Grade 8 - Unit 3 - Linear Relationships

L1 - Understanding Proportional Relationships
- Remember that y/x is called the constant of proportionality, k.
- Remember that a graph representing a proportional relationship is a line through (0,0) and (1,k).
- Graph a proportional relationship from a verbal description.

L2 - Graphs of Proportional Relationships
- Graph a proportional relationship from an equation.
- Identify the same proportional relationship graphed using differently scaled axes.

L3 - Representing Proportional Relationships
- Connect how the constant of proportionality is expressed in different representations of proportional relationships.
- Scale and label a coordinate axes before graphing a proportional relationship.

L4 - Comparing Proportional Relationships
- Compare two different proportional relationships, given different representations of them.

L5 - Introduction to Linear Relationships
- Understand that there are linear relationships that are not proportional.
- Recognize that the rate of change of the linear relationship is the same value as the slope of the graph of the relationship.

L6 - More Linear Relationships
- Identify and interpret the positive vertical intercept of the graph of a linear relationship.

L7 - Representations of Linear Relationships
- Develop a procedure for calculating slope based on coordinates of two points.
- Write an equation for a linear relationship by expressing regularity in repeated reasoning.

L8 - Translating to y=mx+b
- Derive y=mx+b by graphing y=mx and the same graph shifted up using the translation that takes (0,0) to (0,b).
- Connect y=b+mx and y=mx+b equation to the graph generally.
- Encounter a graph where the y-intercept is a negative value.
- Connect features of the equation y=b+mx to the graph.

L9 - Slopes Don't Have to be Positive
- Understand the difference in visual appearance between lines with positive slopes, lines with negative slopes, and lines with zero slope.
- Interpret a line with a negative slope that represents a real-world situation.

L10 - Calculating Slope
- Calculate negative slope values.
- Describe the graph of a line with enough precision that another student can draw the line.

L11 - Equations of All Kinds of Lines
- Write equations of horizontal and vertical lines.
- Write equations of lines that have a negative slope.
- Reason about the graphical representation of a mathematical situation.

(Continued on the next page.)

L12 - Solutions to Linear Equations

- Understand that linear equations don't always look like y=mx+b.
- Understand the graph of an equation is a visual representation of the set of all solutions to an equation.
- Define a "solution" to an equation in two variables.

L13 - More Solutions to Linear Equations
- Understand the graph of an equation is a visual representation of the set of all solutions to an equation.
- Notice features of equations that can make one variable easier or harder to solve for.

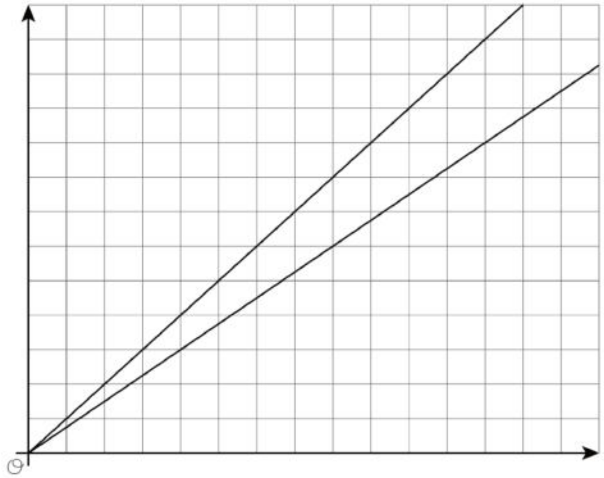
L14 - Using Linear Relations to Solve Problems
- Recognize that solutions to linear equations may be limited based on real-world constraints on the quantities.
- Solve and interpret solutions in contexts using multiple representations of non-proportional linear relationships.

Lessons 1-4: Proportional Relationships

Lesson 1: Understanding Proportional Relationships

Lesson 1 Summary

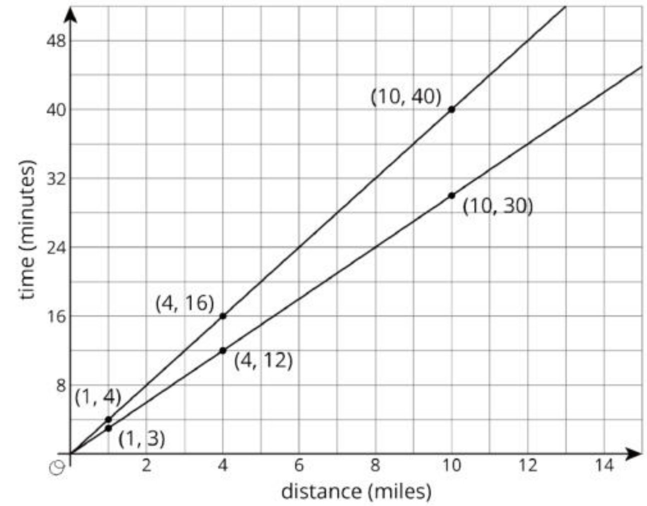
Graphing is a way to help us make sense of relationships. But the graph of a line on a coordinate axes without scale or labels isn't very helpful. For example, let's say we know that on longer bike rides Kiran can ride 4 miles every 16 minutes and Mai can ride 4 miles every 12 minutes. Here are the graphs of these relationships:



Without labels we can't even tell which line is Kiran and which is Mai! Without labels and a scale on the axes, we can't use these graphs to answer questions like:

1. Which graph goes with which rider?
2. Who rides faster?
3. If Kiran and Mai start a bike trip at the same time, how far are they after 24 minutes?
4. How long will it take each of them to reach the end of the 12 mile bike path?

