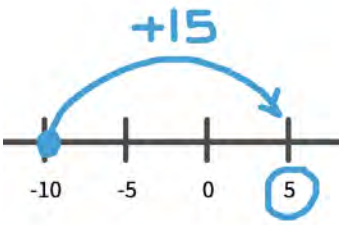
-10 + (-30) = -40

(write equations as student shares) How could I write a subtraction *and* an addition equation to represent this change? Possible Student Answers, Key Points:

- I can write -10 - 30 = -40, since we started at -10 and went back 30.
- I can also write -10 + (-30) = -40, since subtracting is the same as adding a negative value.

Excellent work. We just used a horizontal number line to model temperatures rising and falling. We were able to use equations to show the change in temperature. In the case of the temperature decreasing, we were able to write a subtraction equation and an equation that thought of the change as adding a negative value. Let's keep going.

Let's Think (Slide 5): *(read the problem aloud)* We'll model our thinking similarly for these problems, even though these are about elevation rather than temperature.

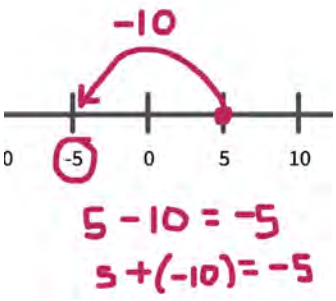


-10 + 15 = 5

Think about Part A. How could I use a number line to model that the fish starts below sea level, and then jumps out of the water? *(sketch on number line as student explains)* Possible Student Answers, Key Points:

- Mark a point at -10, since the fish starts 10 feet below sea level. We should draw a hop to the right 15, because the elevation increased 15 feet.

The number line shows us that the fish's new elevation is positive 5, so 5 feet above sea level. We can represent that with the equation -10 + 15 = 5. *(write equation)* Both the number line and the equation show that the fish started at -10 feet, increased 15 feet in elevation, and ended up with an elevation of +5 feet.



In Part B, we have a seagull diving into the water. How could you use the information from the prompt to model the elevation change on a number line? What words or phrases helped you think about the model? *(sketch on number line as student shares)* Possible Student Answers, Key Points:

- Mark a starting point of +5. The phrase "above sea level" tells me it should be positive 5 rather than -5.
- Draw an arrow to the left 10, since the seagull is "diving". The word diving tells me the elevation is decreasing.

We can think of this as the equation 5 - 10 = -5. The seagull started at 5 feet above sea level. The elevation decreased 10 feet. The seagull ended up at -5 feet. How else can we write this equation? Possible Student Answers, Key Points:

- We can write it as 5 + (-10) = -5. We can always think of subtracting as adding a negative value.

The past several examples hopefully make it clear that number lines are incredibly helpful tools when thinking about increasing and decreasing temperature and elevation.

Let's Try it (Slides 6 - 7): Now let's try some more problems using a horizontal number line to represent changes in temperature and elevation. As we work, we'll want to carefully think about whether the values in a situation are best represented by positive or negative numbers. We'll also want to consider whether the problems involve increasing or decreasing, as that will tell us which direction to shift along the number line. When we write equations to show our thinking, remember that we can think of subtraction equations as addition equations if instead of subtracting, we add a negative value. Let's go for it!

WARM WELCOME

Today we will use a number line to add positive and negative numbers, and generalize how to add positive and negative numbers.

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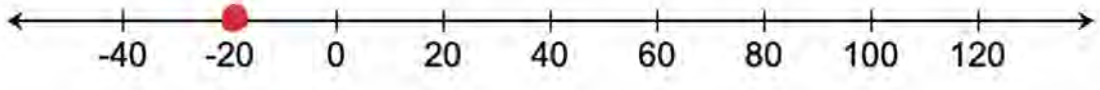
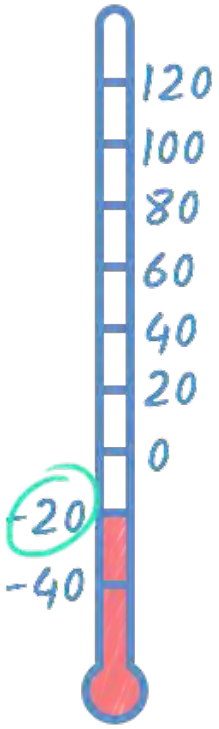
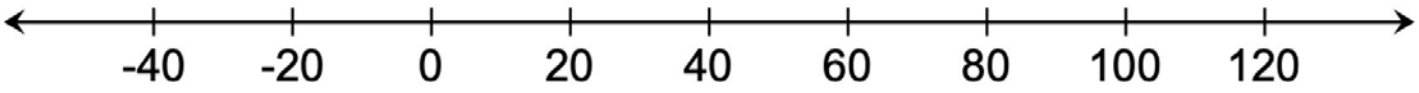
Let's Talk:





Let's Think:

Use the number line to represent each change in temperature.



a. The temperature is 10 degrees. It **increases** 30 degrees.

b. The temperature is 10 degrees. It **decreases** 30 degrees.

c. The temperature is -10 degrees. It **increases** 30 degrees.

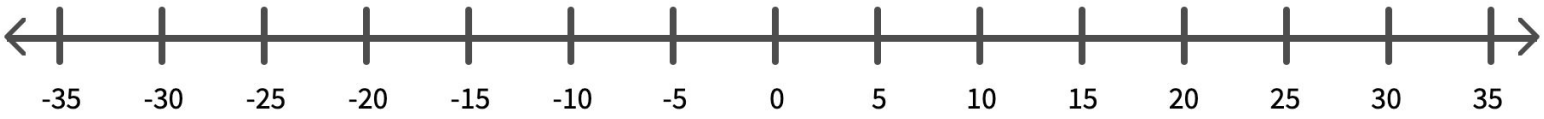
d. The temperature is -10 degrees. It **decreases** 30 degrees.

Let's Think:

Use the number line to represent each change in elevation. Write an equation to match your work.

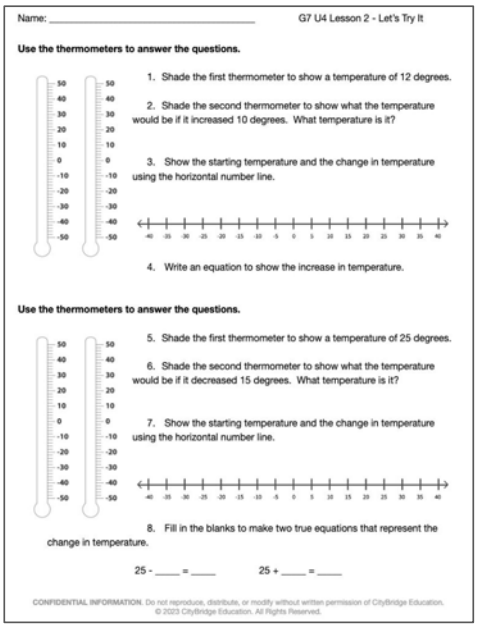
A fish swims 10 feet below sea level. It jumps out of the water, increasing its elevation by 15 feet.

A seagull flies 5 feet above sea level. It dives down 10 feet to catch a fish in the water.



Let's Try It:

Let's explore using a number line to add positive and negative numbers together.



Name: _____ G7 U4 Lesson 2 - Let's Try It

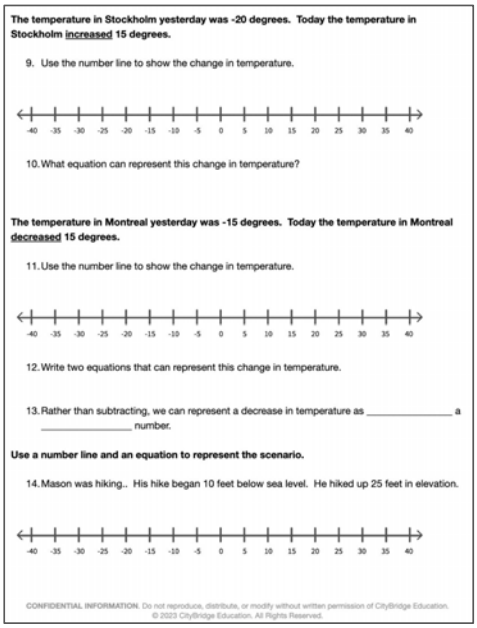
Use the thermometers to answer the questions.

1. Shade the first thermometer to show a temperature of 12 degrees.
2. Shade the second thermometer to show what the temperature would be if it increased 10 degrees. What temperature is it?
3. Show the starting temperature and the change in temperature using the horizontal number line.
4. Write an equation to show the increase in temperature.

Use the thermometers to answer the questions.

5. Shade the first thermometer to show a temperature of 25 degrees.
6. Shade the second thermometer to show what the temperature would be if it decreased 15 degrees. What temperature is it?
7. Show the starting temperature and the change in temperature using the horizontal number line.
8. Fill in the blanks to make two true equations that represent the change in temperature.

25 - ____ = ____ 25 + ____ = ____



The temperature in Stockholm yesterday was -20 degrees. Today the temperature in Stockholm increased 15 degrees.

9. Use the number line to show the change in temperature.
10. What equation can represent this change in temperature?

The temperature in Montreal yesterday was -15 degrees. Today the temperature in Montreal decreased 15 degrees.

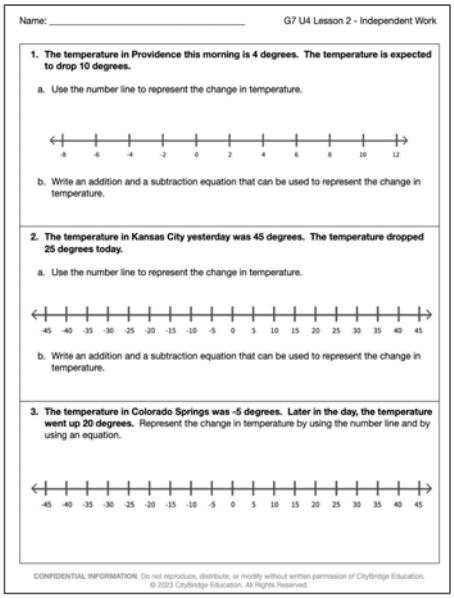
11. Use the number line to show the change in temperature.
12. Write two equations that can represent this change in temperature.
13. Rather than subtracting, we can represent a decrease in temperature as _____ a _____ number.

Use a number line and an equation to represent the scenario.

14. Mason was hiking.. His hike began 10 feet below sea level. He hiked up 25 feet in elevation.

On your Own:

Now it's time to explore using a number line to add positive and negative numbers on your own.



Name: _____ G7 U4 Lesson 2 - Independent Work

1. The temperature in Providence this morning is 4 degrees. The temperature is expected to drop 10 degrees.

a. Use the number line to represent the change in temperature.

b. Write an addition and a subtraction equation that can be used to represent the change in temperature.

2. The temperature in Kansas City yesterday was 45 degrees. The temperature dropped 25 degrees today.

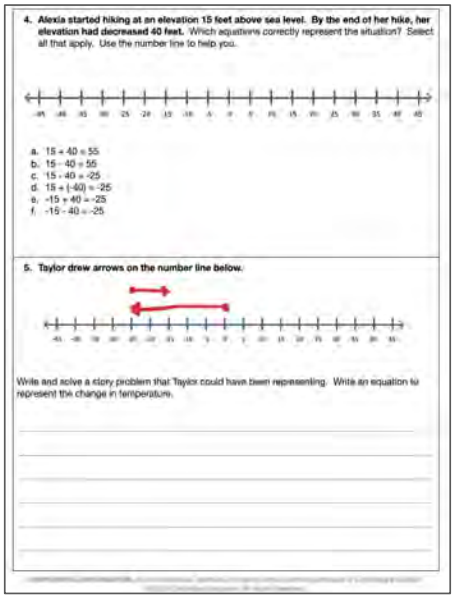
a. Use the number line to represent the change in temperature.

-45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45

b. Write an addition and a subtraction equation that can be used to represent the change in temperature.

3. The temperature in Colorado Springs was -5 degrees. Later in the day, the temperature went up 20 degrees. Represent the change in temperature by using the number line and by using an equation.

-45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45



4. Alexia started hiking at an elevation 15 feet above sea level. By the end of her hike, her elevation had decreased 40 feet. Which equations correctly represent the situation? Select all that apply. Use the number line to help you.

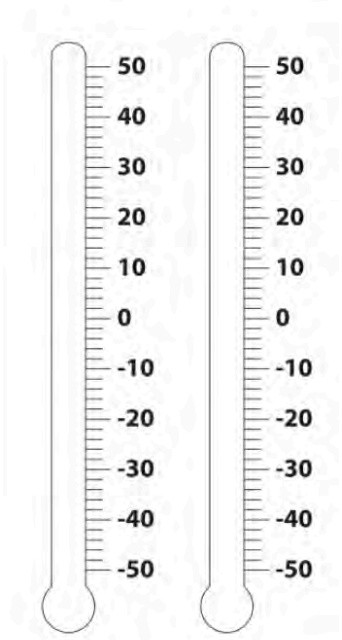
a. $15 + 40 = 55$
b. $15 - 40 = 55$
c. $15 - 40 = -25$
d. $15 + (-40) = -25$
e. $-15 + 40 = -25$
f. $-15 - 40 = -25$

5. Taylor drew arrows on the number line below.

Write and solve a story problem that Taylor could have been representing. Write an equation to represent the change in temperature.

Name: _____ G7 U4 Lesson 2 - Let's Try It

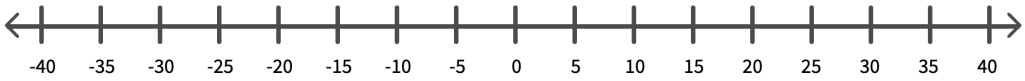
Use the thermometers to answer the questions.



1. Shade the first thermometer to show a temperature of 12 degrees.

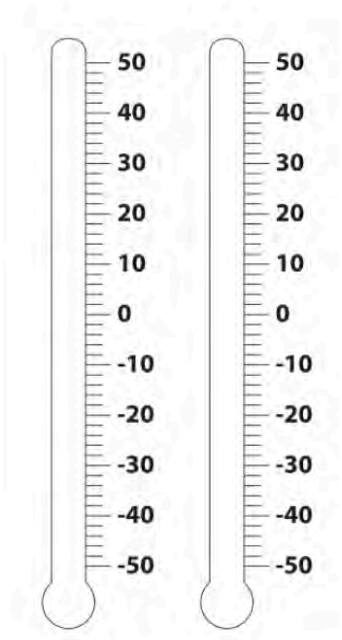
2. Shade the second thermometer to show what the temperature would be if it increased 10 degrees. What temperature is it?

3. Show the starting temperature and the change in temperature using the horizontal number line.



4. Write an equation to show the increase in temperature.

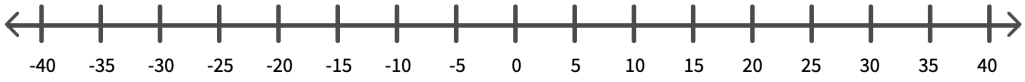
Use the thermometers to answer the questions.



5. Shade the first thermometer to show a temperature of 25 degrees.

6. Shade the second thermometer to show what the temperature would be if it decreased 15 degrees. What temperature is it?

7. Show the starting temperature and the change in temperature using the horizontal number line.

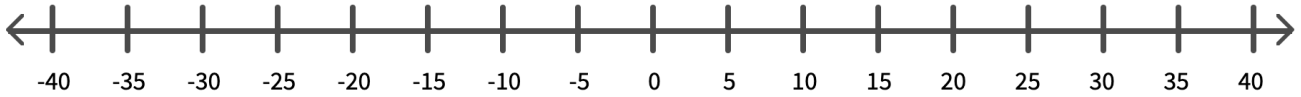


8. Fill in the blanks to make two true equations that represent the change in temperature.

25 - _____ = _____ 25 + _____ = _____

The temperature in Stockholm yesterday was -20 degrees. Today the temperature in Stockholm <u>increased</u> 15 degrees.

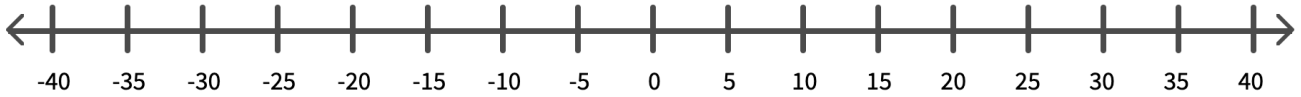
9. Use the number line to show the change in temperature.



10. What equation can represent this change in temperature?

The temperature in Montreal yesterday was -15 degrees. Today the temperature in Montreal <u>decreased</u> 15 degrees.

11. Use the number line to show the change in temperature.

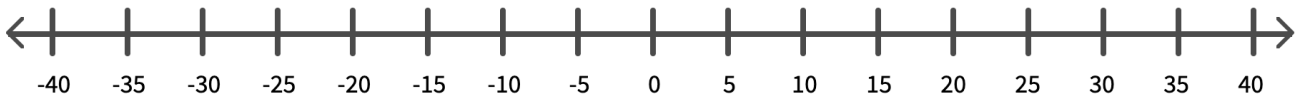


12. Write two equations that can represent this change in temperature.

13. Rather than subtracting, we can represent a decrease in temperature as _____ a _____ number.

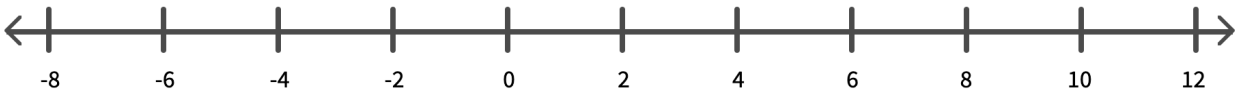
Use a number line and an equation to represent the scenario.

14. Mason was hiking.. His hike began 10 feet below sea level. He hiked up 25 feet in elevation.



1. **The temperature in Providence this morning is 4 degrees. The temperature is expected to drop 10 degrees.**

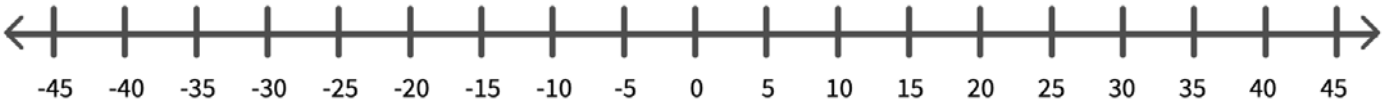
   a. Use the number line to represent the change in temperature.



   b. Write an addition and a subtraction equation that can be used to represent the change in temperature.

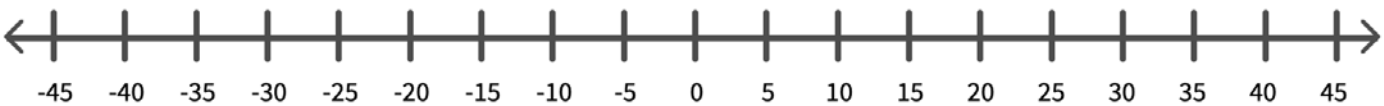
2. **The temperature in Kansas City yesterday was 45 degrees. The temperature dropped 25 degrees today.**

   a. Use the number line to represent the change in temperature.

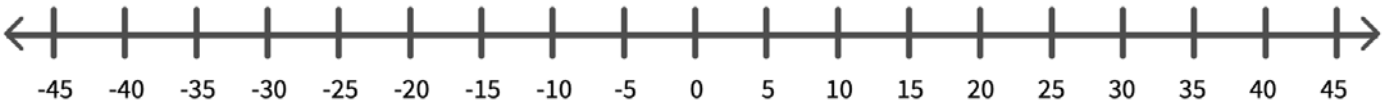


   b. Write an addition and a subtraction equation that can be used to represent the change in temperature.

3. **The temperature in Colorado Springs was -5 degrees. Later in the day, the temperature went up 20 degrees.** Represent the change in temperature by using the number line and by using an equation.

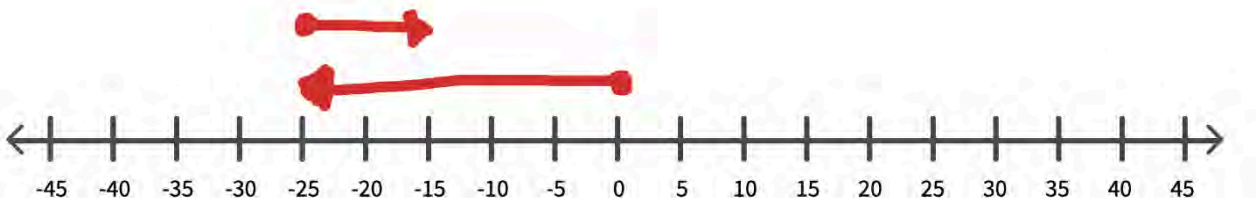


4. **Alexia started hiking at an elevation 15 feet above sea level. By the end of her hike, her elevation had decreased 40 feet.** Which equations correctly represent the situation? Select all that apply. Use the number line to help you.



a. 15 + 40 = 55
b. 15 - 40 = 55
c. 15 - 40 = -25
d. 15 + (-40) = -25
e. -15 + 40 = -25
f. -15 - 40 = -25

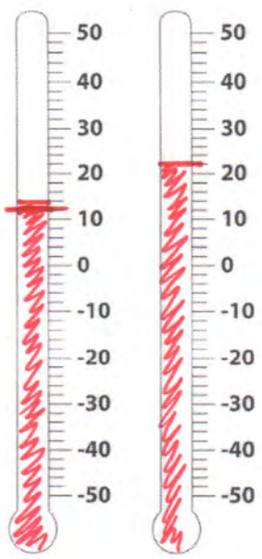
5. **Taylor drew arrows on the number line below.**



Write and solve a story problem that Taylor could have been representing. Write an equation to represent the change in temperature.

Name: KEY

Use the thermometers to answer the questions.

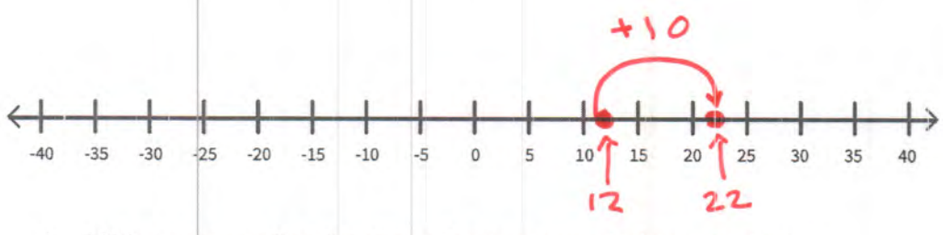


1. Shade the first thermometer to show a temperature of 12 degrees.

2. Shade the second thermometer to show what the temperature would be if it increased 10 degrees. What temperature is it?

22°

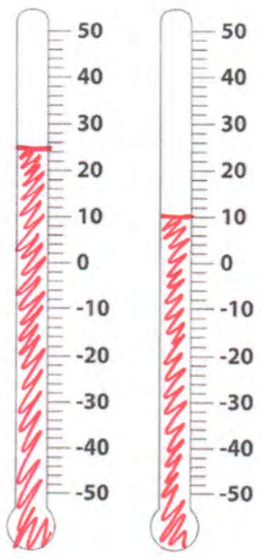
3. Show the starting temperature and the change in temperature using the horizontal number line.



4. Write an equation to show the increase in temperature.

12 + 10 = 22

Use the thermometers to answer the questions.



5. Shade the first thermometer to show a temperature of 25 degrees.

6. Shade the second thermometer to show what the temperature would be if it decreased 15 degrees. What temperature is it?

10°

7. Show the starting temperature and the change in temperature using the horizontal number line.

8. Fill in the blanks to make two true equations that represent the change in temperature.

25 - 15 = 10 25 + -15 = 10

The temperature in Stockholm yesterday was -20 degrees. Today the temperature in Stockholm increased 15 degrees.

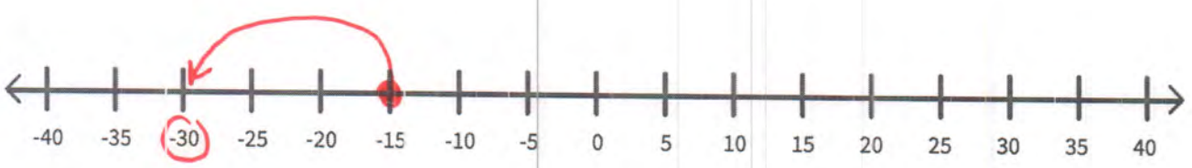
9. Use the number line to show the change in temperature.

10. What equation can represent this change in temperature?

$-20 + 15 = -5$

The temperature in Montreal yesterday was -15 degrees. Today the temperature in Montreal decreased 15 degrees.

11. Use the number line to show the change in temperature.



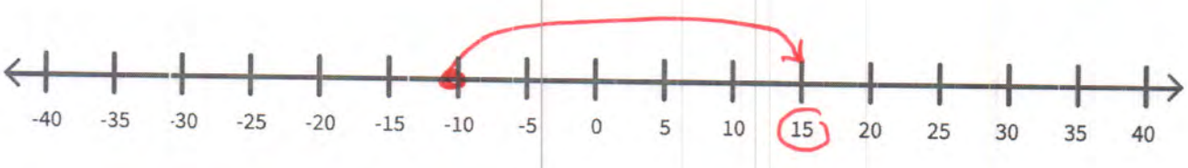
12. Write two equations that can represent this change in temperature.

$-15 - 15 = -30$ $-15 + -15 = -30$

13. Rather than subtracting, we can represent a decrease in temperature as adding a negative number.

Use a number line and an equation to represent the scenario.

14. Mason was hiking.. His hike began 10 feet below sea level. He hiked up 25 feet in elevation.

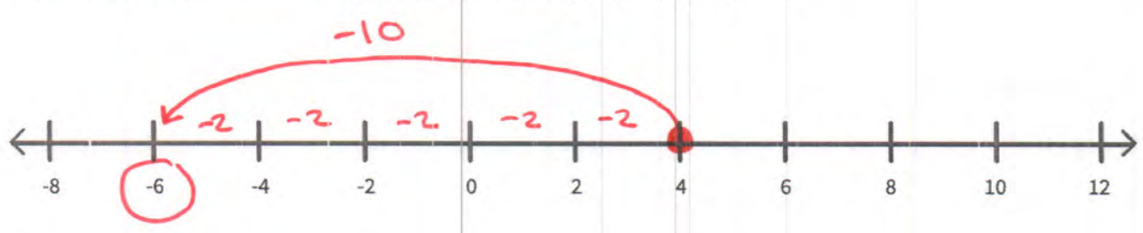


$-10 + 25 = 15$

Name: KEY

1. **The temperature in Providence this morning is 4 degrees. The temperature is expected to drop 10 degrees.**

   a. Use the number line to represent the change in temperature.



   b. Write an addition and a subtraction equation that can be used to represent the change in temperature.

   $4 + -10 = -6$ $4 - 10 = 6$

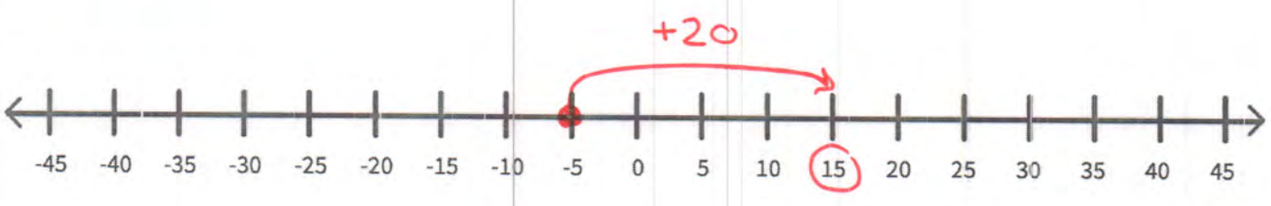
2. **The temperature in Kansas City yesterday was 45 degrees. The temperature dropped 25 degrees today.**

   a. Use the number line to represent the change in temperature.

   b. Write an addition and a subtraction equation that can be used to represent the change in temperature.

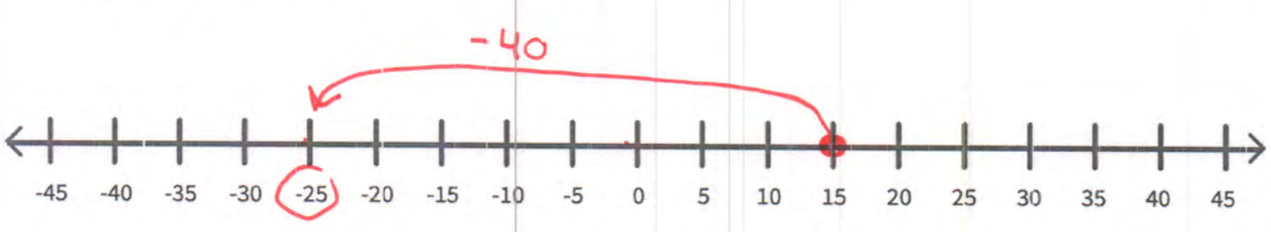
   $45 + -25 = 20$ $45 - 25 = 20$

3. **The temperature in Colorado Springs was -5 degrees. Later in the day, the temperature went up 20 degrees.** Represent the change in temperature by using the number line and by using an equation.



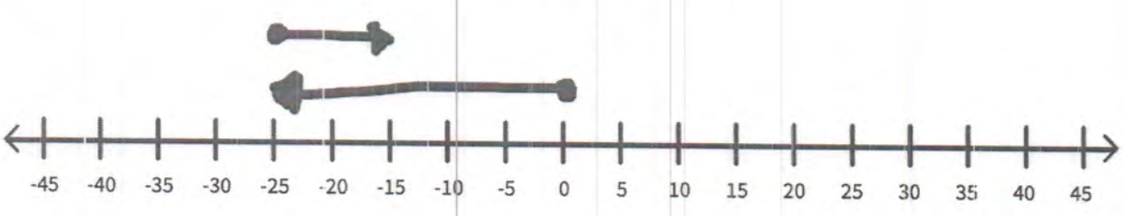
$-5 + 20 = 15$

4. **Alexia started hiking at an elevation 15 feet above sea level. By the end of her hike, her elevation had decreased 40 feet.** Which equations correctly represent the situation? Select all that apply. Use the number line to help you.



a. ~~15 + 40 = 55~~
b. ~~15 - 40 = 55~~
c. 15 - 40 = -25
d. 15 + (-40) = -25
e. ~~-15 + 40 = -25~~
f. ~~-15 - 40 = -25~~

5. **Taylor drew arrows on the number line below.**



Write and solve a story problem that Taylor could have been representing. Write an equation to represent the change in temperature.

The temperature was -25° this morning. It increased 10° by midday. What is the temperature now?

-25 + 10 = -15

G7 U4 Lesson 3

Understand what positive and negative numbers mean in a situation involving money and calculate an account balance after a deposit or withdrawal.

G7 U4 Lesson 3 - Students will understand what positive and negative numbers mean in a situation involving money and calculate an account balance after a deposit or a withdrawal.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We've been learning a lot about negative numbers. We've used number lines to think about negative numbers in the context of both temperature and elevation. Those contexts will continue to help us, but today, we'll focus on thinking about negative numbers in a new context: money! Let's get to work.

Let's Talk (Slide 3): Take a look at the two images here showing screenshots of mobile bank statements. What do you notice about these? What do you wonder? Possible Student Answers, Key Points:

- I notice the first person has a negative total. I notice the second picture shows more money. I notice the second bank statement shows some negative transitions and one positive transaction.
- I wonder how you end up with a negative balance. I wonder how the second amount got to be so much. I wonder if negative numbers mean that the person is spending money.

Negative numbers are very important when thinking about money.

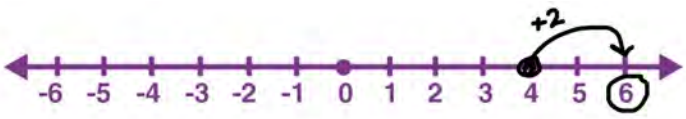
When thinking about money, we typically use positive values to represent *earning* money. For instance, the second screenshot shows the person earned $8,000, so they represent the value with positive 8,000. When money is put into your account like that, it's called a deposit.

You'll also notice their balance, or their bank total, is positive. That means they have $41,682 in their account.

When we see negative numbers on a bank statement, it can mean that you owe money or that you're spending money. The first balance shows -$230.70. This means the person doesn't have any money in their account, and actually owes the bank $230.70. This can happen when you spend more money than you actually have using a credit card. We also see negative numbers in the second bank statement. For example, the person spent $1.68 at Starbucks, so it's represented as negative $1.68. When money is removed from a bank account, it's called a withdrawal.

Let's use positive and negative numbers to think about bank balances, deposits, and withdrawals.

Let's Think (Slide 4): This problem wants us to think about how Prince's account balance of $4 would change if different events occurred. We'll use a number line and equations to show our thinking.



Part A wants us to think about how much Prince will have if he deposits $2. I'll start by marking his beginning balance with a point at positive 4, because he has $4. If he owed $4 for some reason, I would start at -4 on the number line, but that's not the case in this scenario. How can I show he is depositing $2 on this number line? *(sketch as student shares)*
Possible Student Answers, Key Points:

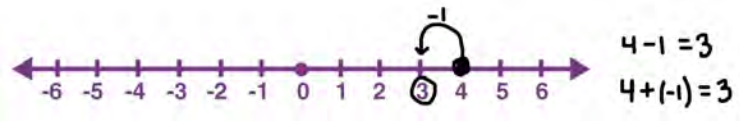
- You should draw an arrow to the right, because a deposit means he is earning money or putting money into his account.
- You should hop 2 spaces right to represent earning $2.

4+2=6

He has $4. He deposits $2. Now he has $6. We can see that on the number line. And we can use the equation 4 + 2 = 6 to represent what is happening. *(write equation)*

Part B is different, because it's asking about a withdrawal of $1. What is happening if Prince is withdrawing money from his account? Possible Student Answers, Key Points:

- He's spending, or he's losing money. His account balance is getting smaller.



(sketch and label as you narrate) I'll mark his starting balance at $4. I'll draw an arrow to the left to show that he withdrew one dollar. I'll label that with -1. We can see on the number line that he now has $3 in his account. We can represent this with subtraction by writing 4 - 1 = 3. We can also think of subtracting as adding a negative value, so another equation that represents this scenario could be 4 + (-1) = 3.

Part C wants us to think about another withdrawal. This time, he is taking withdrawing $10. What do you notice about withdrawing that amount? Possible Student Answers, Key Points:

- He's spending more than he did in Part B.
- He doesn't have enough money in his account.
- I think his balance will end up being negative. He will owe money.

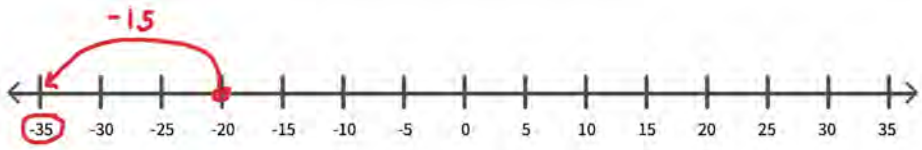
Let's show this on the number line. *(sketch and label as you narrate)* We'll start at 4, because that's his original balance. He is withdrawing, or losing, $10. I'll model that with a big arrow going back 10 spaces. I can see that his balance will now be -$6. This means he actually owes the bank money. What two equations can I use to represent this situation? Possible Student Answers, Key Points:

- We can say 4 - 10 = -6.
- Subtracting a number is the same as adding a negative, so we can also write 4 + (-10) = -6.

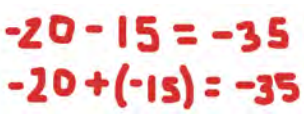
Just like we can use a number line to work with positive and negative numbers in contexts of elevation and temperature, we can use similar thinking to help us tackle problems involving money and bank account balances. Nicely done.

Let's Think (Slide 5): Let's try one more series that's just a bit different. *(read problem aloud)* What do you notice is similar and different about this problem compared to the last one? Possible Student Answers, Key Points:

- It's still about depositing and withdrawing money. It still wants us to use a number line.
- She has a negative balance to start. The number line counts by fives.



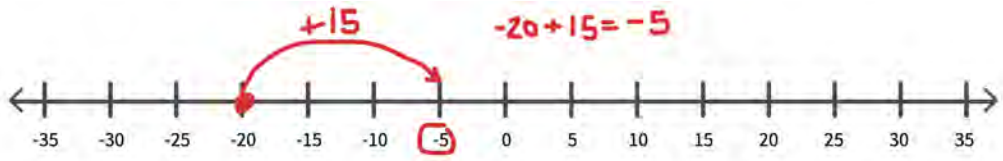
Great, let's start by thinking about Part A. It wants to know her balance if she starts with a balance of $20 and withdraws $15. *(sketch and label number line as you narrate)* Where should I start on the number line given her current account balance? (-20) I'll start at -20. She is withdrawing 15 dollars, so I know her balance is decreasing. I'll show that by labeling an arrow that goes back 15 dollars. Her balance, I can see, is now -$35. This makes sense, because she owed money to start with, and then she kept spending. Her balance shows that she owes more now.



We can represent that change with the equation -20 - 15 = -35. We can also represent it using addition by adding a negative value. That would look like -20 + (-15) = -35. *(write equations)*

Part B is asking us to think about what her balance will be if she deposits, or gains, $15. Describe what that change might look like on the number line. *(sketch and label while student shares)* Possible Student Answers, Key Points:

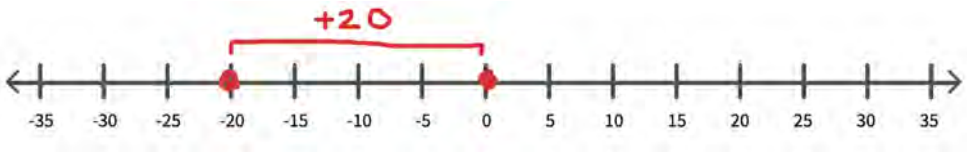
- Plot a point at -20 for her starting balance.
- Since she's earning $15, draw an arrow from -20 to the right 15. You end up on -5.



We ended up at -5. This means her new balance is -$5. We can represent that with the equation -20 + 15 = -5. The balance started at -20, increased 15 dollars, and ended up at -5. Why is it that she earned money, but our answer is still negative? Possible Student Answers, Key Points:

- She didn't earn enough money. She owed the bank more than she deposited, so she still owes the bank a little bit of money.

The last part of this problem asks us to think about what Jayla needs to do to get her balance to $0. The number line can help me think about this situation. I know if her balance is negative, she definitely doesn't want to lose more money if her goal is to get back to $0. I know she'll have to increase her amount. *(sketch a bracket from -20 to 0 on the number line)*. If she wants to have a balance of zero, she needs this much money. How much will she need to earn? ($20) Jayla will need to earn, or deposit, $20 to get her bank balance back to $0 and not owe the bank any more money.



We just used a number line to help us think carefully about situations involving earning and losing money.

Let's Try it (Slides 6 - 7): Now let's practice a few more problems. As we read each problem, pay close attention to the language being used. We can think of a positive balance as the total money in an account and a negative balance as how much somebody owes the bank. We can think of deposits as earning money and withdrawals as losing money. The language in each problem can help us think about how best to model. Should a number be negative or positive? Should my arrow shift left or right? Let's work together to do a few more problems involving money.

WARM WELCOME

Today we will understand what positive and negative numbers mean in a situation involving money and calculate an account balance after a deposit or a withdrawal.

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Let's Talk:

What do you notice?
What do you wonder?

Let's Think:

Prince has a bank balance of $4.

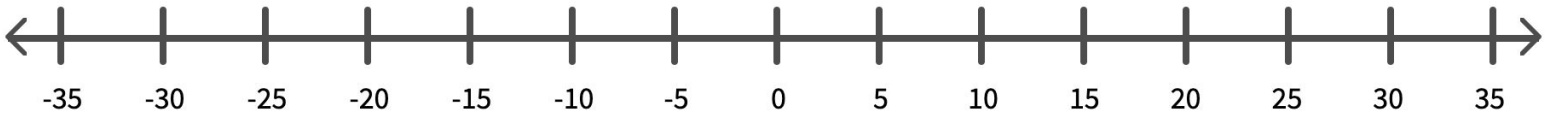
a. How much would Prince have if he deposits $2?

b. How much would Prince have if he withdraws $1?

c. How much would Prince have if he withdraws $10?

Let's Think:

Jayla's bank statement says that her balance is -$20.



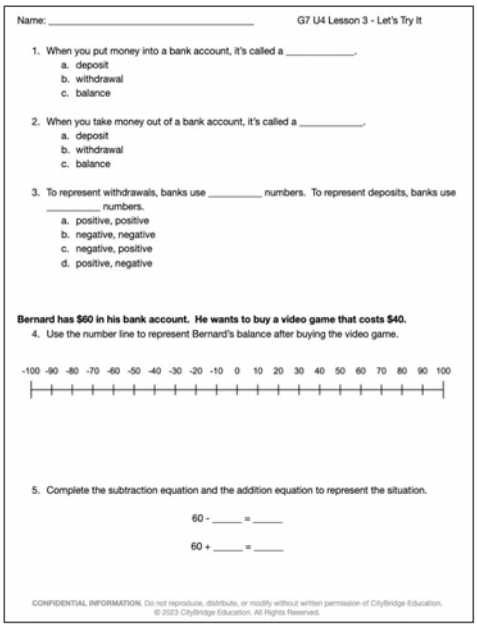
a. What is Jayla's balance if she withdraws $15?

b. What is Jayla's balance if she deposits $15?

c. What does Jayla need to do to have a balance of $0?

Let's Try It:

Let's explore what positive and negative numbers mean in a situation involving money together.



Name: _____ G7 U4 Lesson 3 - Let's Try It

1. When you put money into a bank account, it's called a _____.
   a. deposit
   b. withdrawal
   c. balance

2. When you take money out of a bank account, it's called a _____.
   a. deposit
   b. withdrawal
   c. balance

3. To represent withdrawals, banks use _____ numbers. To represent deposits, banks use _____ numbers.
   a. positive, positive
   b. negative, negative
   c. negative, positive
   d. positive, negative

Bernard has $60 in his bank account. He wants to buy a video game that costs $40.

4. Use the number line to represent Bernard's balance after buying the video game.

-100 -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100

5. Complete the subtraction equation and the addition equation to represent the situation.

60 - ____ = ____

60 + ____ = ____

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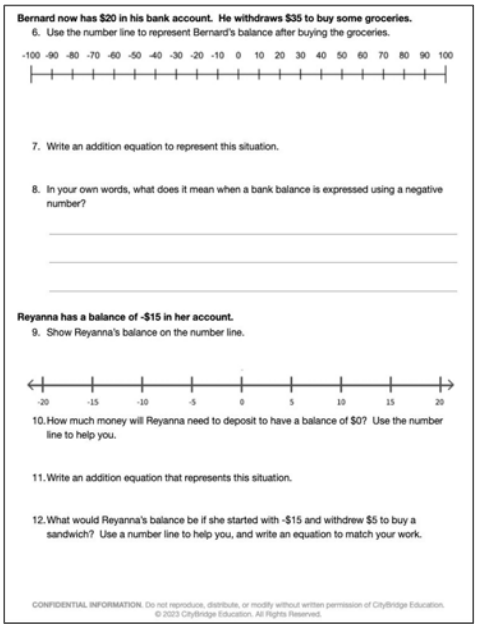

Bernard now has $20 in his bank account. He withdraws $35 to buy some groceries.

6. Use the number line to represent Bernard's balance after buying the groceries.

-100 -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100

7. Write an addition equation to represent this situation.

8. In your own words, what does it mean when a bank balance is expressed using a negative number?

Reyanna has a balance of -$15 in her account.

9. Show Reyanna's balance on the number line.

-20 -15 -10 -5 0 5 10 15 20

10. How much money will Reyanna need to deposit to have a balance of $0? Use the number line to help you.

11. Write an addition equation that represents this situation.

12. What would Reyanna's balance be if she started with -$15 and withdrew $5 to buy a sandwich? Use a number line to help you, and write an equation to match your work.