Here are the same graphs, but now with labels and scale:



Revisiting the questions from earlier:

1. Which graph goes with each rider? If Kiran rides 4 miles in 16 minutes, then the point $(4, 16)$ is on his graph. If he rides for 1 mile, it will take 4 minutes. 10 miles will take 40 minutes. So the upper graph represents Kiran's ride. Mai's points for the same distances are $(1, 3)$, $(4, 12)$, and $(10, 30)$, so hers is the lower graph. (A letter next to each line would help us remember which is which!)
2. Who rides faster? Mai rides faster because she can ride the same distance as Kiran in a shorter time.
3. If Kiran and Mai start a bike trip at the same time, how far are they after 20 minutes? The points on the graphs at height 20 are 5 miles for Kiran and a little less than 7 miles for Mai.
4. How long will it take each of them to reach the end of the 12 mile bike path? The points on the graphs at a horizontal distance of 12 are 36 minutes for Mai and 48 minutes for Kiran. (Kiran's time after 12 miles is almost off the grid!)

(Cool Down is on the next page.)

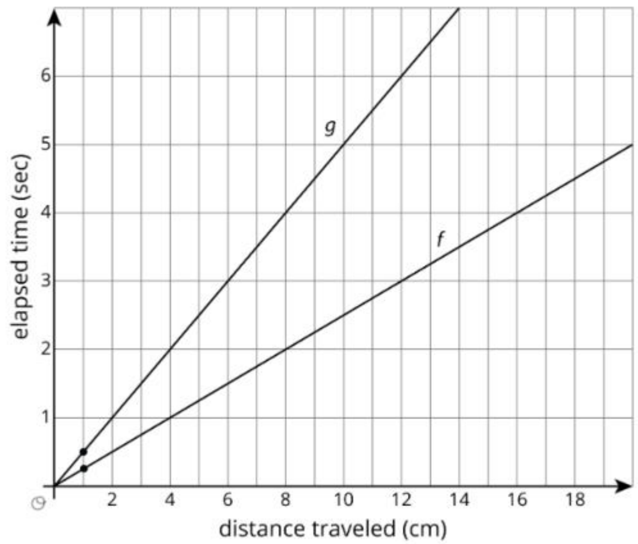
COOL-DOWN: 5 minutes

1.4: Turtle Race

CCSS Standards: Building on	• 7.RP.A.2
CCSS Standards: Building towards	• 8.EE.B.5

Student-Facing Task Statement

This graph represents the positions of two turtles in a race.



1. On the same axes, draw a line for a third turtle that is going half as fast as the turtle described by line g.

2. Explain how your line shows that the turtle is going half as fast.

Student Response

1. A line through $(0, 0)$, $(1, 1)$, $(2, 2)$, etc.

2. Looking at the values for 2 seconds, turtle g moves 4 cm and the third turtle moves only 2 cm. This third turtle covers half the distance in the same amount of time.

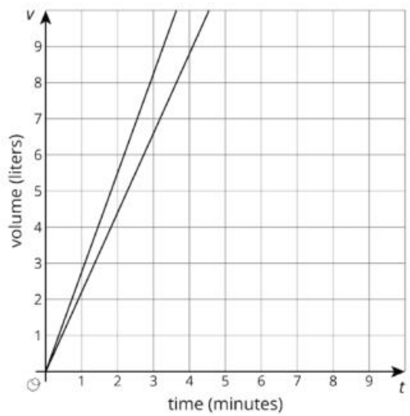
Lesson 2: Graphs of Proportional Relationships

Lesson 2 Summary

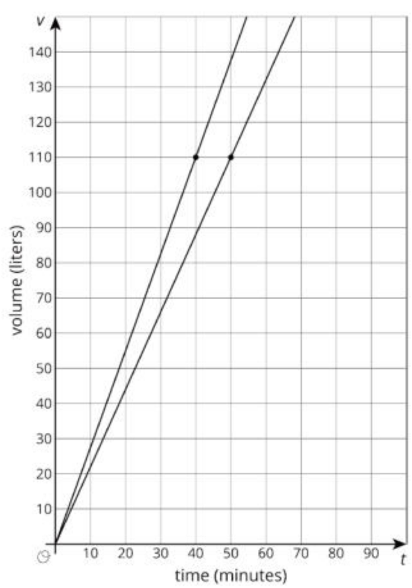
The scales we choose when graphing a relationship often depend on what information we want to know. For example, say two water tanks are filled at different constant rates. The relationship between time in minutes t and volume in liters v of tank A is given by $v = 2.2t$. For tank B the relationship is $v = 2.75t$.

These equations tell us that tank A is being filled at a constant rate of 2.2 liters per minute and tank B is being filled at a constant rate of 2.75 liters per minute.

If we want to use graphs to see at what times the two tanks will have 110 liters of water, then using an axis scale from 0 to 10, as shown here, isn't very helpful.



If we use a vertical scale that goes to 150 liters, a bit beyond the 110 we are looking for, and a horizontal scale that goes to 100 minutes, we get a much more useful set of axes for answering our question.



Now we can see that the two tanks will reach 110 liters 10 minutes apart—tank B after 40 minutes of filling and tank A after 50 minutes of filling.

It is important to note that both of these graphs are correct, but one uses a range of values that helps answer the question. In order to always pick a helpful scale, we should consider the situation and the questions asked about it.

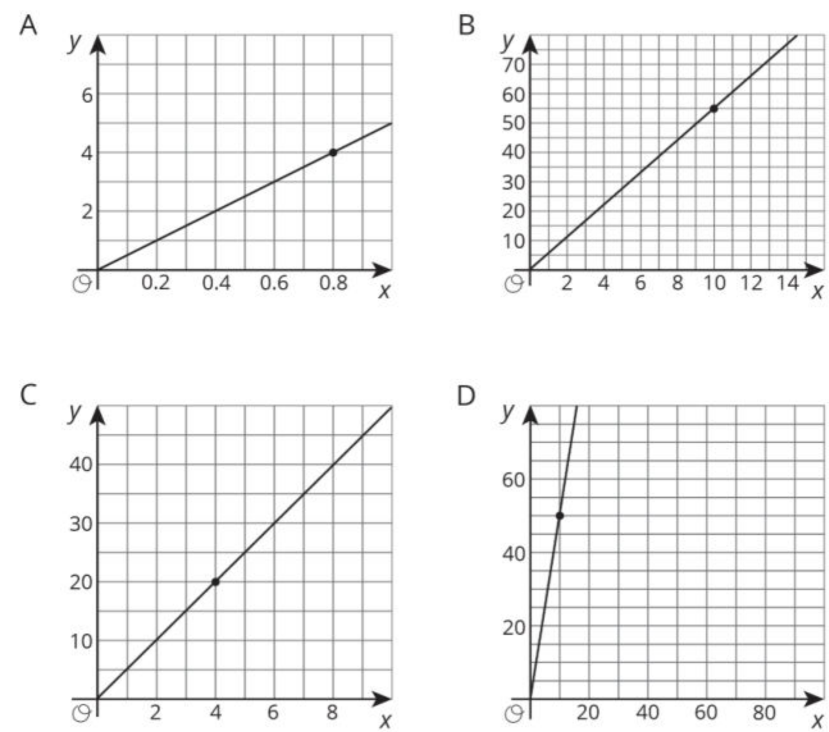
COOL-DOWN: 5 minutes

2.4: Different Axes

CCSS Standards: Addressing	• 8.EE.B
CCSS Standards: Building towards	• 8.EE.B.5

Student-Facing Task Statement

Which one of these relationships is different than the other three? Explain how you know.



Student Response

Answers vary. Sample response: Graphs A, C, and D are all representations of $y = 5x$. Graph B is a representation of $y = 5.5x$.

Lesson 3: Representing Proportional Relationships

Lesson 3 Summary

Proportional relationships can be represented in multiple ways. Which representation we choose depends on the purpose. And when we create representations we can choose helpful values by paying attention to the context. For example, a stew recipe calls for 3 carrots for every 2 potatoes. One way to represent this is using an equation. If there are p potatoes and c carrots, then $c = \frac{3}{2}p$.

Suppose we want to make a large batch of this recipe for a family gathering, using 150 potatoes. To find the number of carrots we could just use the equation: $\frac{3}{2} \cdot 150 = 225$ carrots.

Now suppose the recipe is used in a restaurant that makes the stew in large batches of different sizes depending on how busy a day it is, using up to 300 potatoes at at time. Then we might make a graph to show how many carrots are needed for different amounts of potatoes. We set up a pair of coordinate axes with a scale from 0 to 300 along the horizontal axis and 0 to 450 on the vertical axis, because $450 = \frac{3}{2} \cdot 300$. Then we can read how many carrots are needed for any number of potatoes up to 300.

COOL-DOWN: 5 minutes

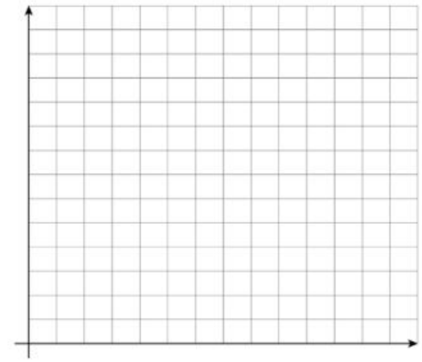
3.4: Graph the Relationship

CCSS Standards: Addressing	• 8.EE.B.5

Student-Facing Task Statement

Sketch a graph that shows the relationship between grams of honey and grams of salt needed for a bakery recipe. Show on the graph how much honey is needed for 70 grams of salt.

salt (g)	honey (g)	flour (c)
10	14	4
25	35	10



Student Response

Answers vary. Possible graph: Label each axis from 0 to 140. For grams of salt on the horizontal axis and grams of honey on the vertical, the points $(0,0)$, $(10,14)$, and $(70,98)$.

Lesson 4: Comparing Proportional Relationships

Lesson 4 Summary

When two proportional relationships are represented in different ways, we compare them by finding a common piece of information.

For example, Clare's earnings are represented by the equation $y = 14.5x$, where y is her earnings in dollars for working x hours.

The table shows some information about Jada's pay.

Who is paid at a higher rate per hour? How much more does that person have after 20 hours?

time worked (hours)	earnings (dollars)
7	92.75
4.5	59.63
37	490.25

In Clare's equation we see that the constant of proportionality relating her earnings to time worked is 14.50. This means that she earns $14.50 per hour.

We can calculate Jada's constant of proportionality by dividing a value in the earnings column by a value in the same row in the time worked column. Using the last row, the constant of proportionality for Jada is 13.25, since $490.25 \div 37 = 13.25$. An equation representing Jada's earnings is $y = 13.25x$. This means she earns $13.25 per hour.

So Clare is paid at a higher rate than Jada. Clare earns $1.25 more per hour than Jada, which means that after 20 hours of work, she has $20 \cdot \$1.25 = \$25$ more than Jada.

COOL-DOWN: 5 minutes

4.3: Different Salt Mixtures

CCSS Standards: Addressing	• 8.EE.B.5

Student-Facing Task Statement

Here are recipes for two mixtures of salt and water that taste different.

Information about Salt Mixture A is shown in the table.

salt (teaspoons)	water (cups)
4	5
7	$8\frac{3}{4}$
9	$11\frac{1}{4}$

Salt Mixture B is defined by the equation $y = 2.5x$, where x is the number of teaspoons of salt and y is the number of cups of water.

1. If you used 10 cups of water, which mixture would use more salt? How much more? Explain or show your reasoning.
2. Which mixture tastes saltier? Explain how you know.