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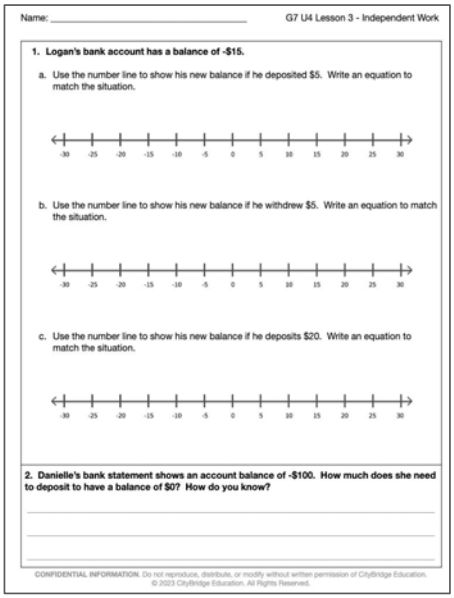
On your Own:

Now it's time to explore what positive and negative numbers mean in a situation involving money own.



Name: _____ G7 U4 Lesson 3 - Independent Work

1. Logan's bank account has a balance of -$15.

a. Use the number line to show his new balance if he deposited $5. Write an equation to match the situation.

-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30

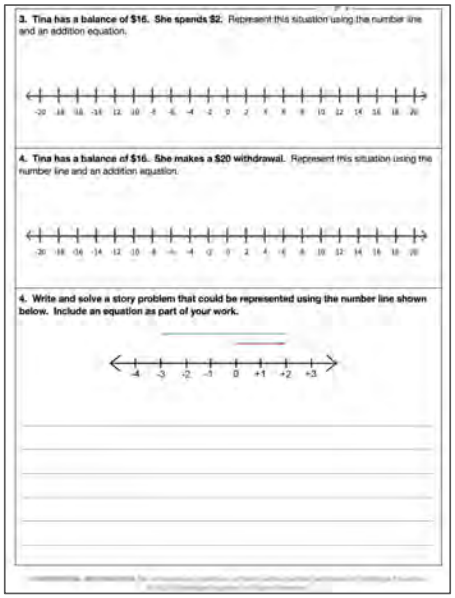
b. Use the number line to show his new balance if he withdrew $5. Write an equation to match the situation.

-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30

c. Use the number line to show his new balance if he deposits $20. Write an equation to match the situation.

-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30

2. Danielle's bank statement shows an account balance of -$100. How much does she need to deposit to have a balance of $0? How do you know?



3. Tina has a balance of $16. She spends $2. Represent this situation using the number line and an addition equation.

4. Tina has a balance of $16. She makes a $20 withdrawal. Represent this situation using the number line and an addition equation.

4. Write and solve a story problem that could be represented using the number line shown below. Include an equation as part of your work.

-4 -3 -2 -1 0 +1 +2 +3

Name: _____ G7 U4 Lesson 3 - Let's Try It

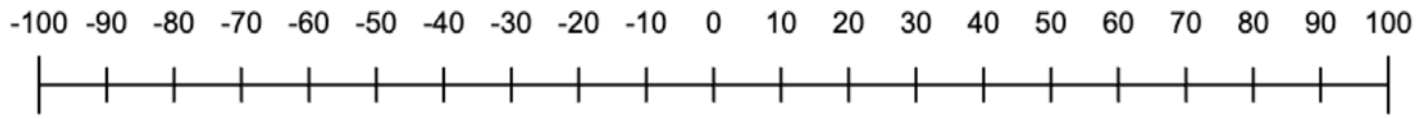
1. When you put money into a bank account, it's called a _____.
   a. deposit
   b. withdrawal
   c. balance

2. When you take money out of a bank account, it's called a _____.
   a. deposit
   b. withdrawal
   c. balance

3. To represent withdrawals, banks use _____ numbers. To represent deposits, banks use _____ numbers.
   a. positive, positive
   b. negative, negative
   c. negative, positive
   d. positive, negative

Bernard has $60 in his bank account. He wants to buy a video game that costs $40.

4. Use the number line to represent Bernard's balance after buying the video game.



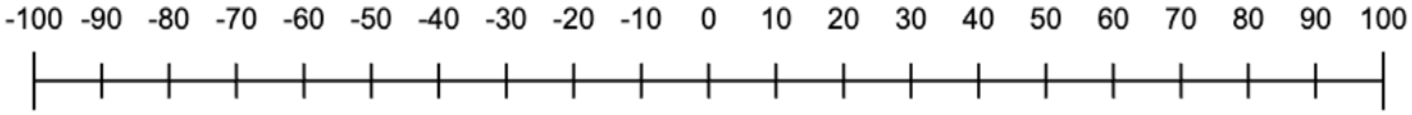
5. Complete the subtraction equation and the addition equation to represent the situation.

60 - _____ = _____

60 + _____ = _____

Bernard now has $20 in his bank account. He withdraws $35 to buy some groceries.

6. Use the number line to represent Bernard's balance after buying the groceries.

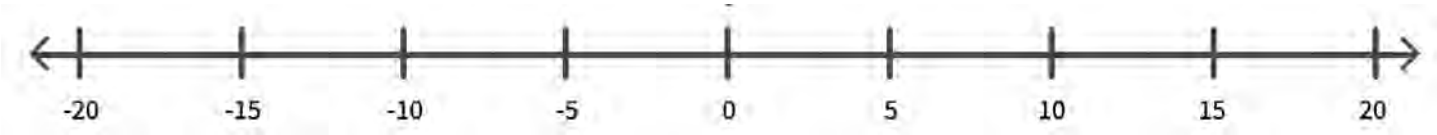


7. Write an addition equation to represent this situation.

8. In your own words, what does it mean when a bank balance is expressed using a negative number?

Reyanna has a balance of -$15 in her account.

9. Show Reyanna's balance on the number line.



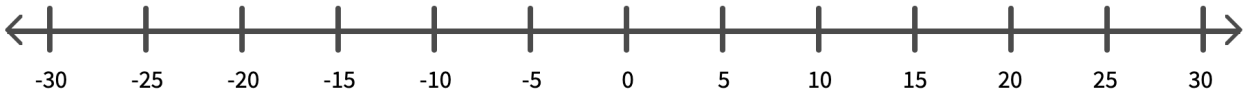
10. How much money will Reyanna need to deposit to have a balance of $0? Use the number line to help you.

11. Write an addition equation that represents this situation.

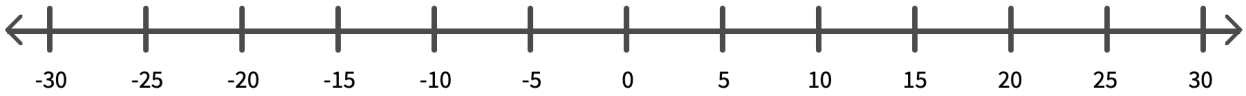
12. What would Reyanna's balance be if she started with -$15 and withdrew $5 to buy a sandwich? Use a number line to help you, and write an equation to match your work.

1. Logan's bank account has a balance of -$15.

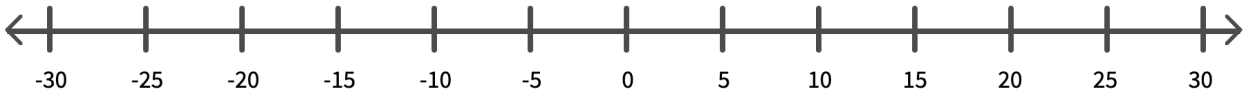
a. Use the number line to show his new balance if he deposited $5. Write an equation to match the situation.



b. Use the number line to show his new balance if he withdrew $5. Write an equation to match the situation.



c. Use the number line to show his new balance if he deposits $20. Write an equation to match the situation.

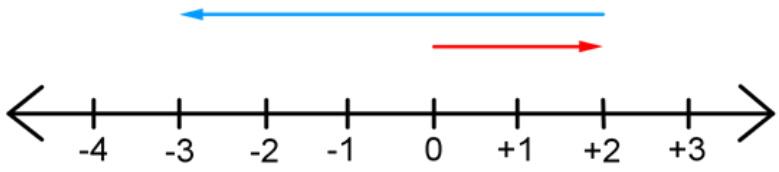


2. Danielle's bank statement shows an account balance of -$100. How much does she need to deposit to have a balance of $0? How do you know?

3. Tina has a balance of $16. She spends $2. Represent this situation using the number line and an addition equation.

4. Tina has a balance of $16. She makes a $20 withdrawal. Represent this situation using the number line and an addition equation.

4. Write and solve a story problem that could be represented using the number line shown below. Include an equation as part of your work.



Name: KEY

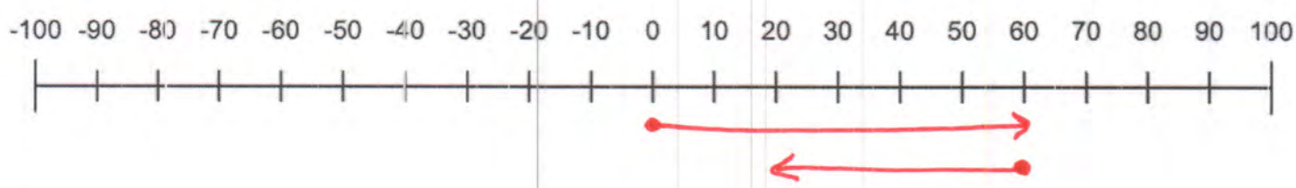
1. When you put money into a bank account, it's called a _____.
   a. deposit
   b. withdrawal
   c. balance

2. When you take money out of a bank account, it's called a _____.
   a. deposit
   b. withdrawal
   c. balance

3. To represent withdrawals, banks use _____ numbers. To represent deposits, banks use _____ numbers.
   a. positive, positive
   b. negative, negative
   c. negative, positive
   d. positive, negative

Bernard has $60 in his bank account. He wants to buy a video game that costs $40.

4. Use the number line to represent Bernard's balance after buying the video game.



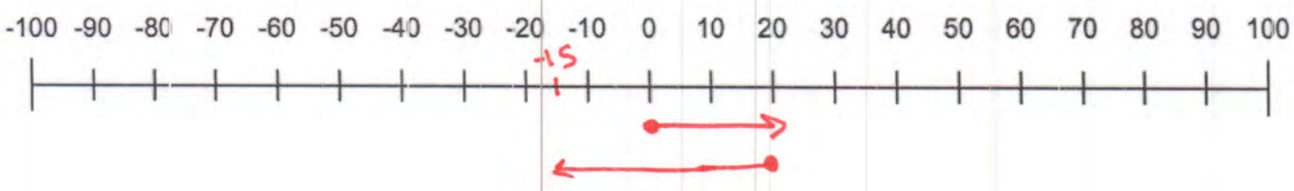
5. Complete the subtraction equation and the addition equation to represent the situation.

$60 - \underline{40} = \underline{20}$

$60 + \underline{-40} = \underline{20}$

Bernard now has $20 in his bank account. He withdraws $35 to buy some groceries.

6. Use the number line to represent Bernard's balance after buying the groceries.



7. Write an addition equation to represent this situation.

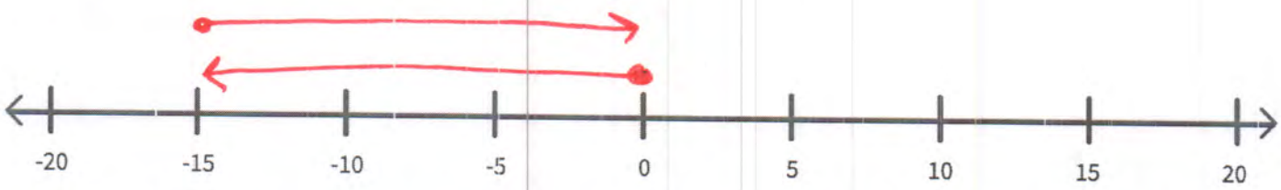
20 + -35 = -15

8. In your own words, what does it mean when a bank balance is expressed using a negative number?

It means you owe the bank money.
You took out more money than you have.

Reyanna has a balance of -$15 in her account.

9. Show Reyanna's balance on the number line.



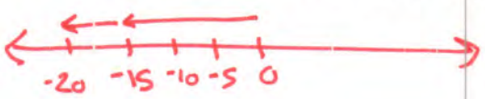
10. How much money will Reyanna need to deposit to have a balance of $0? Use the number line to help you.

$15

11. Write an addition equation that represents this situation.

-15 + 15 = 0

12. What would Reyanna's balance be if she started with -$15 and withdrew $5 to buy a sandwich? Use a number line to help you, and write an equation to match your work.



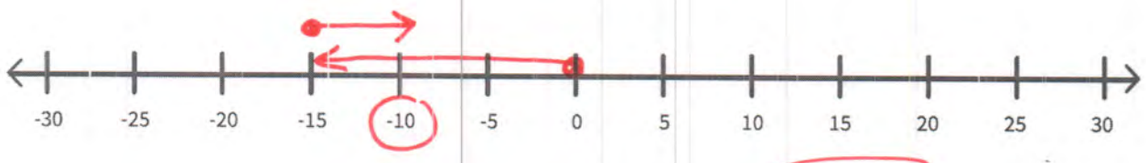
-15 + -5 = -20
-15 - 5 = -20

$-20

Name: KEY

1. Logan's bank account has a balance of -$15.

a. Use the number line to show his new balance if he deposited $5. Write an equation to match the situation.

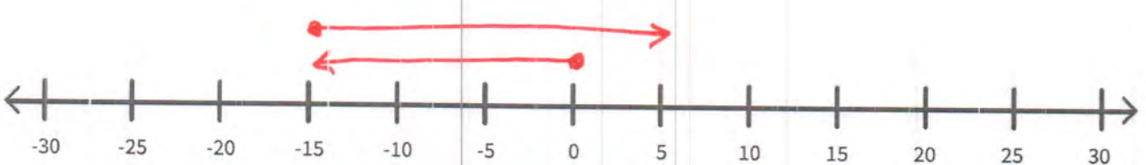


$-15+5=-10$ (-$10)

b. Use the number line to show his new balance if he withdrew $5. Write an equation to match the situation.

$-15-5=-20$ (-$20)

c. Use the number line to show his new balance if he deposits $20. Write an equation to match the situation.



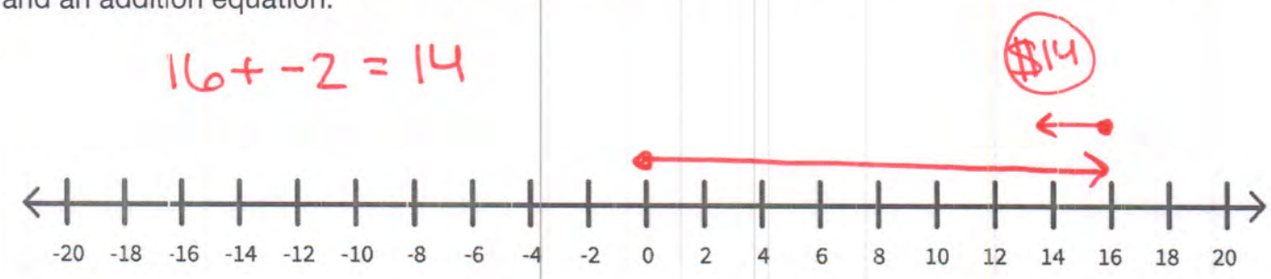
$-15+20=5$ ($5)

2. Danielle's bank statement shows an account balance of -$100. How much does she need to deposit to have a balance of $0? How do you know?

She owes $100 so she needs to deposit $100 to break even and return to $0.

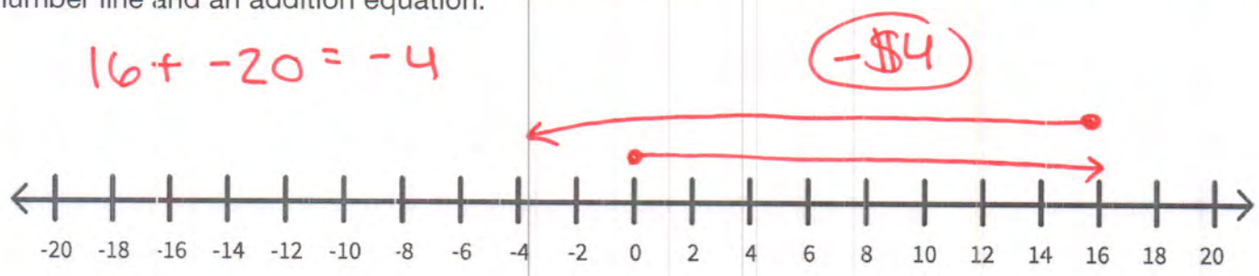
3. Tina has a balance of $16. She spends $2. Represent this situation using the number line and an addition equation.

$16 + -2 = 14$

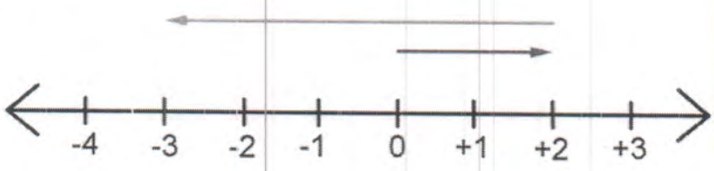


4. Tina has a balance of $16. She makes a $20 withdrawal. Represent this situation using the number line and an addition equation.

$16 + -20 = -4$



4. Write and solve a story problem that could be represented using the number line shown below. Include an equation as part of your work.



I start at an elevation of 2 feet. I descend 5 feet. What is my new elevation.

$2 + -5 = -3$

G7 U4 Lesson 4

Use a number line to subtract positive and negative numbers.

G7 U4 Lesson 4 - Students will use a number line to subtract positive and negative numbers.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): The past several lessons have been dedicated to using number lines to think about negative numbers in various contexts. What important ideas stand out to you so far when you think about negative numbers? Possible Student Answers, Key Points:

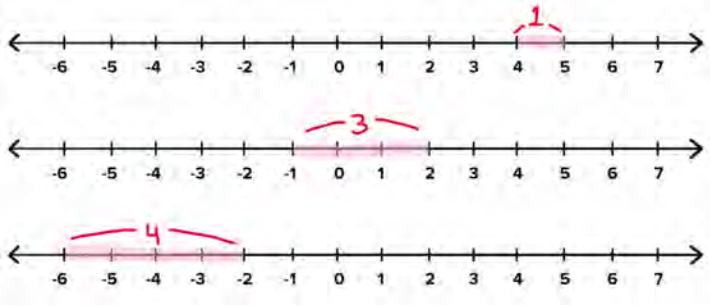
- Temperature, elevation, and money are all contexts where negative numbers are used in everyday life.
- Horizontal or vertical number lines can help us compare negative numbers and add with negative numbers.
- Subtracting a number can be thought of as adding a negative number.

Excellent! Today, we'll continue using some of that thinking to help us think about how to subtract with positive and negative numbers.

Let's Talk (Slide 3): When you first learned about subtraction back in elementary school, you probably learned about it in terms of taking away. For example, I have 6 oranges and I give 2 oranges to my friend. How many oranges do I have now? That's one interpretation, but we also know another interpretation where we can think of subtraction as finding the difference between two quantities. For example, I have 6 oranges and my friend has 2 oranges. What's the difference between our amounts of oranges? In either interpretation, the answer is 4 oranges.

Today, let's focus on the interpretation of subtraction as finding the difference between values. WIth that in mind, let's look at these three brief questions.

What would you say the difference is between 4 and 5? (1) The difference is 1. We can see that on the number line, because there is 1 space between 4 and 5. *(highlight interval between 4 and 5 and label with 1)*



What's the difference between 2 and -1? Count the spaces between 2 and -1 to help you. (3) The difference between 2 and -1 is 3. We see three spaces on the number line between -1 and 2. *(highlight intervals between -1 and 2 and label with 3)*

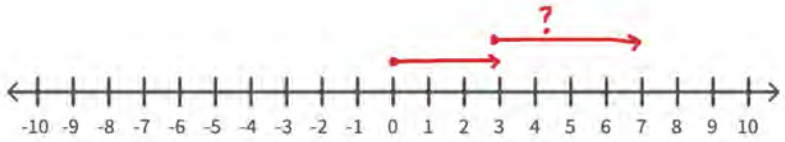
How could we use the number line to find the difference between -2 and -6? *(mark on the number line as student shares thinking)* Possible Student Answers, Key Points:

- We could mark -6 and -2 and count the spaces between the two numbers.
- The difference between -2 and -6 is 4 because there are 4 spaces between -2 and -6.

Nice work! The thinking you just did is all it takes to think about subtracting with positive and negative numbers. Let's keep using the idea of *difference* to help us subtract.

Let's Think (Slide 4): For this problem, we'll find a series of unknowns by using the number line.

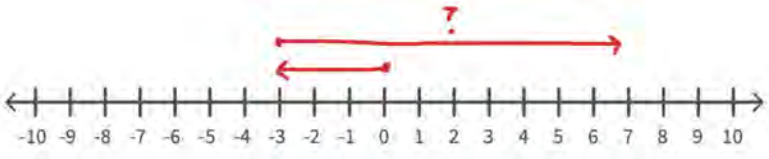
For Part A, they want us to think about 3 plus an unknown number equals 7. You might already know the answer, but let's picture it on a number line so that we can use similar thinking when the problems get a little trickier.



The first number is 3. *(sketch on number line as you narrate)* I'll draw a line from 0 to 3 to show that. The question wants me to find the value I can add to 3 to make 7. I'll draw a line from 3 to 7 and label it with a question mark, since that's the unknown in this problem. What's the value of the unknown, and how can you tell by looking at the number line? Possible Student Answers, Key Points:

- The value is 4. The line from 3 to 7 is 4 spaces long.

Correct! The line from 3 to 7 is 4 units long. So, we can say 3 + 4 = 7. The unknown is 4. I know it is positive 4, because of the direction of the arrow representing the unknown. Let's try the next one.



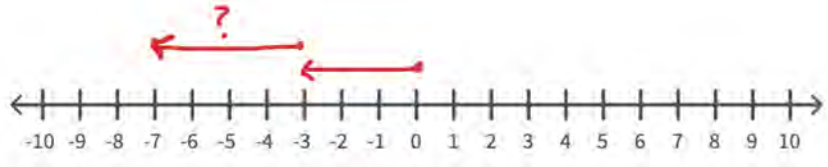
This question has a similar structure, but it's asking us to think about -3 plus an unknown number that would result in 7. *(sketch on number line as you narrate)* I'll draw a line from 0 to -3 to show I'm starting at -3. I'm trying to figure out what I can add to that value to make 7, so I'll draw another line from -3 to 7 and label it with a question mark. What's the value of this unknown? How do you know? Possible Student Answers, Key Points:

- The value is 10. The line going from -3 to 7 is 10 units long.

Nice. The line from -3 to 7 is 10 units long, so I can say that -3 + 10 = 7. The unknown is 10. I know it is positive 10, because of the direction of the arrow representing the unknown. Let's try one more.

This one wants me to think about -3 plus an unknown number that results in -7. How could I set up the number line to show this? Think about how we made the previous models. (sketch as student shares, supporting as necessary) Possible Student Answers, Key Points:

- The first number is -3, so you can draw a line from 0 to -3.
- The problem should result in a total of -7, so draw another line from -3 to -7 and label it with a question mark.



This unknown arrow goes across 4 spaces, but notice the direction of the arrow is different from our other two examples. This arrow points left. That means the value of this unknown isn't 4, it's *negative* 4. So -3 + (-4) = -7. The unknown is -4.

a. 3 + ? = 7 $7-3=4$

b. -3 + ? = 7 $7-(-3)=10$

c. -3 + ? = -7 $-7-(-3)=-4$

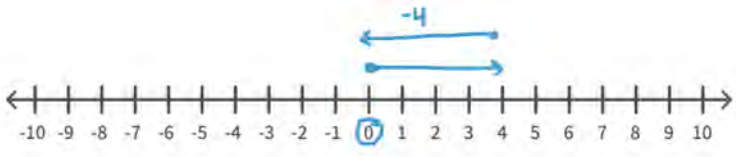
We just found three unknown parts using a number line to help us find the difference between two numbers. In a sense, even though the original equations showed addition, we were actually subtracting. We can rewrite each equation we just solved using subtraction. *(write equations as you narrate)* For part A, we were finding the difference between 3 and 7, which we can write as 7 - 3 = 4. For part B, we were finding the difference between -3 and 7, which we can write as 7 - (-3) = 10.

What subtraction equation could we think about for part C, and why? Possible Student Answers, Key Points:

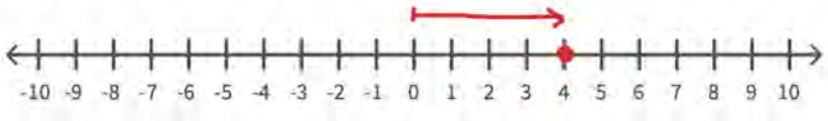
- We were finding the difference between -3 and -7, so we could write -7 -(-3) = -4.

Thinking of unknown parts as finding the difference between two numbers on a number line can be a useful way to find unknown values.

Let's Think (Slide 5): Let's solve a few more problems on a number line.



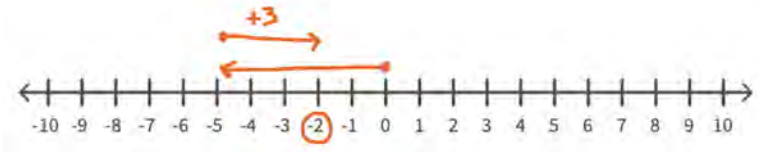
The first problem is 4 + (-4). Let's draw from 0 to 4 to show that value. *(draw line)* Now, we need to add -4. I'll use an arrow facing the left to show that I'm adding -4 to 4. *(draw line from 4 to 0 and label the line as -4)* If I add -4 to 4, where do we end up? (0) The number line shows us that the value of 4 plus -4 is 0.



Part B asks us to find 4 - 4. I can think of this subtraction as the difference between 4 and 4. *(sketch as you narrate)* I'll plot 4 on the number line to represent the first 4. Then, I'll drawn an arrow from 0 to 4 to represent the other 4. What's the difference or the distance between the point on the number line and where my arrow ended? It's 0! They're at the same point in this example.

Look at our last two examples. 4 + (-4) = 0 and 4 - 4 = 0. They both ended up with the same answer. That makes sense, because we've previously learned that we can think of subtracting as adding a negative or adding the opposite value. So, subtracting 4 from 4 in the Part B is the same thing as adding -4 to 4 in Part A.

Part C is asking us to consider -5 - (-3). It wants to know the difference between -5 and -3. I'll make a point at -5. Then I can draw an arrow from 0 to -3 to show that value. I want to draw an arrow to get from -3 to -5. When I do that, I can see the difference is -2. The direction of the arrow helps me see my answer is -2 instead of +2.



Let's wrap up with Part D. How could I use a number line to show -5 + 3? *(sketch as student shares)* Possible Student Answers, Key Points:

- Draw an arrow from 0 to -5 to show our starting point. To add 3, we can draw an arrow from -5 up 3 spaces. We end up at -2.

Note how Part C and Part D have the same answer. -5 - (-3) = -2 and -5 + 3 = 2. Once again, this goes back to the idea that subtracting is the same as adding the opposite value. In Part C, we were subtracting -3. Subtracting -3 is the same as adding its opposite, which is exactly what we did in Part D.

Being able to think flexibly about equations, and being able to model addition and subtraction clearly on a number line can help us carefully find add and subtract with negative numbers.

Let's Try it (Slides 6 - 7): Now let's work on some more problems together, before you get a chance to try some out independently. Number lines will likely be the best way to show our thinking today. If we see subtraction, we know that we can think of it as finding the difference between values. We also saw that subtracting can be thought of as adding the opposite of a number. Both ways of thinking can help us tackle problems, depending on what makes the most sense to us with the numbers we're given. Let's give it a shot!

WARM WELCOME

Today we will use a number line to subtract positive and negative numbers.

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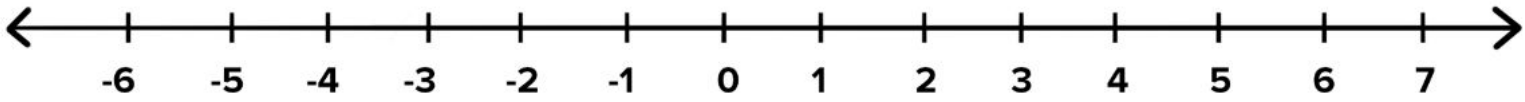
Let's Talk:

What's the difference between…

4 and 5? **2 and -1?** **-2 and -6?**



Let's Think:

Use the number line to find each unknown.

a. 3 + ? = 7

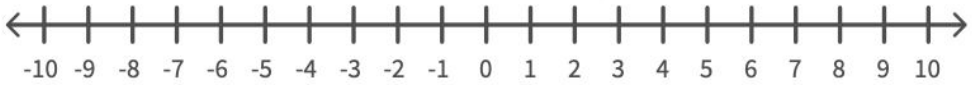
b. -3 + ? = 7

c. -3 + ? = -7

Let's Think:

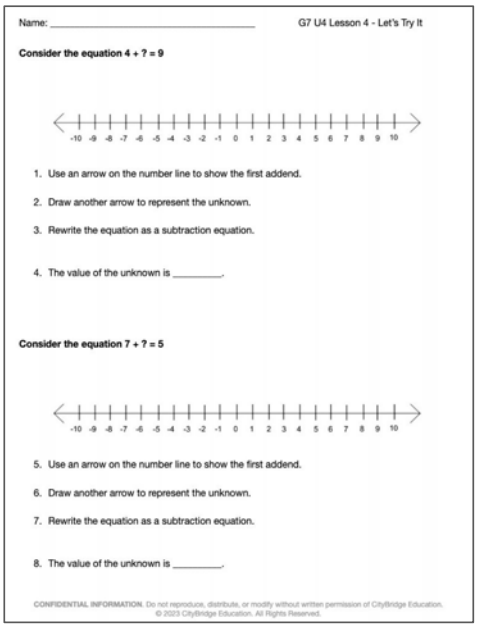
Find the value of each expression in the table. What do you notice?

EXPRESSION	VALUE
4 + (-4)	
4 – 4	
-5 – (-3)	
-5 + 3	



Let's Try It:

Let's explore using a number line to subtract positive and negative numbers together.



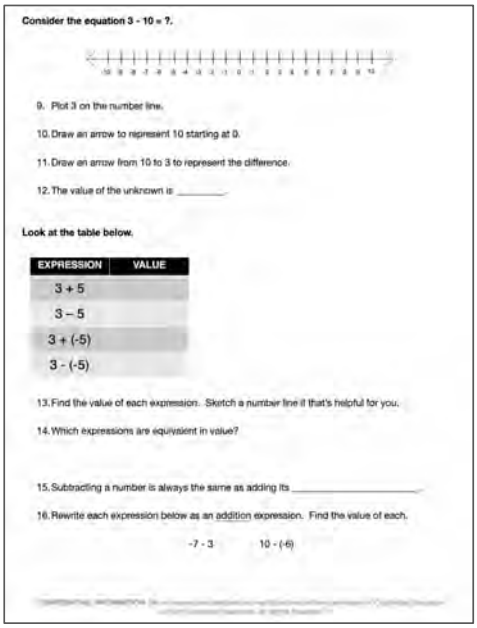
Name: _____ G7 U4 Lesson 4 - Let's Try It

Consider the equation 4 + ? = 9

1. Use an arrow on the number line to show the first addend.
2. Draw another arrow to represent the unknown.
3. Rewrite the equation as a subtraction equation.
4. The value of the unknown is _____.

Consider the equation 7 + ? = 5

5. Use an arrow on the number line to show the first addend.
6. Draw another arrow to represent the unknown.
7. Rewrite the equation as a subtraction equation.
8. The value of the unknown is _____.



Consider the equation 3 - 10 = ?.

9. Plot 3 on the number line.
10. Draw an arrow to represent 10 starting at 0.
11. Draw an arrow from 10 to 3 to represent the difference.
12. The value of the unknown is _____.

Look at the table below.

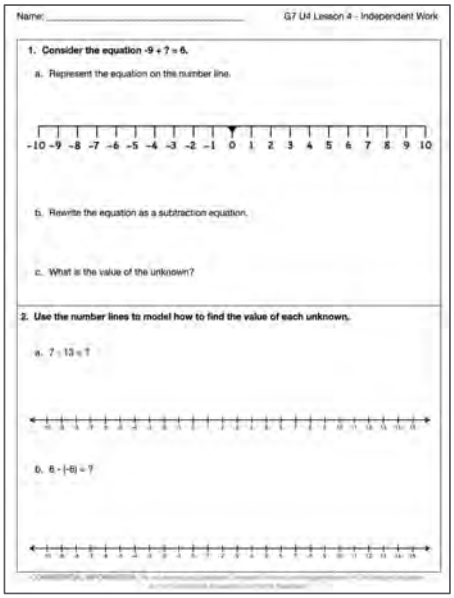
EXPRESSION	VALUE
3 + 5	
3 – 5	
3 + (-5)	
3 - (-5)	

13. Find the value of each expression. Sketch a number line if that's helpful for you.
14. Which expressions are equivalent in value?
15. Subtracting a number is always the same as adding its _____.
16. Rewrite each expression below as an addition expression. Find the value of each.

-7 - 3 10 - (-6)

On your Own:

Now it's time to explore using a number line to subtract positive and negative numbers on your own.



Name: _____ G7 U4 Lesson 4 - Independent Work

1. **Consider the equation -9 + ? = 6.**

a. Represent the equation on this number line.

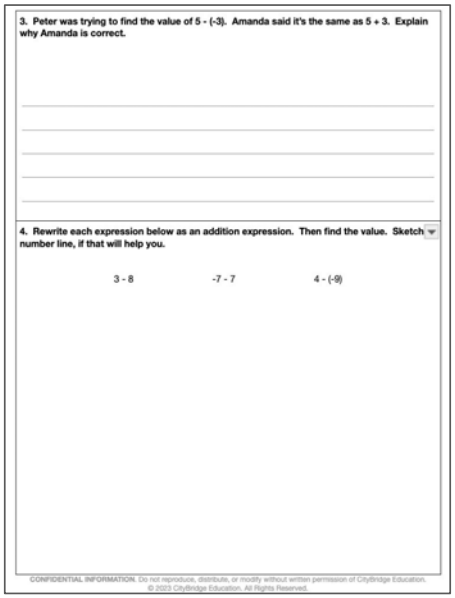
b. Rewrite the equation as a subtraction equation.

c. What is the value of the unknown?

2. **Use the number lines to model how to find the value of each unknown.**

a. 7 + 13 = ?

b. 6 - (-6) = ?

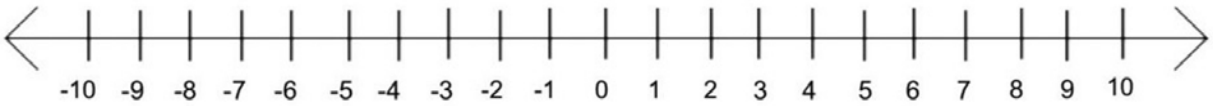


3. **Peter was trying to find the value of 5 - (-3). Amanda said it's the same as 5 + 3. Explain why Amanda is correct.**

4. **Rewrite each expression below as an addition expression. Then find the value. Sketch number line, if that will help you.**

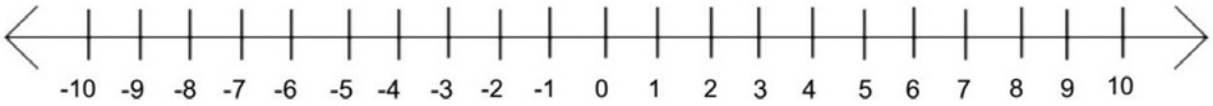
3 - 8 -7 - 7 4 - (-9)

Consider the equation 4 + ? = 9



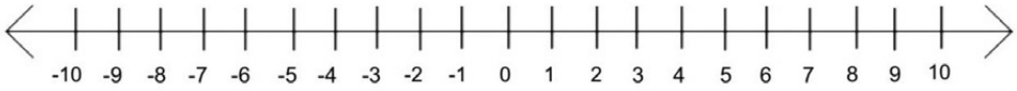
1. Use an arrow on the number line to show the first addend.
2. Draw another arrow to represent the unknown.
3. Rewrite the equation as a subtraction equation.
4. The value of the unknown is _____.

Consider the equation 7 + ? = 5



5. Use an arrow on the number line to show the first addend.
6. Draw another arrow to represent the unknown.
7. Rewrite the equation as a subtraction equation.
8. The value of the unknown is _____.

Consider the equation 3 - 10 = ?.



9. Plot 3 on the number line.

10. Draw an arrow to represent 10 starting at 0.

11. Draw an arrow from 10 to 3 to represent the difference.

12. The value of the unknown is _____.

Look at the table below.

EXPRESSION	VALUE
3 + 5	
3 – 5	
3 + (-5)	
3 - (-5)	

13. Find the value of each expression. Sketch a number line if that's helpful for you.

14. Which expressions are equivalent in value?

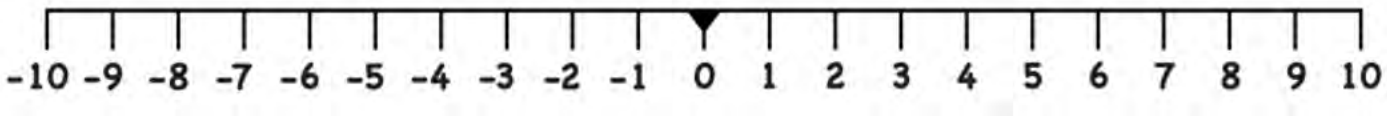
15. Subtracting a number is always the same as adding its _____.

16. Rewrite each expression below as an addition expression. Find the value of each.

-7 - 3 10 - (-6)

1. Consider the equation -9 + ? = 6.

a. Represent the equation on the number line.

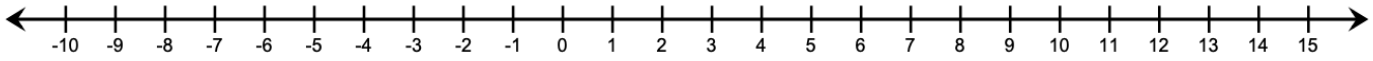


b. Rewrite the equation as a subtraction equation.

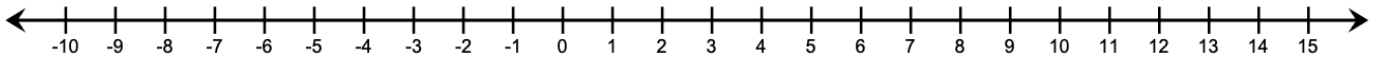
c. What is the value of the unknown?

2. Use the number lines to model how to find the value of each unknown.

a. 7 - 13 = ?



b. 6 - (-6) = ?



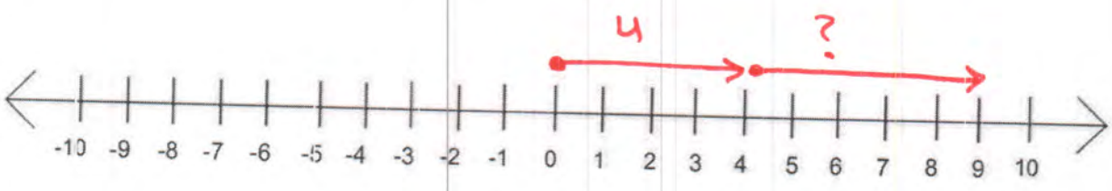
3. Peter was trying to find the value of 5 - (-3). Amanda said it's the same as 5 + 3. Explain why Amanda is correct.

4. Rewrite each expression below as an addition expression. Then find the value. Sketch a number line, if that will help you.

3 - 8 -7 - 7 4 - (-9)

Name: KEY

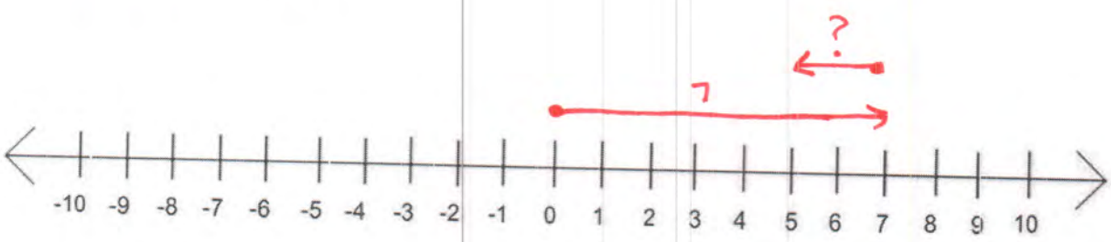
Consider the equation 4 + ? = 9



1. Use an arrow on the number line to show the first addend. ✓
2. Draw another arrow to represent the unknown. ✓
3. Rewrite the equation as a subtraction equation.

   9 - 4 = ?
4. The value of the unknown is 5.

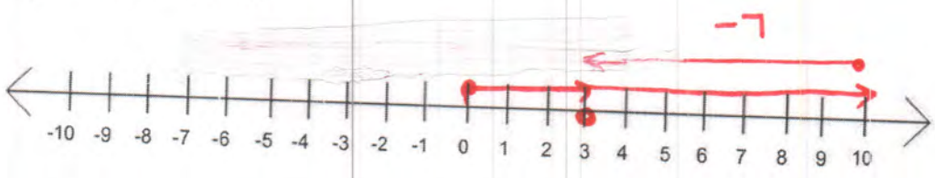
Consider the equation 7 + ? = 5



5. Use an arrow on the number line to show the first addend. ✓
6. Draw another arrow to represent the unknown. ✓
7. Rewrite the equation as a subtraction equation.

   5 - 7 = ?
8. The value of the unknown is -2.

Consider the equation 3 - 10 = ?.



9. Plot 3 on the number line. ✓

10. Draw an arrow to represent 10 starting at 0. ✓

11. Draw an arrow from 10 to 3 to represent the difference. ✓

12. The value of the unknown is -7.

Look at the table below.

EXPRESSION	VALUE
3 + 5	8
3 – 5	-2
3 + (-5)	-2
3 - (-5)	8

13. Find the value of each expression. Sketch a number line if that's helpful for you. ✓

14. Which expressions are equivalent in value?

3+5 = 3 - (-5) and 3 - 5 = 3 + (-5)

15. Subtracting a number is always the same as adding its opposite.

16. Rewrite each expression below as an addition expression. Find the value of each.

-7 - 3

-7 + (-3)

(-10)

10 - (-6)

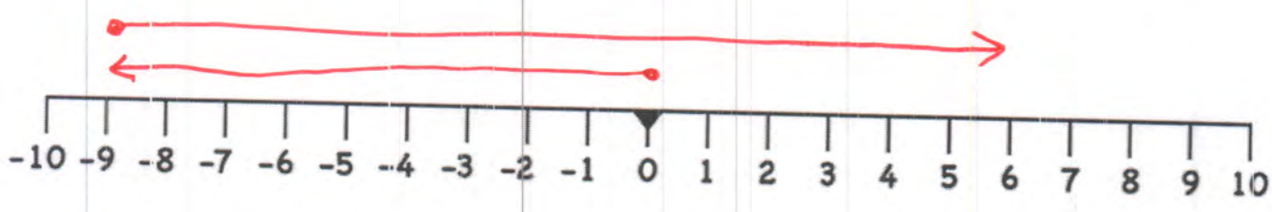
10 + 6

(16)

Name: KEY

1. Consider the equation -9 + ? = 6.

a. Represent the equation on the number line.



b. Rewrite the equation as a subtraction equation.