Student Response

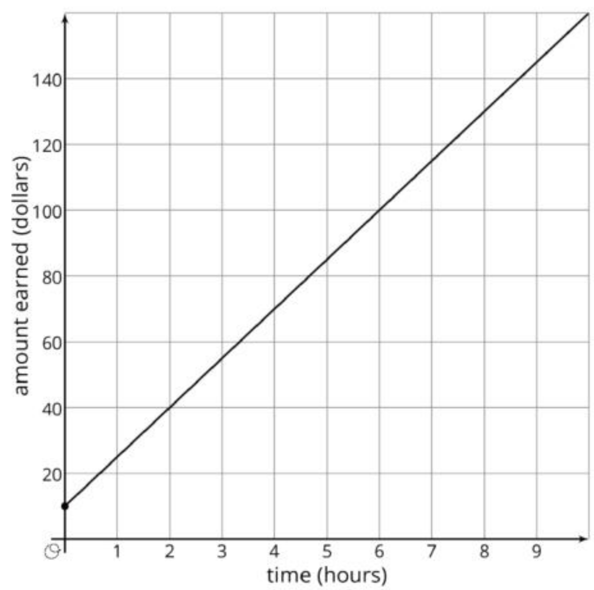
1. Mixture A uses 4 more teaspoons of salt than Mixture B. Mixture A would use 8 teaspoons of salt because I can double the row with 4 and 5 to get 8 and 10. Mixture B would use 4 teaspoons of salt because considering if $10 = 2.5x$, the value of x must be 4.
2. Mixture A tastes saltier because it uses more salt for the same amount of water. Mixture A uses 1.25 cups of water per teaspoon of salt while Mixture B uses 2.5 cups of water per teaspoon of salt.

Lessons 5-8: Representing Linear Relationships

Lesson 5: Introduction to Linear Relationships

Lesson 5 Summary

Andre starts babysitting and charges $10 for traveling to and from the job, and $15 per hour. For every additional hour he works he charges another $15. If we graph Andre's earnings based on how long he works, we have a line that starts at $10 on the vertical axis and then increases by $15 each hour. A **linear relationship** is any relationship between two quantities where one quantity has a constant **rate of change** with respect to the other.



We can figure out the rate of change using the graph. Because the rate of change is constant, we can take any two points on the graph and divide the amount of vertical change by the amount of horizontal change. For example, take the points $(2, 40)$ and $(6, 100)$. They mean that Andre earns $40 for working 2 hours and $100 for working 6 hours. The rate of change is $\frac{100-40}{6-2} = 15$ dollars per hour. Andre's earnings go up $15 for each hour of babysitting. Notice that this is the same way we calculate the **slope** of the line. That's why the graph is a line, and why we call this a linear relationship. The rate of change of a linear relationship is the same as the slope of its graph.

With proportional relationships we are used to graphs that contain the point $(0, 0)$. But proportional relationships are just one type of linear relationship. In the following lessons, we will continue to explore the other type of linear relationship where the quantities are not both 0 at the same time.

Lesson 5 Glossary Terms

- slope
- rate of change
- linear relationship

COOL-DOWN: 5 minutes

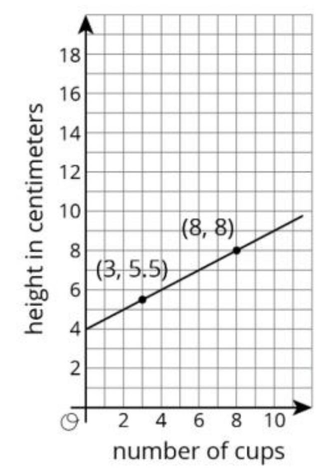
5.4: Stacking More Cups

CCSS Standards: Addressing	• 8.EE.B

Students apply what they have learned about graphing a non-proportional relationship to another stack of cups that are different in size from those analyzed in the activities.

Student-Facing Task Statement

A shorter style of cup is stacked tall. The graph displays the height of the stack in centimeters for different numbers of cups. How much does each cup after the first add to the height of the stack? Explain how you know.



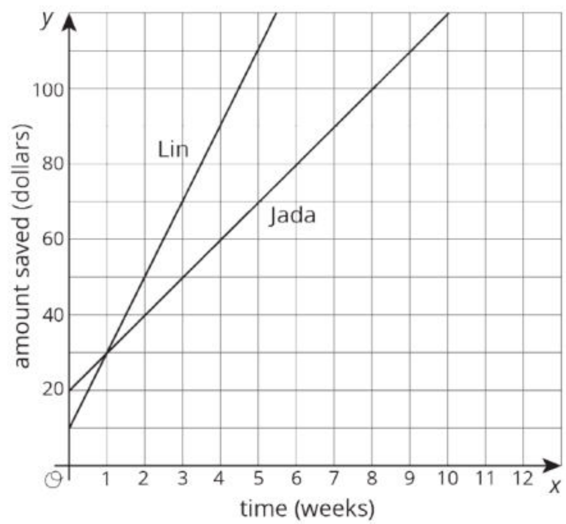
Student Response

0.5 cm (or equivalent). Since 5 cups add 2.5 cm to the height of the stack, each cup adds 0.5 cm.

Lesson 6: More Linear Relationships

Lesson 6 Summary

At the start of summer break, Jada and Lin decide to save some of the money they earn helping out their neighbors to use during the school year. Jada starts by putting \$20 into a savings jar in her room and plans to save \$10 a week. Lin starts by putting \$10 into a savings jar in her room plans to save \$20 a week. Here are graphs of how much money they will save after 10 weeks if they each follow their plans:



The value where a line intersects the vertical axis is called the **vertical intercept**. When the vertical axis is labeled with a variable like y, this value is also often called the *y-intercept*. Jada's graph has a vertical intercept of \$20 while Lin's graph has a vertical intercept of \$10. These values reflect the amount of money they each started with. At 1 week they will have saved the same amount, \$30. But after week 1, Lin is saving more money per week (so she has a larger rate of change), so she will end up saving more money over the summer if they each follow their plans.

Lesson 6 Glossary Terms

- vertical intercept

COOL-DOWN: 5 minutes

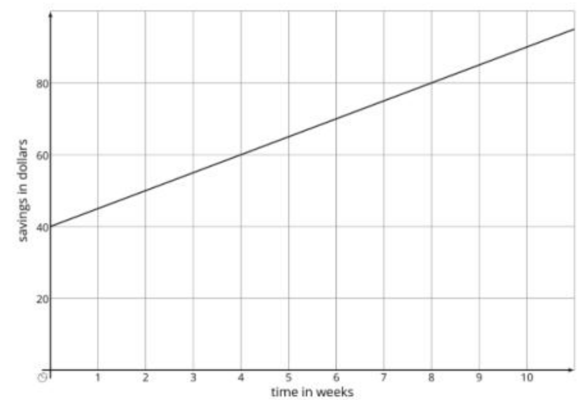
6.4: Savings

CCSS Standards: Addressing	• 8.EE.B.5

Student-Facing Task Statement

The graph shows the savings in Andre's bank account.

1. What is the slope of the line?
2. What is the meaning of the slope in this situation?



Student Response

1. 5
2. Andre saves 5 dollars every week.

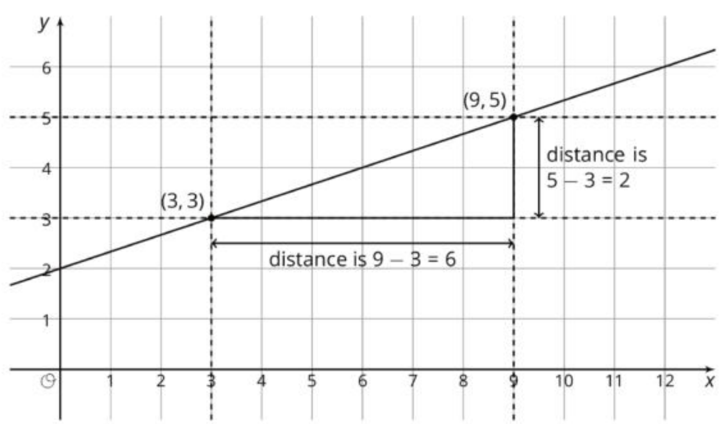
Lesson 7: Representations of Linear Relationships

Lesson 7 Summary

Let's say we have a glass cylinder filled with 50 ml of water and a bunch of marbles that are 3 ml in volume. If we drop marbles into the cylinder one at a time, we can watch the height of the water increase by the same amount, 3 ml, for each one added. This constant rate of change means there is a linear relationship between the number of marbles and the height of the water. Add one marble, the water height goes up 3 ml. Add 2 marbles, the water height goes up 6 ml. Add x marbles, the water height goes up $3x$ ml.

Reasoning this way, we can calculate that the height, y, of the water for x marbles is $y = 3x + 50$. Any linear relationships can be expressed in the form $y = mx + b$ using just the rate of change, m, and the initial amount, b. The 3 represents the rate of change, or slope of the graph, and the 50 represents the initial amount, or vertical intercept of the graph. We'll learn about some more ways to think about this equation in future lessons.

Now what if we didn't have a description to use to figure out the slope and the vertical intercept? That's okay so long as we can find some points on the line! For the line graphed here, two of the points on the line are $(3, 3)$ and $(9, 5)$ and we can use these points to draw in a slope triangle as shown:



The slope of this line is the quotient of the length of the vertical side of the slope triangle and the length of the horizontal side of the slope triangle. So the slope, m, is $\frac{\text{vertical change}}{\text{horizontal change}} = \frac{2}{6} = \frac{1}{3}$. We can also see from the graph that the vertical intercept, b, is 2. Putting these together, we can say that the equation for this line is $y = \frac{1}{3}x + 2$.

COOL-DOWN: 5 minutes

7.4: Graphing a Line

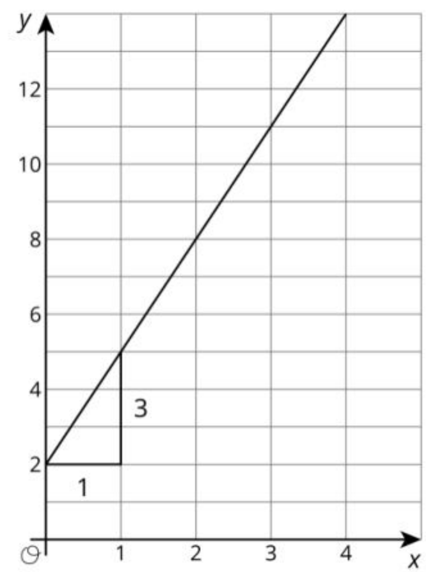
CCSS Standards: Addressing	• 8.EE.B.6

Student-Facing Task Statement

Make a sketch of a linear relationship with slope of 3 that is not a proportional relationship. Show how you know that the slope is 3. Write an equation for the line.

Student Response

Answers vary. Sample response:



The slope triangle has vertical side length 3 and horizontal side length 1, so the slope of the line is 3.

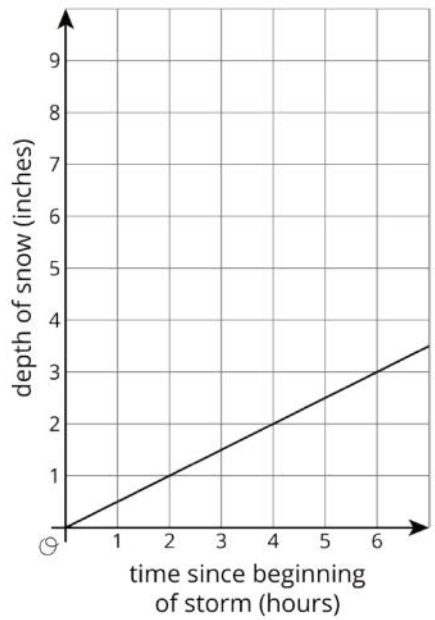
$y = 3x + 2$

Lesson 8: Translating Into *y = mx + b*

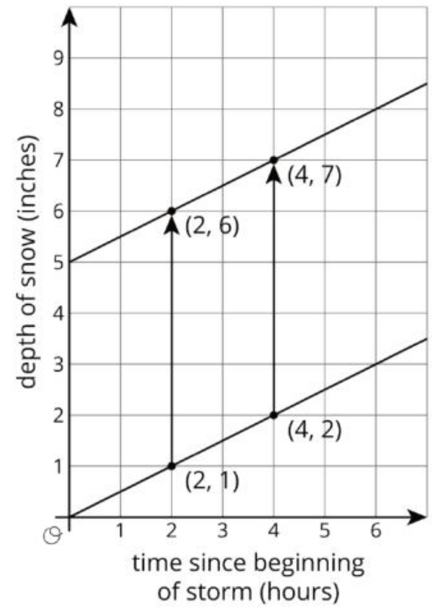
Lesson 8 Summary

During an early winter storm, the snow fell at a rate of $\frac{1}{2}$ inches per hour. We can see the rate of change, $\frac{1}{2}$, in both the equation that represents this storm, $y = \frac{1}{2}x$, and in the slope of the line representing this storm.