$6 - (-9) = ?$

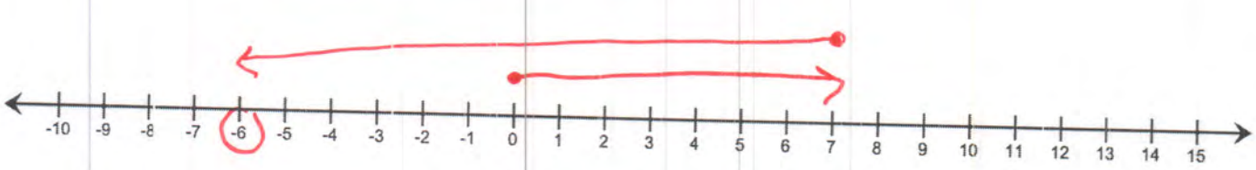
c. What is the value of the unknown?

15

2. Use the number lines to model how to find the value of each unknown.

a. 7 - 13 = ?

-6



b. 6 - (-6) = ?

12

3. Peter was trying to find the value of 5 - (-3). Amanda said it's the same as 5 + 3. Explain why Amanda is correct.

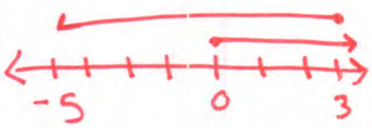
I can think of 5-(-3) as the difference between -3 and 5, which is 8.
5+3 also has a value of 8.

4. Rewrite each expression below as an addition expression. Then find the value. Sketch a number line, if that will help you.

3 - 8

3+(-8)

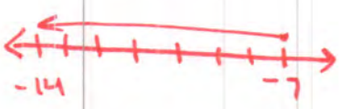
-5



-7 - 7

-7+(-7)

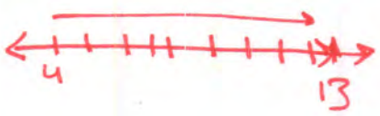
-14



4 - (-9)

4+9

13



G7 U4 Lesson 5

Solve subtraction expressions that have the same numbers in the opposite order, and explain the relationship between their differences.

G7 U4 Lesson 5 - Students will solve subtraction expressions that have the same numbers in the opposite order, and explain the relationship between their differences.

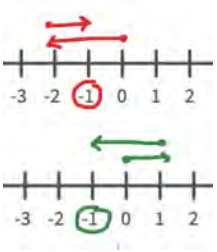
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson, we thought about how we can use a number line to represent subtraction involving negative numbers. We also saw how it can be helpful to think about subtraction as finding the *difference* between two numbers.

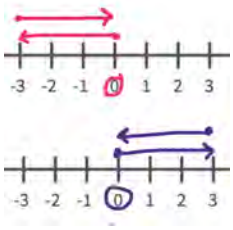
Today, let's keep thinking about subtraction. We'll pay particular attention to the order of the numbers impacts our answer.

Let's Talk (Slide 3): Look at the pairs of addition problems here. What do you notice? What do you wonder?
Possible Student Answers, Key Points:

- I notice each pair has the same numbers in a different order. I notice some pairs have negative numbers and some do not.
- I wonder what some of the answers are. I wonder if we can model each one on the number line.



You already know that 4 + 5 and 5 + 4 will both total 9. When adding signed numbers, the order does not matter. Whether we're adding positive numbers, negative numbers, or both, the order of the addends will not affect the answer. Think about the second pair of problems. *(model on number line as you narrate)* To show -2 + 1, I can draw an arrow to -2 then add 1 with another arrow. The answer is -1. If I reverse the order of the addends and think about 1 plus -2, I can model that by first drawing an arrow to -1. Then, add an arrow showing -2. The answer is still -1. Switching the order of the addends didn't change a thing.

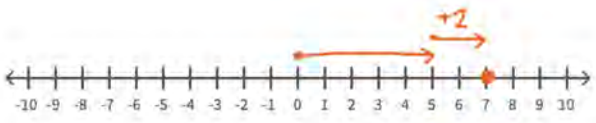


What happens if we add numbers in the opposite order in the third example? *(if necessary, sketch a model on the number line as student shares)* Possible Student Answers, Key Points:

- I know that the answer will be the same. You can add in any order.
- 3 + (-3) would look like an arrow to +3 then we'd add an arrow showing -3, ending up at 0. To show -3 + 3, we'd draw an arrow to -3 then show another arrow adding 3. We end up with an answer of 0 both times.

When adding signed numbers, the order does not matter. Now let's keep this in mind as we think about what happens when we subtract in a different order.

Let's Think (Slide 4): This example wants us to show 7 - 5 and then 5 - 7. Let's start by modeling to find 7 - 5. It's okay if you already know the answer, let's just picture what is happening.



(sketch and label on number line as you narrate) We can think of this as finding the difference between 7 and 5. I can mark 7 on my number line. I'll draw an arrow from 0 to 5 to represent 5. Then I'll draw an arrow from 5 to 7 to represent our unknown. In this case, the direction and length of the arrow make it clear that our answer is +2.

Now, we'll use a number line to model subtracting the same numbers, just in a different order. What do you predict will happen? Possible Student Answers, Key Points:

- Maybe we'll get the same answer like we did with the addition problems.
- I don't think we'll get the same answer. I think 5 - 7 will be negative, because 7 is bigger than 5.

Let's tackle part B and find out. For part B, we're finding the difference between 5 and 7. *(sketch and label on number line as you narrate)* I'll start by marking 5 on the number line. Next, I'll draw an arrow from 0 to 7 to represent 7. Then, I'll draw the arrow from 7 to 5 to represent the unknown value. What is the unknown value in this case, and how do you know? Possible Student Answers, Key Points:

- The unknown value is -2. The arrow is 2 units long and it points left, so I know it is negative.

We found that 7 - 5 is positive 2 and that 5 - 7 is negative 2. Unlike with addition, we can see that the order of signed numbers matters when dealing with subtraction.

Our answers have the same magnitude, but opposite signs. We can think of the first problem as asking us to figure out how to get from 5 to 7. We move 2 up the number line, so the difference is +2. We can think of the second problem as asking us to figure out how to get from 7 to 5. In that example, we moved 2 down the number line, so the difference was -2.

Let's try another set to see if this conjecture holds true.

Let's Think (Slide 5): Notice how the order of numbers in each expression is switched. Let's model -8 - 2 first.

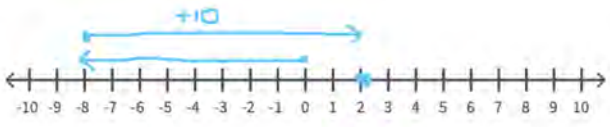
We can think of -8 - 2 as asking us to determine how to get from 2 to -8. How can I model -8 - 2 on the number line? *(sketch and label on number line as student shares)* Possible Student Answers, Key Points:

- Mark -8 with a point on the number line. Then draw an arrow from 0 to 2 to show positive 2. Last, draw an arrow from 2 to -8 to represent the unknown.

Great. Our unknown is this long line. If I look carefully, I see that the line is pointing to the left and is 10 units long. This tells me that -8 - 2 is -10. I can also think of this as showing me that to get from 2 to -8, I have to move 10 spaces left.

Let's try the other example with the numbers in a different order. What do you predict will happen based on the work we've done so far? Possible Student Answers, Key Points:

- I don't think the answer will be the same, because we're subtracting.
- Maybe our answer will be positive, since the answer we just found was negative.



We can think of 2 - (-8) as finding the difference between 2 and -8. In other words, how can we get from -8 to 2. Let's model it. *(sketch and label the number line as you narrate)* I'll mark 2 with a point. I'll draw the first arrow from 0 to -8 to show -8. Then, I'll draw an arrow for our unknown stretching from -8 to +2. What's the value of the unknown? (positive 10) Our answer is +10. The arrow shows that to get from -8 to 2, we have to move up the number line 10 spaces.

The distance between the numbers in each problem we did was the same, so our answers had the same magnitude. In this case, it was 10. The arrows representing the unknowns pointed in different directions, so one answer was -10 and the other was +10.

How is adding signed numbers in the opposite order different from subtracting signed numbers in the opposite order? Possible Student Answers, Key Points:

- When we add signed numbers in a different order, we end up with the same answer.
- When we subtract signed numbers in a different order, the sign on our answer is different.

Let's Try it (Slides 6 - 7): Now let's work on a few more examples where we think about subtraction problems that have the same numbers in a different order. We know that when we add, the order doesn't matter. We now know that when we subtract, the order does matter. When we subtract the same numbers in a different order, the magnitude of our answer stays the same but the sign on our answers is different. We'll carefully use number lines to help us think through a few more examples. Time to get started!

WARM WELCOME

Today we will solve subtraction expressions that have the same numbers in the opposite order, and explain the relationship between the differences.

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Let's Talk:

What happens when we add numbers in the opposite order?

5 + 4	-2 + 1	3 + (-3)
4 + 5	1 + (-2)	-3 + 3

Let's Think:

Use the number line to find each unknown.

a. 7 - 5

b. 5 - 7

Let's Think:

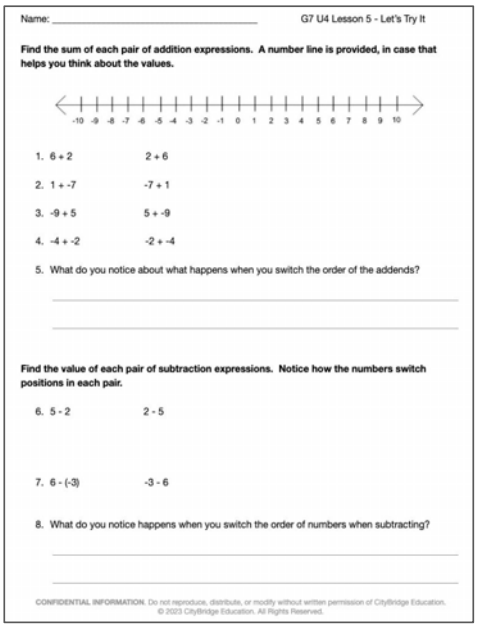
Use the number line to find each unknown.

a. -8 - 2

b. 2 - (-8)

Let's Try It:

Let's explore solving subtraction problems that have the same numbers in the opposite order together.



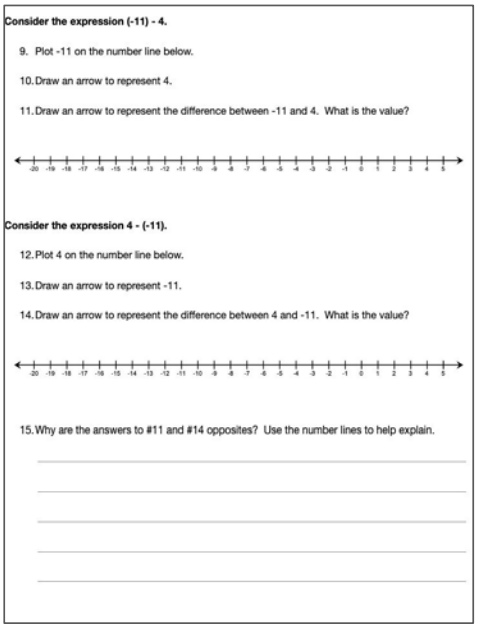
Name: _____ G7 U4 Lesson 5 - Let's Try It

Find the sum of each pair of addition expressions. A number line is provided, in case that helps you think about the values.

1. 6 + 2 2 + 6
2. 1 + -7 -7 + 1
3. -9 + 5 5 + -9
4. -4 + -2 -2 + -4
5. What do you notice about what happens when you switch the order of the addends?

Find the value of each pair of subtraction expressions. Notice how the numbers switch positions in each pair.

6. 5 - 2 2 - 5
7. 6 - (-3) -3 - 6
8. What do you notice happens when you switch the order of numbers when subtracting?



Consider the expression (-11) - 4.

9. Plot -11 on the number line below.
10. Draw an arrow to represent 4.
11. Draw an arrow to represent the difference between -11 and 4. What is the value?

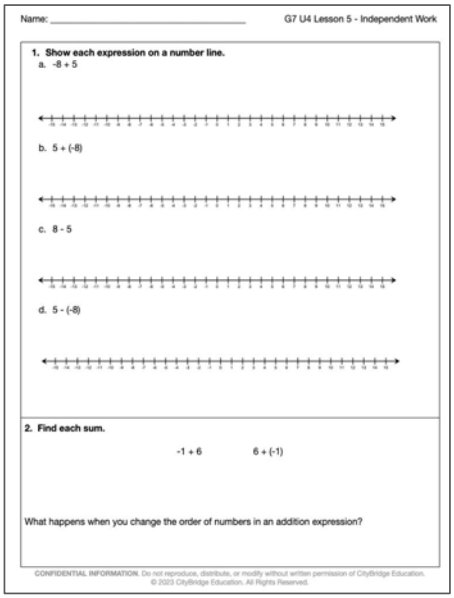
Consider the expression 4 - (-11).

12. Plot 4 on the number line below.
13. Draw an arrow to represent -11.
14. Draw an arrow to represent the difference between 4 and -11. What is the value?

15. Why are the answers to #11 and #14 opposites? Use the number lines to help explain.

On your Own:

Now it's time to explore solving subtraction equations that have the same numbers in the opposite order on your own.



Name: _____ G7 U4 Lesson 5 - Independent Work

1. Show each expression on a number line.

a. -8 + 5

b. 5 + (-8)

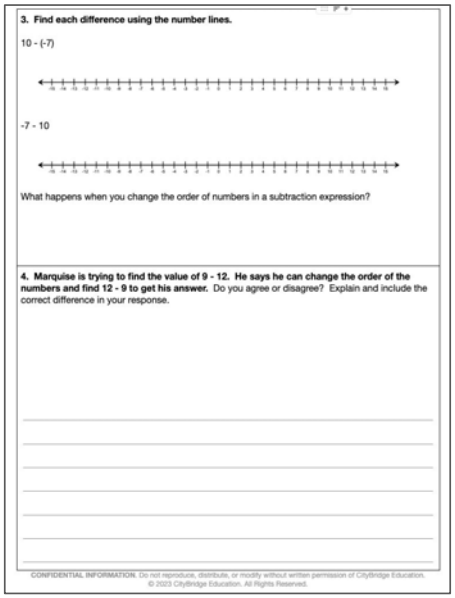
c. 8 - 5

d. 5 - (-8)

2. Find each sum.

-1 + 6 6 + (-1)

What happens when you change the order of numbers in an addition expression?



3. Find each difference using the number lines.

10 - (-7)

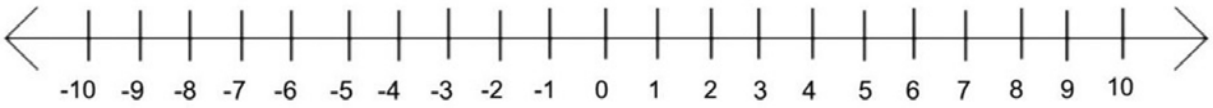
-7 - 10

What happens when you change the order of numbers in a subtraction expression?

4. Marquise is trying to find the value of 9 - 12. He says he can change the order of the numbers and find 12 - 9 to get his answer. Do you agree or disagree? Explain and include the correct difference in your response.

Name: _____ G7 U4 Lesson 5 - Let's Try It

Find the sum of each pair of addition expressions. A number line is provided, in case that helps you think about the values.



1. 6 + 2 2 + 6
2. 1 + -7 -7 + 1
3. -9 + 5 5 + -9
4. -4 + -2 -2 + -4
5. What do you notice about what happens when you switch the order of the addends?

Find the value of each pair of subtraction expressions. Notice how the numbers switch positions in each pair.

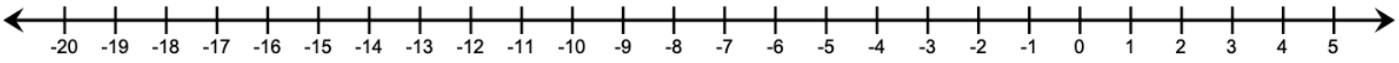
6. 5 - 2 2 - 5
7. 6 - (-3) -3 - 6
8. What do you notice happens when you switch the order of numbers when subtracting?

Consider the expression (-11) - 4.

9. Plot -11 on the number line below.

10. Draw an arrow to represent 4.

11. Draw an arrow to represent the difference between -11 and 4. What is the value?

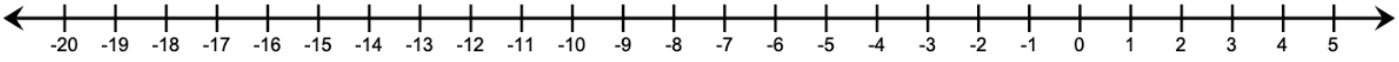


Consider the expression 4 - (-11).

12. Plot 4 on the number line below.

13. Draw an arrow to represent -11.

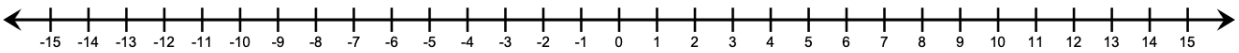
14. Draw an arrow to represent the difference between 4 and -11. What is the value?



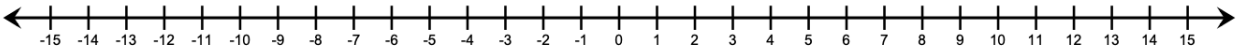
15. Why are the answers to #11 and #14 opposites? Use the number lines to help explain.

1. Show each expression on a number line.

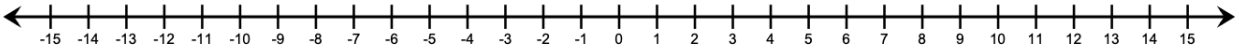
a. -8 + 5



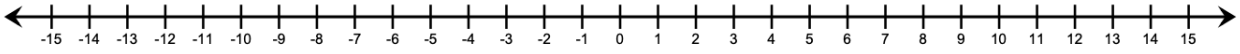
b. 5 + (-8)



c. 8 - 5



d. 5 - (-8)



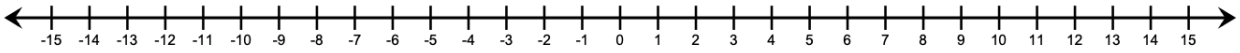
2. Find each sum.

-1 + 6 6 + (-1)

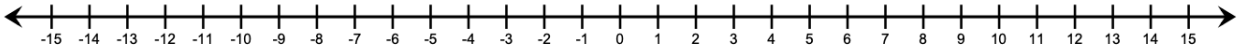
What happens when you change the order of numbers in an addition expression?

3. Find each difference using the number lines.

10 - (-7)



-7 - 10

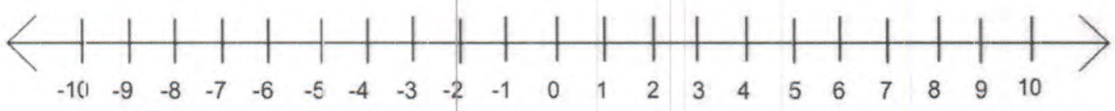


What happens when you change the order of numbers in a subtraction expression?

4. Marquise is trying to find the value of 9 - 12. He says he can change the order of the numbers and find 12 - 9 to get his answer. Do you agree or disagree? Explain and include the correct difference in your response.

Name: KEY

Find the sum of each pair of addition expressions. A number line is provided, in case that helps you think about the values.



1. $6 + 2$ 8 $2 + 6$ 8
2. $1 + -7$ -6 $-7 + 1$ -6
3. $-9 + 5$ -4 $5 + -9$ -4
4. $-4 + -2$ -6 $-2 + -4$ -6
5. What do you notice about what happens when you switch the order of the addends?

The sum is the same when the addends are reversed.

Find the value of each pair of subtraction expressions. Notice how the numbers switch positions in each pair.

6. $5 - 2$ 3 $2 - 5$ -3
7. $6 - (-3)$ 9 $-3 - 6$ -9
8. What do you notice happens when you switch the order of numbers when subtracting?

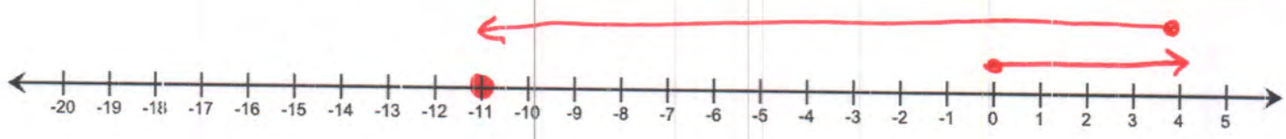
The answers are not the same. They are opposites.

Consider the expression (-11) - 4.

9. Plot -11 on the number line below.

10. Draw an arrow to represent 4.

11. Draw an arrow to represent the difference between -11 and 4. What is the value? -15

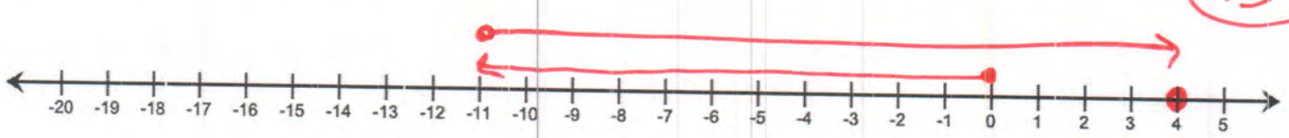


Consider the expression 4 - (-11).

12. Plot 4 on the number line below.

13. Draw an arrow to represent -11.

14. Draw an arrow to represent the difference between 4 and -11. What is the value? 15



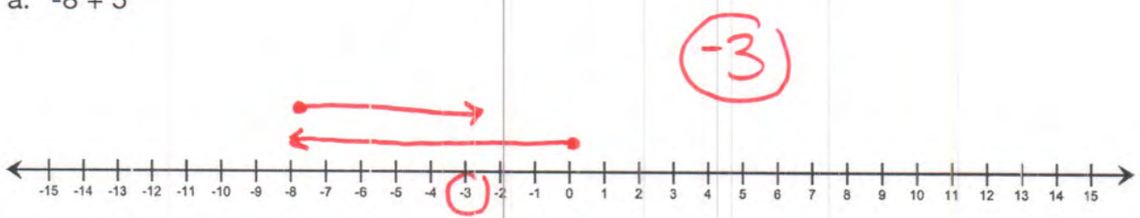
15. Why are the answers to #11 and #14 opposites? Use the number lines to help explain.

The first answer is -15, because the arrow from 4 to -11 represents a value of -15 since it points left. The second answer is 15, because the arrow points right.

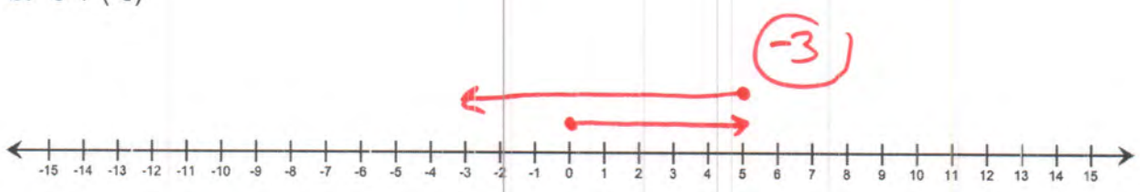
Name: KEY

1. Show each expression on a number line.

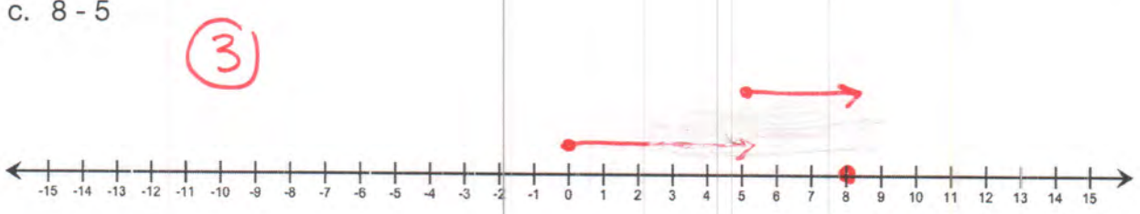
a. -8 + 5



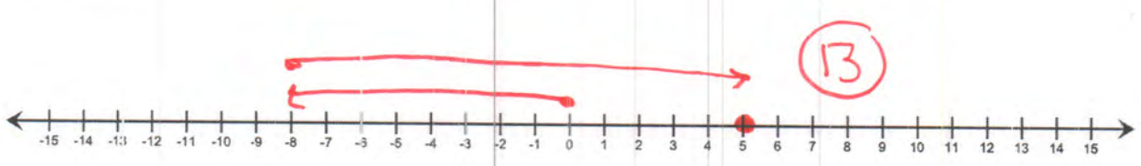
b. 5 + (-8)



c. 8 - 5



d. 5 - (-8)



2. Find each sum.

-1 + 6

5

6 + (-1)

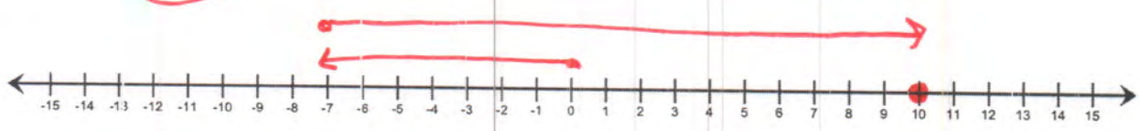
5

What happens when you change the order of numbers in an addition expression?

The sum stays the same.

3. Find each difference using the number lines.

10 - (-7) (17)



-7 - 10 (-17)

What happens when you change the order of numbers in a subtraction expression?

The answer is not the same.
The answers are opposites.

4. Marquise is trying to find the value of 9 - 12. He says he can change the order of the numbers and find 12 - 9 to get his answer. Do you agree or disagree? Explain and include the correct difference in your response.

9-12
9+(-12) = -3

No, Marquise is incorrect. You can't change the order of numbers in a subtraction problem. 9-12 is equal to -3, while 12-9 is equal to 3.

G7 U4 Lesson 6

Add and subtract signed numbers to represent gains and losses in different contexts.

G7 U4 Lesson 6 - Students will add and subtract signed numbers to represent gains and losses in different contexts.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We have been working with adding and subtracting signed numbers for the past few lessons. When you think about everyday contexts that involve signed numbers, what comes to mind? Possible Student Answers, Key Points:

- Temperature involves signed numbers. Warmer temperatures are positive numbers, colder temperatures are often negative numbers.
- When I'm above sea level, my elevation is positive. If I'm below sea level, my elevation is negative.
- My bank account might show positive or negative numbers depending on if I'm earning or spending money. If I owe money to the bank, that can be represented with a negative value.

Today we'll wrap up this set of lessons by exploring adding and subtracting signed numbers in a variety of contexts. Some will be familiar and some might be new. Let's take a look!

Let's Talk (Slide 3): Check out the table shown here. Look it over for a moment, and when you're ready, share out some things you notice and some things you wonder. Possible Student Answers, Key Points:

- I notice the table shows weekdays, inventory, and change. I notice that the inventory goes down and up. I notice some of the changes are positive values and some are negative.
- I wonder what the empty box means. I wonder why Saturday and Sunday aren't included. I wonder what the inventory represents.

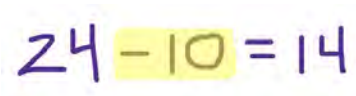
This table represents inventory at a mattress store. It can be useful to use signed numbers to represent inventory at stores to keep track of items you have in stock and to know when you need to order more items. We'll see this context and a few more throughout our work with signed numbers today.

Let's Think (Slide 4): Our first problem asks us to consider the table representing the mattress store's inventory.

Part A asks what the positive and negative numbers mean in this situation. If I put myself in the shoes of a mattress store owner, and I think about my inventory of mattresses, why might the number of mattresses I have in my inventory decrease like we see happening on Monday, Tuesday, and Wednesday? What could be happening with my business if the number of mattresses I have in inventory increases like we see on Thursday? Possible Student Answers, Key Points:

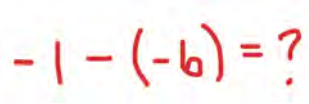
- The negative numbers probably represent mattresses that the store is selling. For every mattress the store sells, there inventory should decrease by 1 mattress.
- The positive numbers could be the store restocking mattresses. They don't want to run out, so they need to reorder every now and then.
- The positive numbers could also be returns, but I'm not sure 20 returns in one day makes sense given this context.

Great. From the table, we can assume that the mattress store sold 1 mattress on Monday, 6 on Tuesday, and 6 on Wednesday. Those changes were all noted with a negative number. Then on Thursday, the change was +20. This likely represents the store restocking 20 new mattresses.

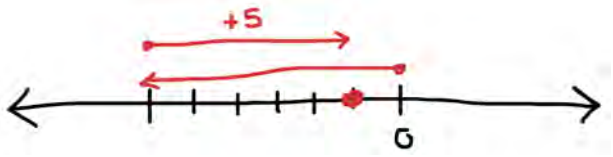


Part B wants us to complete the table if the store sells 10 mattresses on Friday. What number would represent the store *selling* 10 mattresses? (-10) Yes, if the store sells 10 mattresses, those are being removed from the inventory. *(write 24 - 10 = 14)* We could complete the table by writing -10 as the change.

The inventory on Saturday morning would be 14 mattresses.



In Part C, the problem asks us to find the difference between the change on Monday and the change on Tuesday. I can think of that difference by writing the equation -1 - (-6) = ?. *(write equation)*



How can I use a number line to represent this equation? *(sketch a quick number line and draw/label as student shares)* Possible Student Answers, Key Points:

- Draw a number line. Mark -1 with a point on the line, then draw an arrow from 0 to -6 to represent that value. The unknown difference could be marked using an arrow from -6 to -1.

We can see that the difference between the change on Monday and the change on Tuesday is 5 mattresses. We used an equation and a number line to help us find that amount.

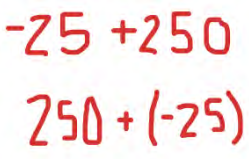
Let's Think (Slide 5): Let's work with some signed numbers in another context. Take a second to review the table shown here, so you can start to get a sense of what this problem is about. *(pause)* This table shows Ms. Han's account balance from April to October. Before we respond to the prompts, what do the positive and negative mean in this situation? Possible Student Answers, Key Points:

- The positive balances mean that she had money in her account. The negative balances mean that she owed the bank money that month.
- The positive changes mean she earned money or made deposits. The negative changes mean she spent money or made withdrawals.

DAY	BALANCE	CHANGE
Apr	$50	$150
May	$200	-$25
June	$175	0
July	$175	-$100
Aug	$75	-$100
Sep	-$25	$250
Oct	$225	$500

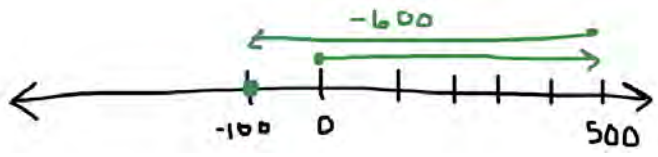
Part A asks us to complete the missing values in the table using the information that we know. Start with the month of May, and let's think about the change. What do you notice happened between May and June? Look at the balances for those months. (The balance went down $25.) Since the balance decreased 25 dollars, I'll mark that the change was negative $25. *(fill in table)*

What about the July balance? What do you notice happened from June to July? (The change in June was $0.) Since the change in June was $0, that means the balance would not increase or decrease. Let's write $175 for the July balance, since it stayed the same as the balance from June. *(fill in table)*



Our last missing value in the table is the October balance. The balance in September was -$25, and the table shows us that it increased $250 that month. I can think of that as -25 + 250. *(write expression)* We could use a number line to model this expression, but I think we can make this problem easier. I know I can switch the order of addends. *(write 250 + (-25))* Now, I can just think of this as 250 plus -25 or 250 minus 25. That's a little easier to consider. What's the balance in October? ($225) Well done.

Part B wants us to find the difference between the change in August, -$100, and the change in October, $500. We can use the equation -100 - 500 to help us think about this. Or, we can use a number line to help us think about this.



(sketch a number line with intervals of 100) I'll mark -100 on the number line, and I'll draw an arrow from 0 to 500 to show positive 500. *(sketch as you narrate)* The unknown difference would be the distance between 500 and -100. We can think of this as -600. Since the question just wants to know the amount of the change, it's appropriate to say the difference between the change was simply $600.

The last prompt is Part C. It asks us how much money Ms. Han will have at the start of the next month, November. What information do we know that can help us figure this out? Possible Student Answers, Key Points:

- We know the balance in October is $225, because we found that earlier.
- We know the change in October is positive $500, so her balance will be higher in November.

The October balance is $225 and it increased $500. We can think of that using the equation 225 + 500 = ?. *(write equation)* What's the balance going to be in November? ($725) Excellent!

We just solved a variety of problems with signed numbers in different contexts. I think you're ready to get some practice.

Let's Try it (Slides 6 - 7): Now let's work on a few more to further improve our skills. As we move through each problem, we'll want to pause and think about the context. We can ask ourselves what the positive and negative numbers mean in that situation to help us make sense of the problem. From there, we can use equations and/or number lines to help us add and subtract with signed numbers depending on what the question asks. We're ready!

WARM WELCOME

Today we will add and subtract signed numbers to represent gains and losses in different contexts.

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Let's Talk:

What do you notice? What do you wonder?

DAY	INVENTORY	CHANGE
Mon	17	-1
Tue	16	-6
Wed	10	-6
Thu	4	+20
Fri	24	

Let's Think:

The table below represents the inventory at a mattress store.

DAY	INVENTORY	CHANGE
Mon	17	-1
Tue	16	-6
Wed	10	-6
Thu	4	+20
Fri	24	

a. What do the positive and negative numbers mean in this situation?

b. If they sell 10 mattresses on Friday, what number completes the table?

c. What is the difference between the change on Monday and the change on Tuesday?

Let's Think:

The table below reflects Ms. Han's bank account balance.

DAY	BALANCE	CHANGE
Apr	$50	$150
May	$200	
June	$175	0
July		-$100
Aug	$75	-$100
Sep	-$25	$250
Oct		$500

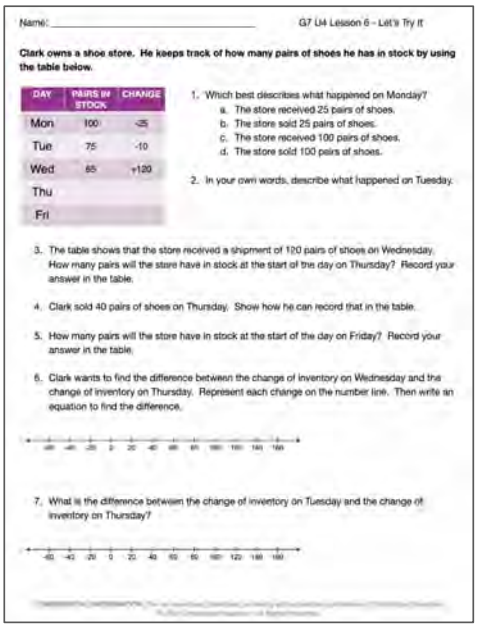
a. Use the information to complete the table.

b. What is the difference between the change in August and the change in October?

c. How much money will she have at the start of the next month?

Let's Try It:

Let's explore adding and subtracting signed numbers to represent gains and losses together.

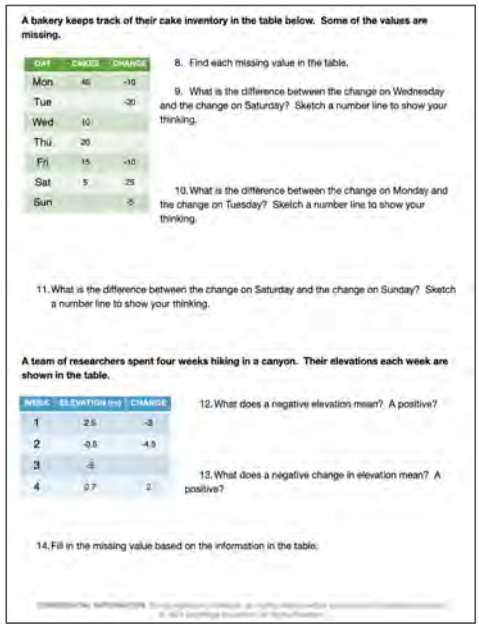


Name: _____ G7 L14 Lesson 6 – Let's Try It

Clark owns a shoe store. He keeps track of how many pairs of shoes he has in stock by using the table below.

DAY	PAIRS IN STOCK	CHANGE
Mon	100	-25
Tue	75	-10
Wed	65	+120
Thu		
Fri		

1. Which best describes what happened on Monday?
   a. The store received 25 pairs of shoes.
   b. The store sold 25 pairs of shoes.
   c. The store received 100 pairs of shoes.
   d. The store sold 100 pairs of shoes.
2. In your own words, describe what happened on Tuesday.
3. The table shows that the store received a shipment of 120 pairs of shoes on Wednesday. How many pairs will the store have in stock at the start of the day on Thursday? Record your answer in the table.
4. Clark sold 40 pairs of shoes on Thursday. Show how he can record that in the table.
5. How many pairs will the store have in stock at the start of the day on Friday? Record your answer in the table.
6. Clark wants to find the difference between the change of inventory on Wednesday and the change of inventory on Thursday. Represent each change on the number line. Then write an equation to find the difference.
7. What is the difference between the change of inventory on Tuesday and the change of inventory on Thursday?



A bakery keeps track of their cake inventory in the table below. Some of the values are missing.

DAY	CAKES	CHANGE
Mon	40	-10
Tue		-20
Wed	10	
Thu	20	
Fri	15	-10
Sat	5	25
Sun		-5

8. Find each missing value in the table.
9. What is the difference between the change on Wednesday and the change on Saturday? Sketch a number line to show your thinking.
10. What is the difference between the change on Monday and the change on Tuesday? Sketch a number line to show your thinking.
11. What is the difference between the change on Saturday and the change on Sunday? Sketch a number line to show your thinking.

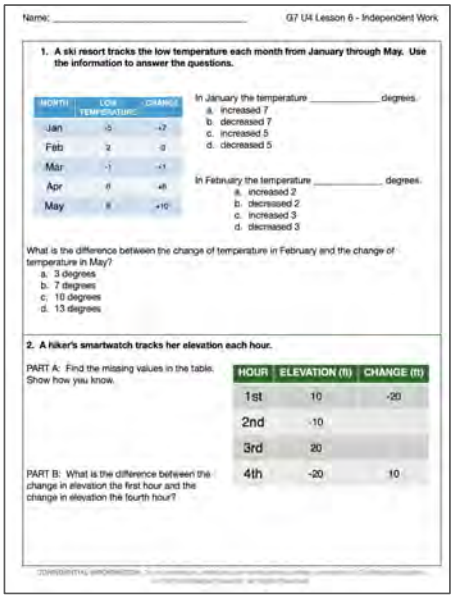
A team of researchers spent four weeks hiking in a canyon. Their elevations each week are shown in the table.

WEEK	ELEVATION (m)	CHANGE
1	2.5	-3
2	-0.5	-4.5
3	-5	
4	0.7	2

12. What does a negative elevation mean? A positive?
13. What does a negative change in elevation mean? A positive?
14. Fill in the missing value based on the information in the table.

On your Own:

Now it's time to explore adding and subtracting signed numbers to represent gains and losses on your own.



Name: _____ G7 U4 Lesson 6 - Independent Work

1. A ski resort tracks the low temperature each month from January through May. Use the information to answer the questions.

MONTH	LOW TEMPERATURE	CHANGE
Jan	-5	-7
Feb	2	7
Mar	-1	-3
Apr	6	+8
May	16	+10

In January the temperature _____ degrees.
a. increased 7
b. decreased 7
c. increased 5
d. decreased 5

In February the temperature _____ degrees.
a. increased 2
b. decreased 2
c. increased 3
d. decreased 3

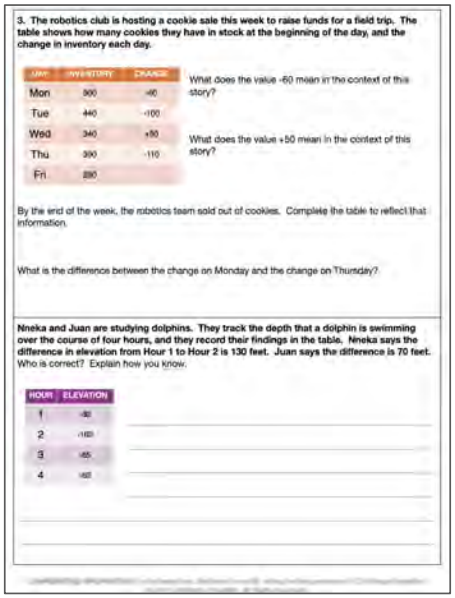
What is the difference between the change of temperature in February and the change of temperature in May?
a. 3 degrees
b. 7 degrees
c. 10 degrees
d. 13 degrees

2. A hiker's smartwatch tracks her elevation each hour.

PART A: Find the missing values in the table. Show how you know.

HOUR	ELEVATION (ft)	CHANGE (ft)
1st	10	-20
2nd	-10	
3rd	20	
4th	-20	10

PART B: What is the difference between the change in elevation the first hour and the change in elevation the fourth hour?



3. The robotics club is hosting a cookie sale this week to raise funds for a field trip. The table shows how many cookies they have in stock at the beginning of the day, and the change in inventory each day.

DAY	INVENTORY	CHANGE
Mon	500	-60
Tue	440	-100
Wed	340	+50
Thu	390	-110
Fri	280	

What does the value -60 mean in the context of this story?

What does the value +50 mean in the context of this story?

By the end of the week, the robotics team sold out of cookies. Complete the table to reflect that information.

What is the difference between the change on Monday and the change on Thursday?

Nneka and Juan are studying dolphins. They track the depth that a dolphin is swimming over the course of four hours, and they record their findings in the table. Nneka says the difference in elevation from Hour 1 to Hour 2 is 130 feet. Juan says the difference is 70 feet. Who is correct? Explain how you know.

HOUR	ELEVATION
1	-30
2	-160
3	-65
4	-60

Clark owns a shoe store. He keeps track of how many pairs of shoes he has in stock by using the table below.

DAY	PAIRS IN STOCK	CHANGE
Mon	100	-25
Tue	75	-10
Wed	65	+120
Thu		
Fri		

1. Which best describes what happened on Monday?
   a. The store received 25 pairs of shoes.
   b. The store sold 25 pairs of shoes.
   c. The store received 100 pairs of shoes.
   d. The store sold 100 pairs of shoes.

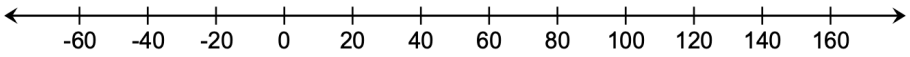
2. In your own words, describe what happened on Tuesday.

3. The table shows that the store received a shipment of 120 pairs of shoes on Wednesday. How many pairs will the store have in stock at the start of the day on Thursday? Record your answer in the table.

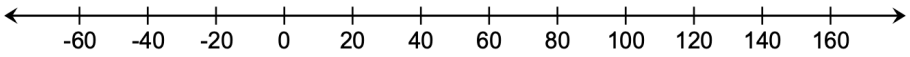
4. Clark sold 40 pairs of shoes on Thursday. Show how he can record that in the table.

5. How many pairs will the store have in stock at the start of the day on Friday? Record your answer in the table.

6. Clark wants to find the difference between the change of inventory on Wednesday and the change of inventory on Thursday. Represent each change on the number line. Then write an equation to find the difference.



7. What is the difference between the change of inventory on Tuesday and the change of inventory on Thursday?



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Tue		-20
Wed	10	
Thu	20	
Fri	15	-10
Sat	5	25
Sun		-5

8. Find each missing value in the table.

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4	0.7	2

12. What does a negative elevation mean? A positive?

13. What does a negative change in elevation mean? A positive?

14. Fill in the missing value based on the information in the table.

1. A ski resort tracks the low temperature each month from January through May. Use the information to answer the questions.