In addition to being a linear relationship between the time since the beginning of the storm and the depth of the snow, we can also call this as a proportional relationship since the depth of snow was 0 at the beginning of the storm.



During a mid-winter storm, the snow again fell at a rate of $\frac{1}{2}$ inches per hour, but this time there was already 5 inches of snow on the ground. We can graph this storm on the same axes as the first storm by taking all the points on the graph of the first storm and translating them up 5 inches.



2 hours after each storm begins, 1 inch of new snow has fallen. For the first storm, this means there is now 1 inch of snow on the ground. For the second storm, this means there are now 6 inches of snow on the ground. Unlike the first storm, the second is not a proportional relationship since the line representing the second storm has a vertical intercept of 5. The equation representing the storm, $y = \frac{1}{2}x + 5$, is of the form $y = mx + b$, where m is the rate of change, also the slope of the graph, and b is the initial amount, also the vertical intercept of the graph.

(Cool Down is on the next page.)

COOL-DOWN: 5 minutes

8.4: Similarities and Differences in Two Lines

CCSS Standards: Addressing	• 8.EE.B

Student-Facing Task Statement

Describe how the graph of $y = 2x$ is the same and different from the graph of $y = 2x - 7$. Explain or show your reasoning.

Student Response

Answers vary. Students may or may not sketch graphs as part of their solution.

Possible responses to how they are the same:

- They have the same slope.
- They both have a slope of 2.
- They are parallel to each other.

Possible responses to how they are different:

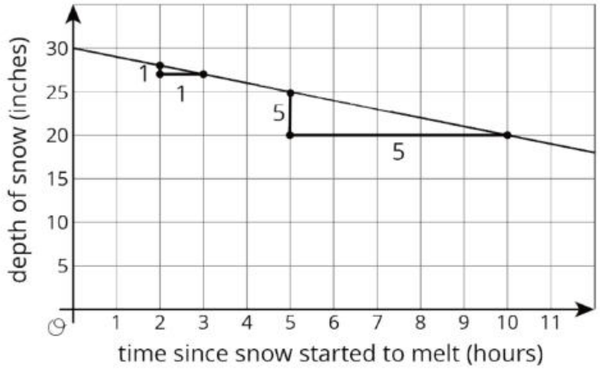
- They are in a different location.
- One is a translation of the other.
- They cross the y-axis (or x-axis) at a different point.
- They don't go through any of the same points.

Lessons 9-11: Finding Slopes

Lesson 9: Slopes Don't Have to be Positive

Lesson 9 Summary

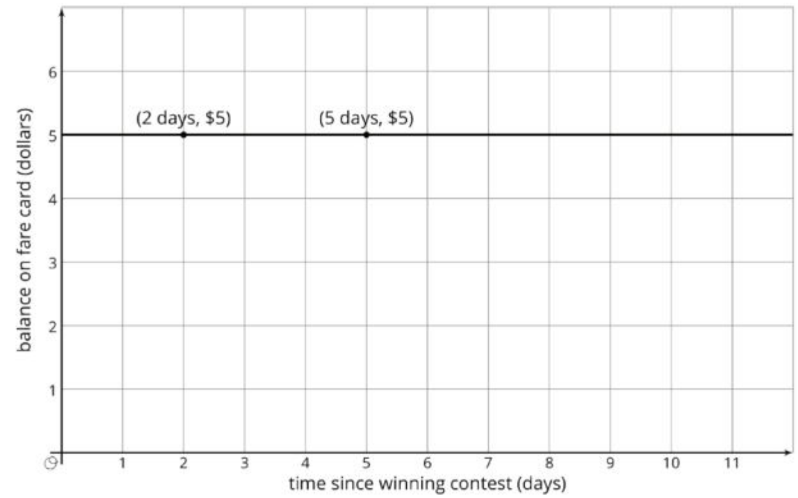
At the end of winter in Maine, the snow on the ground was 30 inches deep. Then there was a particularly warm day and the snow melted at the rate of 1 inch per hour. The graph shows the relationship between the time since the snow started to melt and the depth of the snow.



The slope of the graph is -1 since the rate of change is -1 inch per hour. That is, the depth goes *down* 1 inch per hour. The vertical intercept is 30 since the snow was 30 inches deep when the warmth started to melt the snow. The two slope triangles show how the rate of change is constant. It just also happens to be negative in this case since after each hour that passes, there is 1 inch *less* snow.

Graphs with negative slope often describe situations where some quantity is decreasing over time, like the depth of snow on warm days or the amount of money on a fare card being used to take rides on buses.

Slopes can be positive, negative, or even zero! A slope of 0 means there is no change in the y-value even though the x-value may be changing. For example, Elena won a contest where the prize was a special pass that gives her free bus rides for a year. Her fare card had $5 on it when she won the prize. Here is a graph of the amount of money on her fare card after winning the prize:



The vertical intercept is 5, since the graph starts when she has $5 on her fare card. The slope of the graph is 0 since she doesn't use her fare card for the next year, meaning the amount on her fare card doesn't change for a year. In fact, all graphs of linear relationships with slopes equal to 0 are horizontal—a rate of change of 0 means that, from one point to the next, the y-values remain the same.

(Cool Down is on the next page.)

COOL-DOWN: 5 minutes

9.5: The Slopes of Graphs

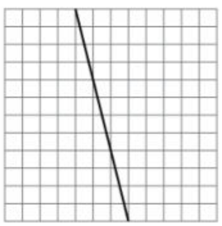
CCSS Standards: Addressing	• 8.EE.B

Student-Facing Task Statement

Each square on a grid represents 1 unit on each side.

1. Calculate the slope of graph D. Explain or show your reasoning.
2. Calculate the slope of graph E. What situation could the graph represent?
3. On the blank grid, draw a line that passes through the indicated point and has slope -2.

D



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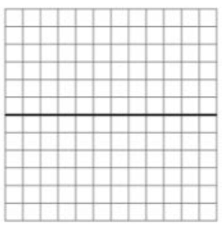

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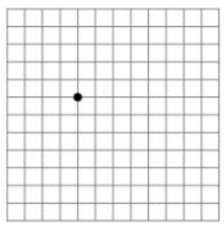


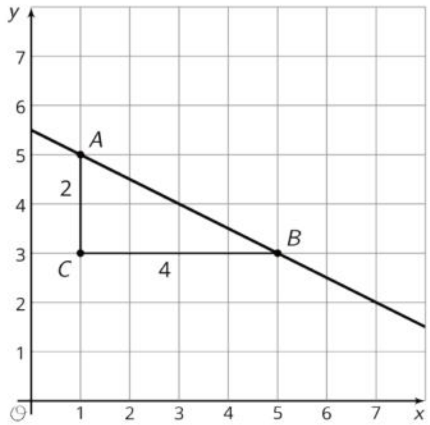
Student Response

1. -4. Explanations vary. Sample explanation: for each horizontal change of 1, the vertical change is -4, so the slope of the line is -4.
2. 0. Responses vary. Sample response: The amount of rainfall on a day with no rain.
3. A graph through the indicated point with a slope of -2.

<u>Lesson 10: Calculating Slope</u>

Lesson 10 Summary

We learned earlier that one way to find the slope of a line is by drawing a slope triangle. For example, using the slope triangle shown here, the slope of the line is $-\frac{2}{4}$, or $-\frac{1}{2}$ (we know the slope is negative because the line is decreasing from left to right).



But slope triangles are only one way to calculate the slope of a line. Let's compute the slope of this line a different way using just the points $A = (1, 5)$ and $B = (5, 3)$. Since we know the slope is the vertical change divided by the horizontal change, we can calculate the change in the y-values and then the change in the x-values. Between points A and B, the y-value change is $3 - 5 = -2$ and the x-value change is $5 - 1 = 4$. This means the slope is $-\frac{2}{4}$, or $-\frac{1}{2}$, which is the same as what we found using the slope triangle.

Notice that in each of the calculations, We subtracted the value from point A from the value from point B. If we had done it the other way around, then the y-value change would have been $5 - 3 = 2$ and the x-value change would have been $1 - 5 = -4$, which still gives us a slope of $-\frac{1}{2}$. But what if we were to mix up the orders? If that had happened, we would think the slope of the line is *positive* $\frac{1}{2}$ since we would either have calculated $\frac{-2}{-4}$ or $\frac{2}{4}$. Since we already have a graph of the line and can see it has a negative slope, this is clearly incorrect. It we don't have a graph to check our calculation, we could think about how the point on the left, $(1, 5)$, is higher than the point on the right, $(5, 3)$, meaning the slope of the line must be negative.

COOL-DOWN: 5 minutes

10.4: Different Slopes

CCSS Standards: Addressing	• 8.EE.B.6

Students calculate the slope of the line through two points. They are only given the coordinates of the points and are specifically directed not to graph the line. By now, students should have internalized an efficient method for finding slope using the coordinates of two points on the line.

Student-Facing Task Statement

Without graphing, find the slope of the line that goes through

1. $(0, 5)$ and $(8, 2)$.
2. $(2, -1)$ and $(6, 1)$.
3. $(-3, -2)$ and $(-1, -5)$.

Student Response

1. $\frac{-3}{8}$
2. $\frac{1}{2}$
3. $\frac{-3}{2}$

Lesson 11: Equations of All Kinds of Lines

Lesson 11 Summary

Horizontal lines in the coordinate plane represent situations where the y value doesn't change at all while the x value changes. For example, the horizontal line that goes through the point $(0, 13)$ can be described in words as "for all points on the line, the y value is always 13." An equation that says the same thing is $y = 13$.

Vertical lines represent situations where the x value doesn't change at all while the y value changes. The equation $x = -4$ describes a vertical line through the point $(-4, 0)$.

COOL-DOWN: 5 minutes

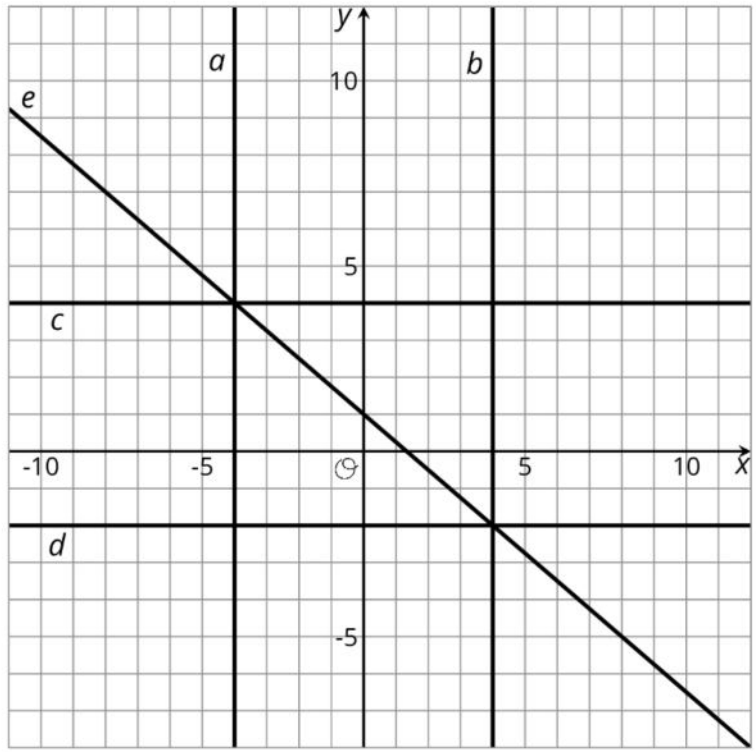
11.4: Line Design

CCSS Standards: Addressing	• 8.EE.B.6

Students write equations for lines that are horizontal, vertical, or have negative slope.