MONTH	LOW TEMPERATURE	CHANGE
Jan	-5	+7
Feb	2	-3
Mar	-1	+1
Apr	0	+6
May	6	+10

In January the temperature _____ degrees.

a. increased 7
b. decreased 7
c. increased 5
d. decreased 5

In February the temperature _____ degrees.

a. increased 2
b. decreased 2
c. increased 3
d. decreased 3

What is the difference between the change of temperature in February and the change of temperature in May?

a. 3 degrees
b. 7 degrees
c. 10 degrees
d. 13 degrees

2. A hiker's smartwatch tracks her elevation each hour.

PART A: Find the missing values in the table. Show how you know.

HOUR	ELEVATION (ft)	CHANGE (ft)
1st	10	-20
2nd	-10	
3rd	20	
4th	-20	10

PART B: What is the difference between the change in elevation the first hour and the change in elevation the fourth hour?

3. The robotics club is hosting a cookie sale this week to raise funds for a field trip. The table shows how many cookies they have in stock at the beginning of the day, and the change in inventory each day.

DAY	INVENTORY	CHANGE
Mon	500	-60
Tue	440	-100
Wed	340	+50
Thu	390	-110
Fri	280	

What does the value -60 mean in the context of this story?

What does the value +50 mean in the context of this story?

By the end of the week, the robotics team sold out of cookies. Complete the table to reflect that information.

What is the difference between the change on Monday and the change on Thursday?

Nneka and Juan are studying dolphins. They track the depth that a dolphin is swimming over the course of four hours, and they record their findings in the table. Nneka says the difference in elevation from Hour 1 to Hour 2 is 130 feet. Juan says the difference is 70 feet. Who is correct? Explain how you know.

HOUR	ELEVATION
1	-30
2	-100
3	-65
4	-60

Name: KEY

G7 U4 Lesson 6 - Let's Try It

Clark owns a shoe store. He keeps track of how many pairs of shoes he has in stock by using the table below.

DAY	PAIRS IN STOCK	CHANGE
Mon	100	-25
Tue	75	-10
Wed	65	+120
Thu	185	-40
Fri	145	

1. Which best describes what happened on Monday?
   a. The store received 25 pairs of shoes.
   b. The store sold 25 pairs of shoes.
   c. The store received 100 pairs of shoes.
   d. The store sold 100 pairs of shoes.

2. In your own words, describe what happened on Tuesday.

   The store sold 10 pairs of shoes.

3. The table shows that the store received a shipment of 120 pairs of shoes on Wednesday. How many pairs will the store have in stock at the start of the day on Thursday? Record your answer in the table.

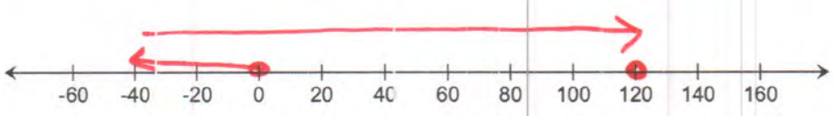
   $65 + 120 = 185$

4. Clark sold 40 pairs of shoes on Thursday. Show how he can record that in the table.

5. How many pairs will the store have in stock at the start of the day on Friday? Record your answer in the table.

   $185 - 40 = 145$

6. Clark wants to find the difference between the change of inventory on Wednesday and the change of inventory on Thursday. Represent each change on the number line. Then write an equation to find the difference.

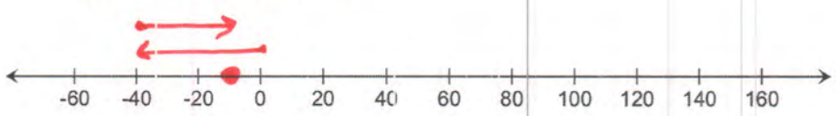


$120 - (-40) = ?$

$120 + 40$

160

7. What is the difference between the change of inventory on Tuesday and the change of inventory on Thursday?



$-10 - (-40)$

$-10 + 40$

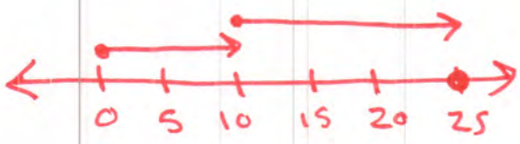
30

A bakery keeps track of their cake inventory in the table below. Some of the values are missing.

DAY	CAKES	CHANGE
Mon	40	-10
Tue	30	-20
Wed	10	+10
Thu	20	-5
Fri	15	-10
Sat	5	25
Sun	30	-5

8. Find each missing value in the table. ✓

9. What is the difference between the change on Wednesday and the change on Saturday? Sketch a number line to show your thinking.



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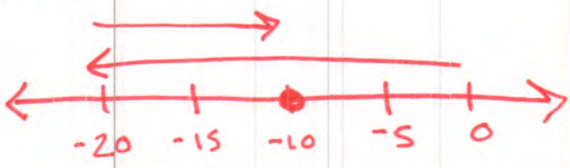
10. What is the difference between the change on Monday and the change on Tuesday? Sketch a number line to show your thinking.



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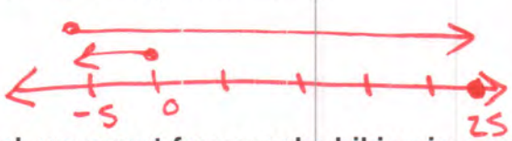
11. What is the difference between the change on Saturday and the change on Sunday? Sketch a number line to show your thinking.



30

A team of researchers spent four weeks hiking in a canyon. Their elevations each week are shown in the table.

WEEK	ELEVATION (m)	CHANGE
1	2.5	-3
2	-0.5	-4.5
3	-5	+5.7
4	0.7	2

12. What does a negative elevation mean? A positive?

A negative elevation means the elevation decreases, whereas a positive elevation means the elevation increases.

13. What does a negative change in elevation mean? A positive?

A positive elevation is above sea level. A negative elevation is below sea level.

switch

14. Fill in the missing value based on the information in the table.

$-5 + ? = 0.7$

Name: KEY

1. A ski resort tracks the low temperature each month from January through May. Use the information to answer the questions.

MONTH	LOW TEMPERATURE	CHANGE
Jan	-5	+7
Feb	2	-3
Mar	-1	+1
Apr	0	+6
May	6	+10

In January the temperature _____ degrees.

a. increased 7
b. decreased 7
c. increased 5
d. decreased 5

In February the temperature _____ degrees.

a. increased 2
b. decreased 2
c. increased 3
d. decreased 3

What is the difference between the change of temperature in February and the change of temperature in May?

a. 3 degrees
b. 7 degrees
c. 10 degrees
d. 13 degrees

$10-(-3)$

$10+3$

2. A hiker's smartwatch tracks her elevation each hour.

PART A: Find the missing values in the table. Show how you know.

HOUR	ELEVATION (ft)	CHANGE (ft)
1st	10	-20
2nd	-10	+30
3rd	20	-40
4th	-20	10

PART B: What is the difference between the change in elevation the first hour and the change in elevation the fourth hour?

$10-(-20)$

$10+20$

30

3. The robotics club is hosting a cookie sale this week to raise funds for a field trip. The table shows how many cookies they have in stock at the beginning of the day, and the change in inventory each day.

DAY	INVENTORY	CHANGE
Mon	500	-60
Tue	440	-100
Wed	340	+50
Thu	390	-110
Fri	280	-280

What does the value -60 mean in the context of this story?

The team sold 60 cookies.

What does the value +50 mean in the context of this story?

The team baked 50 more cookies.

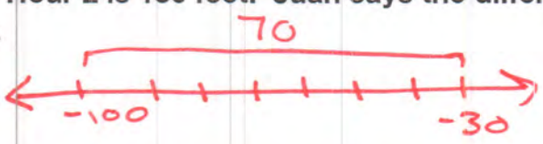
By the end of the week, the robotics team sold out of cookies. Complete the table to reflect that information.

280 - 280 = 0

What is the difference between the change on Monday and the change on Thursday?

-110 - (-60) (-50)

Nneka and Juan are studying dolphins. They track the depth that a dolphin is swimming over the course of four hours, and they record their findings in the table. Nneka says the difference in elevation from Hour 1 to Hour 2 is 130 feet. Juan says the difference is 70 feet. Who is correct? Explain how you know.



HOUR	ELEVATION
1	-30
2	-100
3	-65
4	-60

Juan is correct. The distance between -30 and -100 on a number line is 70.

G7 U4 Lesson 7

Understand that the product of a negative number and positive number is negative and explain how signed numbers can be used to represent position and speed.

G7 U4 Lesson 7 - Students will understand that the product of a negative number and a positive number is negative and explain how signed numbers can be used to represent position and speed.

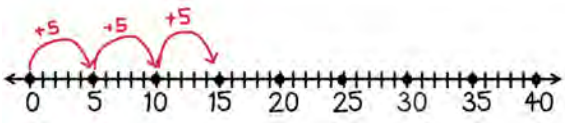
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Up until now, in our work with signed numbers, we've been focusing on addition and subtraction. Today is exciting, because we get to start thinking about what happens when we multiply with signed numbers. When you think about multiplication, what comes to mind? Possible Student Answers, Key Points:

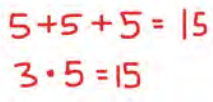
- When we multiply we use the x or • symbol.
- We can think of multiplying as equal groups. It's like repeated addition.
- I know an algorithm to multiply big numbers.

We're going to take everything you already know about multiplication and everything you already know about positive and negative numbers, and we'll work to figure out what happens when you take the product of a negative number and a positive number.

Let's Talk (Slide 3): Let's warm up by thinking about a pot of water doing just that…warming up! Imagine there is a pot of water. You measure the temperature of the water every minute with a thermometer. The temperature of the water starts at 0 degrees. After 1 minute, you notice the temperature increased 5 degrees. What temperature is it now? (5 degrees)



(label a hop of +5 on the number line) After 1 minute, it's 5 degrees. Another minute goes by, and you notice the temperature increased 5 more degrees. What's the temperature now? (10 degrees) It's 10 degrees. *(continue labeling hops on the number line as you narrate)* What if after the next minute it increased 5 degrees again? What temperature would it be? (15 degrees) It would be 15 degrees, correct.



We can represent this change in temperature using repeated addition. *(write 5 + 5 + 5 = 15)* We can also think of this in terms of multiplication. I see three groups of positive 5 on the number line, so I can write that as 3 • 5 = 15. *(write equation)*

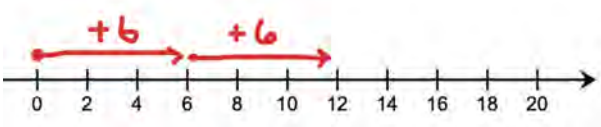
What do you think would be different if instead of increasing, the temperature decreased by 5 degrees each minute? Possible Student Answers, Key Points:

- We'd still hop by groups of 5, but in the other direction along the number line.
- I think our answer would be negative. Maybe it would be -15 degrees.

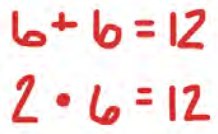
Let's look at some problems to better understand how to multiply a positive number by a negative number.

Let's Think (Slide 4): This problem presents a different context. It wants us to show each car's final position on a number line and using an equation. Notice, each car is moving in a different direction along the line.

Let's start by thinking about the red car. I know the red car moves right 6 feet, and I know this happens each second for 2 seconds. How could I represent that on the number line? *(sketch and label on number line as student share, supporting as needed)* Possible Student Answers, Key Points:



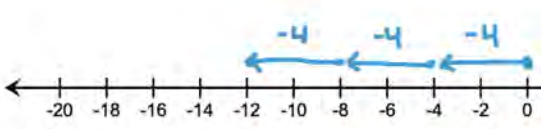
- Start at 0, then draw two arrows to the right. Each arrow should be 6 units long.
- Draw an arrow going to the 6, so three tick marks right. Then draw another the same length.



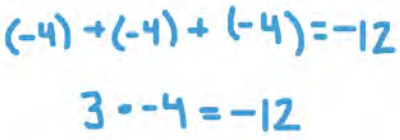
We can draw two arrows moving right, with each arrow representing 6 feet. I have to be a little careful because the scale on this number line is counting by two. I can think of two equations to represent that. Repeated addition could work. *(write equations as you narrate)* That would look like 6 + 6 = 12. Or, we see two groups of 6 on the number line. I can show that using multiplication by writing 2 • 6 = 12. The red car's final position is positive 12.

What's different about the movement of the blue car? Possible Student Answers, Key Points:

- It's pointing the other direction.
- It moves 4 feet each time.
- It moves for 3 seconds.

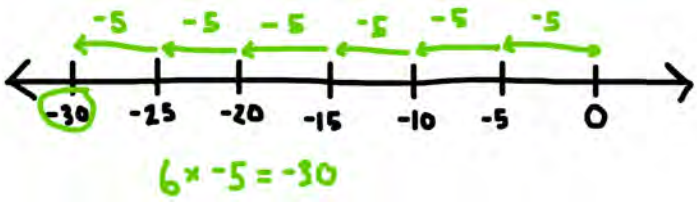


The blue car is moving left, toward the negative numbers on the number line. It movies 4 feet every second, and it does that for 3 seconds. I could represent that by drawing three arrows left, each showing -4. I should keep in mind that the number line is still counting by two. *(sketch and label number line)*

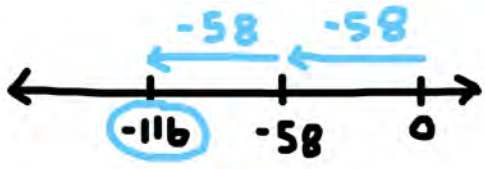


What repeated addition equation could I write to represent this? (-4 plus -4 plus -4 equals -12) *(write that)* We can also use multiplication to represent this, even though the groups are negative. It works the same way. I see on the number line that we have 3 groups, and each group is -4. I can think of 3 groups of -4 as being 3 • -4 = -12. We just multiplied a whole number by a negative number using a number line. Nicely done!

Let's Think (Slide 5): These three problems don't involve a context. Let's see if we can find the product of each.



For part A, it wants us to find the product of 6 • -5. We can think of that as 6 groups of -5. *(sketch a simple number line from 0 to -30 using a scale of 5)* I'm going to use a scale of 5. I don't need to draw every individual number when I make my own number line. Now, all I have to do is draw 6 groups of -5. I can six arrows to represent the groups, and I'll make each arrow worth -5. *(draw and label what you described)* Where did we end up on the number line? (-30) The product of 6 • -5 is -30. *(write multiplication equation)* That makes sense, because I know 6 groups of positive 5 would be 30. So, 6 groups of negative 5 would be negative 30.

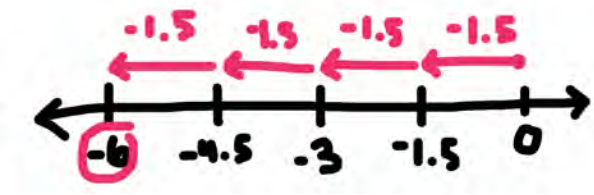


For part B, it wants us to find the product of -58 • 2. Thinking of -58 groups is a little strange, because it's hard to wrap my head around the idea of negative groups. I know we can switch the order of factors in a multiplication problem, though. Let's rewrite -58 • 2 as 2 • -58. Now, I'm just thinking of 2 groups of -58. How could I represent this on a number line? *(sketch and label as student shares)*

Possible Student Answers, Key Points:

- Show two arrows going left, since they are negative. Each arrow should represent -58.

We could think of this as -58 plus -58, or we can use multiplication to think of it as 2 • -58 = -116. Multiplying a positive times a negative number is not too different from multiplying two positive numbers, we just need to be mindful of the signs in our factors and product.



Let's do one more. Part C asks us to find the product of 4 and negative 1.5. How can I think of this equation in terms of a number line? Possible Student Answers, Key Points:

- We can think of it as 4 groups of -1.5
- I can show 4 arrows to the left to represent the groups. Each arrow can be -1.5.
- I can use a scale of 0.5, 1, or 1.5 depending on what I think will be easiest.

(sketch as you narrate) I'll use a scale of 1.5 to make my number line. If I show four groups of -1.5, my number line will need 4 arrows each representing negative 1.5. We end up with a product of -6. So, 4 times -1.5 is equal to -6. *(write equation)*

How is multiplying a positive and negative number the same as and different than multiplying a positive and a positive number? Possible Student Answers, Key Points:

- When multiplying a positive by a negative, your arrows go left. Your answer ends up being negative.
- We can think of both situations as being ___ groups of ____. We can use arrows to represent the equal groups.
- We kind of use the same facts, just the sign changes. 4 x 2 = 8 and 4 x -2 = -8, for example.

Great thinking.

Let's Try it (Slides 6 - 7): Now let's practice a little more together before you try some on your own. As we work, we'll think about each multiplication problem as being equal groups of a given quantity. If we need to rewrite our multiplication in a different order, we absolutely can. Number lines, repeated addition, and multiplication equations can all help us think about a problem and represent our thinking. Let's give it a try.

WARM WELCOME

Today we will understand that the product of a negative number and a positive number is negative and explain how signed numbers can be used to represent position and speed.

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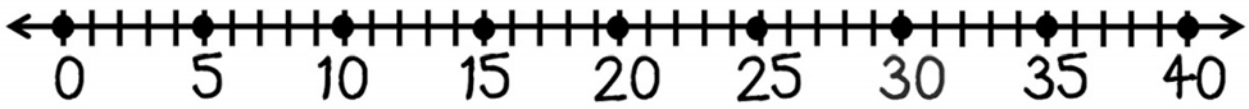
Let's Talk:

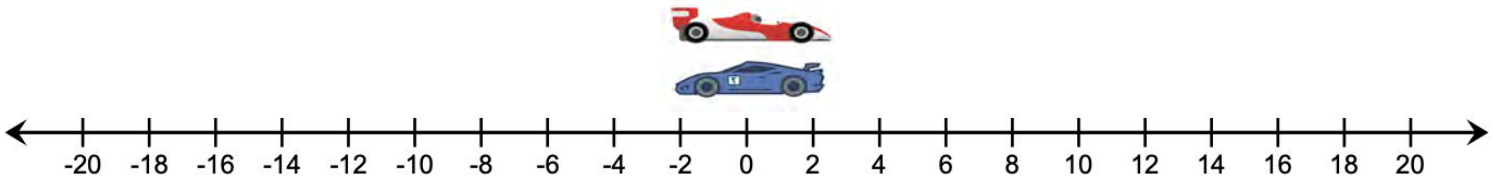
The thermometer in a pot of water measures 0 degrees.

-After 1 minute, the temperature increases 5 degrees.
-After another minute, the temperature increases 5 degrees.
-After another minute, the temperature increases 5 degrees.



Let's Think:

The red car moves 6 feet right every second for 2 seconds. The blue car moves 4 feet left every second for 3 seconds. Write equations to show each car's final position on the number line.



Let's Think:

Sketch a number line to find each product.

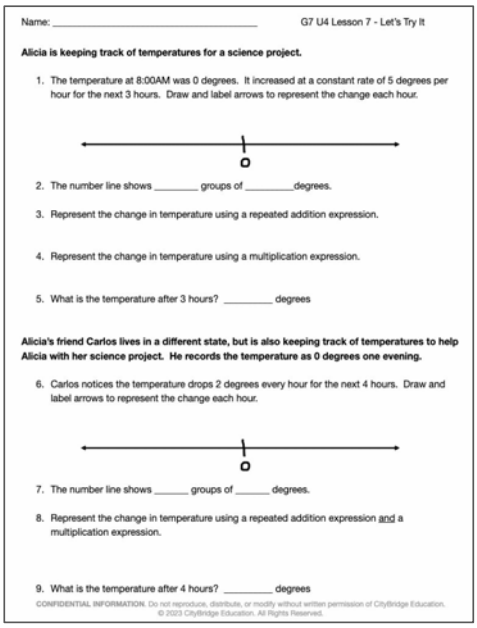
a. 6 • -5

b. -58 • 2

c. 4 • -1.5

Let's Try It:

Let's explore understanding that the product of a negative number and a positive number is negative together.



Name: _____ G7 U4 Lesson 7 - Let's Try It

Alicia is keeping track of temperatures for a science project.

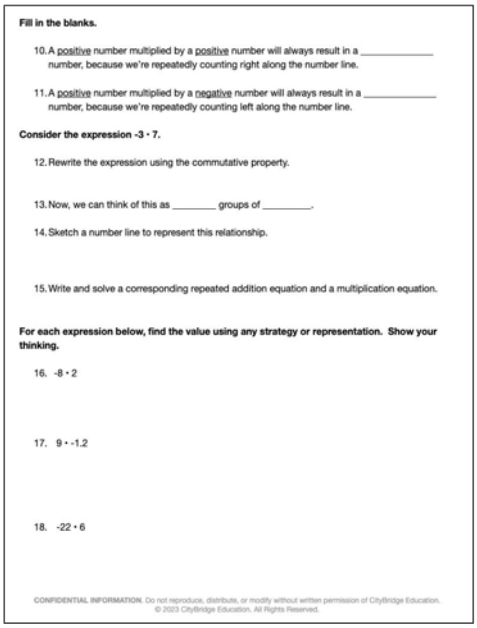
1. The temperature at 8:00AM was 0 degrees. It increased at a constant rate of 5 degrees per hour for the next 3 hours. Draw and label arrows to represent the change each hour.

2. The number line shows _____ groups of _____degrees.
3. Represent the change in temperature using a repeated addition expression.
4. Represent the change in temperature using a multiplication expression.
5. What is the temperature after 3 hours? _____ degrees

Alicia's friend Carlos lives in a different state, but is also keeping track of temperatures to help Alicia with her science project. He records the temperature as 0 degrees one evening.

6. Carlos notices the temperature drops 2 degrees every hour for the next 4 hours. Draw and label arrows to represent the change each hour.

7. The number line shows _____ groups of _____ degrees.
8. Represent the change in temperature using a repeated addition expression and a multiplication expression.
9. What is the temperature after 4 hours? _____ degrees



Fill in the blanks.

10. A positive number multiplied by a positive number will always result in a _____ number, because we're repeatedly counting right along the number line.
11. A positive number multiplied by a negative number will always result in a _____ number, because we're repeatedly counting left along the number line.

Consider the expression -3 • 7.

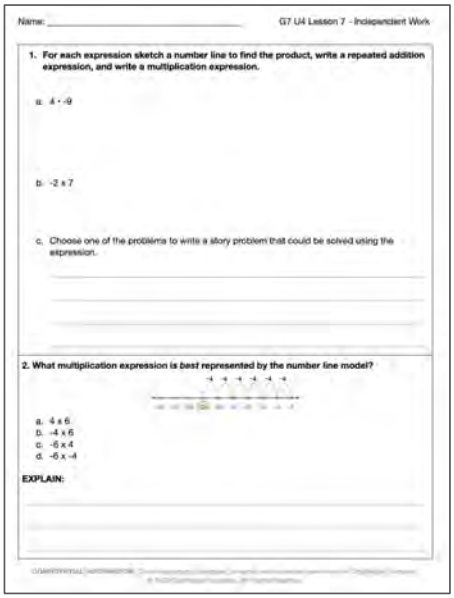
12. Rewrite the expression using the commutative property.
13. Now, we can think of this as _____ groups of _____.
14. Sketch a number line to represent this relationship.
15. Write and solve a corresponding repeated addition equation and a multiplication equation.

For each expression below, find the value using any strategy or representation. Show your thinking.

16. -8 • 2
17. 9 • -1.2
18. -22 • 6

On your Own:

Now it's time to explore understanding that the product of a negative number and a positive number is negative on your own.



Name: _____ G7 U4 Lesson 7 - Independent Work

1. For each expression sketch a number line to find the product, write a repeated addition expression, and write a multiplication expression.

a. $4 \cdot -9$

b. -2×7

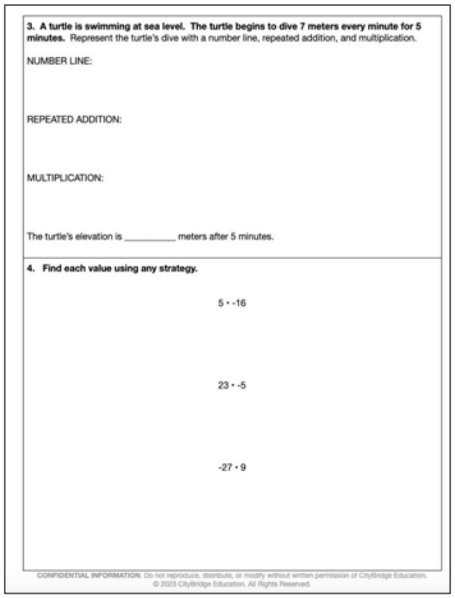
c. Choose one of the problems to write a story problem that could be solved using the expression.

2. What multiplication expression is *best* represented by the number line model?

-4 -4 -4 -4 -4 -4

a. 4×6
b. -4×6
c. -6×4
d. -6×-4

EXPLAIN:



3. A turtle is swimming at sea level. The turtle begins to dive 7 meters every minute for 5 minutes. Represent the turtle's dive with a number line, repeated addition, and multiplication.

NUMBER LINE:

REPEATED ADDITION:

MULTIPLICATION:

The turtle's elevation is _____ meters after 5 minutes.

4. Find each value using any strategy.

$5 \cdot -16$

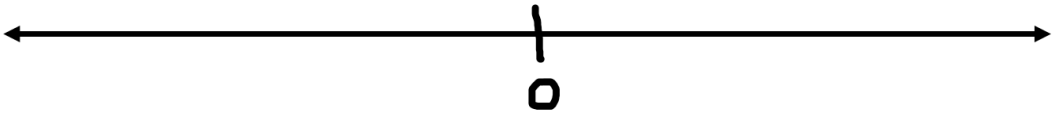
$23 \cdot -5$

$-27 \cdot 9$

Name: _____ G7 U4 Lesson 7 - Let's Try It

Alicia is keeping track of temperatures for a science project.

1. The temperature at 8:00AM was 0 degrees. It increased at a constant rate of 5 degrees per hour for the next 3 hours. Draw and label arrows to represent the change each hour.



2. The number line shows _____ groups of _____degrees.

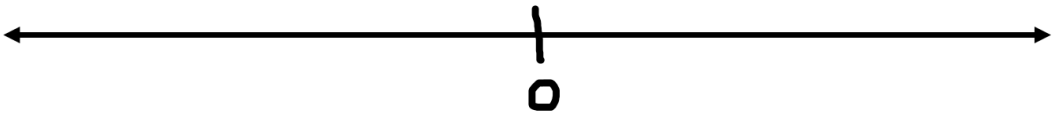
3. Represent the change in temperature using a repeated addition expression.

4. Represent the change in temperature using a multiplication expression.

5. What is the temperature after 3 hours? _____ degrees

Alicia's friend Carlos lives in a different state, but is also keeping track of temperatures to help Alicia with her science project. He records the temperature as 0 degrees one evening.

6. Carlos notices the temperature drops 2 degrees every hour for the next 4 hours. Draw and label arrows to represent the change each hour.



7. The number line shows _____ groups of _____ degrees.

8. Represent the change in temperature using a repeated addition expression and a multiplication expression.

9. What is the temperature after 4 hours? _____ degrees

Fill in the blanks.

10. A positive number multiplied by a positive number will always result in a _____ number, because we're repeatedly counting right along the number line.

11. A positive number multiplied by a negative number will always result in a _____ number, because we're repeatedly counting left along the number line.

Consider the expression -3 • 7.

12. Rewrite the expression using the commutative property.

13. Now, we can think of this as _____ groups of _____.

14. Sketch a number line to represent this relationship.

15. Write and solve a corresponding repeated addition equation and a multiplication equation.

For each expression below, find the value using any strategy or representation. Show your thinking.

16. -8 • 2

17. 9 • -1.2

18. -22 • 6

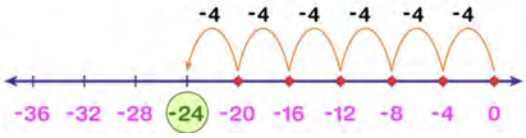
1. For each expression sketch a number line to find the product, write a repeated addition expression, and write a multiplication expression.

a. 4 • -9

b. -2 x 7

c. Choose one of the problems to write a story problem that could be solved using the expression.

2. What multiplication expression is *best* represented by the number line model?



a. 4 x 6
b. -4 x 6
c. -6 x 4
d. -6 x -4

EXPLAIN:

3. A turtle is swimming at sea level. The turtle begins to dive 7 meters every minute for 5 minutes. Represent the turtle's dive with a number line, repeated addition, and multiplication.

NUMBER LINE:

REPEATED ADDITION:

MULTIPLICATION:

The turtle's elevation is _____ meters after 5 minutes.

4. Find each value using any strategy.

5 • -16

23 • -5

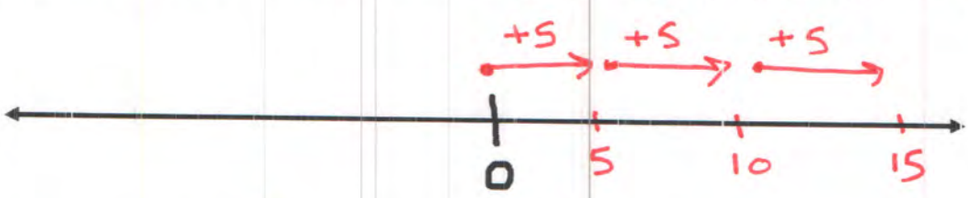
-27 • 9

Name: KEY

G7 U4 Lesson 7 - Let's Try It

Alicia is keeping track of temperatures for a science project.

1. The temperature at 8:00AM was 0 degrees. It increased at a constant rate of 5 degrees per hour for the next 3 hours. Draw and label arrows to represent the change each hour.



2. The number line shows 3 groups of 5 degrees.

3. Represent the change in temperature using a repeated addition expression.

5 + 5 + 5

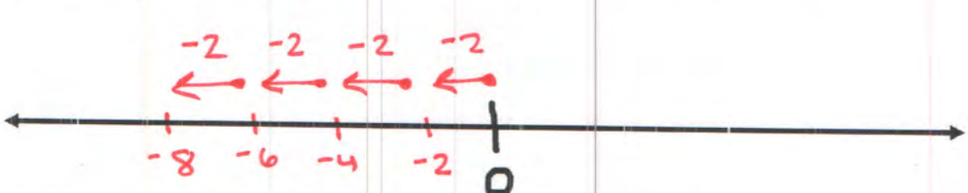
4. Represent the change in temperature using a multiplication expression.

3 × 5

5. What is the temperature after 3 hours? 15 degrees

Alicia's friend Carlos lives in a different state, but is also keeping track of temperatures to help Alicia with her science project. He records the temperature as 0 degrees one evening.

6. Carlos notices the temperature drops 2 degrees every hour for the next 4 hours. Draw and label arrows to represent the change each hour.



7. The number line shows 4 groups of -2 degrees.

8. Represent the change in temperature using a repeated addition expression and a multiplication expression.

-2 + -2 + -2 + -2

4 × -2

9. What is the temperature after 4 hours? -8 degrees

Fill in the blanks.

10. A positive number multiplied by a positive number will always result in a positive number, because we're repeatedly counting right along the number line.

11. A positive number multiplied by a negative number will always result in a negative number, because we're repeatedly counting left along the number line.

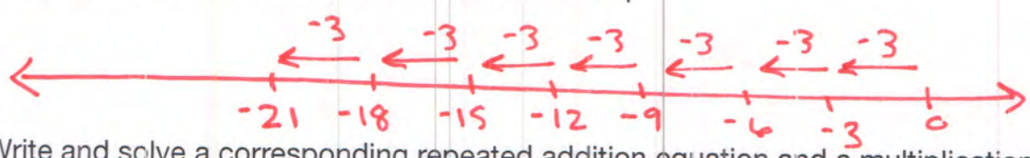
Consider the expression -3 • 7.

12. Rewrite the expression using the commutative property.

7 • -3

13. Now, we can think of this as 7 groups of -3.

14. Sketch a number line to represent this relationship.



15. Write and solve a corresponding repeated addition equation and a multiplication equation.

-3 + -3 + -3 + -3 + -3 + -3 + -3 = -21

7 • -3 = -21

For each expression below, find the value using any strategy or representation. Show your thinking.

16. -8 • 2

2 • -8 = (-16)

17. 9 • -1.2

(-10.8)

12 × 9 = 108
1.2 × 9 = 10.8

18. -22 • 6

6 • -22

(-132)

22
× 6
132

Name: KEY

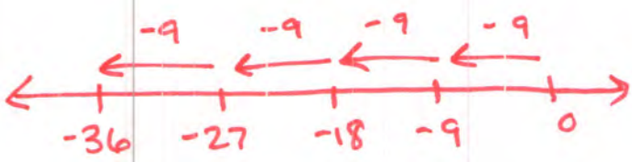
G7 U4 Lesson 7 - Independent Work

1. For each expression sketch a number line to find the product, write a repeated addition expression, and write a multiplication expression.

a. 4 • -9

$-9+-9+-9+-9=-36$

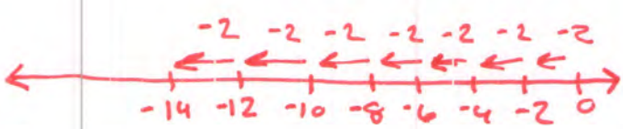
$4 \cdot -9 = -36$



b. -2 x 7

$7 \times -2 = -14$

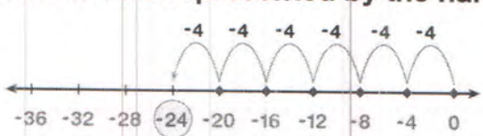
$-2+-2+-2+-2+-2+-2+-2$



c. Choose one of the problems to write a story problem that could be solved using the expression.

The temperature starts at 0° and drops 2 degrees every hour for 7 hours. What is the temperature now?

2. What multiplication expression is *best* represented by the number line model?



a. 4 x 6

b. -4 x 6

c. -6 x 4

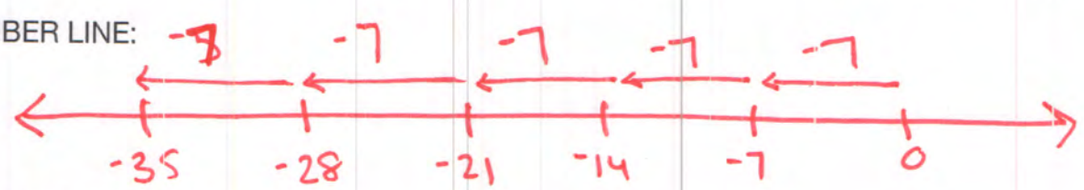
d. -6 x -4

EXPLAIN:

I see 6 groups of -4 which I can write as 6×-4 or -4×6.

3. A turtle is swimming at sea level. The turtle begins to dive 7 meters every minute for 5 minutes. Represent the turtle's dive with a number line, repeated addition, and multiplication.

NUMBER LINE:



REPEATED ADDITION:

$-7 + -7 + -7 + -7 + -7 = ?$

MULTIPLICATION:

$-7 \times 5 = ?$

The turtle's elevation is -35 meters after 5 minutes.

4. Find each value using any strategy.

$16 \times 5 = 80$

5 • -16

-80

$23 \times 5 = 115$

23 • -5

-115

$27 \times 9 = 243$

-27 • 9

-243

G7 U4 Lesson 8

Interpret signed numbers when used to represent time in situations about speed and direction as well as understand that the product of two negative numbers is positive.

G7 U4 Lesson 8 - Students will interpret signed numbers when used to represent time in situations about speed and direction as well as understand that the product of two negative numbers is positive.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): You've known how to multiply positive numbers by positive numbers for many years. When we were last together, we explored how how to multiply a positive number by a negative number. What do you remember about how multiplying positive numbers is similar to and different from multiplying a positive number by a negative number? Possible Student Answers, Key Points:

- No matter the signs on the numbers, we can think of multiplying as equal groups or repeated addition.
- When we model multiplying a positive number by a negative number, we draw arrows to the left rather than the right.
- Two positive numbers result in a product that is positive. When we multiply a positive number by a negative number, the product is negative.

Those are excellent points. Today, we'll explore what happens when we multiply a negative value by another negative value. Do you have any predictions as to what will happen? Possible Student Answers, Key Points:

- I think it will be negative, since the two factors are also negative.
- I think it will be positive, because a negative times a positive is negative. This must be different.
- I'm not sure. It's hard to think about two negative numbers as being equal groups of a value.

Let's find out…

Let's Talk (Slide 3): Before we dive in, let's practice some multiplication. Feel free to use the number line to help you solve or explain your thinking.

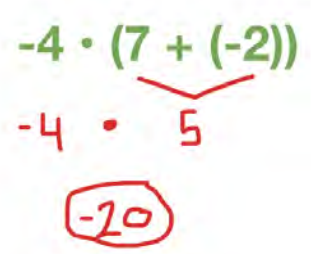
What would be the product of 2 • 5? (10) Correct. 2 • 5 = 10. A positive number times a positive number is always positive.

What would be the product of 2 • -5? (-10) 2 • -5 can be thought of as two groups of -5. The product is -10. The product of a positive and a negative number is always negative.

What would be the product of -2 • 5? (-10) We can reorder this expression, if that helps. If I think of it as 5 • -2, I can picture 5 hops of -2 on the number line. The product is -10. Again, the product of a negative and a positive number is a negative number.

The last example is a negative number times a negative number. We haven't learned that yet, so let's come back to this one.

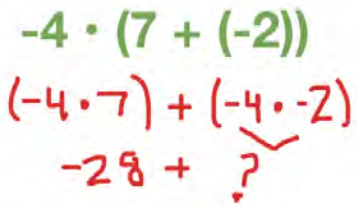
Let's Think (Slide 4): Before we jump straight into multiplying two negative numbers together, let's consider this expression. We'll first think about it by evaluating what is in parentheses first. Then we'll do it again, but we'll distribute the -4 first. By the end of this process, we'll know how to think about the product of two negative numbers.



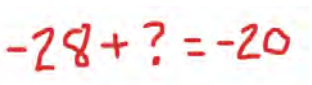
Let's begin by evaluating what is in parentheses first. What is 7 + (-2), and how do you know? Possible Student Answers, Key Points:

- I can think of 7 + (-2) as 7 - 2. 7 minus 2 is 5.
- I can picture a number line. If I plot a point at 7 and add -2 with an arrow going left 2 spaces, I'll end up at -5.

7 plus -2 is 5. *(rewrite expression as -4 • 5)* Now all we have left to do is multiply -4 • 5. We can reorder the factors and think of it as 5 • -4, or 5 groups of -4. What is the value of 5 groups of -4? (-20) The value of the expression is -20. Keep that in mind, as we evaluate the expression another way.



Let's use the distributive property first this time. We can distribute the -4 to each term in parentheses. Let's rewrite the expression. *(rewrite as (-4 • 7) + (-4 • -2))* I know -4 • 7 is -28, because I can think of it as being 7 groups of -4. We don't yet know how to multiply -4 times -2, so I'll write a question mark for that product. *(write -28 + ?)*

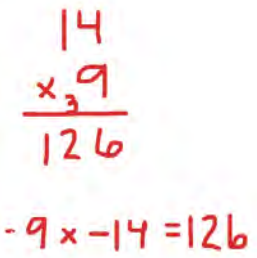


We already simplified the expression, so we know it has to equal -20. *(write -28 + ? = -20)* So, based on this, does -4 • -2 equal positive or negative 8? How do you know? Possible Student Answers, Key Points:

- It can't equal -8, because -28 + (-8) would be -36.
- It has to equal +8. I know -28 + 8 is -20.

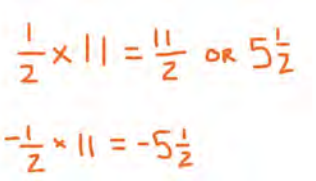
Negative 4 times negative 2 must be positive 8. This example helps us see that the product of two negative numbers is always positive. Let's keep that in mind as we find a few more products.

Let's Think (Slide 5): Part A wants us to find the product of -9 and -14.



We just learned that two negative numbers multiplied together will result in a positive product. So will this product be positive or negative? (positive) Let's multiply 14 by 9 without thinking about the sign, then we'll make sure to note that our product is positive. *(write 14 x 9 in vertical form as you narrate)* I know 4 x 9 is 36. I'll write a 6 in the ones place, then regroup 3 tens. 1 ten x 9 is 9 tens. 9 tens plus the 3 tens we regrouped, means we have 12 tens. The product of 14 and 9 is 126.

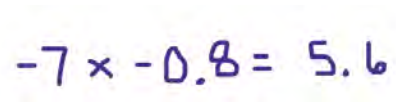
The product of-9 x -14 is positive 126. *(write equation horizontally)*



Let's try the next one. It wants us to find the product of -½ x 11. What do we know about the product of a negative number and a positive number? (It will be negative.) We know the product will be negative, so let's multiply the numbers without worrying about the signs. How can I multiply ½ by 11? *(write equation as student explains, supporting as needed)* Possible Student Answers, Key Points:

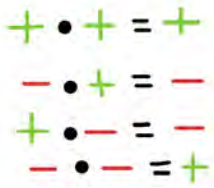
- One half times 11 will be 11 halves, or 11/2. 11/2 is equal to 5 ½.
- You can multiply the 1 in the numerator by 11 to get 11. The denominator will stay 2. The answer is 11/2 or 5 ½.

We know ½ x 11 is equal to 11/2 or 5 ½. We also know that a negative value times a positive value equals a negative value. So -½ x 11 = -5 ½. *(write equation)*



The last example wants us to find the product of -7 and -0.8, or negative 8 tenths. I know 7 x 8 tenth is 56 tenths or 5.6. What will be the sign on the product? (A negative times a negative is a positive.) Negative 7 times negative 0.8 is equal to positive 5.6. *(write equation)*

No matter if our numbers are whole numbers, decimals, or fractions, the same multiplication rules apply.



(write out symbols as shown as you summarize the multiplication rules) We know that two positive numbers multiplied together results in a positive product. A negative times a positive results in a negative number. A positive times a negative results in a negative number. And we just learned that a negative times a negative results in a positive number. We can use these rules to help us multiply any two numbers moving forward.

Earlier in our time together we looked at the expression -2 • -5. At the time, we weren't able to find the value. Now we can! What is the value of -2 • -5? (-10) Great job!

Let's Try it (Slides 6 - 7): Now let's practice with some more problems. We must pay careful attention to the sign on each of our factors in order to carefully arrive at the correct product. We know two positive numbers will result in a positive product. Any combination of a positive and negative number will result in a negative product. And today we learned that two negative numbers will result in a positive product. Let's use everything we've learned to carefully respond to the next few questions.

WARM WELCOME

Today we will understand that the product of two negative numbers is positive.

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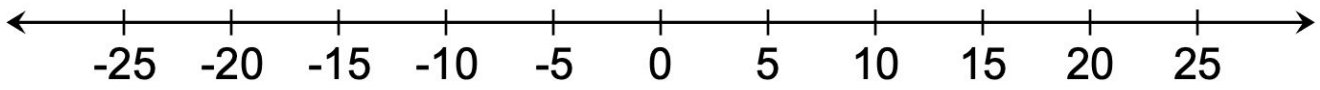
Let's Talk:

2 • 5 **2 • -5** **-2 • 5** **-2 • -5**



Let's Think:

-4 • (7 + (-2))

Evaluate the expression by evaluating what is in parentheses first.

Evaluate the expression again using the distributive property.

The product of two negative numbers is always _____.

Let's Think:

Find each product.

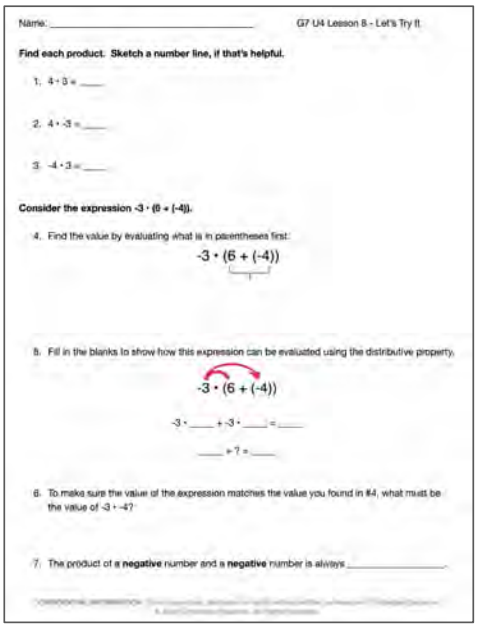
a. -9 • -14

b. -½ • 11

c. -7 • -0.8

Let's Try It:

Let's explore understanding that the product of two negative numbers is positive together.



Name: _____ G7 U4 Lesson 8 - Let's Try It

Find each product. Sketch a number line, if that's helpful.

1. 4 • 3 = ____
2. 4 • -3 = ____
3. -4 • 3 = ____

Consider the expression -3 • (6 + (-4)).

4. Find the value by evaluating what is in parentheses first:

-3 • (6 + (-4))

5. Fill in the blanks to show how this expression can be evaluated using the distributive property.

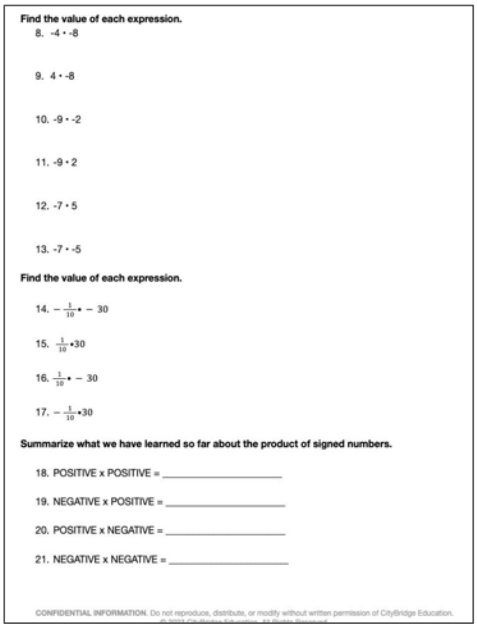
-3 • (6 + (-4))

-3 • ____ + -3 • ____ = ____

____ + ? = ____

6. To make sure the value of the expression matches the value you found in #4, what must be the value of -3 • -4?

7. The product of a **negative** number and a **negative** number is always _____.



Find the value of each expression.

8. -4 • -8
9. 4 • -8
10. -9 • -2
11. -9 • 2
12. -7 • 5
13. -7 • -5

Find the value of each expression.

14. $-\frac{1}{10} \cdot -30$
15. $\frac{1}{10} \cdot 30$
16. $\frac{1}{10} \cdot -30$
17. $-\frac{1}{10} \cdot 30$

Summarize what we have learned so far about the product of signed numbers.

18. POSITIVE x POSITIVE = _____
19. NEGATIVE x POSITIVE = _____
20. POSITIVE x NEGATIVE = _____
21. NEGATIVE x NEGATIVE = _____

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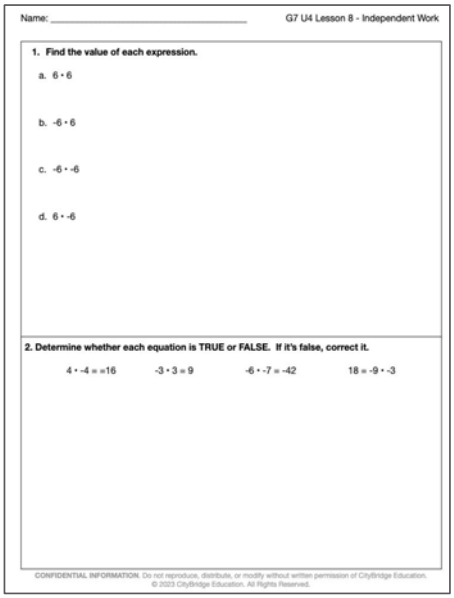
On your Own:

Now it's time to explore understanding that the product of two negative numbers is positive on your own.



Name: _____ G7 U4 Lesson 8 - Independent Work

1. Find the value of each expression.

a. $6 \cdot 6$

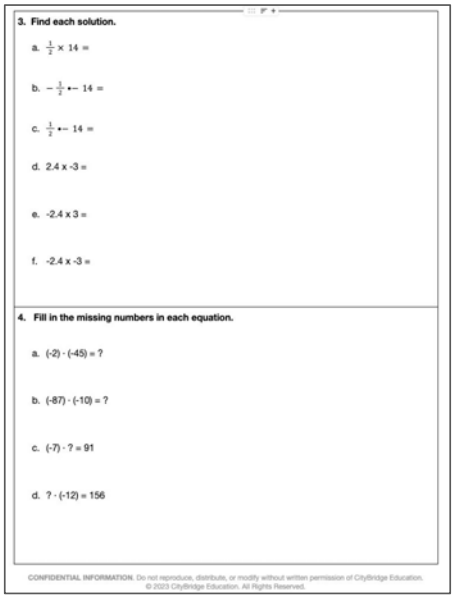
b. $-6 \cdot 6$

c. $-6 \cdot -6$

d. $6 \cdot -6$

2. Determine whether each equation is TRUE or FALSE. If it's false, correct it.

$4 \cdot -4 = =16$ $-3 \cdot 3 = 9$ $-6 \cdot -7 = -42$ $18 = -9 \cdot -3$



3. Find each solution.

a. $\frac{1}{2} \times 14 =$

b. $-\frac{1}{2} \cdot -14 =$

c. $\frac{1}{2} \cdot -14 =$

d. $2.4 \times -3 =$

e. $-2.4 \times 3 =$

f. $-2.4 \times -3 =$

4. Fill in the missing numbers in each equation.

a. $(-2) \cdot (-45) = ?$

b. $(-87) \cdot (-10) = ?$

c. $(-7) \cdot ? = 91$

d. $? \cdot (-12) = 156$

Name: _____ G7 U4 Lesson 8 - Let's Try It

Find each product. Sketch a number line, if that's helpful.

1. 4 • 3 = _____

2. 4 • -3 = _____

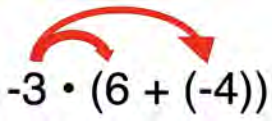
3. -4 • 3 = _____

Consider the expression -3 • (6 + (-4)).

4. Find the value by evaluating what is in parentheses first.

$$-3 \cdot (6 + (-4))$$

5. Fill in the blanks to show how this expression can be evaluated using the distributive property.



-3 • _____ + -3 • _____ = _____

_____ + ? = _____

6. To make sure the value of the expression matches the value you found in #4, what must be the value of -3 • -4?

7. The product of a **negative** number and a **negative** number is always _____.

Find the value of each expression.

8. -4 • -8

9. 4 • -8

10. -9 • -2

11. -9 • 2

12. -7 • 5

13. -7 • -5

Find the value of each expression.

14. $-\frac{1}{10} \bullet -30$

15. $\frac{1}{10} \bullet 30$

16. $\frac{1}{10} \bullet -30$

17. $-\frac{1}{10} \bullet 30$

Summarize what we have learned so far about the product of signed numbers.

18. POSITIVE x POSITIVE = _____

19. NEGATIVE x POSITIVE = _____

20. POSITIVE x NEGATIVE = _____

21. NEGATIVE x NEGATIVE = _____

1. Find the value of each expression.

a. 6 • 6

b. -6 • 6

c. -6 • -6

d. 6 • -6

2. Determine whether each equation is TRUE or FALSE. If it's false, correct it.

4 • -4 = =16 -3 • 3 = 9 -6 • -7 = -42 18 = -9 • -3

3. Find each solution.

a. $\frac{1}{2} \times 14 =$

b. $-\frac{1}{2} \bullet - 14 =$

c. $\frac{1}{2} \bullet - 14 =$

d. 2.4 x -3 =

e. -2.4 x 3 =

f. -2.4 x -3 =

4. Fill in the missing numbers in each equation.

a. (-2) · (-45) = ?

b. (-87) · (-10) = ?

c. (-7) · ? = 91

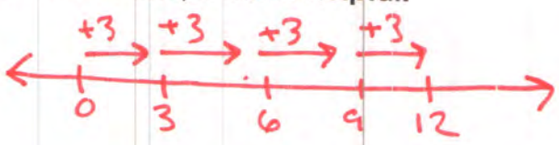
d. ? · (-12) = 156

Name: KEY

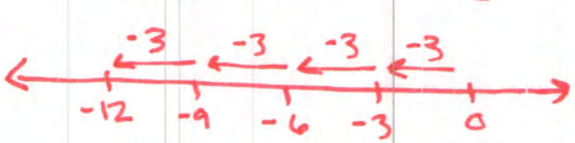
G7 U4 Lesson 8 - Let's Try It

Find each product. Sketch a number line, if that's helpful.

1. $4 \cdot 3 =$ 12

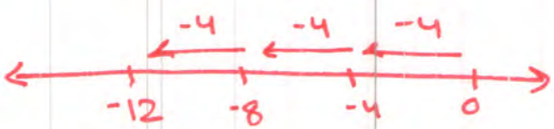


2. $4 \cdot -3 =$ -12



3. $-4 \cdot 3 =$ -12

3 • -4



Consider the expression $-3 \cdot (6 + (-4))$.

4. Find the value by evaluating what is in parentheses first.

$$-3 \cdot (6 + (-4))$$

$-3 \cdot (2)$

(-6)

5. Fill in the blanks to show how this expression can be evaluated using the distributive property.

$$-3 \cdot (6 + (-4))$$

$-3 \cdot$ 6 $+ -3 \cdot$ -4 $=$ -6

-18 $+ ? =$ -6

6. To make sure the value of the expression matches the value you found in #4, what must be the value of $-3 \cdot -4$?

(+12)

7. The product of a **negative** number and a **negative** number is always positive.

Find the value of each expression.

8. -4 • -8 (32)

9. 4 • -8 (-32)

10. -9 • -2 (18)

11. -9 • 2 (-18)

12. -7 • 5 (-35)

13. -7 • -5 (35)

Find the value of each expression.

14. $-\frac{1}{10} \bullet -30$ $\frac{-30}{-10} = (3)$

15. $\frac{1}{10} \bullet 30$ $\frac{30}{10} = (3)$

16. $\frac{1}{10} \bullet -30$ $\frac{-30}{10} = (-3)$

17. $-\frac{1}{10} \bullet 30$ $-\frac{30}{10} = (-3)$

Summarize what we have learned so far about the product of signed numbers.

18. POSITIVE x POSITIVE = positive

19. NEGATIVE x POSITIVE = negative

20. POSITIVE x NEGATIVE = negative

21. NEGATIVE x NEGATIVE = positive

Name: KEY

G7 U4 Lesson 8 - Independent Work

1. Find the value of each expression.

a. $6 \cdot 6$ 36

b. $-6 \cdot 6$ -36

c. $-6 \cdot -6$ 36

d. $6 \cdot -6$ -36

2. Determine whether each equation is TRUE or FALSE. If it's false, correct it.

$4 \cdot -4 = =16$

FALSE

$4 \cdot -4 = -16$

$-3 \cdot 3 = 9$

FALSE

$-3 \cdot 3 = -9$

$-6 \cdot -7 = -42$

FALSE

$-6 \cdot -7 = 42$

$18 = -9 \cdot -3$

TRUE

3. Find each solution.

a. $\frac{1}{2} \times 14 =$ $\frac{14}{2} = 7$

b. $-\frac{1}{2} \bullet - 14 =$ $\frac{-14}{-2} = 7$

c. $\frac{1}{2} \bullet - 14 =$ $\frac{-14}{2} = -7$

d. 2.4 x -3 = -7.2

e. -2.4 x 3 = -7.2

f. -2.4 x -3 = 7.2

$24 \times 3 = 72 \rightarrow 2.4 \times 3 = 7.2$

4. Fill in the missing numbers in each equation.

a. (-2) · (-45) = ? 90

b. (-87) · (-10) = ? 870

c. (-7) · ? = 91

-13

$7 \overline{)91}$ → 13, -70, 21, -21, 0

d. ? · (-12) = 156

-13

$12 \overline{)156}$ → 13, -120, 36, -36, 0

G7 U4 Lesson 9

Use the relationship between multiplication and division to develop the rules for dividing rational numbers.

G7 U4 Lesson 9 - Students will use the relationship between multiplication and division to develop rules for dividing rational numbers.

Warm Welcome (Slide 1): Tutor choice

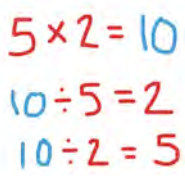
Frame the Learning/Connect to Prior Learning (Slide 2): In our previous lesson, we spent time learning about multiplication with signed numbers. We already knew that when we multiply two positive numbers together, the product is positive. Then we learned that when we multiply a positive number by a negative number, the product was negative. We also learned that when we multiply two negative numbers together, the product is positive. Today, we'll focus on dividing with signed numbers. What do you predict will be the same or different when we divide signed numbers compared to when we multiply signed numbers? Possible Student Answers, Key Points:

- Maybe the rules will be the same, since multiplication and division are related.
- Maybe the rules will be different, because division is the opposite of multiplication.

Let's use what we know about multiplication to help us think about division.

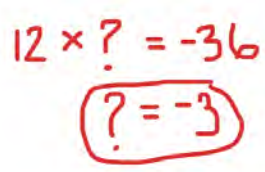
Let's Talk (Slide 3): Let's think. How are multiplication and division related? Consider using the multiplication problem here to help explain what you mean. Possible Student Answers, Key Points:

- Multiplication and division are opposites.
- Multiplication and division both involve equal groups.
- If I know 5 x 2 = 10, then I know 10 ÷ 2 = 5 and 10 ÷ 5 = 2.



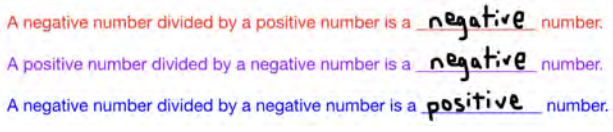
(write each equation as you narrate) Multiplication and division are opposites. So, if I know positive 5 times positive 2 is positive 10, I can use that to help me think about division. I can write related division facts that represent this same relationship. I know positive 10 divided by positive 5 is positive 2. I also know positive 10 divided by positive 2 is positive 5. We're going to use this thinking to help us think about the sign of numbers in a few more problems.

Let's Think (Slide 4): Take a look at the three division equations here. We haven't yet learned the rules for dividing with signed numbers, so let's use what we know about multiplication to help us find the unknown values in each equation.

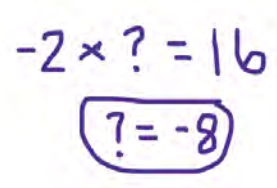


Part A wants us to find negative 36 divided by positive 12. I can think of a related multiplication fact to help me. I'll think of this as 12 x ? = -36. *(write equation)* Now I can think about a number I can multiply by 12 to make -36. Does it make more sense for my unknown to be +3 or -3? Possible Student Answers, Key Points:

- The answer should be -3, because a positive times a negative would result in a negative.

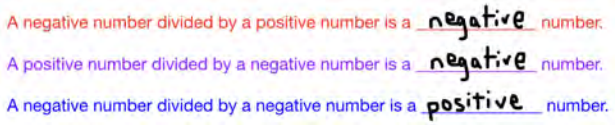


Positive 12 times *negative* 3 would result in negative 36. The value of the unknown is -3. Based on this, we know that a negative number divided by a positive number, is a negative number. *(fill in first blank)*

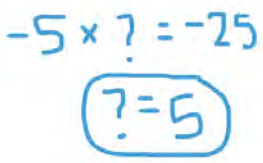


The next problem, part B, wants us to find the quotient of positive 16 divided by -2. We haven't divided a positive dividend by a negative divisor yet, so let's think about a related multiplication fact. What related multiplication fact can I consider to help us think about this division problem? (-2 x ? = 16 or ? x -2 = 16) *(write equation)*

Now I can think of -2 times *something* results in positive 16. The unknown must be -8, not +8, because -2 x -8 would result in positive 16.

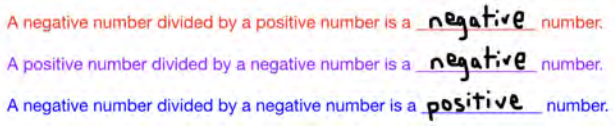


Based on this, we know that a positive number divided by a negative number is a negative number. *(fill in second blank)*



Let's try one more. Part C wants us to find the quotient of -25 divided by -5. We haven't divided a negative dividend by a negative divisor before, so let's use multiplication to help us. I can write a related multiplication fact of -5 x ? = -25. How can I use this fact to help me think about the unknown value? Possible Student Answers, Key Points:

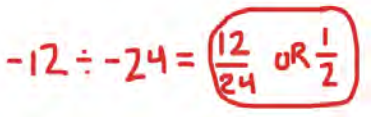
- I know 5 x 5 = 25. So I can narrow the answer to our problem down to either 5 or -5.
- I know a negative times a negative is a positive, and a negative times a positive is a negative. That means, our unknown must be positive.



-5 times +5 will equal -25. Our unknown has a value of +5. Based on this, we know that a negative number divided by a negative number is a positive number. *(fill in third blank)*

Let's Think (Slide 5): Let's use what we just found out to solve a few more division equations. What do you notice about the numbers in these problems? Possible Student Answers, Key Points:

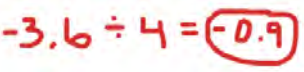
- Some are positive, and some are negative.
- I see some decimals and some fractions.
- I notice that the first one has a bigger dividend than divisor.



Whether we divide with whole numbers, fractions, or decimal numbers, the rules about signs stay the same. Let's look at Part A. It wants us to divide negative 12 by negative 24. Let's think about the problem without signs first. What is 12 divided by 24? (12/24 or ½) It's 12/24 or ½. Now, let's go back and think about the signs. A negative number divided by a negative number results in a positive number. Therefore our answer will be positive 12/24 or positive ½. *(write equation)*

Look at Part B. Let's divide as if the numbers are just normal, positive numbers. Then we'll worry about the signs. How can I think about 3.6 divided by 4? Possible Student Answers, Key Points:

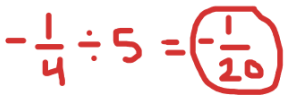
- I know 3.6 is 36 tenths. I can think 36 tenths divided by 4 is 9 tenths or 0.9.
- I can set up long division. I know 9 goes into 36 four times. So I can write 4 in my quotient, making sure my decimal point is in the correct place. 0.4 is the quotient.



3.6 divided by 4 is 0.9. Now, let's remember that the problem is a negative number divided by a positive number. Our answer should be *negative* 9 tenths, or -0.9. Even though we're working with decimal numbers, that doesn't change how we think about the signs of our numbers. *(write equation)*

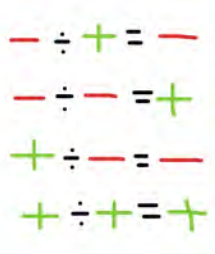
Part C is our last one. It wants us to divide -¼ by 5. We can divide without thinking about the sign, then think about the sign once we have our numeric quotient. How can I think about ¼ divided by 5? Possible Student Answers, Key Points:

- I can draw a model showing ¼ and split it 5 ways. The answer is 1/20.
- I can think of splitting ¼ of a whole five ways. ¼ divided by 5 is 1/20.



Great, ¼ divided by 5 is 1/20. What sign should our answer have, and how do you know? *(write equation)* Possible Student Answers, Key Points:

- Our answer should be -1/20. A negative divided by a positive is a negative.



Let's summarize our rules for dividing with signed numbers. *(write symbols as shown as you prompt the student)* A negative number divided by a positive number results in a…(negative number). A negative number divided by a negative number results in a…(positive number). A positive number divided by a negative number results in a…(negative number). And of course we know that a positive number divided by a positive number results in a…(positive number). The same rules that we use to multiply with signed numbers apply when we divide with signed numbers.

Let's Try it (Slides 6 - 7): Now let's work on some more division problems with signed numbers. We can divide any numbers as if they are positive, and then think about the sign after we do the division. We know that the rules for signs when we divide are the exact same as when we multiply with signed numbers. I know you're going to do great!

WARM WELCOME

Today we will use the relationship between multiplication and division to develop the rules for dividing rational numbers.

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Let's Talk:

How are multiplication and division related?

5 x 2 = 10

Let's Think:

Use multiplication to find the unknown.

-36 ÷ 12 = ?

16 ÷ -2 = ?

-25 ÷ -5 = ?

A negative number divided by a positive number is a _____ number.

A positive number divided by a negative number is a _____ number.

A negative number divided by a negative number is a _____ number.

Let's Think:

Find each quotient.

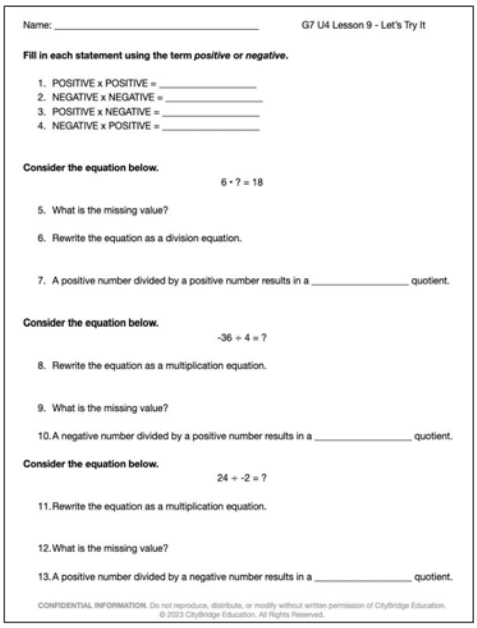
a. -12 ÷ -24

b. -3.6 ÷ 4

c. -¼ ÷ 5

Let's Try It:

Let's explore using the relationship between multiplication and division to develop the rules for dividing rational numbers together.



Name: _____ G7 U4 Lesson 9 - Let's Try It

Fill in each statement using the term *positive* or *negative*.

1. POSITIVE x POSITIVE = _____
2. NEGATIVE x NEGATIVE = _____
3. POSITIVE x NEGATIVE = _____
4. NEGATIVE x POSITIVE = _____

Consider the equation below.

$6 \cdot ? = 18$

5. What is the missing value?
6. Rewrite the equation as a division equation.
7. A positive number divided by a positive number results in a _____ quotient.

Consider the equation below.

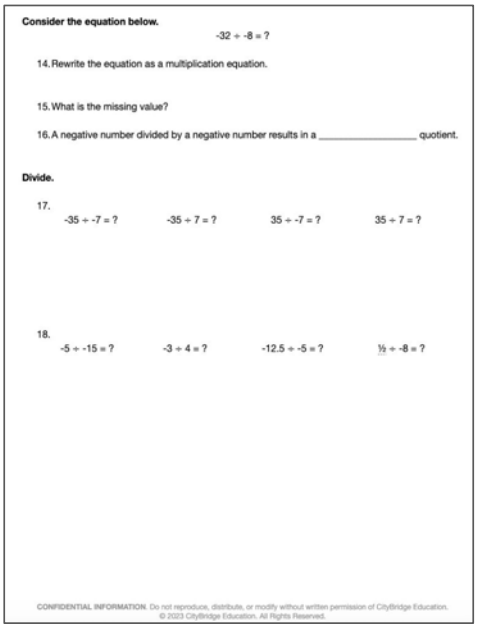
$-36 \div 4 = ?$

8. Rewrite the equation as a multiplication equation.
9. What is the missing value?
10. A negative number divided by a positive number results in a _____ quotient.

Consider the equation below.

$24 \div -2 = ?$

11. Rewrite the equation as a multiplication equation.
12. What is the missing value?
13. A positive number divided by a negative number results in a _____ quotient.



Consider the equation below.

$-32 \div -8 = ?$

14. Rewrite the equation as a multiplication equation.
15. What is the missing value?
16. A negative number divided by a negative number results in a _____ quotient.

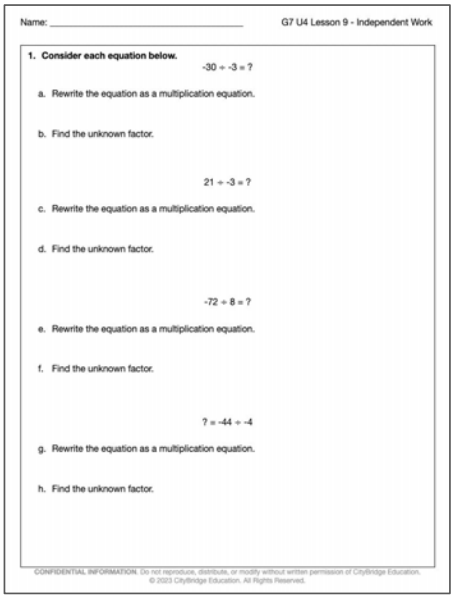
Divide.

17. $-35 \div -7 = ?$ $-35 \div 7 = ?$ $35 \div -7 = ?$ $35 \div 7 = ?$

18. $-5 \div -15 = ?$ $-3 \div 4 = ?$ $-12.5 \div -5 = ?$ $\frac{1}{2} \div -8 = ?$

On your Own:

Now it's time to explore using the relationship between multiplication and division to develop the rules for dividing rational numbers on your own.



Name: _____ G7 U4 Lesson 9 - Independent Work

1. Consider each equation below.

-30 ÷ -3 = ?

a. Rewrite the equation as a multiplication equation.

b. Find the unknown factor.

21 ÷ -3 = ?

c. Rewrite the equation as a multiplication equation.

d. Find the unknown factor.

-72 ÷ 8 = ?

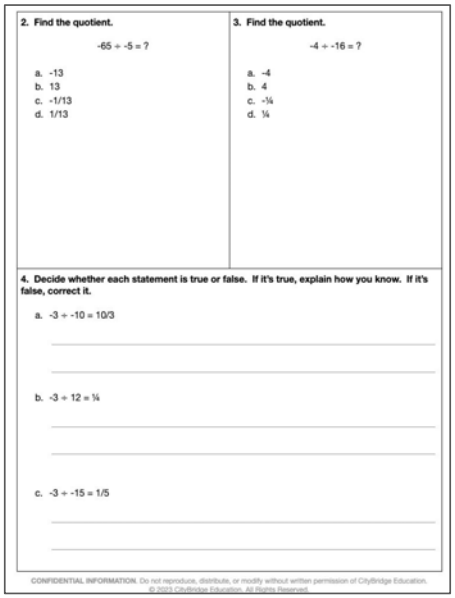
e. Rewrite the equation as a multiplication equation.

f. Find the unknown factor.

? = -44 ÷ -4

g. Rewrite the equation as a multiplication equation.

h. Find the unknown factor.



2. Find the quotient.

-65 ÷ -5 = ?

a. -13
b. 13
c. -1/13
d. 1/13

3. Find the quotient.

-4 ÷ -16 = ?

a. -4
b. 4
c. -¼
d. ¼

4. Decide whether each statement is true or false. If it's true, explain how you know. If it's false, correct it.

a. -3 ÷ -10 = 10/3

b. -3 ÷ 12 = ¼

c. -3 ÷ -15 = 1/5

Name: _____ G7 U4 Lesson 9 - Let's Try It

Fill in each statement using the term *positive* or *negative*.

1. POSITIVE x POSITIVE = _____
2. NEGATIVE x NEGATIVE = _____
3. POSITIVE x NEGATIVE = _____
4. NEGATIVE x POSITIVE = _____

Consider the equation below.

$$6 \bullet ? = 18$$

5. What is the missing value?

6. Rewrite the equation as a division equation.

7. A positive number divided by a positive number results in a _____ quotient.

Consider the equation below.

$$-36 \div 4 = ?$$

8. Rewrite the equation as a multiplication equation.

9. What is the missing value?

10. A negative number divided by a positive number results in a _____ quotient.

Consider the equation below.

$$24 \div -2 = ?$$

11. Rewrite the equation as a multiplication equation.

12. What is the missing value?

13. A positive number divided by a negative number results in a _____ quotient.

Consider the equation below.

$$-32 \div -8 = ?$$

14. Rewrite the equation as a multiplication equation.

15. What is the missing value?

16. A negative number divided by a negative number results in a _____ quotient.

Divide.

17.

-35 ÷ -7 = ? -35 ÷ 7 = ? 35 ÷ -7 = ? 35 ÷ 7 = ?

18.

-5 ÷ -15 = ? -3 ÷ 4 = ? -12.5 ÷ -5 = ? ½ ÷ -8 = ?

1. Consider each equation below.

$$-30 \div -3 = ?$$

a. Rewrite the equation as a multiplication equation.

b. Find the unknown factor.

$$21 \div -3 = ?$$

c. Rewrite the equation as a multiplication equation.

d. Find the unknown factor.

$$-72 \div 8 = ?$$

e. Rewrite the equation as a multiplication equation.

f. Find the unknown factor.

$$? = -44 \div -4$$

g. Rewrite the equation as a multiplication equation.

h. Find the unknown factor.

2. Find the quotient.

-65 ÷ -5 = ?

a. -13
b. 13
c. -1/13
d. 1/13

3. Find the quotient.

-4 ÷ -16 = ?

a. -4
b. 4
c. -¼
d. ¼

4. Decide whether each statement is true or false. If it's true, explain how you know. If it's false, correct it.

a. -3 ÷ -10 = 10/3

b. -3 ÷ 12 = ¼

c. -3 ÷ -15 = 1/5

Name: KEY

Fill in each statement using the term *positive* or *negative*.

1. POSITIVE x POSITIVE = positive
2. NEGATIVE x NEGATIVE = positive
3. POSITIVE x NEGATIVE = negative
4. NEGATIVE x POSITIVE = negative

Consider the equation below.

$6 \cdot ? = 18$

5. What is the missing value? 3

6. Rewrite the equation as a division equation.

$18 \div 3 = ?$ $\quad ? = 6$

7. A positive number divided by a positive number results in a positive quotient.

Consider the equation below.

$-36 \div 4 = ?$

8. Rewrite the equation as a multiplication equation.

$4 \cdot ? = -36$

9. What is the missing value? -9

10. A negative number divided by a positive number results in a negative quotient.

Consider the equation below.

$24 \div -2 = ?$

11. Rewrite the equation as a multiplication equation.

$-2 \cdot ? = 24$

12. What is the missing value? -12

13. A positive number divided by a negative number results in a negative. quotient.

Consider the equation below.

$-32 \div -8 = ?$

14. Rewrite the equation as a multiplication equation.

$-8 \cdot ? = -32$

15. What is the missing value?

4

16. A negative number divided by a negative number results in a positive quotient.

Divide.

17.

$-35 \div -7 = ?$ → 5

$-35 \div 7 = ?$ → -5

$35 \div -7 = ?$ → -5

$35 \div 7 = ?$ → 5

18.

$-5 \div -15 = ?$ → $\frac{1}{3}$

$-3 \div 4 = ?$ → $-\frac{3}{4}$

$-12.5 \div -5 = ?$ → 2.5

$\frac{1}{2} \div -8 = ?$ → $-\frac{1}{16}$

$$5\overline{)12.5}$$

2.5

-10

2.5

-2.5

0

$\frac{1}{2} \div -8$

$\frac{1}{2} \times -\frac{1}{8}$

Name: KEY

1. Consider each equation below.

$-30 \div -3 = ?$

a. Rewrite the equation as a multiplication equation.

$-3 \cdot ? = -30$

b. Find the unknown factor.

10

$21 \div -3 = ?$

c. Rewrite the equation as a multiplication equation.

$-3 \cdot ? = 21$

d. Find the unknown factor.

-7

$-72 \div 8 = ?$

e. Rewrite the equation as a multiplication equation.

$8 \cdot ? = -72$

f. Find the unknown factor.

-9

$? = -44 \div -4$

g. Rewrite the equation as a multiplication equation.

$-4 \cdot ? = -44$

h. Find the unknown factor.

11

2. Find the quotient.

$-65 \div -5 = ?$

~~a. -13~~

b. 13

~~c. -1/13~~

d. 1/13

$$5\overline{)65}\quad 13$$
$$-5$$
$$15$$
$$-15$$
$$0$$

3. Find the quotient.

$-4 \div -16 = ?$

a. -4

b. 4

c. -¼

d. ¼

$$\frac{-4}{-16} = +\frac{4}{16}$$

4. Decide whether each statement is true or false. If it's true, explain how you know. If it's false, correct it.

a. $-3 \div -10 = 10/3$

False. $-3 \div -10 = \frac{3}{10}$

b. $-3 \div 12 = ¼$

False. $-3 \div 12 = -\frac{3}{12} = -\frac{1}{4}$

c. $-3 \div -15 = 1/5$

True. A negative divided by a negative is a positive, and $3 \div 15 = \frac{3}{15}$ or $\frac{1}{5}$

G7 U4 Lesson 10

Multiply and divide rational numbers to solve problems involving constant rates.

G7 U4 Lesson 10 - Students will multiply and divide rational numbers to solve problems involving constant rate.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We have been learning a lot about multiplying and dividing with signed numbers lately. Today, we'll get the chance to apply some of that mathematical thinking to solve real-world problems about rates. When we refer to rates, we typically mean a ratio with two quantities that have different units. Miles per gallon. Kilometers per hour. Feet per second. We'll see a variety of rates in our work today, and we'll use what we know about multiplying and dividing signed numbers to help us tackle those problems.

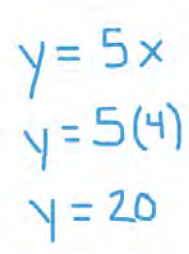
Let's jump in.

Let's Talk (Slide 3): Take a moment to read both of these short problems. Do you think these problems deal with rates? How do you know? Possible Student Answers, Key Points:

- I think they do. Each problem has us thinking about two different units.
- Yes. The first problem is asking us about blueberries per minute. The second problem is asking us about chapters per day. Those are examples of rates.

We can think of both of these problems as having to do with rates. Let's think about the blueberry problem first. What is known in that problem? What is unknown? Possible Student Answers, Key Points:

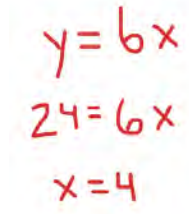
- We know that she eats 5 blueberries every minute for 4 minutes.
- We don't know the total number of blueberries she eats in that time.



I know she eats 5 blueberries every minute. 1 minute, 5 blueberries. 2 minutes, 10 blueberries. 3 minutes, 15 blueberries. I can represent this relationship with an equation. *(write as you narrate)* I know the total blueberries, *y*, is equal to 5 times the number of minutes, *x*. This equation makes it very easy for me to substitute in what I know, in this case 4 minutes, and answer the problem. I know y = 5(4), because she eats for 4 minutes. So, the total number of blueberries is 20. We just used an equation to help solve that rate problem.

Think about the other problem. What is known? What is unknown? Possible Student Answers, Key Points:

- Ivan reads 6 chapters every day, and he wants to read 24 chapters total.
- We don't know how many days he'll take to read that many chapters.



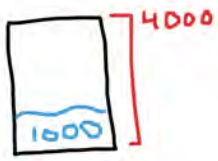
We can represent this problem with an equation too. I know he reads 6 chapters each day, so the total number of chapters he reads is equal to 6 times the number of days. In this case, I'll use y to represent the total number of chapters and x to represent the number of days Ivan reads. *(write equation y = 6x)* I know the total in this problem is 24 chapters, so I'll substitute that value in for y. Now I just need to think…24 is equal to 6 times what value? How could we solve this? Possible Student Answers, Key Points:

- The answer is x = 4, because I divided 24 by 6.
- The answer is x = 4, because I know 6 x 4 is equal to 24.

Nice work. Equations can be used to represent situations with rates. In this case, these were positive rates. We didn't work with any negative numbers. As we'll see in some of our work today, there can be negative rates, and we can think about them similarly to how we think about positive rates. Let's look at our first official problem together.

Let's Think (Slide 4): I'm going to read this problem once through. *(read the problem aloud)* In your own words, what is this story about? Possible Student Answers, Key Points:

- It's about water in a swimming pool. There is some water being pumped into the tank, and some water is leaking out of the tank. It's asking how long it will take for the pool to overflow or to empty out.



I think it will help us if we picture the pool. I know there is 1,000 gallons in the pool at this moment, and that the pool could hold 4,000 gallons in all. *(sketch and label a simple drawing of the pool)*

The first question is asking us whether the water in the pool is rising or falling. I know the hose is spraying 25 gallons into the pool every minute. I can think of that as a positive rate of 25 gallons per minute. We also know there is water leaking out of the pool. It's leaking, which means it's leaving the pool, so we can think of that rate as -5 gallons per minute. *(write +25 + (-5) = ?)* Those two things are happening at the same time, so if I combine the positive rate of +25 and the negative rate of -5, at what rate is the water changing? How do you know?

$+25 + (-5) = +20$

Possible Student Answers, Key Points:

- 25 + (-5) is like subtracting 25 - 5. The rate is 20.
- The rate would be positive 20. The water is filling at a rate of 20 gallons per minute.

If we combine the two rates, we can see that the water in the pool is rising at a rate of 20 gallons per minute. *(write +20 as solution to the equation)*

Part B now asks us to think how long it will take for the pool to overflow or empty completely. Which option makes the most sense based on what we know is happening to the pool? (Overflowing, since the water is rising.) There are already 1,000 gallons in the pool, and the pool can hold 4,000 gallons. That means, the pool has 3,000 gallons to go before it will overflow.

$20x = 3000$

$x = 150$ min.

I'm thinking that the water is rising at a rate of 20 gallons per minute, and the most water that can fit in the pool is 3,000 more gallons. I can think of that as the equation 20x = 3,000. 20 times an unknown number of minutes, x, is equal to 3,000.

Take a second to do the math that makes sense to you to find the unknown. Then share out how you found the value of x. Possible Student Answers, Key Points:

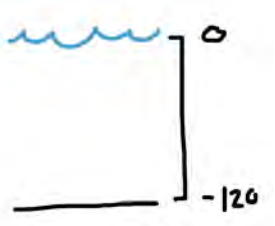
- I divided 3,000 by 20. 3,000 divided by 20 is 150. It will take 150 minutes for the pool to overflow.
- I know 20 x 150 = 3,000. I know 2 x 15 = 30, so 2 tens x 15 tens is 30 hundreds or 3,000. The unknown is equal to 150 minutes.

We can use division or a related multiplication fact to help us find that the unknown is 150. That means it will take 150 minutes for the pool to reach capacity and begin to overflow.

We just thought about positive and negative rates in the context of a swimming pool to help us solve this real-world problem. Let's try another with a different context.

Let's Think (Slide 5): Like last time, I'm going to read this problem once through. *(read the problem aloud)* In your own words, what is this story about? Possible Student Answers, Key Points:

- It's about a scuba diver who dives down to the bottom of the ocean, and we want to figure out how long it takes them to reach the bottom. Then they come back up, and we want to know at what rate.

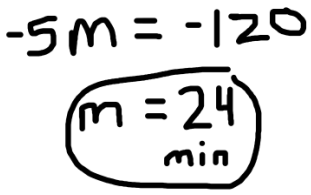


Let's start with part A which asks us to think about the depth to which the person dives. We have seen several examples together in previous lessons where we consider elevation as a signed number. What signed number could represent this elevation, and how do you know? *(sketch and label a simple picture as shown while the student explains)* Possible Student Answers, Key Points:

- We could represent the elevation with -120. It's negative, because the elevation is below sea level. It's 120, because that's how far down the ocean floor is.

Now let's consider part B. The scuba diver is diving at a rate of 5 feet per minute. Since they're diving, I can think of the rate as being *negative* five feet per second. After 1 minute, they'd be at an elevation of -5 feet.

After another minute, they'd be at -10 feet. After another minute, they'd be at -15 feet, and so on. Do you see a pattern? To represent this relationship, we can use an equation. *(write rate x # of minutes = elevation)*



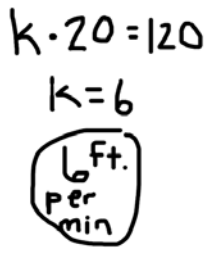
I know the rate is -5. I don't know how many minutes, so I'll use *m*. Any variable would work. I also know that the diver ends up at an elevation of -120 feet. *(substitute each value in the equation as you narrate)* All I need to do now is solve the equation to find the unknown number of minutes. How could I go about solving in this case? Take some time and use scratch paper if necessary. Possible Student Answers, Key Points:

- I can divide both sides by -5. 120 divided by 5 is 24. -120 divided by -5 is +24, because the quotient of two negative numbers is positive.
- I know 5 x 24 = 120. So, -5 x 24 = -120. It couldn't be -24, because two negatives would multiply to get positive 120.

Nicely done. It would take the scuba diver 24 minutes to reach the ocean floor at that rate. We substituted values we knew from the problem into an equation that represents the relationship. Then, we solved to find our unknown. Let's see if we can use similar thinking to answer part C.

(re-read problem) In our last problem, we knew the rate and the final elevation. What's different about this problem? Possible Student Answers, Key Points:

- It's still a rate problem, but the scuba diver is going up.
- We don't know the rate, but we do know the number of minutes. We're trying to find the unknown rate.



We can still think of our situation as rate times number of minutes equals distance. Let's substitute in what we know. *(substitute values as you narrate)* I'll use *k* to represent rate, because that's commonly what mathematicians use, but any variable is acceptable. I know it takes the scuba diver 20 minutes, so I'll substitute 20 in for time. And the scuba diver is traveling 120 feet. I'll use a positive 120 since the scuba diver is going *up* 120 feet in this scenario. I can either use division divide both sides of this equation by 20, or I can use a multiplication fact to think about a number times 20 that equals 120. Either way, I end up with a solution of 6. The unknown rate is 6. In this context, that means the scuba diver's elevation is increasing 6 feet per minute.

How can equations help us solve problems involving positive and negative rates? Possible Student Answers, Key Points:

- We can use an equation to represent problems involving rates. Once we have an equation that represents the relationship, we can substitute values and carefully solve to find unknowns.

Let's Try it (Slides 6 - 7): You've been working hard. Now let's try a couple more examples together before you have some time to work independently. We'll think about the values in rate problems and carefully consider whether values are best represented with positive or negative values. We'll also think about equations that can match the relationship in a given context. Like the scuba diver in our previous problem, let's "dive" in.

WARM WELCOME

Today we will multiply and divide numbers to solve problems involving constant rate.

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Let's Talk:

Maria eats 5 blueberries per minute for 4 minutes. How many blueberries does Maria eat?

Ivan reads 6 chapters per day. How many days will it take to read 24 chapters?

Let's Think:

A swimming pool contains 1,000 gallons of water. It can hold 4,000 gallons of water before overflowing. A hose sprays water into the pool at 25 gallons per minute, but there is a also a leak in the pool that lets out 5 gallons of water per minute.

a. Is the water in the pool rising or falling?

b. How long will it take before the pool overflows or empties?

Let's Think:

The Great Barrier Reef is 120 feet below the ocean's surface. A scuba diver dives all the way to the ocean floor.

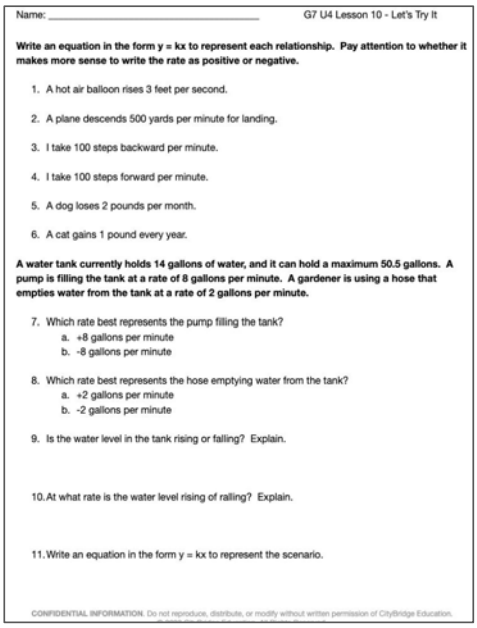
a. How can you represent the depth that the scuba diver dives?

a. The scuba diver descends at a rate of -5 feet per minute. How much time will it take the diver to get to the bottom?

b. It takes the scuba diver takes 20 minutes to swim back up to the surface. At what rate does the scuba diver ascend?

Let's Try It:

Let's explore multiplying and dividing numbers to solve problems involving constant rate together.



Name: _____ G7 U4 Lesson 10 - Let's Try It

Write an equation in the form y = kx to represent each relationship. Pay attention to whether it makes more sense to write the rate as positive or negative.

1. A hot air balloon rises 3 feet per second.
2. A plane descends 500 yards per minute for landing.
3. I take 100 steps backward per minute.
4. I take 100 steps forward per minute.
5. A dog loses 2 pounds per month.
6. A cat gains 1 pound every year.

A water tank currently holds 14 gallons of water, and it can hold a maximum 50.5 gallons. A pump is filling the tank at a rate of 8 gallons per minute. A gardener is using a hose that empties water from the tank at a rate of 2 gallons per minute.

7. Which rate best represents the pump filling the tank?
   a. +8 gallons per minute
   b. -8 gallons per minute
8. Which rate best represents the hose emptying water from the tank?
   a. +2 gallons per minute
   b. -2 gallons per minute
9. Is the water level in the tank rising or falling? Explain.
10. At what rate is the water level rising of ralling? Explain.
11. Write an equation in the form y = kx to represent the scenario.

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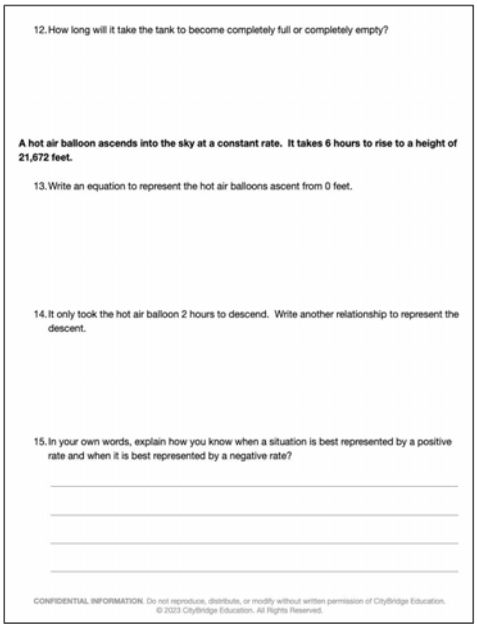

12. How long will it take the tank to become completely full or completely empty?

A hot air balloon ascends into the sky at a constant rate. It takes 6 hours to rise to a height of 21,672 feet.

13. Write an equation to represent the hot air balloons ascent from 0 feet.
14. It only took the hot air balloon 2 hours to descend. Write another relationship to represent the descent.
15. In your own words, explain how you know when a situation is best represented by a positive rate and when it is best represented by a negative rate?

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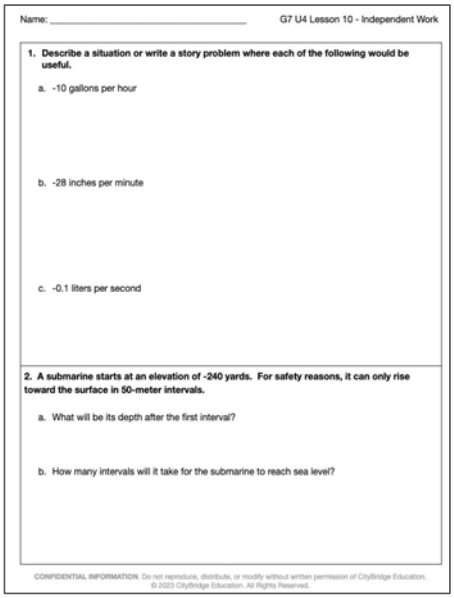
On your Own:

Now it's time to explore multiplying and dividing numbers to solve problems with constant rate on your own.



Name: _____ G7 U4 Lesson 10 - Independent Work

1. Describe a situation or write a story problem where each of the following would be useful.

a. -10 gallons per hour

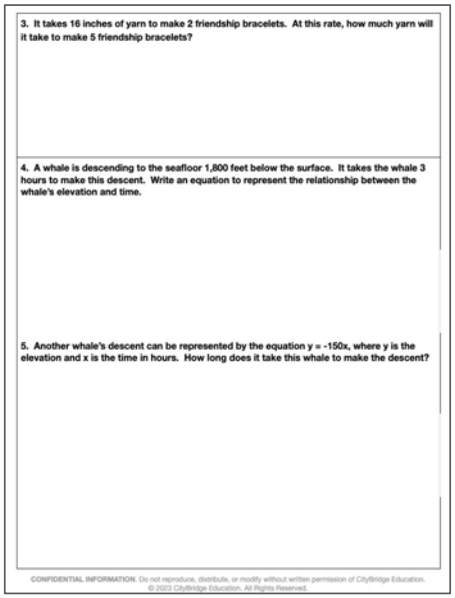
b. -28 inches per minute

c. -0.1 liters per second

2. A submarine starts at an elevation of -240 yards. For safety reasons, it can only rise toward the surface in 50-meter intervals.

a. What will be its depth after the first interval?

b. How many intervals will it take for the submarine to reach sea level?



3. It takes 16 inches of yarn to make 2 friendship bracelets. At this rate, how much yarn will it take to make 5 friendship bracelets?

4. A whale is descending to the seafloor 1,800 feet below the surface. It takes the whale 3 hours to make this descent. Write an equation to represent the relationship between the whale's elevation and time.

5. Another whale's descent can be represented by the equation y = -150x, where y is the elevation and x is the time in hours. How long does it take this whale to make the descent?

Write an equation in the form y = kx to represent each relationship. Pay attention to whether it makes more sense to write the rate as positive or negative.

1. A hot air balloon rises 3 feet per second.

2. A plane descends 500 yards per minute for landing.

3. I take 100 steps backward per minute.

4. I take 100 steps forward per minute.

5. A dog loses 2 pounds per month.

6. A cat gains 1 pound every year.

A water tank currently holds 14 gallons of water, and it can hold a maximum 50.5 gallons. A pump is filling the tank at a rate of 8 gallons per minute. A gardener is using a hose that empties water from the tank at a rate of 2 gallons per minute.

7. Which rate best represents the pump filling the tank?
    a. +8 gallons per minute
    b. -8 gallons per minute

8. Which rate best represents the hose emptying water from the tank?
    a. +2 gallons per minute
    b. -2 gallons per minute

9. Is the water level in the tank rising or falling? Explain.

10. At what rate is the water level rising of ralling? Explain.

11. Write an equation in the form y = kx to represent the scenario.

12. How long will it take the tank to become completely full or completely empty?

A hot air balloon ascends into the sky at a constant rate. It takes 6 hours to rise to a height of 21,672 feet.

13. Write an equation to represent the hot air balloons ascent from 0 feet.

14. It only took the hot air balloon 2 hours to descend. Write another relationship to represent the descent.

15. In your own words, explain how you know when a situation is best represented by a positive rate and when it is best represented by a negative rate?

1. Describe a situation or write a story problem where each of the following would be useful.

a. -10 gallons per hour

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2. A submarine starts at an elevation of -240 yards. For safety reasons, it can only rise toward the surface in 50-meter intervals.

a. What will be its depth after the first interval?

b. How many intervals will it take for the submarine to reach sea level?

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5. Another whale's descent can be represented by the equation y = -150x, where y is the elevation and x is the time in hours. How long does it take this whale to make the descent?

Name: KEY

Write an equation in the form y = kx to represent each relationship. Pay attention to whether it makes more sense to write the rate as positive or negative.

1. A hot air balloon rises 3 feet per second. $y = 3x$
2. A plane descends 500 yards per minute for landing. $y = -500x$
3. I take 100 steps backward per minute. $y = -100x$
4. I take 100 steps forward per minute. $y = 100x$
5. A dog loses 2 pounds per month. $y = -2x$
6. A cat gains 1 pound every year. $y = 1x$ or $y = x$

A water tank currently holds 14 gallons of water, and it can hold a maximum 50.5 gallons. A pump is filling the tank at a rate of 8 gallons per minute. A gardener is using a hose that empties water from the tank at a rate of 2 gallons per minute.

7. Which rate best represents the pump filling the tank?
   a. +8 gallons per minute
   b. -8 gallons per minute

8. Which rate best represents the hose emptying water from the tank?
   a. +2 gallons per minute
   b. -2 gallons per minute

9. Is the water level in the tank rising or falling? Explain.
   It is rising. More water is being pumped in than emptied out.

10. At what rate is the water level rising of ralling? Explain.
    $+8 + -2 = +6$ The rate is +6 gallons per minute.

11. Write an equation in the form y = kx to represent the scenario.
    $y = 6x + 14$ OR $6x + 14 = 50.5$

12. How long will it take the tank to become completely full or completely empty?

$$\begin{array}{r} {}^{4}\cancel{5}{}^{10}\cancel{0}.5 \\ -\ 14.0 \\ \hline 36.5 \end{array}$$

$6x = 36.5$

$x = 6.083\ldots$

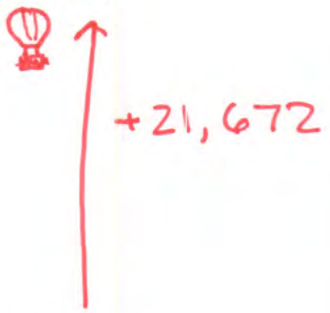
or

$x = 6\frac{1}{12}$ minutes

A hot air balloon ascends into the sky at a constant rate. It takes 6 hours to rise to a height of 21,672 feet.

13. Write an equation to represent the hot air balloons ascent from 0 feet.

$6x = 21{,}672$



14. It only took the hot air balloon 2 hours to descend. Write another relationship to represent the descent.

$-2x = -21{,}672$

15. In your own words, explain how you know when a situation is best represented by a positive rate and when it is best represented by a negative rate?

Positive rates are used to represent increases, while negative rates best represent decreases.

Name: KEY

1. Describe a situation or write a story problem where each of the following would be useful.

a. -10 gallons per hour

emptying water from a pool

b. -28 inches per minute

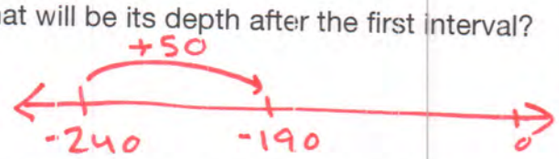
a bubble descending at a constant rate

c. -0.1 liters per second

pouring water out of a watering can

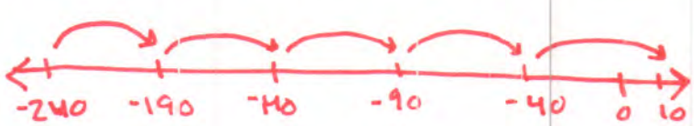
2. A submarine starts at an elevation of -240 yards. For safety reasons, it can only rise toward the surface in 50-meter intervals.

a. What will be its depth after the first interval?



-190 yd

b. How many intervals will it take for the submarine to reach sea level?



5 intervals

3. It takes 16 inches of yarn to make 2 friendship bracelets. At this rate, how much yarn will it take to make 5 friendship bracelets?

16 inches for 2 bracelets → 8" per bracelet

$y = 8x$

$y = 8(5)$

40 inches

4. A whale is descending to the seafloor 1,800 feet below the surface. It takes the whale 3 hours to make this descent. Write an equation to represent the relationship between the whale's elevation and time.

$3 \cdot x = -1800$

$x = -600$

-600 ft per hour

5. Another whale's descent can be represented by the equation $y = -150x$, where y is the elevation and x is the time in hours. How long does it take this whale to make the descent?

$-1800 = -150x$

$12 = x$

$$\begin{array}{r} 12 \\ 150\overline{)1800} \\ 150 \\ \hline 300 \\ -300 \\ \hline 0 \end{array}$$

12 hrs

G7 U4 Lesson 11

Use the relationship between addition and subtraction, and the relationship between multiplication and division, to evaluate expressions with all four operations on the rational numbers.

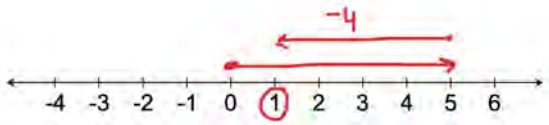
G7 U4 Lesson 11 - Students will use the relationship between addition and subtraction, and the relationship between multiplication and division, to evaluate expressions with all four operations on rational numbers.

Warm Welcome (Slide 1): Tutor choice

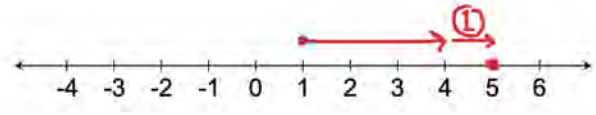
Frame the Learning/Connect to Prior Learning (Slide 2): We've been working hard to understand adding, subtracting, multiplying, and dividing with signed numbers, and we've been applying what we know to real world scenarios. Through this process, we've learned several different strategies to think about and tackle problems. Today is exciting, because our focus is all about choosing the *easiest* pathway toward a solution. Our goal is to be efficient. It's always nice when you can make the math a bit quicker or easier. I'll show you what I mean after we spend a couple minutes talking about inverses…

Let's Talk (Slide 3): We're going to look at two pairs of problems. Before we do any math, take a second and review both problem pairs. What do you notice? What do you wonder? Possible Student Answers, Key Points:

- I notice the red problems both start with 5. One adds -4, and the other subtracts +4.
- I notice the blue problems both start with 6. One multiplies by ½, and the other divides by 2.
- I wonder what the answers are. I wonder if the answers are the same or different? I wonder which ones are easier to solve.



Let's focus on the red problem pair first. I could represent 5 + (-4) on a number line. *(sketch and label as you narrate)* I can show an arrow going to 5, and then add another arrow pointing left representing -4. I see the answer is 1.



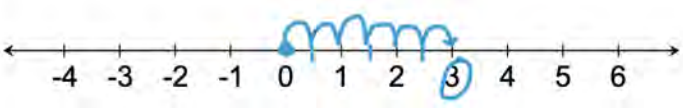
The other equation wants to think about 5 - (+4). I can think of this as the difference between 5 and 4. *(sketch and label as you narrate)* I'll mark 5 on the number line. I can draw an arrow to positive 4, and then drawn an arrow to show the difference between the two values. I can see that the difference can be represented with an arrow representing +1.

These two equations are equivalent. The second, equivalent equation was created by using the additive inverse of the first equation. Instead of *adding* a *negative* 4, we can *subtract* an *positive* 4. Numbers are additive inverses if they can be added together to result in 0.

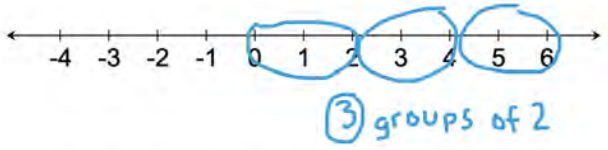
Either equation could be solved to find the value of +1, but sometimes certain equations make more sense with certain numbers or just feel easier for the person solving them. Which of these two equations feels easiest or most accessible to you? Why? Possible Student Answers, Key Points:

- I like the first equation, because It's easy for me to count back 4 from 5.
- I like the second equation, because I can picture the difference between 5 and 4 easily on the number line since they're close together.

There is no right or wrong choice to make, but it's always nice to consider your options before solving an equation. If you can make the math feel easier, why not do that?



Let's look at the blue equations now. For the first equation, I can model 6 x ½ by showing 6 groups of ½ on the number line. *(mark ½ tick marks, and show 6 hops to land at 3)* The product is 3.



For the second equation I can think of 6 divided into groups of 2. *(sketch and label as you narrate)* I can show hops or circles on my number line to make groups of 2. I see that I can make 3 groups of 2. The quotient is 3.

These equations involve what we call multiplicative inverses. Numbers are multiplicative inverses if you can multiply them together to get 1. In this case 2 and ½ are multiplicative inverses. 2 x ½ = 1. I can rewrite multiplication and division equations by using the multiplicative inverse and the opposite operation to write equivalent expressions.

Like in the red equations, we might notice that certain equivalent expressions feel better to solve than others. In the case of the blue equations, which version would prefer to think about and why? Possible Student Answers, Key Points:

- I prefer the first equation, because halves are easy for me to think about. I know 6 halves is 3.
- I prefer the second equation, because I don't have to think about fractions. I like when I can work with whole numbers.

We can use additive or multiplicative inverses to write equivalent expressions. Sometimes an equivalent expression might be easier to solve than the expression we're given. Let's look at some examples and think about which expressions work best for us.

Let's Think (Slide 4): Our first set of problems asks us to rewrite each expression using the additive inverse. Then, we get to pick which expression we prefer to help us find the value.

EXPRESSION	12 + -8	7 – (-10)	-2 – 20	-3 + 15
EQUIVALENT EXPRESSION	12 - 8	7 + 10	-2 + (-20)	-3 - (-15)
VALUE	4	17	-22	12

(fill in values in the table as shown as you narrate through each example)

The first expression is 12 + -8. I know the additive inverse of -8 is +8, because -8 and +8 combined have a value of 0. I can rewrite the expression as 12 - 8. These two expressions are equivalent. Which one would you prefer to use to solve, and why? Possible Student Answers, Key Points:

- I prefer the second one, because it just looks like a simple math fact from elementary school. I know 12 - 8 is 4 by heart.

The value of both expressions is 4. We can use either expression to arrive at that value.

(NOTE: Student preferences may vary. As they choose their preferred expressions in this lesson, circle or highlight the ones they name, and push them to justify their preference.)

The second expression is 7 - (-10). What is the additive inverse of -10? (+10) Instead of subtracting negative 10, I can add positive 10 to make an equivalent expression. Which one would you prefer to use to solve, and why? Possible Student Answers, Key Points:

- I prefer the second one, because the first one has two symbols next to each other which can sometimes be confusing to think about. I also just know 7 + 10 as a math fact.

The value of both expressions is 17. We can use either expression to arrive at that value.

The third expression is -2 - 20. How can I rewrite this expression using the additive inverse? (-2 + (-20)) Instead of subtracting positive 20, I can add negative 20. Use either expression to think about the value, then justify why you used the expression you chose. ? Possible Student Answers, Key Points:

- The value is -22. I used the second expression because I could just combine both negative numbers. I could just think of it as adding 2 and 20, but they're negative.

Let's try one more. How could you rewrite the last problem using the additive inverse? ? Possible Student Answers, Key Points:

- Instead of adding positive 15, I can subtract -15. The equivalent expression is -3 - (-15).

Either way we think about this problem, we should arrive at the same answer. I can think of the first expression as a number line. I'm picturing an arrow to -3, then an arrow going up 15 spaces to land at +12. The other problem, I can think about as the difference between -3 and -15. That may or may not be a little harder to picture in your mind. Whichever expression you choose to work with is fine as long as it is actually equivalent and it helps you think about the math in a way that is friendly for you.

Let's Think (Slide 5): For our last problem set together, we're going to follow the same sequence, but you'll notice these problems aren't addition and subtraction. This problem set wants us to use the

EXPRESSION	-20 • 1/5	20 ÷ -1/5	42 x 1/7	7 x 42
EQUIVALENT EXPRESSION	-20 ÷ 5	20 x -5	42 ÷ 7	7 ÷ 1/42
VALUE	-4	-100	6	294

(fill in values in the table as shown as you narrate through each example)

I'll start by thinking about -20 • ⅕. I know the multiplicative inverse of ⅕ is 5, because ⅕ • 5 = 1. Instead of -20 • 1/5, I can write an equivalent expression of -20 divided by 5. Either expression can work to help me find the value. Between these two, I would prefer to use -20 divided by 5, to avoid having to work with the fraction ⅕. I know -20 divided by positive 5 is -4. Choosing the easier expression for me, helped me efficiently arrive at my answer.

Look at the second example. Instead of dividing by -⅕, I can multiply by the multiplicative inverse. What equivalent expression can I write? (20 x -5) 20 x -5 is equivalent to 20 divided by -⅕. -5 and -⅕ are multiplicative inverses, because if we multiply them together the product is 1. Which equivalent expression would you prefer to use to find the value, and why? Possible Student Answers, Key Points:

- The first one involves dividing by fractions. I know how to do that, but I think it'd be easier to multiply without the fraction. I'd choose the second equation.

The second equation avoids having to divide by fractions. I can easily think 20 x -5 = -100.

For the third expression, I can think of the multiplicative inverse of 1/7. Instead of multiplying by 1/7, I can divide 42 by 7. That feels a little easier to me than multiplying by a fraction. I know 42 divided by 6 is 7 without having to do too much work.

Take a moment to write an equivalent expression for the last expression. Pick one to use to find the value and justify your choice. Possible Student Answers, Key Points:

- Instead of multiplying 7 by 42, I can divide 7 by 1/42. I know 42 and 1/42 are multiplicative inverses.
- I don't know 7 x 42 by heart, but I think it would probably be easier to think about than dividing by 1/42, so I'd use the first expression to find the value. 7 x 42 is equal to 294.

An equivalent expression will give us the correct value. Quickly thinking about an equivalent expression with the additive or multiplicative inverse can help us consider potentially better options to help us arrive at the solution to a given problem.

Let's Try it (Slides 6 - 7): Now let's use this thinking to work through some more problems. When given an adding or subtracting expression, we know we can use the opposite operations and the additive inverse to find an equivalent expression. When given a multiplication or division expression, we can use the opposite operation and the multiplicative inverse to find an equivalent expression. When it comes time to evaluate or solve, it's up to our own preference to decide which solution pathway makes more sense. Personally, I prefer to avoid complicated sign combinations and unfriendly fraction operations, but everyone's preferences can be different. Let's see how efficient we can be…

WARM WELCOME

Today we will use the relationship between addition and subtraction, and the relationship between multiplication and division to evaluate expressions with all four operations.

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Let's Talk:

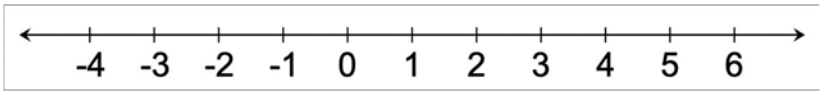
What do you notice? What do you wonder?

$5 + (-4) = ?$

$5 - (+4) = ?$

$6 \bullet \frac{1}{2} = ?$

$6 \div 2 = ?$



Let's Think:

Rewrite each expression to make an equivalent expression using the <u>additive inverse</u>. Then use either expression to find the value.

EXPRESSION	12 + -8	7 – (-10)	-2 – 20	-3 + 15
EQUIVALENT EXPRESSION				
VALUE				

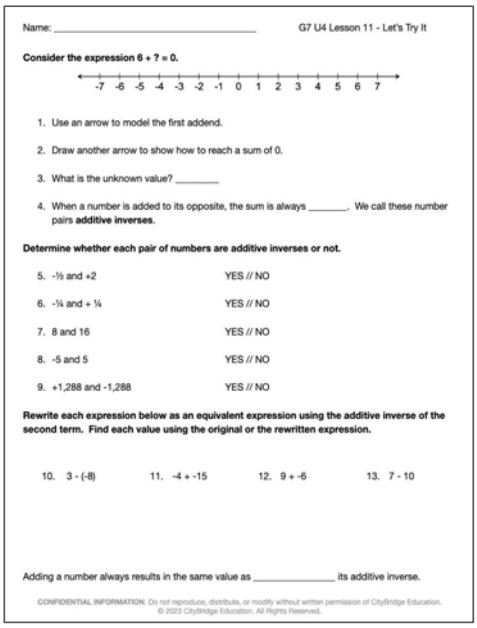
Let's Think:

Rewrite each expression to make an equivalent expression using the multiplicative inverse. Then use either expression to find the value.

EXPRESSION	-20 • 1/5	20 ÷ -1/5	42 x 1/7	7 x 42
EQUIVALENT EXPRESSION				
VALUE				

Let's Try It:

Let's explore using the relationship between addition and subtraction, and the relationship between multiplication and division to evaluate expressions with all four operations together.



Name: _____ G7 U4 Lesson 11 - Let's Try It

Consider the expression 6 + ? = 0.

-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7

1. Use an arrow to model the first addend.
2. Draw another arrow to show how to reach a sum of 0.
3. What is the unknown value? _____
4. When a number is added to its opposite, the sum is always _____. We call these number pairs **additive inverses**.

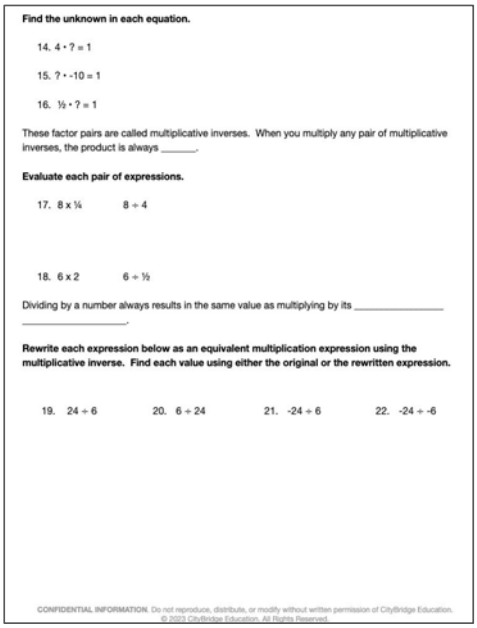
Determine whether each pair of numbers are additive inverses or not.

5. -½ and +2 YES // NO
6. -¼ and + ¼ YES // NO
7. 8 and 16 YES // NO
8. -5 and 5 YES // NO
9. +1,288 and -1,288 YES // NO

Rewrite each expression below as an equivalent expression using the additive inverse of the second term. Find each value using the original or the rewritten expression.

10. 3 - (-8) 11. -4 + -15 12. 9 + -6 13. 7 - 10

Adding a number always results in the same value as _____ its additive inverse.



Find the unknown in each equation.

14. 4 • ? = 1
15. ? • -10 = 1
16. ½ • ? = 1

These factor pairs are called multiplicative inverses. When you multiply any pair of multiplicative inverses, the product is always _____.

Evaluate each pair of expressions.

17. 8 x ¼ 8 ÷ 4

18. 6 x 2 6 ÷ ½

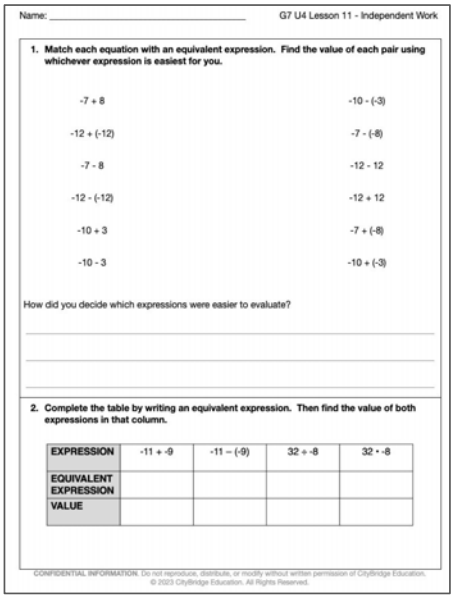
Dividing by a number always results in the same value as multiplying by its _____ _____.

Rewrite each expression below as an equivalent multiplication expression using the multiplicative inverse. Find each value using either the original or the rewritten expression.

19. 24 ÷ 6 20. 6 ÷ 24 21. -24 ÷ 6 22. -24 ÷ -6

On your Own:

Now it's time to explore using the relationship between addition and subtraction, and the relationship between multiplication and division to evaluate expressions with all four operations on your own.



Name: _____ G7 U4 Lesson 11 - Independent Work

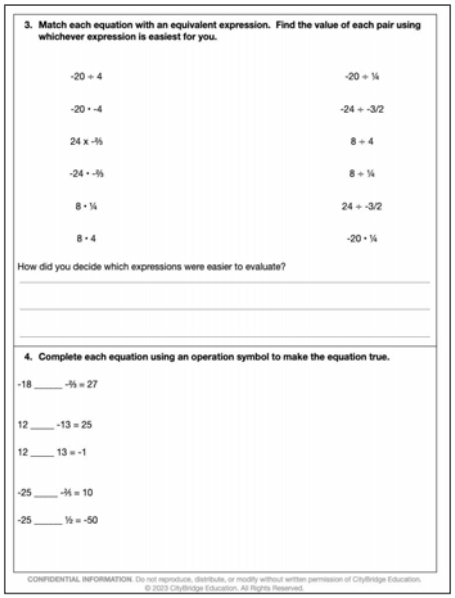
1. Match each equation with an equivalent expression. Find the value of each pair using whichever expression is easiest for you.

-7 + 8	-10 - (-3)
-12 + (-12)	-7 - (-8)
-7 - 8	-12 - 12
-12 - (-12)	-12 + 12
-10 + 3	-7 + (-8)
-10 - 3	-10 + (-3)

How did you decide which expressions were easier to evaluate?

2. Complete the table by writing an equivalent expression. Then find the value of both expressions in that column.

EXPRESSION	-11 + -9	-11 – (-9)	32 ÷ -8	32 • -8
EQUIVALENT EXPRESSION				
VALUE				



3. Match each equation with an equivalent expression. Find the value of each pair using whichever expression is easiest for you.

-20 ÷ 4	-20 ÷ ¼
-20 • -4	-24 ÷ -3/2
24 x -⅓	8 ÷ 4
-24 • -⅓	8 ÷ ¼
8 • ¼	24 ÷ -3/2
8 • 4	-20 • ¼

How did you decide which expressions were easier to evaluate?

4. Complete each equation using an operation symbol to make the equation true.

-18 ____ -⅓ = 27

12 ____ -13 = 25

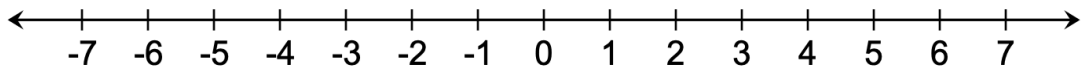
12 ____ 13 = -1

-25 ____ -½ = 10

-25 ____ ½ = -50

Name: _____ G7 U4 Lesson 11 - Let's Try It

Consider the expression 6 + ? = 0.



1. Use an arrow to model the first addend.
2. Draw another arrow to show how to reach a sum of 0.
3. What is the unknown value? _____
4. When a number is added to its opposite, the sum is always _____. We call these number pairs **additive inverses**.

Determine whether each pair of numbers are additive inverses or not.

5. -½ and +2 YES // NO
6. -¼ and + ¼ YES // NO
7. 8 and 16 YES // NO
8. -5 and 5 YES // NO
9. +1,288 and -1,288 YES // NO

Rewrite each expression below as an equivalent expression using the additive inverse of the second term. Find each value using the original or the rewritten expression.

10. 3 - (-8)
11. -4 + -15
12. 9 + -6
13. 7 - 10

Adding a number always results in the same value as _____ its additive inverse.

Find the unknown in each equation.

14. $4 \bullet ? = 1$

15. $? \bullet -10 = 1$

16. $\frac{1}{2} \bullet ? = 1$

These factor pairs are called multiplicative inverses. When you multiply any pair of multiplicative inverses, the product is always _____.

Evaluate each pair of expressions.

17. $8 \times \frac{1}{4}$ $8 \div 4$

18. 6×2 $6 \div \frac{1}{2}$

Dividing by a number always results in the same value as multiplying by its _____ _____.

Rewrite each expression below as an equivalent multiplication expression using the multiplicative inverse. Find each value using either the original or the rewritten expression.

19. $24 \div 6$

20. $6 \div 24$

21. $-24 \div 6$

22. $-24 \div -6$

1. Match each equation with an equivalent expression. Find the value of each pair using whichever expression is easiest for you.

-7 + 8	-10 - (-3)
-12 + (-12)	-7 - (-8)
-7 - 8	-12 - 12
-12 - (-12)	-12 + 12
-10 + 3	-7 + (-8)
-10 - 3	-10 + (-3)

How did you decide which expressions were easier to evaluate?

_____

_____

_____

2. Complete the table by writing an equivalent expression. Then find the value of both expressions in that column.

EXPRESSION	-11 + -9	-11 – (-9)	32 ÷ -8	32 • -8
EQUIVALENT EXPRESSION				
VALUE				

3. Match each equation with an equivalent expression. Find the value of each pair using whichever expression is easiest for you.

-20 ÷ 4	-20 ÷ ¼
-20 • 4	-24 ÷ -3/2
24 x -⅔	8 ÷ 4
-24 • -⅔	8 ÷ ¼
8 • ¼	24 ÷ -3/2
8 • 4	-20 • ¼

How did you decide which expressions were easier to evaluate?

4. Complete each equation using an operation symbol to make the equation true.

-18 _____ -⅔ = 27

12 _____ -13 = 25

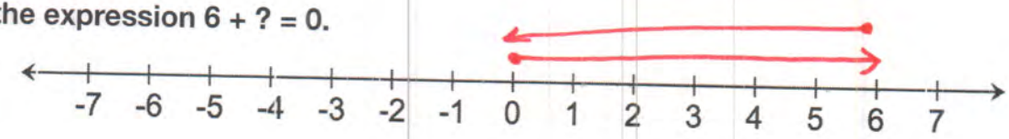
12 _____ 13 = -1

-25 _____ -⅖ = 10

-25 _____ ½ = -50

Name: KEY

Consider the expression 6 + ? = 0.



1. Use an arrow to model the first addend.
2. Draw another arrow to show how to reach a sum of 0.
3. What is the unknown value? -6
4. When a number is added to its opposite, the sum is always 0. We call these number pairs **additive inverses**.

Determine whether each pair of numbers are additive inverses or not.

5. -½ and +2 — YES // (NO)
6. -¼ and + ¼ — (YES) // NO
7. 8 and 16 — YES // (NO)
8. -5 and 5 — (YES) // NO
9. +1,288 and -1,288 — (YES) // NO

Rewrite each expression below as an equivalent expression using the additive inverse of the second term. Find each value using the original or the rewritten expression.

10. 3 - (-8)
    3 + 8
    (11)
11. -4 + -15
    -4 - 15
    (-19)
12. 9 + -6
    9 - 6
    (3)
13. 7 - 10
    7 + (-10)
    (-3)

Adding a number always results in the same value as Subtracting its additive inverse.

Find the unknown in each equation.

14. $4 \cdot ? = 1$ $\frac{1}{4}$

15. $? \cdot -10 = 1$ $-\frac{1}{10}$

16. $\frac{1}{2} \cdot ? = 1$ 2

These factor pairs are called multiplicative inverses. When you multiply any pair of multiplicative inverses, the product is always 1.

Evaluate each pair of expressions.

17. $8 \times \frac{1}{4}$ $\frac{8}{4} = 2$ $8 \div 4$ 2

18. 6×2 12 $6 \div \frac{1}{2}$ 12

Dividing by a number always results in the same value as multiplying by its multiplicative inverse.

Rewrite each expression below as an equivalent multiplication expression using the multiplicative inverse. Find each value using either the original or the rewritten expression.

19. $24 \div 6$ $24 \times \frac{1}{6}$ 4

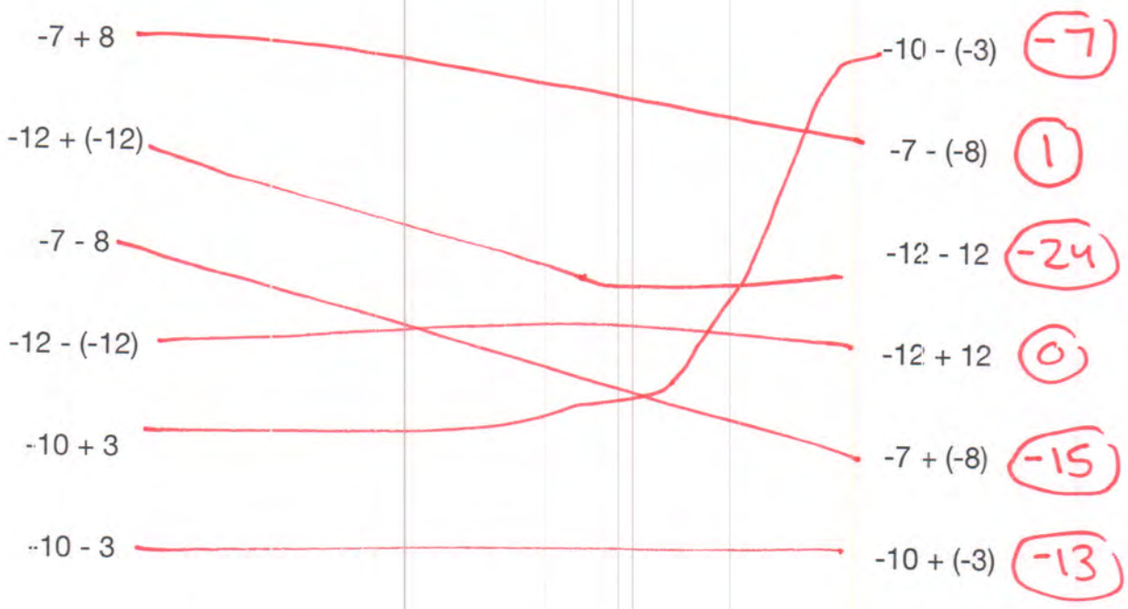
20. $6 \div 24$ $6 \times \frac{1}{24}$ $\frac{6}{24}$ $\frac{1}{4}$

21. $-24 \div 6$ $-24 \times \frac{1}{6}$ $\frac{-24}{6}$ -4

22. $-24 \div -6$ $-24 \times -\frac{1}{6}$ $\frac{-24}{-6}$ 4

Name: KEY

1. **Match each equation with an equivalent expression. Find the value of each pair using whichever expression is easiest for you.**



How did you decide which expressions were easier to evaluate? (answers may vary)

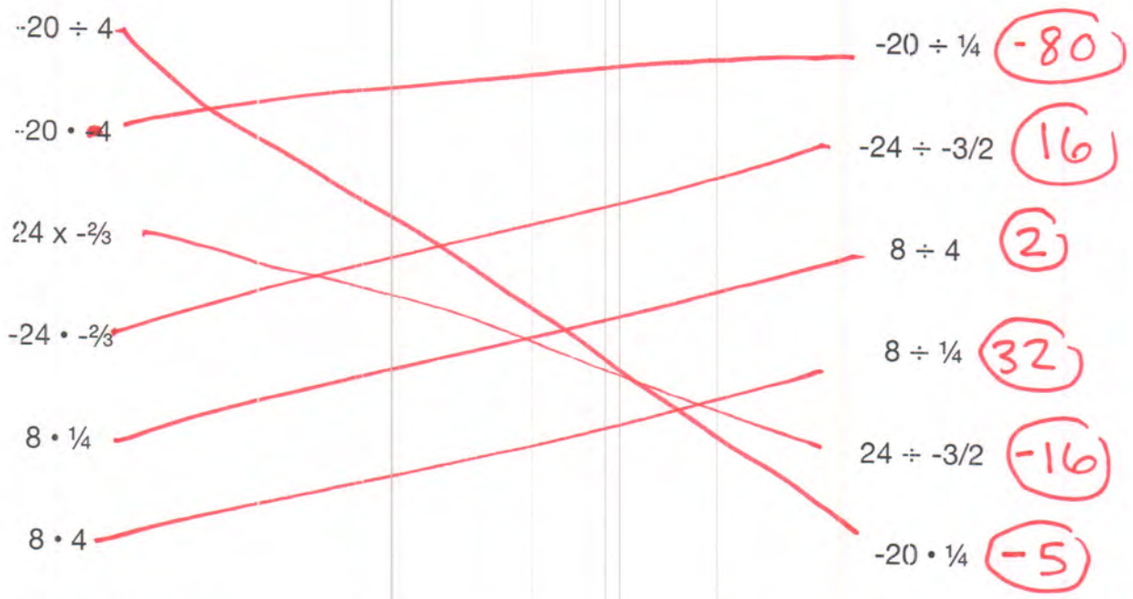
- It helps me when the expressions are addition.
- It helps when there aren't too many + or − symbols.

2. **Complete the table by writing an equivalent expression. Then find the value of both expressions in that column.**

EXPRESSION	-11 + -9	-11 – (-9)	32 ÷ -8	32 • -8
EQUIVALENT EXPRESSION	-11 - 9	-11 + 9	$32 \times -\frac{1}{8}$	$32 \div -\frac{1}{8}$
VALUE	-20	-2	-4	-256

32 × 8 = 256

3. Match each equation with an equivalent expression. Find the value of each pair using whichever expression is easiest for you.



How did you decide which expressions were easier to evaluate? (answers may vary)

- I prefer expressions with whole numbers.
- I prefer multiplying.

4. Complete each equation using an operation symbol to make the equation true.

-18 ÷ -⅔ = 27 $-18 \times -\frac{3}{2} = \frac{54}{2} = 27$

12 − -13 = 25 $12 + 13 = 25$

12 − 13 = -1 $12 + -13 = -1$

-25 × -⅖ = 10 $-25 \times -\frac{2}{5} = \frac{50}{5} = 10$

-25 ÷ ½ = -50 $-25 \times 2 = -50$

G7 U4 Lesson 12

Interpret situations involving rational numbers, including positive and negative values, and use rational numbers to represent and solve problems.

G7 U4 Lesson 12 - Students will interpret situations involving rational numbers, including positive and negative values, and use rational numbers to represent and solve problems.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In some previous lessons we considered how signed numbers show up in problems about rates. You likely remember that a rate is a ratio with two quantities that have different units. Price per pound. Miles per gallon. Visits per year. Can you think of any other examples of rates you might see or hear in everyday life? Possible Student Answers, Key Points:

- I think about miles per hour or kilometers per hour when I think about the speed of a car or bus.
- If I work at a store, I might get paid hourly. Dollars per hour is a rate that would come in handy.
- Points per game is a rate that matters for football or basketball.

In today's lesson, we'll continue seeing how we can use positive and negative numbers to solve problems involving rates.

Let's Talk (Slide 3): Take a minute to look over the images here. Which images make you think of positive rates? Which images make you think of negative rates? Are there images that could represent positive *and* negative rates? Possible Student Answers, Key Points:

- The fire hydrant makes me think of a negative rate, because water is spraying out of it.
- The faucet and the gas pump make me think of positive rates, because they're filling things up.
- The money could be a positive or a negative rate. It depends on if they're depositing or withdrawing.
- The scuba diver and hot air balloon could be either. It depends on if they are going up or down.

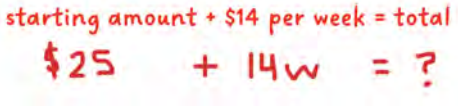
Great thinking! As we work today, we'll want to carefully consider whether a given story involves a positive or negative rate based on the context. Then we'll use what we know about positive and negative numbers to help us answer questions.

Let's Think (Slide 4): I'm going to read through this first problem once. Then, I'll ask you to summarize what the problem is about in your own words. *(read problem)* What would you say this problem is about? What do we know? What is unknown? Possible Student Answers, Key Points:

- Adriana is saving money. She has some in her account already and she deposits the same amount each week for 9 weeks.
- We don't know the total after 9 weeks.

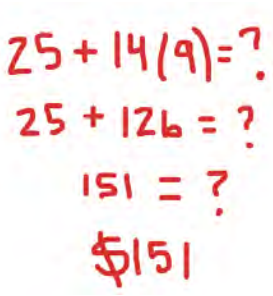
I'm going to start with a table, just to make sure I'm clear on what is happening with the numbers in this story. *(draw t-chart labeled with weeks and $, and write 0 - 3 in the column for weeks)* At the start of the story, 0 weeks, how much is in Adriana's account? ($25) *(fill in dollar values as you and the student discuss)* One week later, I know she'll have $14 more dollars based on the information in the story. After Week 1, I know that means she'll have $39. She's going to keep depositing $14 each week. How much will she have for Week 2 and Week 3? ($53 and $67) Let's pause there. From the table, we see that she starts with $25, then she deposits $14 per week as time goes on.

We can write this relationship using an equation. That might help us get to 9 weeks faster than continuing down our table. I know her total is equal to the starting amount plus her weekly deposits. *(write starting amount + $14 per week = total)* I know her starting amount is $25. She earns $14 per week, which I'll represent as 14w. I'll use a question mark to represent the unknown total. The equation that matches the story is 25 + 14w = ?. *(write it)*



Why do you think I represented the weekly rate in the equation as 14w instead of -14w? Possible Student Answers, Key Points:

- She's gaining money, so it makes sense to think of it as a positive rate.
- -14w would mean that she was losing or withdrawing money.



Now, let's use our equation to find how much Adriana has in her account after 9 weeks. I'll substitute in a 9 for w. *(rewrite equation replacing w with 9)* Use any strategy to find 14 x 9, and let me know when you're ready. (14 x 9 = 126) So, she had $25 in her account, and 14 dollars per week for 9 weeks is $126 additional dollars. *(write 25 + 126 = ?)* If I add those together, I know Adriana will have a total of $151 in her account after 9 weeks.

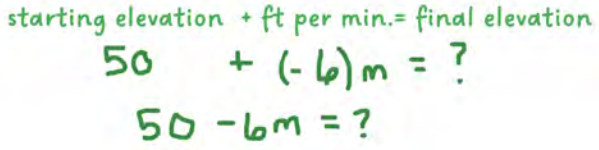
We just solved a problem involving rates by using an equation. We started with a table. Tables can be helpful tools to think about how numbers are changing, but equations can often be more efficient. We could use this equation to quickly find any number of weeks simply by substituting for w. Want to know 14 weeks? Substitute 14 for w. Want to know 100 weeks? Substitute 100 for w. Equations are flexible tools that can help us represent relationships involving rates.

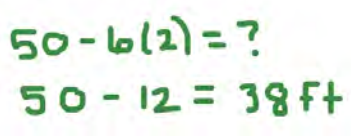
I think you're ready to try one more.

Let's Think (Slide 5): I'm going to read through this problem aloud. Like last time, I'll ask you to summarize what the problem is about in your own words. *(read problem)* What would you say this problem is about? What do we know? What is unknown? Possible Student Answers, Key Points:

- This problem is about elevation.
- A hiker starts at 50 feet and climbs down at 6 feet per minute.
- It's asking us to find the hiker's elevation at two different points.

We could represent this information in a table like the last problem, but let's see if we can just use an equation. To write an equation, it can be helpful to think of the story bit by bit and represent each part of the story as you go. In this case, I know the hiker started at an elevation, descended at a constant rate, and ended up at a different elevation. *(write starting elevation + feet per minute = final elevation)* Let's layer on specific information from the story now. What was the starting elevation? (50 feet) I'll start by writing 50. *(continue writing equation as you narrate)* Now I need to consider the rate. I'll use -6m to represent that the climber is *descending* 6 feet per minute, rather than +6m which would mean the hiker is ascending higher and higher. The equation 50 - 6m = ? represents this scenario. It shows the hiker's starting height and the resulting change after climbing *down* at a rate of 6 feet per minute.

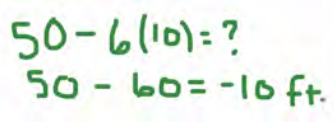




Great! Now that we have the equation, we can use it to help us answer questions about the relationship. The first question asks us to find the hiker's elevation after 2 minutes. Let's substitute 2 in place of *m*. *(rewrite equation)* I know 6 x 2 is 12 feet, so the hiker will have descended 12 feet during those 2 minutes. 50 - 12 means the final elevation after 2 minutes will be 38 feet.

What's will we do the same and what will we do different to find the hiker's elevation after 10 minutes? Possible Student Answers, Key Points:

- We'll still substitute a value in for *m* and then do the math.
- We'll substitute 10 instead of 2 like we did before.



(write equation substituting in 10 for m) I know 6 x 10 is 60. What is 50 minus 60? (-10) What does a solution of -10 mean in the context of this problem?
Possible Student Answers, Key Points:

- The hiker's elevation was 10 feet below sea level after hiking for 10 minutes.

Nice work. We just explored two contexts where we used rates involving positive or negative numbers.

Let's Try it (Slides 6 - 7): Now let's get a little more practice. Each context will be a bit different, so we'll want to consider carefully whether the rates involved should be positive or negative. We know tables can help us think about how our values change, but we saw today that equations can be particularly helpful in answering rate-related questions. Let's use all that we've just done to try a few more examples together before you show what you know independently.

WARM WELCOME

Today we will interpret situations involving rational numbers, including positive and negative values, and use rational numbers to represent and solve problems.

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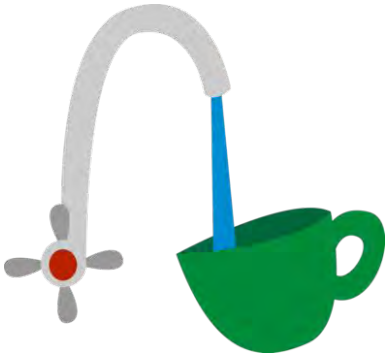
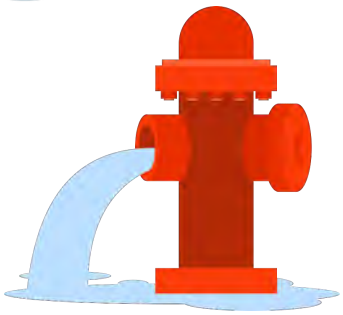
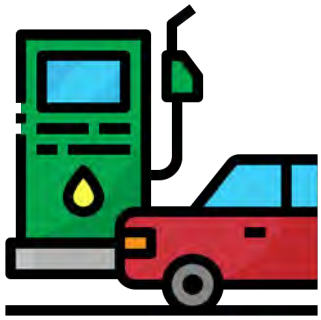
Let's Talk:

Which images might involve a positive rate? Which might involve a negative rate?







Let's Think:

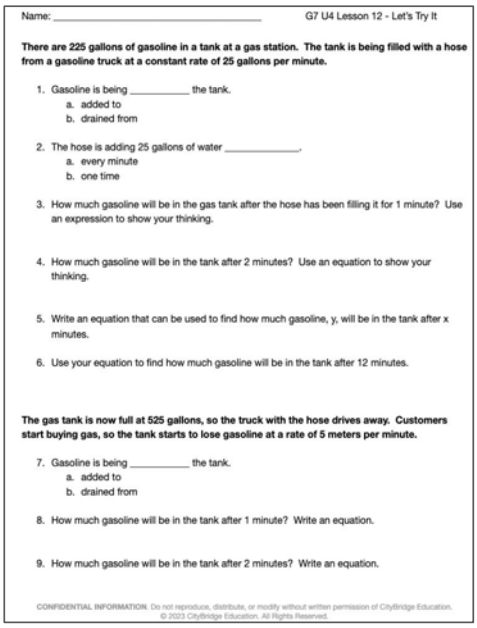
Adriana has $25 in her savings account. She deposits $14 every week and does not make any withdrawals. How much money does she have in her savings after 9 weeks?

Let's Think:

A hiker is climbing at an elevation of 50 feet. If he descends 6 feet per minute, what will the hiker's elevation be after 2 minutes? 10 minutes?

Let's Try It:

Let's explore interpreting situations involving rational numbers and using rational numbers to represent and solve problems together.



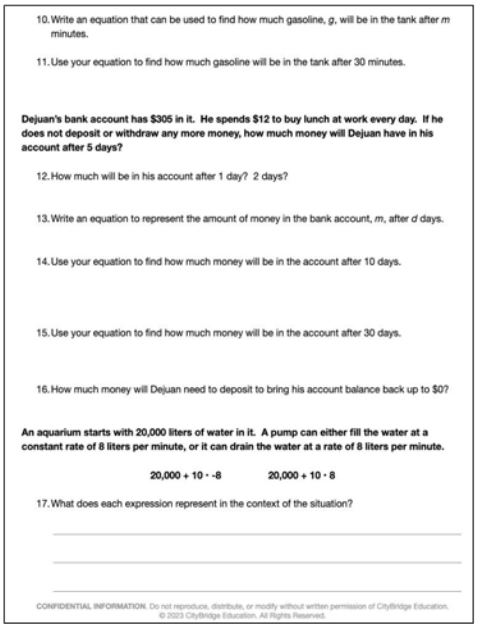
Name: _____ G7 U4 Lesson 12 - Let's Try It

There are 225 gallons of gasoline in a tank at a gas station. The tank is being filled with a hose from a gasoline truck at a constant rate of 25 gallons per minute.

1. Gasoline is being _____ the tank.
   a. added to
   b. drained from
2. The hose is adding 25 gallons of water _____.
   a. every minute
   b. one time
3. How much gasoline will be in the gas tank after the hose has been filling it for 1 minute? Use an expression to show your thinking.
4. How much gasoline will be in the tank after 2 minutes? Use an equation to show your thinking.
5. Write an equation that can be used to find how much gasoline, y, will be in the tank after x minutes.
6. Use your equation to find how much gasoline will be in the tank after 12 minutes.

The gas tank is now full at 525 gallons, so the truck with the hose drives away. Customers start buying gas, so the tank starts to lose gasoline at a rate of 5 meters per minute.

7. Gasoline is being _____ the tank.
   a. added to
   b. drained from
8. How much gasoline will be in the tank after 1 minute? Write an equation.
9. How much gasoline will be in the tank after 2 minutes? Write an equation.



10. Write an equation that can be used to find how much gasoline, *g*, will be in the tank after *m* minutes.
11. Use your equation to find how much gasoline will be in the tank after 30 minutes.

Dejuan's bank account has $305 in it. He spends $12 to buy lunch at work every day. If he does not deposit or withdraw any more money, how much money will Dejuan have in his account after 5 days?

12. How much will be in his account after 1 day? 2 days?
13. Write an equation to represent the amount of money in the bank account, *m*, after *d* days.
14. Use your equation to find how much money will be in the account after 10 days.
15. Use your equation to find how much money will be in the account after 30 days.
16. How much money will Dejuan need to deposit to bring his account balance back up to $0?

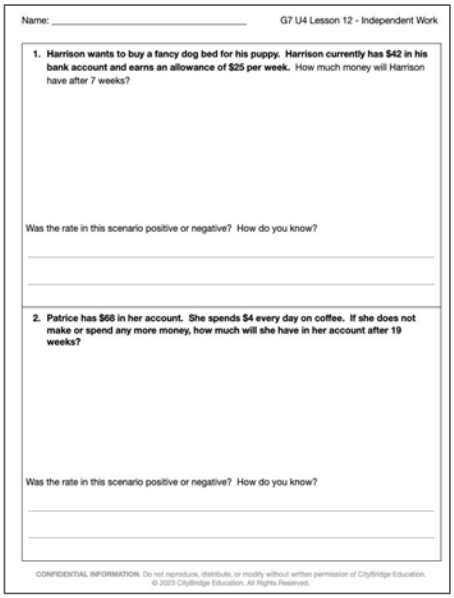
An aquarium starts with 20,000 liters of water in it. A pump can either fill the water at a constant rate of 8 liters per minute, or it can drain the water at a rate of 8 liters per minute.

20,000 + 10 · -8 **20,000 + 10 · 8**

17. What does each expression represent in the context of the situation?

On your Own:

Now it's time to explore interpreting situations with rational numbers and using rational numbers to represent and solve problems on your own.



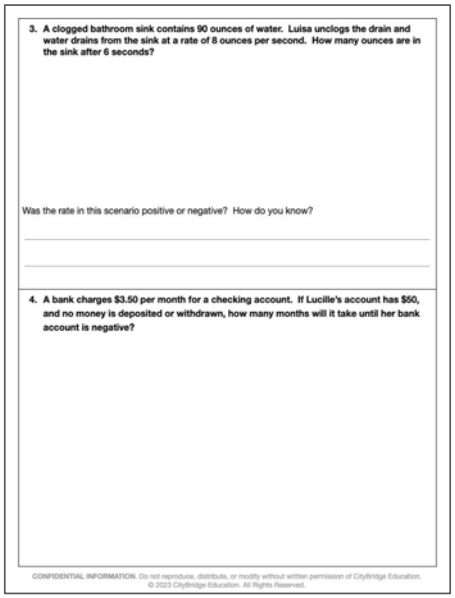
Name: _____ G7 U4 Lesson 12 - Independent Work

1. **Harrison wants to buy a fancy dog bed for his puppy. Harrison currently has $42 in his bank account and earns an allowance of $25 per week.** How much money will Harrison have after 7 weeks?

Was the rate in this scenario positive or negative? How do you know?

2. **Patrice has $68 in her account. She spends $4 every day on coffee. If she does not make or spend any more money, how much will she have in her account after 19 weeks?**

Was the rate in this scenario positive or negative? How do you know?



3. **A clogged bathroom sink contains 90 ounces of water. Luisa unclogs the drain and water drains from the sink at a rate of 8 ounces per second. How many ounces are in the sink after 6 seconds?**

Was the rate in this scenario positive or negative? How do you know?

4. **A bank charges $3.50 per month for a checking account. If Lucille's account has $50, and no money is deposited or withdrawn, how many months will it take until her bank account is negative?**

Name: _____ G7 U4 Lesson 12 - Let's Try It

There are 225 gallons of gasoline in a tank at a gas station. The tank is being filled with a hose from a gasoline truck at a constant rate of 25 gallons per minute.

1. Gasoline is being _____ the tank.
    a. added to
    b. drained from

2. The hose is adding 25 gallons of water _____.
    a. every minute
    b. one time

3. How much gasoline will be in the gas tank after the hose has been filling it for 1 minute? Use an expression to show your thinking.

4. How much gasoline will be in the tank after 2 minutes? Use an equation to show your thinking.

5. Write an equation that can be used to find how much gasoline, y, will be in the tank after x minutes.

6. Use your equation to find how much gasoline will be in the tank after 12 minutes.

The gas tank is now full at 525 gallons, so the truck with the hose drives away. Customers start buying gas, so the tank starts to lose gasoline at a rate of 5 gallons per minute.

7. Gasoline is being _____ the tank.
    a. added to
    b. drained from

8. How much gasoline will be in the tank after 1 minute? Write an equation.

9. How much gasoline will be in the tank after 2 minutes? Write an equation.

10. Write an equation that can be used to find how much gasoline, g, will be in the tank after m minutes.

11. Use your equation to find how much gasoline will be in the tank after 30 minutes.

Dejuan's bank account has $305 in it. He spends $12 to buy lunch at work every day. If he does not deposit or withdraw any more money, how much money will Dejuan have in his account after 5 days?

12. How much will be in his account after 1 day? 5 days?

13. Write an equation to represent the amount of money in the bank account, m, after d days.

14. Use your equation to find how much money will be in the account after 10 days.

15. Use your equation to find how much money will be in the account after 30 days.

16. How much money will Dejuan need to deposit to bring his account balance back up to $0?

An aquarium starts with 20,000 liters of water in it. A pump can either fill the water at a constant rate of 8 liters per minute, or it can drain the water at a rate of 8 liters per minute.

$20{,}000 + 10 \cdot -8$ **$20{,}000 + 10 \cdot 8$**

17. What does each expression represent in the context of the situation?

1. **Harrison wants to buy a fancy dog bed for his puppy. Harrison currently has $42 in his bank account and earns an allowance of $25 per week.** How much money will Harrison have after 7 weeks?

Was the rate in this scenario positive or negative? How do you know?

2. **Patrice has $68 in her account. She spends $4 every day on coffee. If she does not make or spend any more money, how much will she have in her account after 19 weeks?**

Was the rate in this scenario positive or negative? How do you know?

3. **A clogged bathroom sink contains 90 ounces of water. Luisa unclogs the drain and water drains from the sink at a rate of 8 ounces per second. How many ounces are in the sink after 6 seconds?**

Was the rate in this scenario positive or negative? How do you know?

4. **A bank charges $3.50 per month for a checking account. If Lucille's account has $50, and no money is deposited or withdrawn, how many months will it take until her bank account is negative?**

Name: KEY

There are 225 gallons of gasoline in a tank at a gas station. The tank is being filled with a hose from a gasoline truck at a constant rate of 25 gallons per minute.

1. Gasoline is being _____ the tank.
   a. added to
   b. drained from

2. The hose is adding 25 gallons of water _____.
   a. every minute
   b. one time

3. How much gasoline will be in the gas tank after the hose has been filling it for 1 minute? Use an expression to show your thinking.

   $225 + 25$ 250 gallons

4. How much gasoline will be in the tank after 2 minutes? Use an equation to show your thinking.

5. Write an equation that can be used to find how much gasoline, y, will be in the tank after x minutes.

   $y = 225 + 25x$

6. Use your equation to find how much gasoline will be in the tank after 12 minutes.

   $y = 225 + 25(12)$
   $y = 225 + 300$
   525 gallons

The gas tank is now full at 525 gallons, so the truck with the hose drives away. Customers start buying gas, so the tank starts to lose gasoline at a rate of 5 ~~meters~~ gallons per minute.

7. Gasoline is being _____ the tank.
   a. added to
   b. drained from

8. How much gasoline will be in the tank after 1 minute? Write an equation.

   $525 - 5 = 520$ 520 gallons

9. How much gasoline will be in the tank after 2 minutes? Write an equation.

   $525 - 2(5) = 515$
   $525 - 10$
   515 gallons

10. Write an equation that can be used to find how much gasoline, g, will be in the tank after m minutes.

$525 - 5m = g$

11. Use your equation to find how much gasoline will be in the tank after 30 minutes.

$525 - 5(30) = g$
$525 - 150 = g$

$4\,\overset{1}{5}\,\overset{12}{\cancel{2}}5$
$-\ 150$
375

375 gallons

Dejuan's bank account has $305 in it. He spends $12 to buy lunch at work every day. If he does not deposit or withdraw any more money, how much money will Dejuan have in his account after 5 days?

12. How much will be in his account after 1 day? ~~2 days~~? 5 days?

$305 - 12 = \$293$ $305 - 60 = \$240$

13. Write an equation to represent the amount of money in the bank account, m, after d days.

$305 - 12d = m$

14. Use your equation to find how much money will be in the account after 10 days.

$305 - 12(10) = m$
$305 - 120 = m$
$\$185 = m$

15. Use your equation to find how much money will be in the account after 30 days.

$305 - 12(30) = m$
$305 - 360 = m$

$-\$55$

16. How much money will Dejuan need to deposit to bring his account balance back up to $0?

$-55 + 55 = 0$ $\$55$

An aquarium starts with 20,000 liters of water in it. A pump can either fill the water at a constant rate of 8 liters per minute, or it can drain the water at a rate of 8 liters per minute.

$20{,}000 + 10 \cdot -8$ **$20{,}000 + 10 \cdot 8$**

17. What does each expression represent in the context of the situation?

The first equation represents the liters after draining for 10 minutes. The second equation represents liters after filling for 10 minutes.

Name: KEY

1. **Harrison wants to buy a fancy dog bed for his puppy. Harrison currently has $42 in his bank account and earns an allowance of $25 per week.** How much money will Harrison have after 7 weeks?

$42 + 25w = ?$

$42 + 25(7) = ?$

$42 + 175 = ?$

$217

$$\begin{array}{r} {\scriptstyle 1}\\ 175 \\ +\ 42. \\ \hline 217 \end{array}$$

Was the rate in this scenario positive or negative? How do you know?

It is positive. Harrison is earning money.

2. **Patrice has $68 in her account. She spends $4 every day on coffee. If she does not make or spend any more money, how much will she have in her account after 19 weeks?**

$68 - 4x = ?$

$68 - 4(19) = ?$

$68 - 76 = ?$

-$8

Was the rate in this scenario positive or negative? How do you know?

The rate was negative, because she spends money.

3. **A clogged bathroom sink contains 90 ounces of water. Luisa unclogs the drain and water drains from the sink at a rate of 8 ounces per second. How many ounces are in the sink after 6 seconds?**

$90 - 8x = ?$

$90 - 8(6)$

$90 - 48$

42 oz

Was the rate in this scenario positive or negative? How do you know?

It was negative because the sink is losing water.

4. **A bank charges $3.50 per month for a checking account. If Lucille's account has $50, and no money is deposited or withdrawn, how many months will it take until her bank account is negative?**

$50 - 3.5x = 0$

$50 \div 3.5 = ?$

$$35\overline{)500}\quad 14$$

35

150

-140

10

$14\frac{10}{35}$ or $14\frac{2}{7}$ months

It would take 15 months to reach a negative value

G7 U4 Lesson 13

Solve equations that involve negative numbers.

G7 U4 Lesson 13 - Students will solve equations that involve negative numbers.

Warm Welcome (Slide 1): Tutor choice

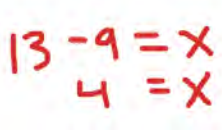
Frame the Learning/Connect to Prior Learning (Slide 2): You've been solving equations since 6th grade or earlier. Today, we're going to use everything we've been learning about working with positive and negative numbers to help solve one-step equations that involve negative numbers. There are many ways to solve one-step equations, but today we'll lean into writing related facts to help arrive at a solution.

Before we dive into negative numbers, let's refresh a bit by looking at equations with positive numbers.

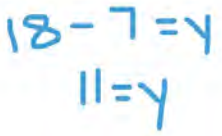
Let's Talk (Slide 3): As I named, there are many ways to think about solving equations. Take a few moments, and see if you can determine what number could make each equation true. Possible Student Answers, Key Points:

- I know x = 4, because 9 + 4 is equal to 13.
- I know y = 11, because 18 - 7 = 11.
- I know h = 3, because 3 groups of 2 makes 6.
- I know k = 4, because 5 x 4 is the same as 20.

Great thinking! There are many ways to solve equations. I want us to think about related facts for a moment…



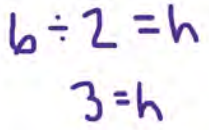
Let's consider how related facts could help us think about each of the solutions here. I'll use 9 + x = 13 as my first example. I know in this equation, 13 is my total and x and 4 are my parts that compose the total. Rather than write 9 + x = 13, I can think of this as the total minus the part I know is equal to the part I don't know. I can write that as 13 - 9 = x. *(write equation)* Rewriting this as a related fact, helps confirm that x must equal 4.



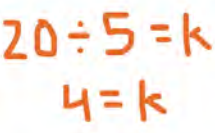
What about y + 7 = 18? Can you think of a related subtraction fact that could help us prove that y = 11? Possible Student Answers, Key Points:

- I know y and 7 are the parts in this relationship, and 18 is the total. I can write 18 - 7 = y as a related fact.

(write equation) To help us solve this equation, we can use the related fact 18 - 7 = y. We can see that y = 11.



Related facts can also help us solve multiplication equations. We can think of a related division fact that can help us arrive at a solution. Let's think about h • 2 = 6. I know h groups of 2 is equal to 6. I can think of this as 6 divided by 2 is equal to something. *(write equation)* So h is equal to 3.



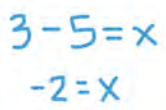
How can I use similar thinking to think about finding k? Possible Student Answers, Key Points:

- I know 5 times something is equal to 20. So I can think of 20 divided by 5 to help me find the unknown.

(write related fact) 20 divided by 5 equals k can help us arrive at our solution. 20 divided by 5 is equal to 4.

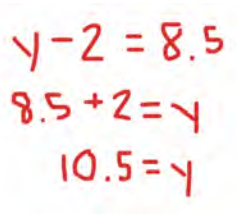
Related facts can be a helpful way to solve various one-step equations. Let's see if that idea stays true when we consider negative numbers.

Let's Think (Slide 4): Let's start by solving two addition problems.



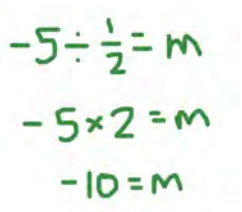
We'll start by considering the solution to 5 plus x equals 3. In this example 5 and x are the parts that make 3. I can rewrite this as a related number sentence. *(write 3 - 5 = x)* Now, all I have to do is think about the value of 3 minus 5. What is the value of 3 - 5? How do you know? Possible Student Answers, Key Points:

- 3 minus 5 is -2.
- I can think of this as 3 take away 5. I can also think of this as the difference between 3 and 5. Either way, x = -2.

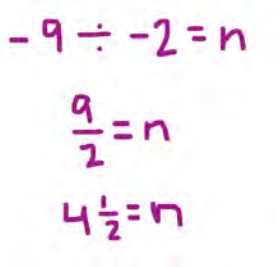


Let's look at the next example. This equation says y plus -2 is equal to 8.5. Let's start by rewriting this as y - 2 = 8.5, since adding -2 is the same as subtracting positive 2. *(write equation)* Based on this equation, we can still use a related fact to help us find the value of y. In the rewritten equation, I know that y is the total and 2 and 8.5 are the parts. So we can rewrite this as 8.5 + 2 = y. *(rewrite equation)* Based on our related equation, we can add 8.5 and 2 to find the value of y. Take a moment, and let me know the value of y when you're ready. (10.5) Nice work. y = 10.5

Let's Think (Slide 5): Now we'll use some similar thinking to consider two multiplication equations.



The first equation says ½ times an unknown number, *m*, equals -5. I know that I can write a related division fact to represent this multiplication equation. If ½ x m = -5, then I know -5 divided by ½ is equal to m. *(write related fact)* To solve for the unknown, I can divide -5 by ½. Thinking back to our last lesson, this might be easier to think about if we use the multiplicative inverse. Dividing by ½ is the same as multiplying by the multiplicative inverse of 2. What is -5 times 2? (-10) Correct. Negative 5 times positive 2 is equal to -10. Even though this original problem involved fractions, writing a related fact was helpful in terms of arriving at a solution efficiently.



Let's look at one more example. How could I use a related fact to think about this equation? Possible Student Answers, Key Points:

- We can write a related division fact to represent this multiplication equation.
- If -2 times a number equals -9, then I know -9 divided by -2 is equal to that number.

(write -9 divided by -2 = n) This related fact can help us solve the original multiplication equation. -9 divided by -2 aren't necessarily friendly numbers. Even before we consider solving, what do we know about a negative number divided by a negative number? (It will result in a positive number) So -9 divided by -2 will be a positive value. We can think of 9 divided by 2 as 9 over 2, or 9/2 The solution to this equation is 9/2 or 4 ½ depending on whether you prefer a fraction greater than 1 or a mixed number.

Writing related facts can be immensely helpful when solving one-step equations.

Let's Try it (Slides 6 - 7): Now let's use what we've practiced to solve more one-step equations involving negative numbers. We've seen that writing related facts can help us arrive at an answer efficiently. We can write subtraction facts to think about addition equations. We can write division facts to think about multiplication equations. Let's apply what we've been practicing on a few more examples together.

WARM WELCOME

Today we will solve equations that involve negative numbers.

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Let's Talk:

What is each missing value? How do you know?

$9 + x = 13$

$h \bullet 2 = 6$

$y + 7 = 18$

$5(k) = 20$

Let's Think:

Solve each equation.

$5 + x = 3$

$y + (-2) = 8.5$

Let's Think:

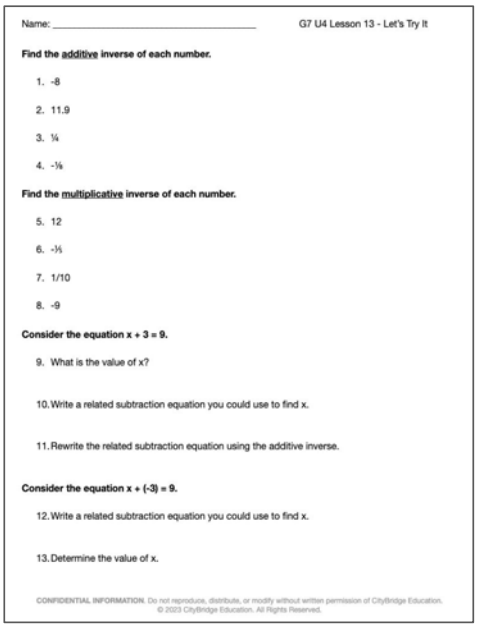
Solve each equation.

$(\frac{1}{2})m = -5$

$-9 = -2n$

Let's Try It:

Let's explore solving equations that involve negative numbers together.



Name: _____ G7 U4 Lesson 13 - Let's Try It

Find the additive inverse of each number.

1. -8
2. 11.9
3. ¼
4. -⅛

Find the multiplicative inverse of each number.

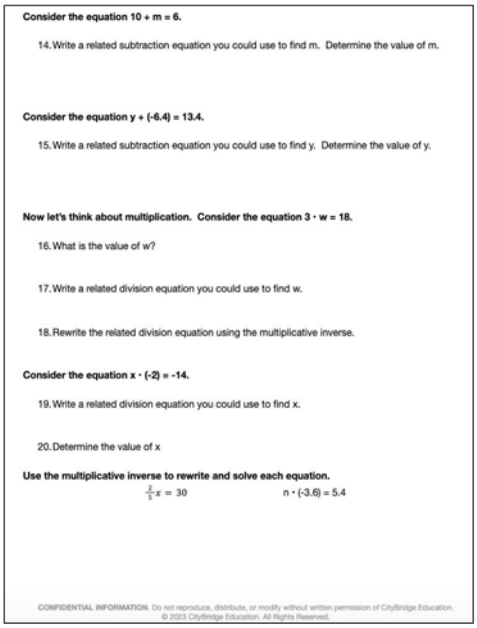
5. 12
6. -⅓
7. 1/10
8. -9

Consider the equation x + 3 = 9.

9. What is the value of x?
10. Write a related subtraction equation you could use to find x.
11. Rewrite the related subtraction equation using the additive inverse.

Consider the equation x + (-3) = 9.

12. Write a related subtraction equation you could use to find x.
13. Determine the value of x.



Consider the equation 10 + m = 6.

14. Write a related subtraction equation you could use to find m. Determine the value of m.

Consider the equation y + (-6.4) = 13.4.

15. Write a related subtraction equation you could use to find y. Determine the value of y.

Now let's think about multiplication. Consider the equation 3 · w = 18.

16. What is the value of w?
17. Write a related division equation you could use to find w.
18. Rewrite the related division equation using the multiplicative inverse.

Consider the equation x · (-2) = -14.

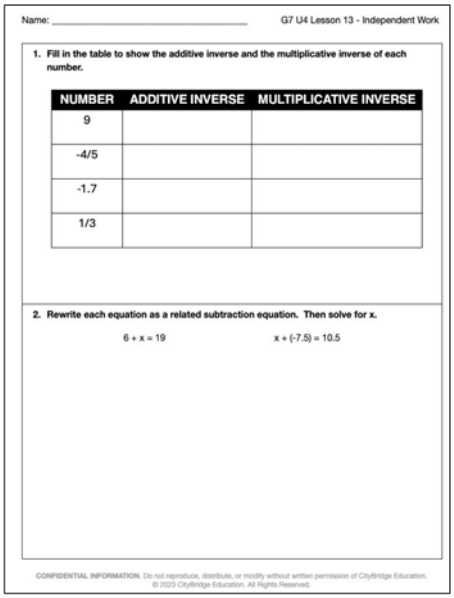
19. Write a related division equation you could use to find x.
20. Determine the value of x

Use the multiplicative inverse to rewrite and solve each equation.

$\frac{2}{5}x = 30$ $n \cdot (-3.6) = 5.4$

On your Own:

Now it's time to solve equations that involve negative numbers on your own.



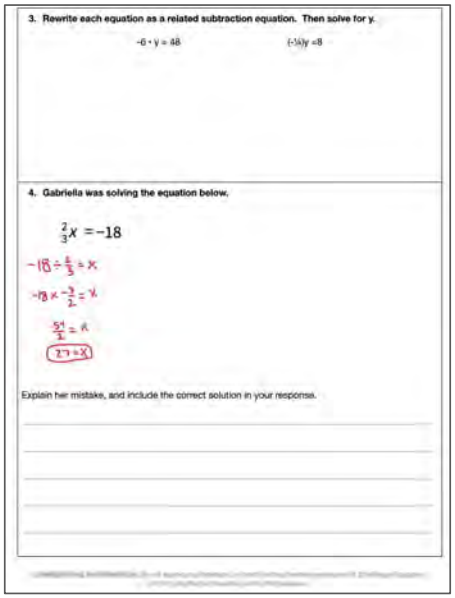
Name: _____ G7 U4 Lesson 13 - Independent Work

1. Fill in the table to show the additive inverse and the multiplicative inverse of each number.

NUMBER	ADDITIVE INVERSE	MULTIPLICATIVE INVERSE
9		
-4/5		
-1.7		
1/3		

2. Rewrite each equation as a related subtraction equation. Then solve for x.

6 + x = 19 x + (-7.5) = 10.5



3. Rewrite each equation as a related subtraction equation. Then solve for y.

-6 + y = 48 (-1/4)y =8

4. Gabriella was solving the equation below.

$\frac{2}{3}x = -18$

$-18 \div \frac{2}{3} = x$

$-18 \times -\frac{3}{2} = x$

$\frac{54}{2} = x$

$27 = x$

Explain her mistake, and include the correct solution in your response.

Find the <u>additive</u> inverse of each number.

1. -8
2. 11.9
3. ¼
4. -⅛

Find the <u>multiplicative</u> inverse of each number.

5. 12
6. -⅕
7. 1/10
8. -9

Consider the equation x + 3 = 9.

9. What is the value of x?

10. Write a related subtraction equation you could use to find x.

11. Rewrite the related subtraction equation using the additive inverse.

Consider the equation x + (-3) = 9.

12. Write a related subtraction equation you could use to find x.

13. Determine the value of x.

Consider the equation 10 + m = 6.

14. Write a related subtraction equation you could use to find m. Determine the value of m.

Consider the equation y + (-6.4) = 13.4.

15. Write a related subtraction equation you could use to find y. Determine the value of y.

Now let's think about multiplication. Consider the equation 3 • w = 18.

16. What is the value of w?

17. Write a related division equation you could use to find w.

18. Rewrite the related division equation using the multiplicative inverse.

Consider the equation x • (-2) = -14.

19. Write a related division equation you could use to find x.

20. Determine the value of x

Use the multiplicative inverse to rewrite and solve each equation.

$\frac{2}{5}x = 30$ n • (-3.6) = 5.4

1. Fill in the table to show the additive inverse and the multiplicative inverse of each number.

NUMBER	ADDITIVE INVERSE	MULTIPLICATIVE INVERSE
9		
-4/5		
-1.7		
1/3		

2. Rewrite each equation as a related subtraction equation. Then solve for x.

$6 + x = 19$

$x + (-7.5) = 10.5$

3. Rewrite each equation as a related division equation. Then solve for y.

$-6 \bullet y = 48$ $(-\frac{1}{4})y = 8$

4. Gabriella was solving the equation below.

$$\frac{2}{3}x = -18$$

$-18 \div \frac{2}{3} = x$

$-18 \times -\frac{3}{2} = x$

$\frac{54}{2} = x$

$27 = x$

Explain her mistake, and include the correct solution in your response.

Name: KEY

Find the additive inverse of each number.

1. -8 (8)
2. 11.9 (-11.9)
3. ¼ ($-\frac{1}{4}$)
4. -⅛ ($\frac{1}{8}$)

Find the multiplicative inverse of each number.

5. 12 ($\frac{1}{12}$)
6. -⅕ (-5)
7. 1/10 (10)
8. -9 ($-\frac{1}{9}$)

Consider the equation x + 3 = 9.

9. What is the value of x?

   x = 6

10. Write a related subtraction equation you could use to find x.

    9 - 3 = x

11. Rewrite the related subtraction equation using the additive inverse.

    9 + (-3) = x

Consider the equation x + (-3) = 9.

12. Write a related subtraction equation you could use to find x.

    9 - (-3) = x

13. Determine the value of x.

    9 + 3 = 12 x = 12

Consider the equation 10 + m = 6.

14. Write a related subtraction equation you could use to find m. Determine the value of m.

$6 - 10 = m$

$-4 = m$

Consider the equation y + (-6.4) = 13.4.

15. Write a related subtraction equation you could use to find y. Determine the value of y.

$13.4 - (-6.4) = y$

$13.4 + 6.4 = y$

$y = 19.8$

Now let's think about multiplication. Consider the equation 3 · w = 18.

16. What is the value of w?

$w = 6$

17. Write a related division equation you could use to find w.

$18 \div 3 = w$

18. Rewrite the related division equation using the multiplicative inverse.

$18 \times \frac{1}{3} = \frac{18}{3} = 6$ $\quad w = 6$

Consider the equation x · (-2) = -14.

19. Write a related division equation you could use to find x.

$-14 \div -2 = x$

20. Determine the value of x

$x = 7$

Use the multiplicative inverse to rewrite and solve each equation.

$\frac{2}{5}x = 30$

$30 \div \frac{2}{5} = x$

$30 \times \frac{5}{2} = \frac{150}{2}$

$x = 75$

n • (-3.6) = 5.4

$5.4 \div -3.6 = n$

$5.4 \times -\frac{1}{3.6} = n$

$-\frac{5.4}{3.6} = n$

$-1.5 = n$

$36\overline{)54.0}$ → 1.5, -36, 180

Name: KEY

1. **Fill in the table to show the additive inverse and the multiplicative inverse of each number.**

NUMBER	ADDITIVE INVERSE	MULTIPLICATIVE INVERSE
9	-9	$\frac{1}{9}$
-4/5	$+\frac{4}{5}$	$-\frac{5}{4}$
-1.7	$+1.7$	$-\frac{1}{1.7}$
1/3	$-\frac{1}{3}$	3

2. **Rewrite each equation as a related subtraction equation. Then solve for x.**

$6 + x = 19$

$19 - 6 = x$

$13 = x$

$x + (-7.5) = 10.5$

$10.5 - (-7.5) = x$

$10.5 + 7.5 = x$

$18 = x$

3. Rewrite each equation as a related ~~subtraction~~ multiplication ↕ division equation. Then solve for y.

$-6 \cdot y = 48$

$48 \div -6 = y$

$-8 = y$

$(-\frac{1}{4})y = 8$

$8 \div -\frac{1}{4} = y$

$8 \times -4 = y$

$-32 = y$

4. Gabriella was solving the equation below.

$\frac{2}{3}x = -18$

$-18 \div \frac{2}{3} = x$

$-18 \times -\frac{3}{2} = x$

$\frac{54}{2} = x$

$27 = x$

$-18 \times \frac{3}{2} = \frac{-54}{2} = -27$

Explain her mistake, and include the correct solution in your response.

She used the wrong multiplicative inverse. $\frac{3}{2}$ is the correct multiplicative inverse of $\frac{2}{3}$. The correct answer is $-27 = x$.

G7 U4 Lesson 14

Write and solve equations to represent situations that involve negative numbers.

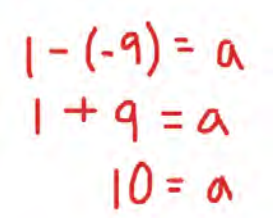
G7 U4 Lesson 14 - Students will write and solve equations to represent situations that involve negative numbers.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): We're almost at the end of our unit that's been all about rational number arithmetic. We've learned how to add, subtract, multiply, and divide with negative values. We've learned how to use negative numbers in contexts like temperature, elevation, and money. Today we're going to keep pulling all these ideas we've been working with together to help us write and solve equations to represent situations involving negative numbers. Let's get started.

Let's Talk (Slide 3): Here we see two equations without a context. To get us warmed up, think about how you could solve the first equation. When you have an idea, share it. Possible Student Answers, Key Points:

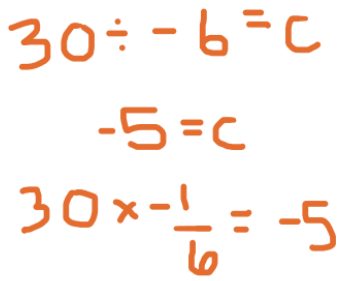
- I can think about -9 plus what number would get me to positive 1 on a number line. I know it would take 10 hops to get to 1, so a = 10.
- I could rewrite the problem as a related subtraction fact and solve for the unknown.



Let's rewrite this addition equation as a related subtraction equation to help us solve. *(write as you narrate)* I know -9 and a are my parts that total positive 1. I can rewrite that as subtraction, starting with the total. 1 minus -9 is equal to a. Instead of minus -9, which can be tricky to think about, I'll use the additive inverse and add +9. 1 + 9 = a, so a = 10.

Now think about how you could solve the second equation. When you have an idea, share it. Possible Student Answers, Key Points:

- I know -6 times -5 would equal +30, so *c* must equal -5.
- I can rewrite as a related division fact to help me solve the multiplication equation.



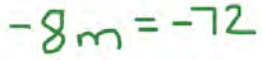
Let's again use a related fact to help us find the unknown value. Since the equation involves multiplication, I'll use division to write the related fact. *(write as you narrate)* I know +30 divided by -5 will equal *c*. That means *c* must equal -5.

I could also use the multiplicative inverse to help me solve. The multiplicative inverse of -6 is -⅙. -30 x -⅙ is equal to 30/6. 30/6 is still equal to 5. Either way, dividing by -6 or multiplying by -⅙, will help us arrive at the correct solution.

Let's take this thinking and use it in contexts from the world around us.

Let's Think (Slide 4): I'll read this problem once through, then I want you to summarize what the story is about in your own words. *(read problem)* Possible Student Answers, Key Points:

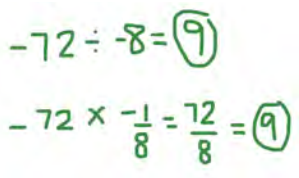
- The story is about a hiker. She starts at an elevation of 0 feet and we want to know how long it will take her to reach -72 feet.
- Raquel is descending 8 feet every minute from sea level, and we need to figure out how long it will take her to arrive at an elevation of -72 feet.



There are many ways to solve this problem, but we'll use an equation since that's what we've been working with a lot lately. I know from our previous work with rates, that I can represent Raquel's descent of 8 feet per minute as the expression -8m. I'll write -8m = -72 to represent this problem. *(write equation)* Why do you think I used a

negative value to help represent the rate and a negative value to help represent the total in the equation? Possible Student Answers, Key Points:

- The -8m makes sense because she is climbing down. If she was climbing up, we might use +8m instead.
- The -72 makes sense, because she ended up at 72 feet below sea level. If she ended up at 72 feet above sea level, we would have used +72.



Let's solve this equation to find how long it will take Raquel to reach an elevation -72 feet. We can use a related fact to help us solve. I'll rewrite the multiplication equation using division. I know -72 divided by -8 will equal *m*. *(write equation)* What will *m* equal? (positive 9) The solution is +9. I know 72 divided by 8 is 9, and a negative value divided by a negative value, results in a positive value.

We could have also used the multiplicative inverse to solve this, depending on what we prefer. What's the multiplicative inverse of -8? (-⅛) Instead of -72 divided by -8, I can multiply -72 by the multiplicative inverse. -72 times -⅛ is equal to positive 72/8, or positive 9. Either solution pathway can help us arrive at our correct answer.

What does a solution of 9 represent in the context of this problem? Go back to the original question, if that helps. Possible Student Answers, Key Points:

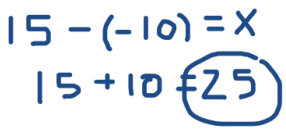
- The question asked for how many minutes it will take Raquel to get to the elevation of 72 feet below sea level. A solution of 9 means it takes her 9 minutes to travel that distance.

Excellent work. Let's look at one more problem with a different context.

Let's Think (Slide 5): Both of these questions we see will involve thinking about changes in Tina's bank account. Let's start with part A. What is known? What is unknown? Possible Student Answers, Key Points:

- We know her bank balance was lower on Monday and higher on Tuesday. Her balance started at -10 and increased up to +15.
- We don't know how much it changed. The unknown is the change in her balance.

We can use an equation to represent this story. *(write equation as you narrate)* You noticed that she started with a balance of -10 dollars. She added some money, but we're not sure how much. I'll use "+ *x*" to represent that unknown amount. Once she added that money, her bank account total was +15. I'll write = 15 in my equation to represent that. -10 plus x equals 15 is one way to represent this situation using an equation. Let's solve!



I'll rewrite this addition equation as a related subtraction equation. I can take the total, 15, and take away the part I know, -10, and that will give me the other part. I'll write that as 15 minus -10 equals x. *(write equation)* Instead of subtracting -10, which can be a little tricky to wrap my head around, I'll add the additive inverse of +10. 15 + 10 = x, so I know x = 25. What does a solution of 25 mean in the context of this problem? Possible Student Answers, Key Points:

- The question was asking for the change in her balance. That means Tina deposited $25 to increase her balance from Monday to Tuesday.

Nice work. We'll keep thinking about Tina and her money as we look at part B. *(read question)* This problem is a little different. In this case, we don't know the starting amount. We know she deposited, or added, $15 into the account and ended up with a total of $10. We can use an equation to represent this relationship. *(write equation as you narrate)* I'll use x to represent the unknown starting balance. I'll write + 15 to represent

the amount she deposited into her account. Then I know the total equals 10 dollars, so I can write = 10. x + 15 = 10 represents the given story. How can we use a related equation to solve for x? Possible Student Answers, Key Points:

- If x and 15 are the parts and 10 is the total, I can take the total and subtract a part I know to find the other part.
- 10 - 15 = x is a related equation I can use.

I know 10 minus 15 is -5. I could also use the additive inverse and think 10 + (-15) is -5. In either case, my solution is x = -5. What does a solution of -5 mean in the context of this story problem? Possible Student Answers, Key Points:

- We were trying to find the unknown starting balance, so this means her balance was -5 to begin with. That means she owed the bank 5 dollars before she deposited the 15 dollars.

We've just used equations to solve a variety of real-world problems involving negative numbers. Excellent work!

Let's Try it (Slides 6 - 7): We'll tackle a few more collaboratively before you get a chance to try some on your own. Like we've been doing, after reading a word problem, we'll pause to think about what we know and what is unknown. From there, we'll use the information in the problem to write an equation, using a variable for our unknown. Then, as we saw today, it can be helpful to solve equations by writing a related fact and/or using the additive or multiplicative inverse to arrive at our solution. Throughout this, pay attention to whether it makes more sense to represent values as positive or negative based on the story. Let's give it a try.

WARM WELCOME

Today we will write and solve equations to represent situations that involve negative numbers.

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Let's Talk:

How can we solve each equation?

$-9 + a = 1$

$-6(c) = 30$

Let's Think:

Raquel begins hiking at sea level, and she descends 8 feet every minute. How many minutes will it take her to reach an elevation of -72 feet?

Let's Think:

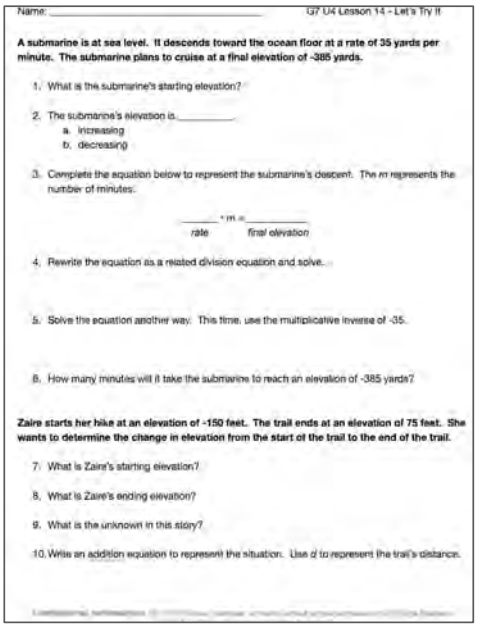
Write and solve an equation to represent each situation.

A) Tina's bank balance on Monday was -$10. On Tuesday, her bank balance was $15. How did her account balance change?

B) Tina deposited $15 into her bank account, and now her balance is $10. What was her starting balance?

Let's Try It:

Let's explore writing and solving equations to represent situations that involve negative numbers together.



Name: _____ G7 U4 Lesson 14 - Let's Try It

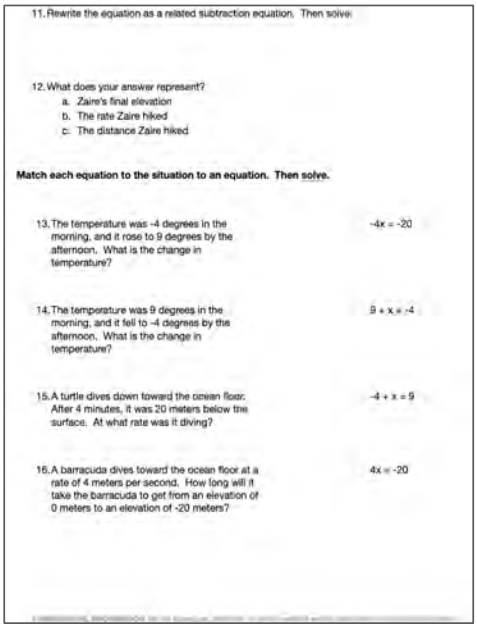
A submarine is at sea level. It descends toward the ocean floor at a rate of 35 yards per minute. The submarine plans to cruise at a final elevation of -385 yards.

1. What is the submarine's starting elevation?
2. The submarine's elevation is _____.
   a. increasing
   b. decreasing
3. Complete the equation below to represent the submarine's descent. The *m* represents the number of minutes.

   _____ * m = _____
   rate final elevation
4. Rewrite the equation as a related division equation and solve.
5. Solve the equation another way. This time, use the multiplicative inverse of -35.
6. How many minutes will it take the submarine to reach an elevation of -385 yards?

Zaire starts her hike at an elevation of -150 feet. The trail ends at an elevation of 75 feet. She wants to determine the change in elevation from the start of the trail to the end of the trail.

7. What is Zaire's starting elevation?
8. What is Zaire's ending elevation?
9. What is the unknown in this story?
10. Write an addition equation to represent the situation. Use *d* to represent the trail's distance.



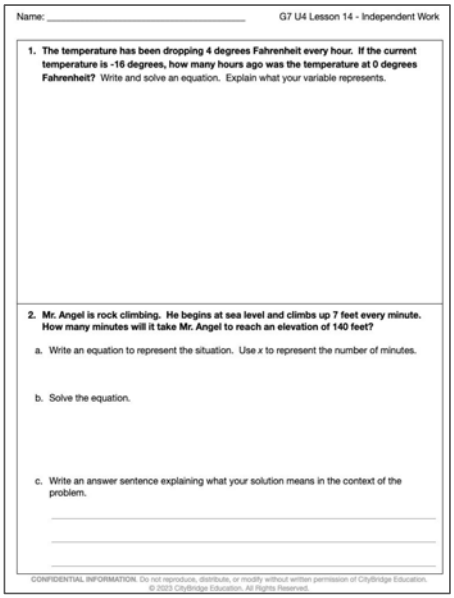
11. Rewrite the equation as a related subtraction equation. Then solve:
12. What does your answer represent?
    a. Zaire's final elevation
    b. The rate Zaire hiked
    c. The distance Zaire hiked

Match each equation to the situation to an equation. Then solve.

13. The temperature was -4 degrees in the morning, and it rose to 9 degrees by the afternoon. What is the change in temperature? — $-4x = -20$
14. The temperature was 9 degrees in the morning, and it fell to -4 degrees by the afternoon. What is the change in temperature? — $9 + x = -4$
15. A turtle dives down toward the ocean floor. After 4 minutes, it was 20 meters below the surface. At what rate was it diving? — $-4 + x = 9$
16. A barracuda dives toward the ocean floor at a rate of 4 meters per second. How long will it take the barracuda to get from an elevation of 0 meters to an elevation of -20 meters? — $4x = -20$

On your Own:

Now it's time to write and solve equations to represent situations that involve negative numbers on your own.



Name: _____ G7 U4 Lesson 14 - Independent Work

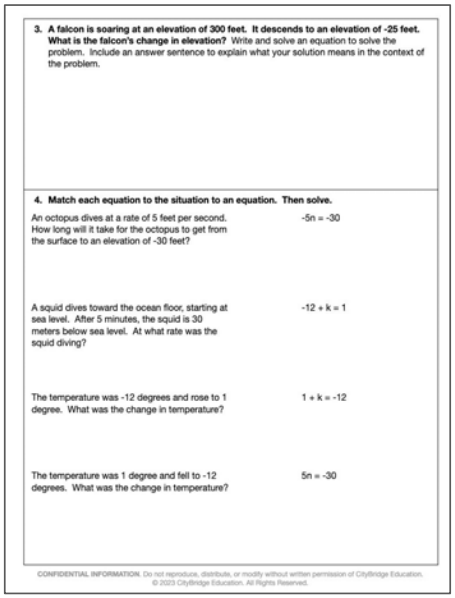
1. The temperature has been dropping 4 degrees Fahrenheit every hour. If the current temperature is -16 degrees, how many hours ago was the temperature at 0 degrees Fahrenheit? Write and solve an equation. Explain what your variable represents.

2. Mr. Angel is rock climbing. He begins at sea level and climbs up 7 feet every minute. How many minutes will it take Mr. Angel to reach an elevation of 140 feet?

a. Write an equation to represent the situation. Use x to represent the number of minutes.

b. Solve the equation.

c. Write an answer sentence explaining what your solution means in the context of the problem.



3. A falcon is soaring at an elevation of 300 feet. It descends to an elevation of -25 feet. What is the falcon's change in elevation? Write and solve an equation to solve the problem. Include an answer sentence to explain what your solution means in the context of the problem.

4. Match each equation to the situation to an equation. Then solve.

An octopus dives at a rate of 5 feet per second. How long will it take for the octopus to get from the surface to an elevation of -30 feet?	$-5n = -30$
A squid dives toward the ocean floor, starting at sea level. After 5 minutes, the squid is 30 meters below sea level. At what rate was the squid diving?	$-12 + k = 1$
The temperature was -12 degrees and rose to 1 degree. What was the change in temperature?	$1 + k = -12$
The temperature was 1 degree and fell to -12 degrees. What was the change in temperature?	$5n = -30$

Name: _____ G7 U4 Lesson 14 - Let's Try It

A submarine is at sea level. It descends toward the ocean floor at a rate of 35 yards per minute. The submarine plans to cruise at a final elevation of -385 yards.

1. What is the submarine's starting elevation?

2. The submarine's elevation is _____.
   a. increasing
   b. decreasing

3. Complete the equation below to represent the submarine's descent. The *m* represents the number of minutes.

$$\underset{\textit{rate}}{\_\_\_\_\_} \cdot m = \underset{\textit{final elevation}}{\_\_\_\_\_}$$

4. Rewrite the equation as a related division equation and solve.

5. Solve the equation another way. This time, use the multiplicative inverse of -35.

6. How many minutes will it take the submarine to reach an elevation of -385 yards?

Zaire starts her hike at an elevation of -150 feet. The trail ends at an elevation of 75 feet. She wants to determine the change in elevation from the start of the trail to the end of the trail.

7. What is Zaire's starting elevation?

8. What is Zaire's ending elevation?

9. What is the unknown in this story?

10. Write an addition equation to represent the situation. Use *d* to represent the trail's distance.

11. Rewrite the equation as a related subtraction equation. Then solve.

12. What does your answer represent?
    a. Zaire's final elevation
    b. The rate Zaire hiked
    c. The distance Zaire hiked

Match each equation to the situation to an equation. Then solve.

13. The temperature was -4 degrees in the morning, and it rose to 9 degrees by the afternoon. What is the change in temperature?

$-4x = -20$

14. The temperature was 9 degrees in the morning, and it fell to -4 degrees by the afternoon. What is the change in temperature?

$9 + x = -4$

15. A turtle dives down toward the ocean floor. After 4 minutes, it was 20 meters below the surface. At what rate was it diving?

$-4 + x = 9$

16. A barracuda dives toward the ocean floor at a rate of 4 meters per second. How long will it take the barracuda to get from an elevation of 0 meters to an elevation of -20 meters?

$4x = -20$

1. **The temperature has been dropping 4 degrees Fahrenheit every hour. If the current temperature is -16 degrees, how many hours ago was the temperature at 0 degrees Fahrenheit?** Write and solve an equation. Explain what your variable represents.

2. **Mr. Angel is rock climbing. He begins at sea level and climbs up 7 feet every minute. How many minutes will it take Mr. Angel to reach an elevation of 140 feet?**

   a. Write an equation to represent the situation. Use x to represent the number of minutes.

   b. Solve the equation.

   c. Write an answer sentence explaining what your solution means in the context of the problem.

3. **A falcon is soaring at an elevation of 300 feet. It descends to an elevation of -25 feet. What is the falcon's change in elevation?** Write and solve an equation to solve the problem. Include an answer sentence to explain what your solution means in the context of the problem.

4. **Match each equation to the situation to an equation. Then solve.**

An octopus dives at a rate of 5 feet per second. How long will it take for the octopus to get from the surface to an elevation of -30 feet?	-5n = -30
A squid dives toward the ocean floor, starting at sea level. After 5 minutes, the squid is 30 meters below sea level. At what rate was the squid diving?	-12 + k = 1
The temperature was -12 degrees and rose to 1 degree. What was the change in temperature?	1 + k = -12
The temperature was 1 degree and fell to -12 degrees. What was the change in temperature?	5n = -30

Name: KEY

A submarine is at sea level. It descends toward the ocean floor at a rate of 35 yards per minute. The submarine plans to cruise at a final elevation of -385 yards.

1. What is the submarine's starting elevation? 0 yd

2. The submarine's elevation is _____.
   a. increasing
   b. decreasing

3. Complete the equation below to represent the submarine's descent. The *m* represents the number of minutes.

$$\underset{\text{rate}}{-35} \cdot m = \underset{\text{final elevation}}{-385}$$

4. Rewrite the equation as a related division equation and solve.

$-385 \div -35 = m$

$11 = m$

$$35\overline{)385}\quad 11,\ 35,\ 35,\ -35,\ 0$$

5. Solve the equation another way. This time, use the multiplicative inverse of -35.

$-385 \times -\frac{1}{35} = \frac{385}{35} = 11$

$m = 11$

6. How many minutes will it take the submarine to reach an elevation of -385 yards?

11 minutes

Zaire starts her hike at an elevation of -150 feet. The trail ends at an elevation of 75 feet. She wants to determine the change in elevation from the start of the trail to the end of the trail.

7. What is Zaire's starting elevation? -150 ft

8. What is Zaire's ending elevation? +75 ft

9. What is the unknown in this story? the change in elevation

10. Write an addition equation to represent the situation. Use *d* to represent the trail's distance.

$-150 + d = 75$

11. Rewrite the equation as a related subtraction equation. Then solve.

$75 - (-150) = d$

$75 + 150 = d$

$225 = d$

12. What does your answer represent?
    a. Zaire's final elevation
    b. The rate Zaire hiked
    c. The distance Zaire hiked

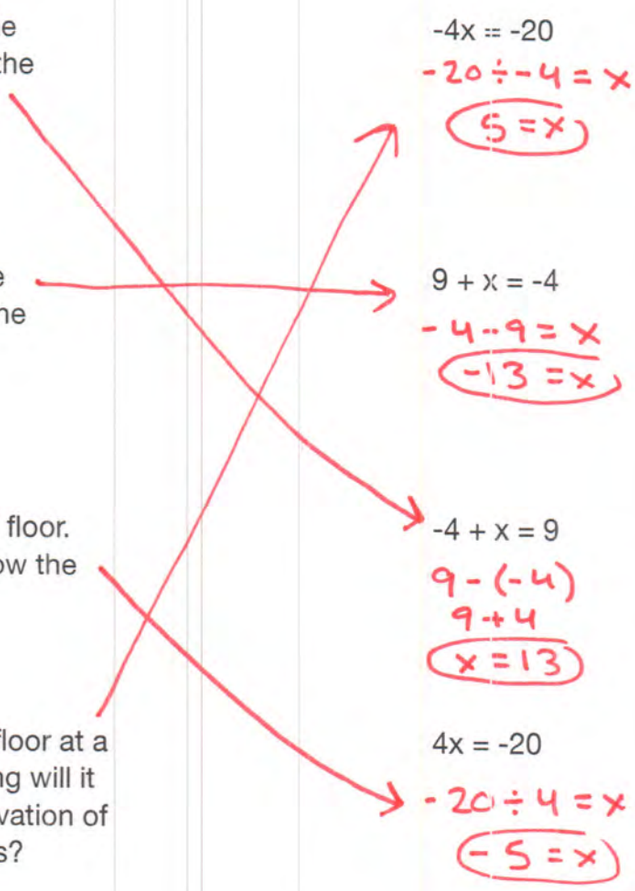
Match each equation to the situation to an equation. Then solve.

13. The temperature was -4 degrees in the morning, and it rose to 9 degrees by the afternoon. What is the change in temperature?

14. The temperature was 9 degrees in the morning, and it fell to -4 degrees by the afternoon. What is the change in temperature?

15. A turtle dives down toward the ocean floor. After 4 minutes, it was 20 meters below the surface. At what rate was it diving?

16. A barracuda dives toward the ocean floor at a rate of 4 meters per second. How long will it take the barracuda to get from an elevation of 0 meters to an elevation of -20 meters?



$-4x = -20$

$-20 \div -4 = x$

$5 = x$

$9 + x = -4$

$-4 - 9 = x$

$-13 = x$

$-4 + x = 9$

$9 - (-4)$

$9 + 4$

$x = 13$

$4x = -20$

$-20 \div 4 = x$

$-5 = x$

Name: KEY

1. **The temperature has been dropping 4 degrees Fahrenheit every hour. If the current temperature is -16 degrees, how many hours ago was the temperature at 0 degrees Fahrenheit?** Write and solve an equation. Explain what your variable represents.

$-4x = -16$

$-16 \div -4 = x$

$4 = x$

x = # of hours

2. **Mr. Angel is rock climbing. He begins at sea level and climbs up 7 feet every minute. How many minutes will it take Mr. Angel to reach an elevation of 140 feet?**

   a. Write an equation to represent the situation. Use x to represent the number of minutes.

   $7x = 140$

   b. Solve the equation.

   $140 \div 7 = x$

   $20 = x$

   c. Write an answer sentence explaining what your solution means in the context of the problem.

   It will take him 20 minutes to climb to an elevation of 140 feet.

3. **A falcon is soaring at an elevation of 300 feet. It descends to an elevation of -25 feet. What is the falcon's change in elevation?** Write and solve an equation to solve the problem. Include an answer sentence to explain what your solution means in the context of the problem.

$300 + x = -25$

$-25 - 300 = x$

$-325 = x$

The change in elevation is -325 feet.

4. **Match each equation to the situation to an equation. Then solve.**

An octopus dives at a rate of 5 feet per second. How long will it take for the octopus to get from the surface to an elevation of -30 feet?

$-5n = -30$

$-30 \div -5 = n$

$6 = n$

A squid dives toward the ocean floor, starting at sea level. After 5 minutes, the squid is 30 meters below sea level. At what rate was the squid diving?

$-12 + k = 1$

$1 - (-12) = k$

$1 + 12 = k$

$13 = k$

The temperature was -12 degrees and rose to 1 degree. What was the change in temperature?

$1 + k = -12$

$-12 - 1 = k$

$-13 = k$

The temperature was 1 degree and fell to -12 degrees. What was the change in temperature?

$5n = -30$

$-30 \div 5 = n$

$-6 = n$

G7 U4 Lesson 15

Use positive and negative numbers to represent directed change.

G7 U4 Lesson 15 - Students will use positive and negative numbers to represent directed change.

NOTE: It is appropriate to have students use a calculator for the computation in this lesson.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): I'm excited to work with you today, because this will be our final lesson in our unit about rational numbers. What are some things that stand out to you about what we've learned so far? Possible Student Answers, Key Points:

- We can represent temperature, elevation, money and other contexts using signed numbers.
- We can add and subtract signed numbers by using a number line.
- A negative number multiplied or divided by a negative number is positive. A negative number multiplied or divided by a positive number is negative.

We've learned so much! Today we'll tie everything we've been doing together with a few problems with varied contexts.

Let's Talk (Slide 3): Before we jump into solving problems, I'm curious. What do you already know or understand about stocks or the stock market? If you're unsure, can you use the image or the table to make some educated guesses? Possible Student Answers, Key Points:

- I've heard of the stock market on the news. I know stock prices go up and down.
- I'm not sure what stocks are. I think based on the pictures they involve money.
- People buy stocks in companies and they can earn money from them.

A stock is just a piece of a company that somebody can buy. When you buy stocks you own a small portion of the business. The price of the stock goes up and down depending on how the business is doing. People who own stocks are called shareholders, and many shareholders like to keep an eye on stock prices to see how their investment in the company is doing.

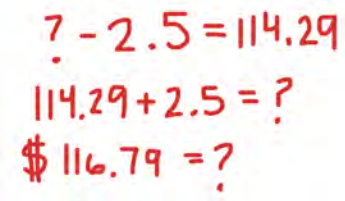
If you look at the table, you can see some information about a particular stock price. What do you notice from the table? Possible Student Answers, Key Points:

- I notice the stock is for Apple, the tech company.
- I notice the stock price increased from Day 1 to Day 2.
- I notice the table shows the change in price as a dollar amount and as a percent.

Some of our problems today will involve stock prices. You don't need to be a stock expert to solve the problems, and I can help answer questions you might have as we go. Let's look at our first problems.

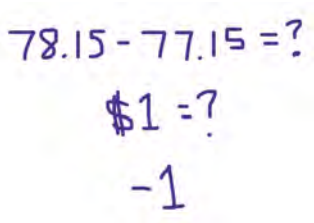
Let's Think (Slide 4): For this problem, we'll work to complete the table before answering two questions about the information in the table. Review the table for a moment, and tell me what you notice and wonder before we start doing any math. Possible Student Answers, Key Points:

- I notice the Apple information from the last slide. I also see Dell and Google.
- I notice Google shows a negative change, which makes me think their stock price went down.
- I notice the Dell stock price went down a dollar.

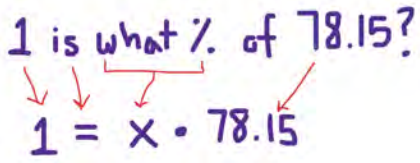


Let's start by finding the Day 1 price of the Google stock. I notice based on the other columns that the price of the stock decreased. The negative change in value makes that clear. That means the stock was higher, and it dropped a bit. *(write equation)* I can write the equation ? - 2.5 = 114.29 to represent that I don't know the starting price, but I know it dropped 2.5 dollars and ended up costing

$114.29. To solve the subtraction equation, I can write a related addition equation. I'll rewrite the equation as 114.29 + 2.5 = ? *(write related equation)*
Take a moment to add these two numbers. If you use vertical form, make sure to carefully line up each place value. Let me know when you find the unknown starting value. ($116.79) The Day 1 price of the Google stock was $116.79. *(fill the price in the blank on the chart)*



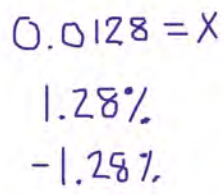
What's left to figure out in the chart? *(We need to find the change in price for the Dell stock.)* Let's find the change in price for the Dell stock by subtracting. *(write equation)* What is 78.15 minus 77.15? (1) Since the price *decreased* 1 dollar, I'll note that the change in dollar value was -1, and I'll fill that in the chart. *(write -1 in the corresponding blank on the chart)*



The last thing we need to determine is the percent change. We know the dollar value change was -1, so we need to determine what percent of the original price 1 represents. In other words I'm trying to think "1 is what percent of 78.15"? *(write that question out as shown)* We can write a matching equation by writing 1 = x • 78.15, where x is the unknown percent. *(write equations with arrows to show the corresponding parts of the question and the equation)*

We can write a related division equation to help us find the unknown in this multiplication equation. What related division equation can help us? How do you know? Possible Student Answers, Key Points:

- Instead of 1 = x • 78.15, I can write 1 ÷ 78.15 = x.
- I can think of 1 as the total product of x and 78.15. I can divide the total by the factor I know to find the unknown factor.



(write related division equation) When I divide 1 by 78.15, my calculator shows a long decimal number. We can think of x as being about 0.0128 if I round to the ten thousandths place. That's our percent change in decimal form. To think about this as a percent, I can multiply the decimal by 100 or think about each digit shifting two place values left. The price changed about 1.28%. I'll write -1.28% in the box on the chart, since I know the percent represents a decrease and not an increase.

COMPANY	DAY 1 VALUE ($)	DAY 2 VALUE ($)	CHANGE IN VALUE ($)	PERCENT CHANGE IN VALUE
Apple	106.5	112.75	6.25	5.87%
Google	116.79	114.29	-2.5	-2.14%
Dell	78.15	77.15	-1	-1.28%

The table is complete. Let's wrap up this section by answering the two questions. Both questions ask about magnitude, which we've seen before. Magnitude is simply the distance a value is from 0, regardless if whether the value is positive or negative. *(highlight all three values representing the change in dollars)* Which company's change in value has the greatest magnitude? How do you know? Possible Student Answers, Key Points:

- Apple has the greatest change in value, because 6.25 is farther from 0 than -2.5 and -1. Their value changed the most.

Apple's change in value is the greatest, because their stock price changed the most. 6.25 is the farthest value away from 0 of the three values.

(highlight all three values representing the percent change) Which company's percent change shows the smallest magnitude? How do you know? Possible Student Answers, Key Points:

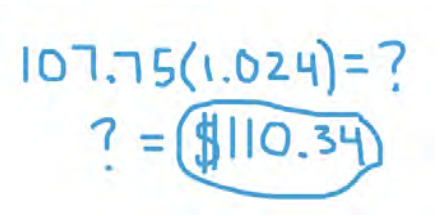
- Dell's percent change is the smallest. -1.28 is closest to 0 compared to the other values.

Dell's percent change has the smallest magnitude, because it's closer to 0 than the other percent change values. In other words, Dell's stock price changed the least.

We're becoming stock market experts! We just solved multiple problems involving the stock price of three major tech corporations.

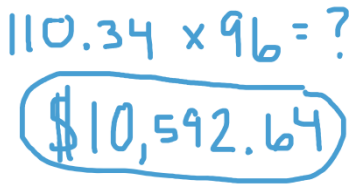
Let's Think (Slide 5): *(read the problem aloud)* We have some information about a stock price that we can now use to respond to a few prompts. The first question wants us to find the new price of a stock. We know the stock increased 2.4% from $107.75. That means the price will be 100% of $107.75 plus 2.4% more. I can think of the new price as being 100% + 2.4%, or 102.4%. How can I write 102.4% as a decimal, so that I can work with it in an equation? Possible Student Answers, Key Points:

- I can divide 102.4 by 100 to get 1.024.
- To convert a percent into a decimal, I can shift every digit two place values to the right.



If I want to find 102.4% of $107.75, I can multiply 107.75 by 1.024, which is the decimal equivalent to 102.4%. *(write equation)* If I plug that into my calculator, I get a new stock price of about $110.34. I did a little rounding to the nearest penny, just to make my answer look like a typical dollar amount.

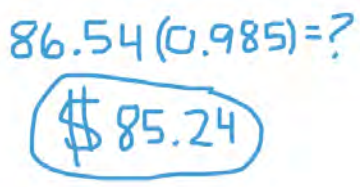
We just thought of an increase of 2.4% as 100% plus 2.4%. From there, we were able to use a decimal equivalent and multiplication to arrive at a stock price that was 2.4% more than the original.



Part B wants us to find the total cost of 96 shares of the new stock price. Assuming we have access to a calculator, how could I find the total cost of 96 shares? *(write and solve equation as student shares, supporting as needed)* Possible Student Answers, Key Points:

- I can multiply 110.34 by 96, since I'm buying 96 shares at that same share price. The product comes out to be 10592.64, which is $10,592.64.

If we multiply the cost of 1 new share, $110.34, by 96, we end up with a grand total of $10,592.64.



The last question wants us to consider a stock that decreases in value by 1.5%. So, the new stock won't be 100% of the price of the old stock. It will be 1.5% less. What is 1.5% less than 100%? (98.5%) The new stock price will be 98.5% of the old stock price. Let's use an equation to figure out the new stock price. What decimal value is equivalent to 98.5%? (0.985) I'll multiply the old price of the stock, $86.54, by the decimal equivalent of 98.5%. *(write equation)* If I use my calculator to compute, I see 85.2419. Why might that be an unusual answer? How can I make it better fit the context of this problem? Possible Student Answers, Key Points:

- It's unusual because money is only represented to the hundredths place, since the hundredths digit represents pennies.
- You can just round the answer to the nearest hundredth. A more reasonable answer would be $85.24.

We used our understanding of signed numbers along with our understanding of percents and decimal equivalents to respond to a variety of stock-related questions. Great work!

Let's Try it (Slides 6 - 7): Now let's try solving problems representing positive and negative change together. Later you're get a chance to try some on your own. Not every problem we see today will be about stocks, so we'll want to read the problem carefully to think about whether the change involved is best represented by a positive or a negative value. We'll also be dealing with percents in some problems, so we'll want to make sure we're careful when converting from decimal values to percents or vice versa. Let's try a few more out as we bring this unit to a close.

WARM WELCOME

Today we will use positive and negative numbers to represent directed change.

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Let's Talk:

What do you know about stocks and the stock market?

COMPANY	DAY 1 VALUE ($)	DAY 2 VALUE ($)	CHANGE IN VALUE ($)	PERCENT CHANGE IN VALUE
Apple	106.5	112.75	6.25	5.87%

Let's Think:

Complete the table.

COMPANY	DAY 1 VALUE ($)	DAY 2 VALUE ($)	CHANGE IN VALUE ($)	PERCENT CHANGE IN VALUE
Apple	106.5	112.75	6.25	5.87%
Google		114.29	-2.5	−2.14%
Dell	78.15	77.15		

A) Which company's change in value has the greatest magnitude?

B) Which company's percent change has the smallest magnitude?

Let's Think:

A company's old stock price was $107.75. The stock price increased +2.4%.

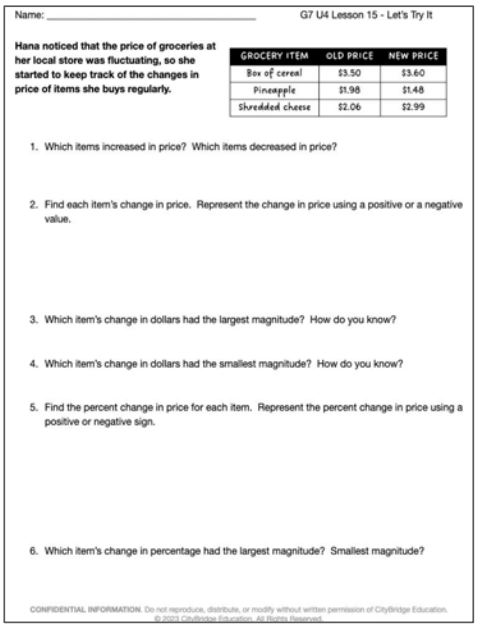
A) What is the new price of the stock?

B) What is the value of 96 shares at the new price?

C) Another company's old stock price was $86.54. The company experienced a -1.5% change in stock price. What is the new stock price?

Let's Try It:

Let's explore using positive and negative numbers to represent directed change together.

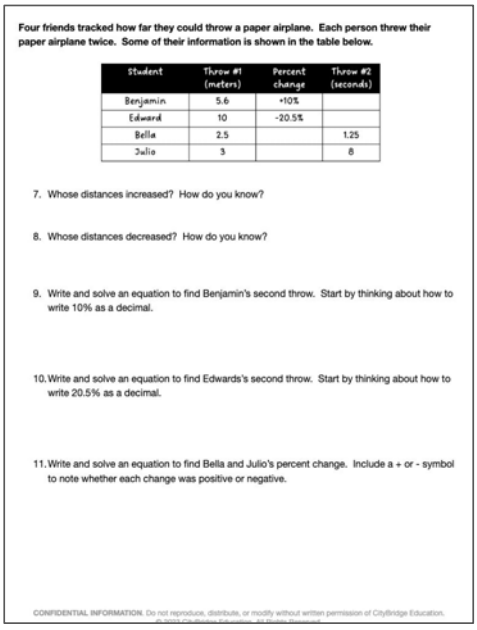


Name: _____ G7 U4 Lesson 15 - Let's Try It

Hana noticed that the price of groceries at her local store was fluctuating, so she started to keep track of the changes in price of items she buys regularly.

GROCERY ITEM	OLD PRICE	NEW PRICE
Box of cereal	$3.50	$3.60
Pineapple	$1.98	$1.48
Shredded cheese	$2.06	$2.99

1. Which items increased in price? Which items decreased in price?
2. Find each item's change in price. Represent the change in price using a positive or a negative value.
3. Which item's change in dollars had the largest magnitude? How do you know?
4. Which item's change in dollars had the smallest magnitude? How do you know?
5. Find the percent change in price for each item. Represent the percent change in price using a positive or negative sign.
6. Which item's change in percentage had the largest magnitude? Smallest magnitude?



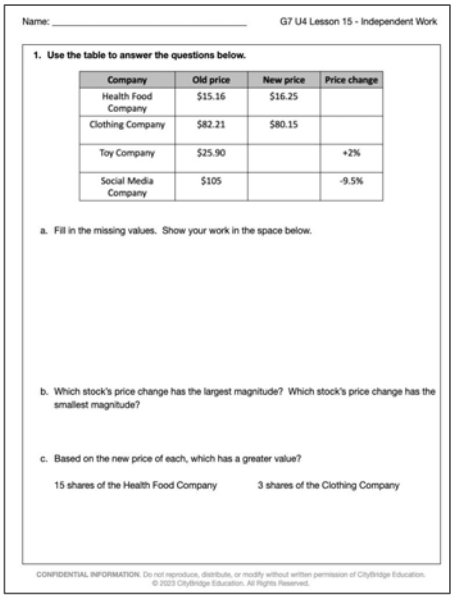
Four friends tracked how far they could throw a paper airplane. Each person threw their paper airplane twice. Some of their information is shown in the table below.

Student	Throw #1 (meters)	Percent change	Throw #2 (seconds)
Benjamin	5.6	+10%	
Edward	10	-20.5%	
Bella	2.5		1.25
Julio	3		8

7. Whose distances increased? How do you know?
8. Whose distances decreased? How do you know?
9. Write and solve an equation to find Benjamin's second throw. Start by thinking about how to write 10% as a decimal.
10. Write and solve an equation to find Edwards's second throw. Start by thinking about how to write 20.5% as a decimal.
11. Write and solve an equation to find Bella and Julio's percent change. Include a + or - symbol to note whether each change was positive or negative.

On your Own:

Now it's time to use negative numbers to represent directed change on your own.



Name: _____ G7 U4 Lesson 15 - Independent Work

1. Use the table to answer the questions below.

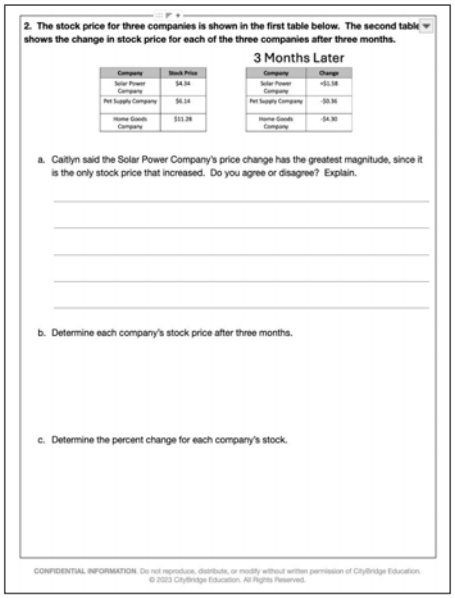
Company	Old price	New price	Price change
Health Food Company	$15.16	$16.25	
Clothing Company	$82.21	$80.15	
Toy Company	$25.90		+2%
Social Media Company	$105		-9.5%

a. Fill in the missing values. Show your work in the space below.

b. Which stock's price change has the largest magnitude? Which stock's price change has the smallest magnitude?

c. Based on the new price of each, which has a greater value?

15 shares of the Health Food Company 3 shares of the Clothing Company



2. The stock price for three companies is shown in the first table below. The second table shows the change in stock price for each of the three companies after three months.

3 Months Later

Company	Stock Price
Solar Power Company	$4.34
Pet Supply Company	$6.14
Home Goods Company	$11.28

Company	Change
Solar Power Company	+$1.58
Pet Supply Company	-$0.36
Home Goods Company	-$4.30

a. Caitlyn said the Solar Power Company's price change has the greatest magnitude, since it is the only stock price that increased. Do you agree or disagree? Explain.

b. Determine each company's stock price after three months.

c. Determine the percent change for each company's stock.

Hana noticed that the price of groceries at her local store was fluctuating, so she started to keep track of the changes in price of items she buys regularly.

GROCERY ITEM	OLD PRICE	NEW PRICE
Box of cereal	$3.50	$3.60
Pineapple	$1.98	$1.48
Shredded cheese	$2.06	$2.99

1. Which items increased in price? Which items decreased in price?

2. Find each item's change in price. Represent the change in price using a positive or a negative value.

3. Which item's change in dollars had the largest magnitude? How do you know?

4. Which item's change in dollars had the smallest magnitude? How do you know?

5. Find the percent change in price for each item. Represent the percent change in price using a positive or negative sign.

6. Which item's change in percentage had the largest magnitude? Smallest magnitude?

Four friends tracked how far they could throw a paper airplane. Each person threw their paper airplane twice. Some of their information is shown in the table below.

Student	Throw #1 (meters)	Percent change	Throw #2 (seconds)
Benjamin	5.6	+10%	
Edward	10	-20.5%	
Bella	2.5		1.25
Julio	3		8

7. Whose distances increased? How do you know?

8. Whose distances decreased? How do you know?

9. Write and solve an equation to find Benjamin's second throw. Start by thinking about how to write 10% as a decimal.

10. Write and solve an equation to find Edwards's second throw. Start by thinking about how to write 20.5% as a decimal.

11. Write and solve an equation to find Bella and Julio's percent change. Include a + or - symbol to note whether each change was positive or negative.

1. Use the table to answer the questions below.

Company	Old price	New price	Price change
Health Food Company	$15.16	$16.25	
Clothing Company	$82.21	$80.15	
Toy Company	$25.90		+2%
Social Media Company	$105		-9.5%

a. Fill in the missing values. Show your work in the space below.

b. Which stock's price change has the largest magnitude? Which stock's price change has the smallest magnitude?

c. Based on the new price of each, which has a greater value?

15 shares of the Health Food Company 3 shares of the Clothing Company

2. The stock price for three companies is shown in the first table below. The second table shows the change in stock price for each of the three companies after three months.

Company	Stock Price
Solar Power Company	$4.34
Pet Supply Company	$6.14
Home Goods Company	$11.28

3 Months Later

Company	Change
Solar Power Company	+$1.58
Pet Supply Company	-$0.36
Home Goods Company	-$4.30

a. Caitlyn said the Solar Power Company's price change has the greatest magnitude, since it is the only stock price that increased. Do you agree or disagree? Explain.

b. Determine each company's stock price after three months.

c. Determine the percent change for each company's stock.

Name: KEY

Hana noticed that the price of groceries at her local store was fluctuating, so she started to keep track of the changes in price of items she buys regularly.

GROCERY ITEM	OLD PRICE	NEW PRICE
Box of cereal	$3.50	$3.60
Pineapple	$1.98	$1.48
Shredded cheese	$2.06	$2.99

1. Which items increased in price? Which items decreased in price?

   box of cereal, shredded cheese

   pineapple

2. Find each item's change in price. Represent the change in price using a positive or a negative value.

   3.60 - 3.50 = ?

   +$0.10

   cereal

   1.98 - 1.48 = ?

   -$0.50

   pineapple

   2.99 - 2.06 = ?

   $0.93

   cheese

3. Which item's change in dollars had the largest magnitude? How do you know?

   The cheese is the farthest from 0.

4. Which item's change in dollars had the smallest magnitude? How do you know?

   The cereal is the closest to 0.

5. Find the percent change in price for each item. Represent the percent change in price using a positive or negative sign.

   cereal

   0.1 = x • 3.50

   0.1 ÷ 3.5 = x

   0.0286 ≈ x

   +2.86%

   pineapple

   0.5 = x • 1.98

   0.5 ÷ 1.98 = x

   0.2525 ≈ x

   -25.25%

   cheese

   0.93 = x • 2.06

   0.93 ÷ 2.06 = x

   0.4515 ≈ x

   +45.15%

6. Which item's change in percentage had the largest magnitude? Smallest magnitude?

   cheese

   cereal

Four friends tracked how far they could throw a paper airplane. Each person threw their paper airplane twice. Some of their information is shown in the table below.

Student	Throw #1 (meters)	Percent change	Throw #2 (seconds)
Benjamin	5.6	+10%	
Edward	10	-20.5%	
Bella	2.5		1.25
Julio	3		8

7. Whose distances increased? How do you know?

Ben → positive % change

Julio → increase from 3 to 8

8. Whose distances decreased? How do you know?

Edward → negative % change

Bella → decrease from 2.5 to 1.25

9. Write and solve an equation to find Benjamin's second throw. Start by thinking about how to write 10% as a decimal.

$5.6 \times 1.10 = ?$

(6.16 sec.)

10. Write and solve an equation to find Edwards's second throw. Start by thinking about how to write 20.5% as a decimal.

$10 \times 0.795 = ?$

(7.95 sec)

11. Write and solve an equation to find Bella and Julio's percent change. Include a + or - symbol to note whether each change was positive or negative.

[B]

$2.5 - 1.25 = 1.25$

$1.25 = x \cdot 2.5$

$1.25 \div 2.5 = x$

$0.5 = x$

(-50%)

[J]

$8 - 3 = 5$

$5 = x \cdot 3$

$5 \div 3 = x$

$x \approx 1.67$

(+167%)

Name: KEY

1. **Use the table to answer the questions below.**

Company	Old price	New price	Price change
Health Food Company	$15.16	$16.25	+7.19 %
Clothing Company	$82.21	$80.15	-2.51 %
Toy Company	$25.90	$26.42	+2%
Social Media Company	$105	$95.03	-9.5%

a. Fill in the missing values. Show your work in the space below.

$16.25 - 15.16 = 1.09$

$1.09 = x \cdot 15.16$

$1.09 \div 15.16 = x$

$0.0719 \approx x$

$+7.19\%$

$82.21 - 80.15 = 2.06$

$2.06 = x \cdot 82.21$

$2.06 \div 82.21 = x$

$0.0251 \approx x$

-2.51%

$25.9 \times 1.02 = x$

$26.42 \approx x$

$105 \times 0.905 = x$

$95.03 \approx x$

b. Which stock's price change has the largest magnitude? Which stock's price change has the smallest magnitude?

Social Media Company

Toy Company

c. Based on the new price of each, which has a greater value?

15 shares of the Health Food Company

$15(16.25) = ?$

$\$243.75$

3 shares of the Clothing Company

$3(80.15) = ?$

$\$240.45$

2. The stock price for three companies is shown in the first table below. The second table shows the change in stock price for each of the three companies after three months.

Company	Stock Price
Solar Power Company	$4.34
Pet Supply Company	$6.14
Home Goods Company	$11.28

3 Months Later

Company	Change
Solar Power Company	+$1.58
Pet Supply Company	-$0.36
Home Goods Company	-$4.30

a. Caitlyn said the Solar Power Company's price change has the greatest magnitude, since it is the only stock price that increased. Do you agree or disagree? Explain.

I disagree. I can think of magnitude as distance from 0. The Home Good's company has the greatest magnitude.

b. Determine each company's stock price after three months.

SP
4.34
+1.58
$5.92

PS
5 10 14
6.14
-0.36
$5.78

HG
10 12
11.28
- 4.30
$6.98

c. Determine the percent change for each company's stock.

SP
$1.58 = x \cdot 4.34$
$1.58 \div 4.34 = x$
$0.3641 \approx x$
36.41%

PS
$0.36 = x \cdot 6.14$
$0.36 \div 6.14 = x$
$0.0586 \approx x$
-5.86%

HG
$4.3 = x \cdot 11.28$
$4.3 \div 11.28 = x$
$0.3812 \approx x$
-38.12%