Student-Facing Task Statement

Here are 5 lines on a coordinate grid:



Write equations for lines a, b, c, d, and e.

Student Response

a: $x = -4$ b: $x = 4$ c: $y = 4$ d: $y = -2$ e: $y = \frac{-3}{4}x + 1$ or $\frac{y-1}{x} = \frac{-3}{4}$ (or equivalent equation)

Lessons 12-13: Linear Equations

Lesson 12: Solutions to Linear Equations

Lesson 12 Summary

Think of all the rectangles whose perimeters are 8 units. If x represents the width and y represents the length, then

$$2x + 2y = 8$$

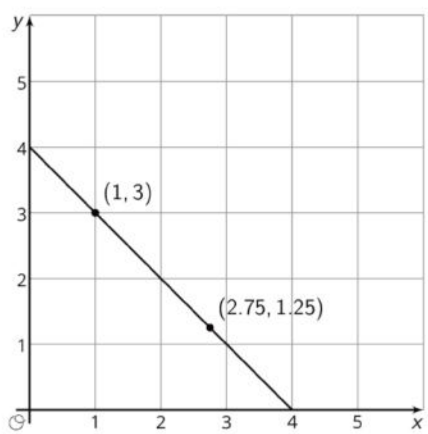
expresses the relationship between the width and length for all such rectangles.

For example, the width and length could be 1 and 3, since $2 \cdot 1 + 2 \cdot 3 = 8$ or the width and length could be 2.75 and 1.25, since $2 \cdot (2.75) + 2 \cdot (1.25) = 8$.

We could find many other possible pairs of width and length, (x, y), that make the equation true—that is, pairs (x, y) that when substituted into the equation make the left side and the right side equal.

A **solution to an equation with two variables** is any pair of values (x, y) that make the equation true.

We can think of the pairs of numbers that are solutions of an equation as points on the coordinate plane. Here is a line created by all the points (x, y) that are solutions to $2x + 2y = 8$. Every point on the line represents a rectangle whose perimeter is 8 units. All points not on the line are not solutions to $2x + 2y = 8$.



Lesson 12 Glossary Terms

- solution to an equation with two variables

COOL-DOWN: 5 minutes

12.4: Identify the Points

CCSS Standards: Addressing	• 8.EE.C

Students verify whether or not certain points in the x-y plane make a linear equation true.

Student-Facing Task Statement

Which of the following coordinate pairs make the equation $x - 9y = 12$ true?

1. $(12, 0)$
2. $(0, 12)$
3. $(3, -1)$
4. $(0, -\frac{4}{3})$

Student Response

1. Yes.
2. No.
3. Yes.
4. Yes.

Lesson 13: More Solutions to Linear Equations

Lesson 13 Summary

Let's think about the linear equation $2x - 4y = 12$. If we know $(0, -3)$ is a solution to the equation, then we also know $(0, -3)$ is a point on the graph of the equation. Since this point is on the y-axis, we also know that it is the vertical intercept of the graph. But what about the coordinate of the horizontal intercept, when $y = 0$? Well, we can use the equation to figure it out.

$$\begin{aligned} 2x - 4y &= 12 \\ 2x - 4(0) &= 12 \\ 2x &= 12 \\ x &= 6 \end{aligned}$$

Since $x = 6$ when $y = 0$, we know the point $(6, 0)$ is on the graph of the line. No matter the form a linear equation comes in, we can always find solutions to the equation by starting with one value and then solving for the other value.

COOL-DOWN

13.4: Intercepted

CCSS Standards: Addressing	• 8.EE.C.8.a

Students show their understanding of solutions to linear equations in two variables and connections to the graph of the equation.

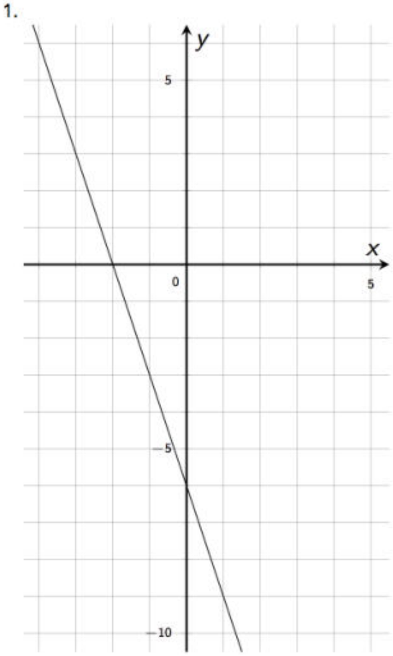
Student-Facing Task Statement

A graph of a linear equation passes through $(-2, 0)$ and $(0, -6)$.

1. Use the two points to sketch the graph of the equation.
2. Is $3x - y = -6$ an equation for this graph? Explain how you know.

Student Response

1.



2. No. Answers vary. Sample response: Test the two given pairs: $3(-2) - 0 = -6 - 0 = -6$ so the coordinates of this point represent a solution to the equation. $3(0) - (-6) = 0 + 6 = 6$, not -6, so the coordinates of this point do not represent a solution to the equation. The graph of a linear equation contains only ordered pairs whose coordinates are solutions to the equation, so the equation is not represented by the line with the two given points.

Lessons 14: Let's Put it to Work

Lesson 14: Using Linear Relations to Solve Problems

Learning Goals:

- Recognize that solutions to linear equations may be limited based on real-world constraints on the quantities.
- Solve and interpret solutions in contexts using multiple representations of non-proportional linear relationships.

Notes: