COMPOSITION BOOK

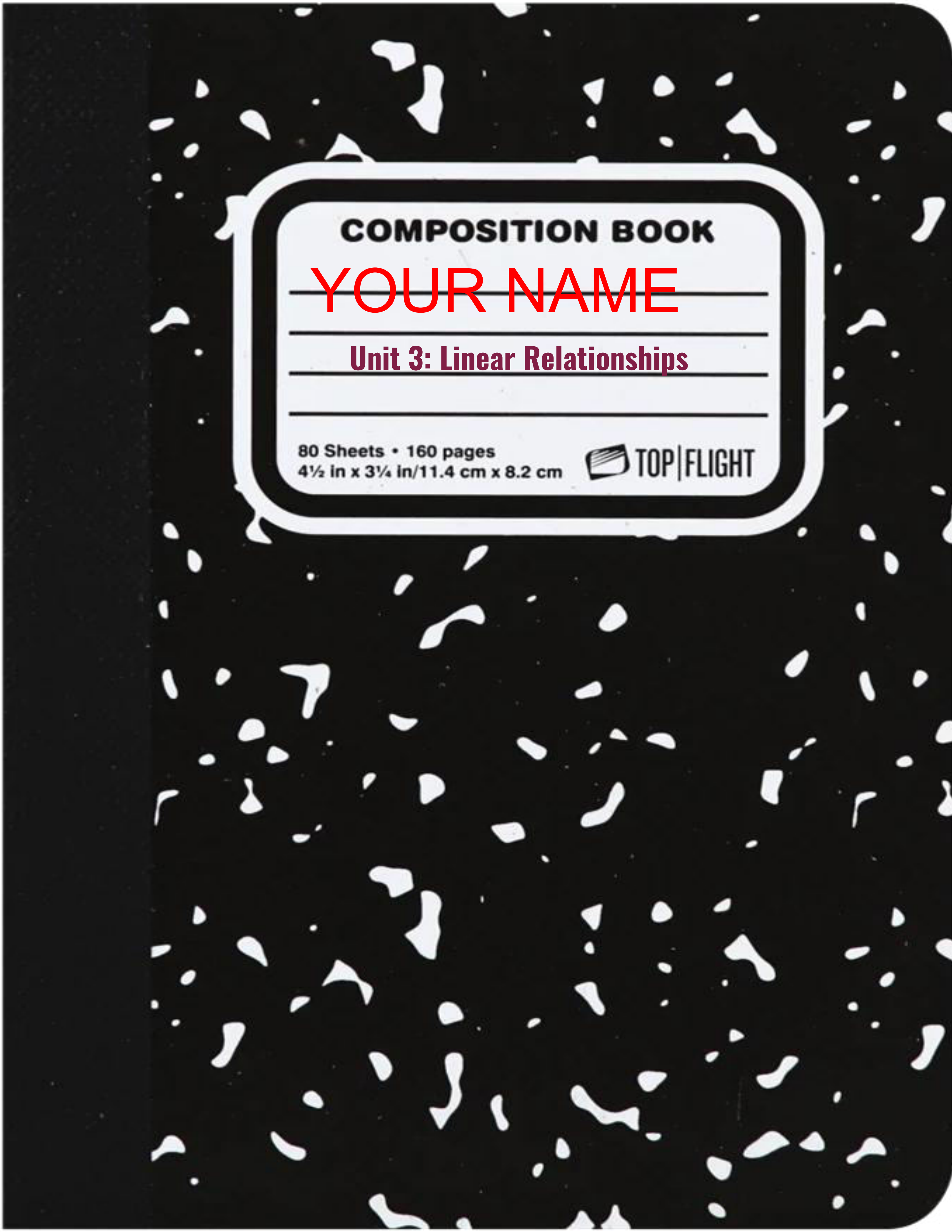
Ms. Forbes'

Math 8 Journal

Unit 3: Linear Relationships

80 Sheets • 160 pages
4½ in x 3¼ in/11.4 cm x 8.2 cm

TOP|FLIGHT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YOUR NAME
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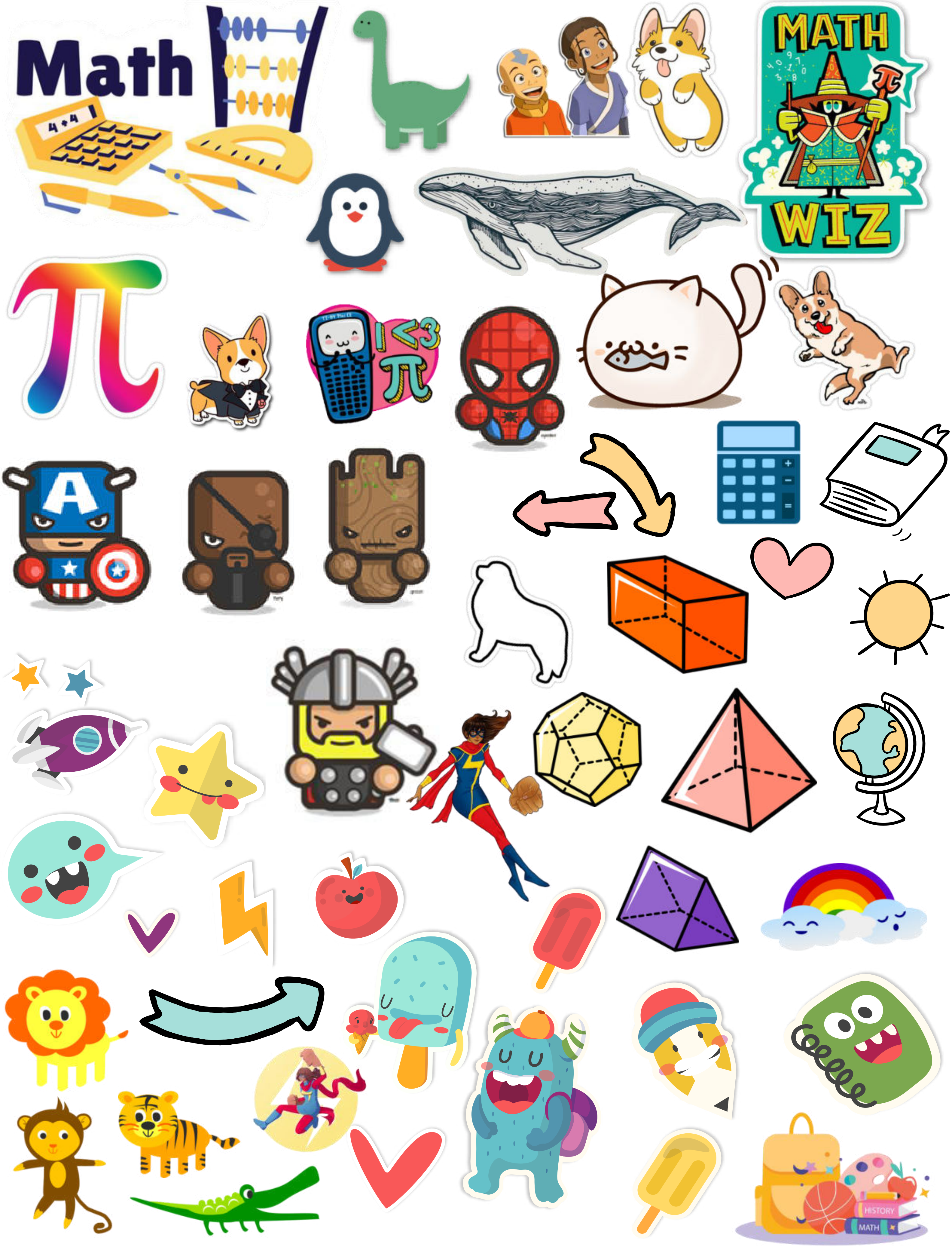
Math
4+4
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HISTORY
MATH


OK!
STRANGER THINGS
NOPE
COMPOSITION
OMG!
LOL!
STAR WARS

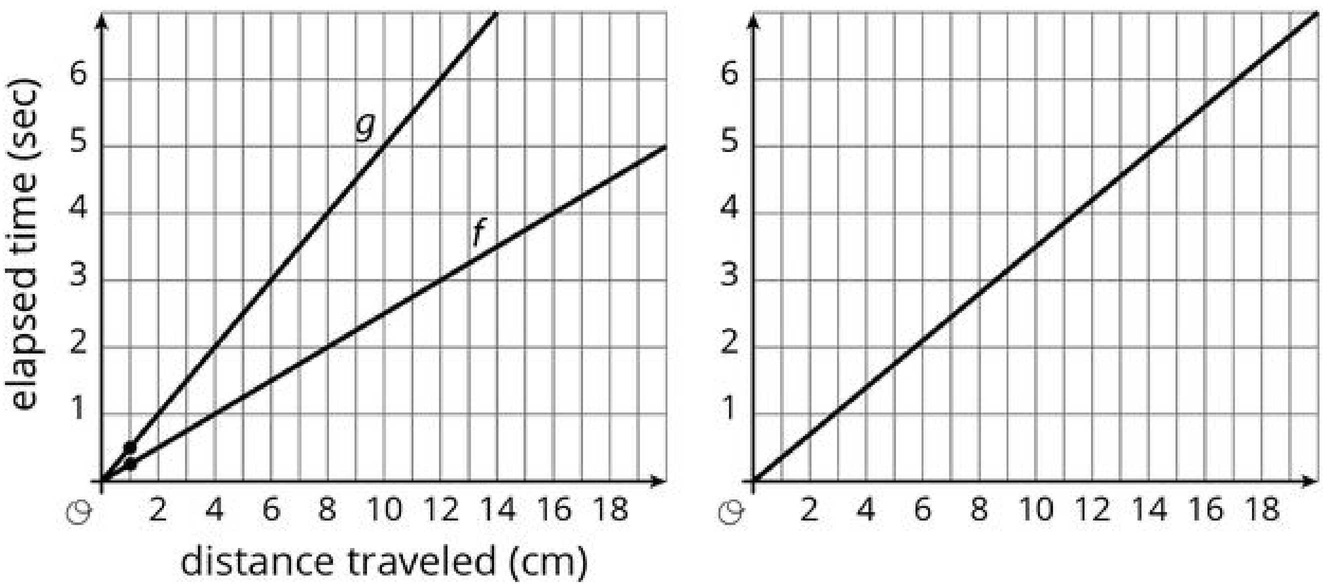
Table of Contents

Lesson 1

Lesson 1: Understanding Proportional Relationships

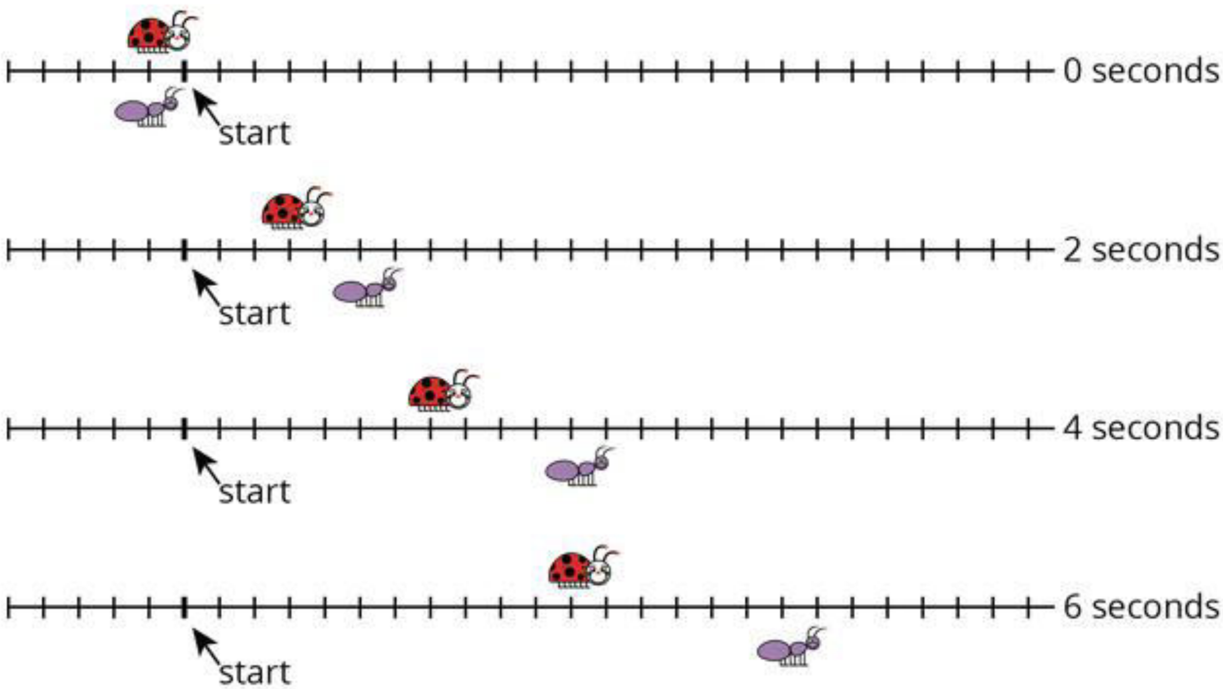
Two Graphs

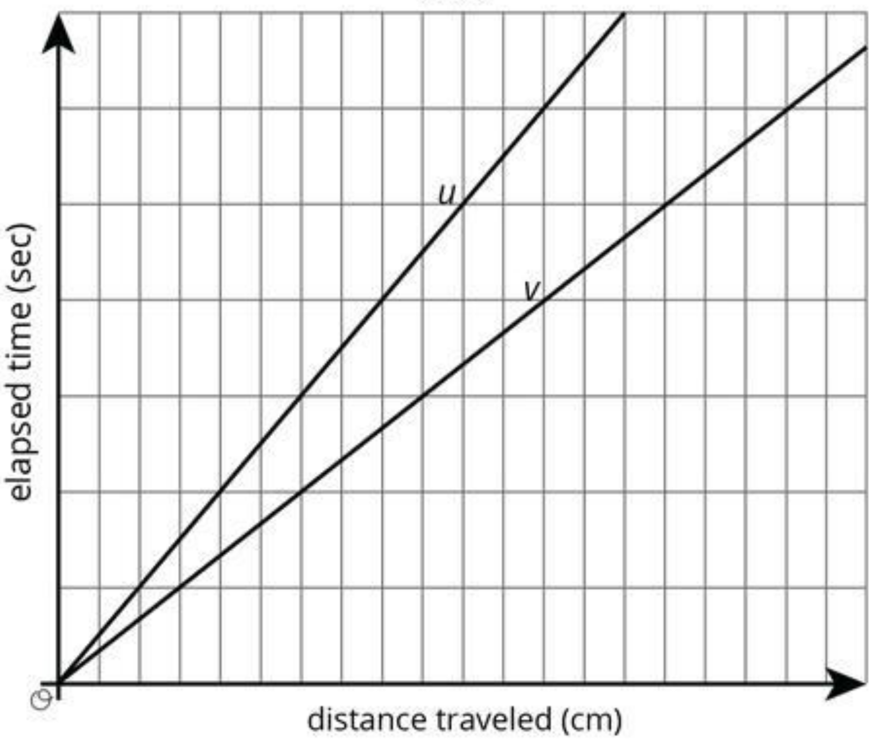
What do you notice? What do you wonder?



Moving Through Representations

A ladybug and ant move at constant speeds. The diagrams with tick marks show their positions at different times.
Each tick mark represents 1 centimeter.





1. Lines *u* and *v* also show the positions of the two bugs. Which line shows the ladybug's movement? Which line shows the ant's movement? Explain your reasoning?

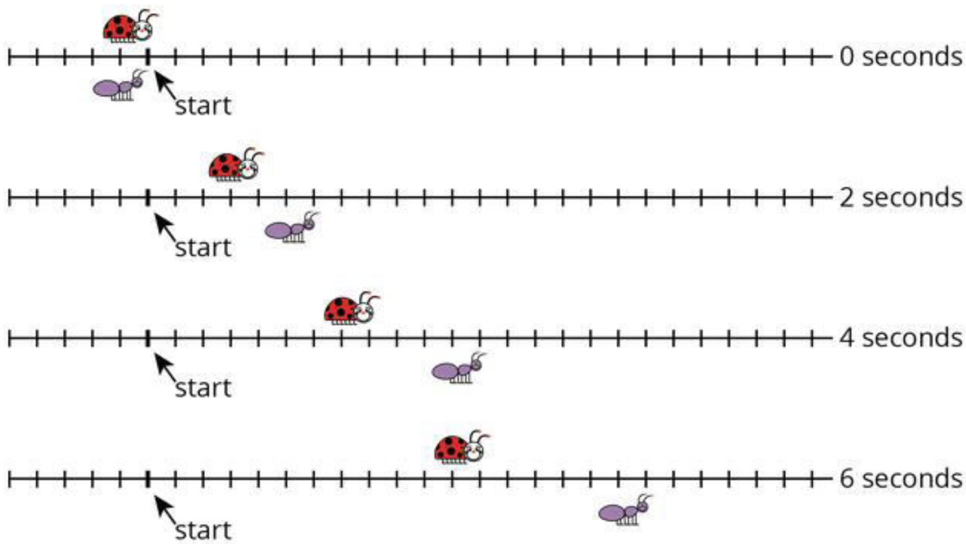
1. How long does it take the ladybug to travel 12 cm? The ant?

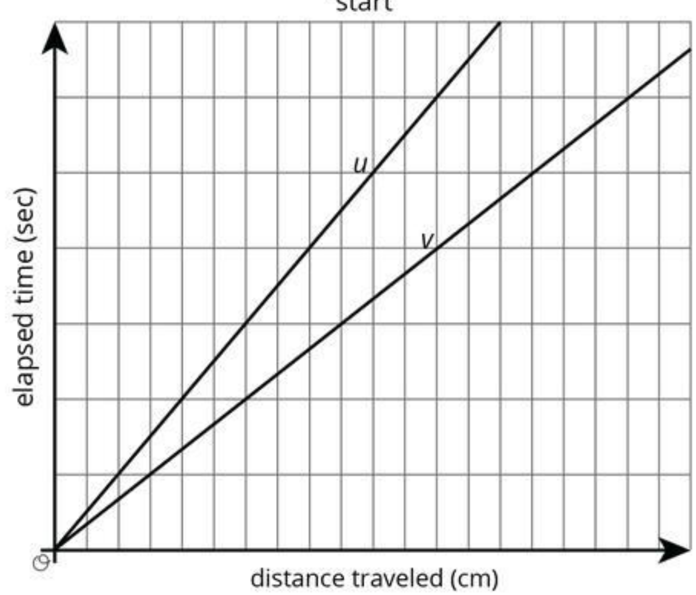
1. Scale the vertical and horizontal axes by labeling each grid with a number. You will need to use the time and distance information shown in the tick-mark diagrams.
2. Mark and label the point on line *u* and the point on line *v* that represent the time and position of each bug after travelling 1 cm.

Moving Twice as Fast

Refer to the tick-mark diagrams and graph in the earlier activity when needed.

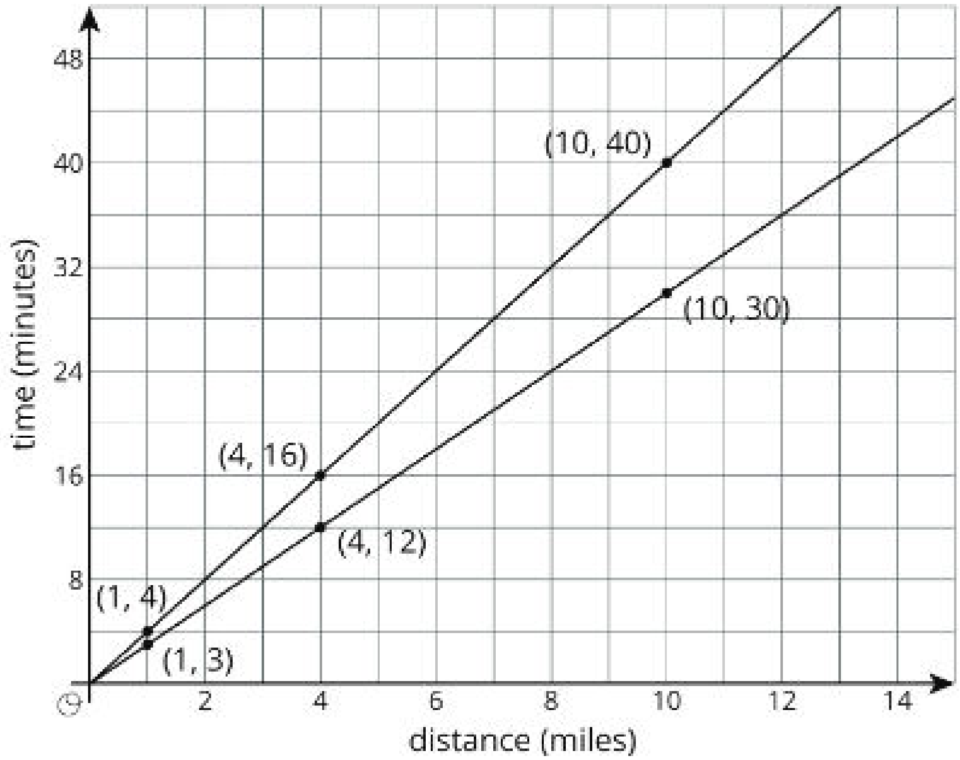
1. Imagine a bug that is moving twice as fast as the ladybug. One each tick-mark diagram, mark the position of this bug.
2. Plot this bug's positions on the coordinate axes with lines *u* and *v*, and connect them with a line.
3. Write an equation for each of the three lines.





Lesson 1 Summary

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.

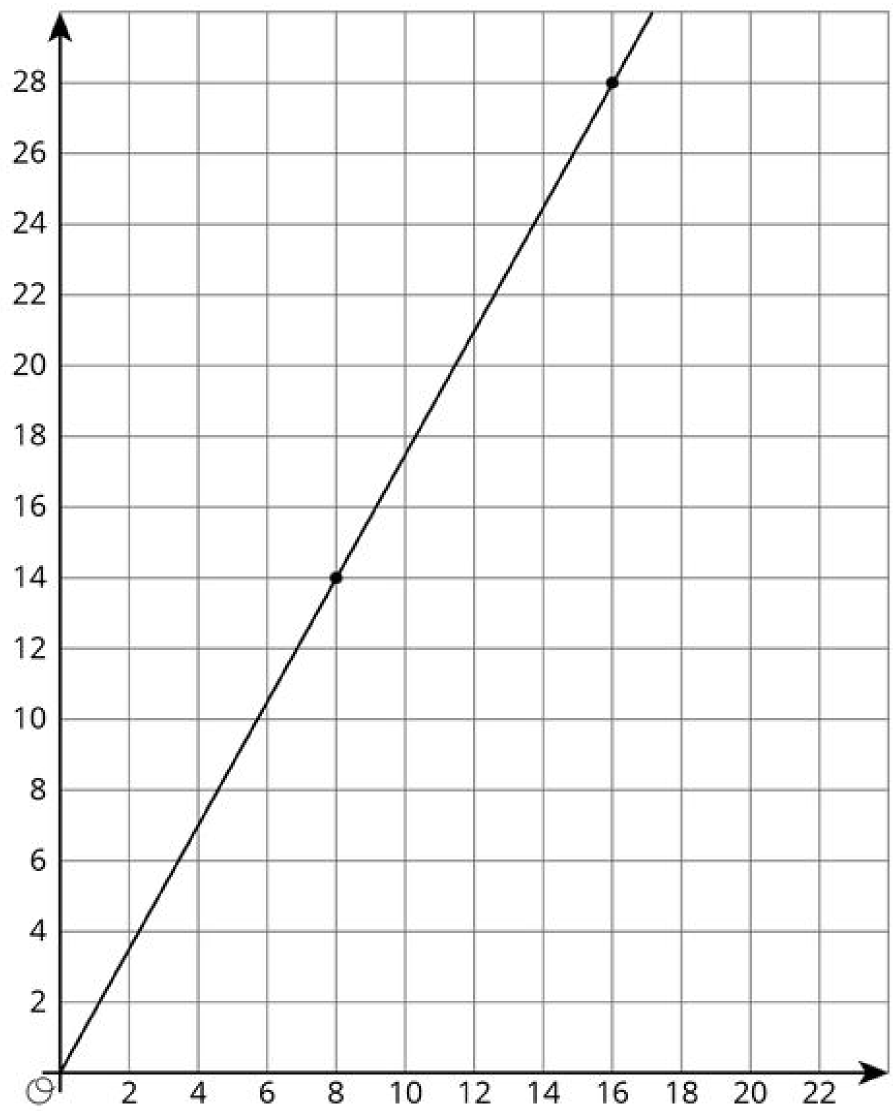
4. How long will it take each of them to reach the end of the 12 mile bike path? The points on the graphs at a horizontal distance of 12 are 36 minutes for Mai and 48 minutes for Kiran. (Kiran's time after 12 miles is almost off the grid!)

Lesson 2

Lesson 2: Graphs of Proportional Relationships

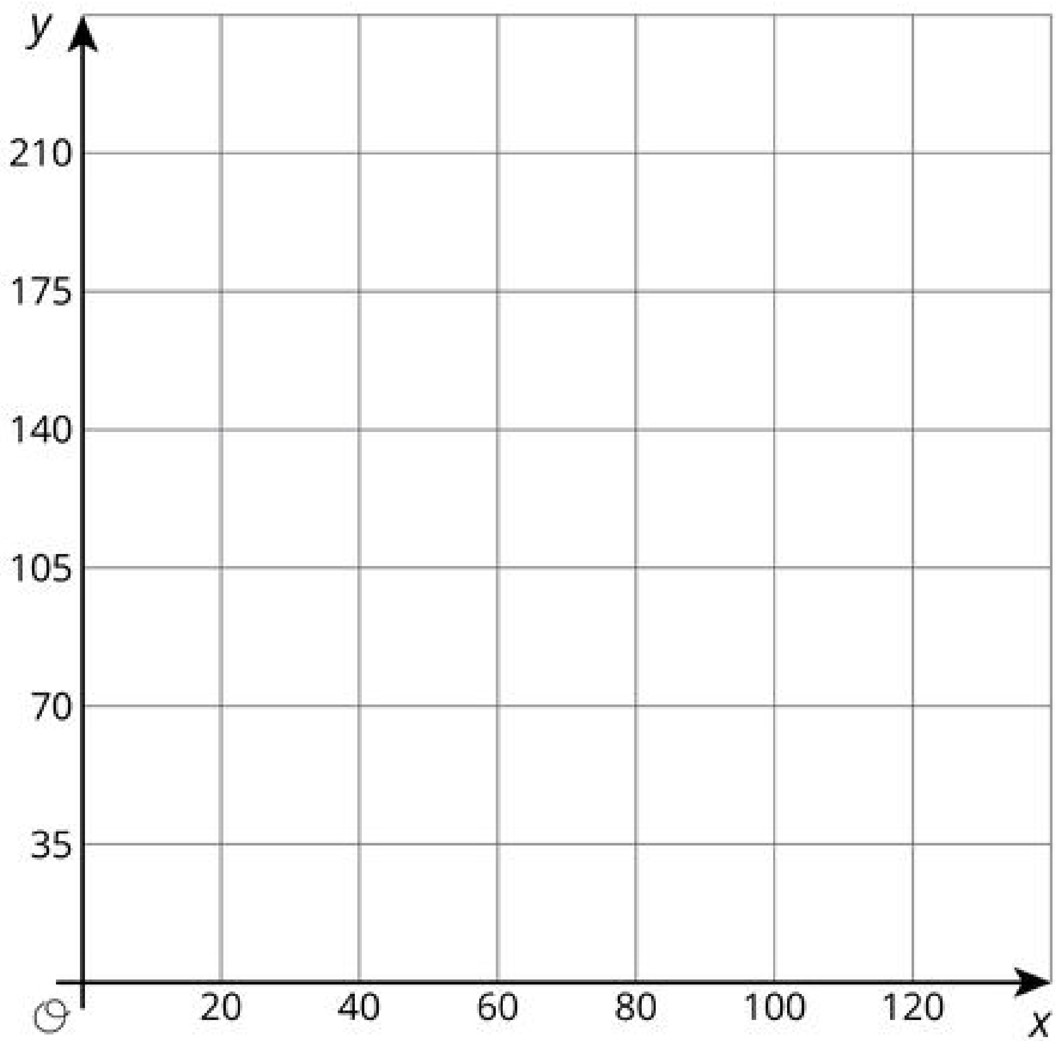
An Unknown Situation

Here is a graph that could represent a variety of different situations.



Write an equation for the graph.

Sketch a new graph of this relationship.



Proportional Relationships

Sort the graphs into groups based on what proportonal relationshiip they represent.

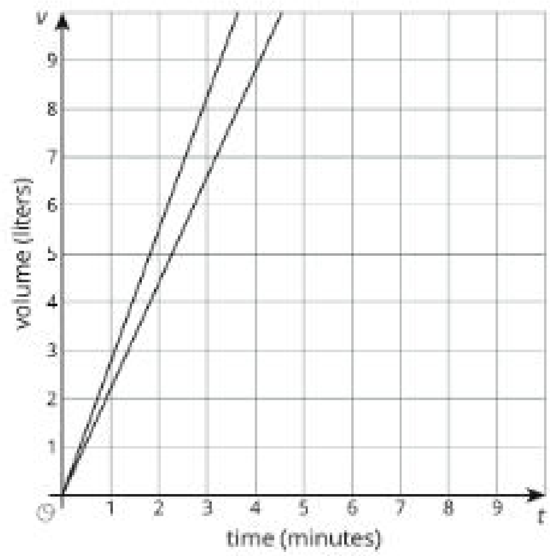
Wrte an equation for each *different* propportional relationship you find.

Lesson 2 Summary

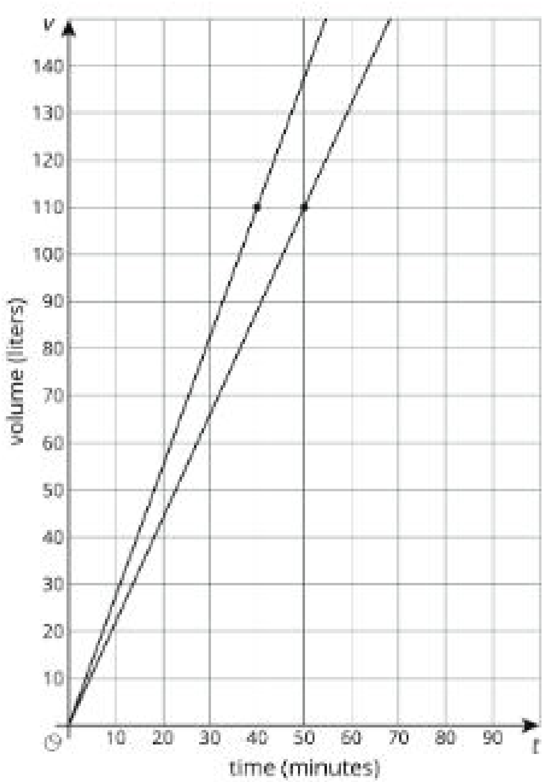
The scales we choose when graphing a relationship often depend on what information we want to know. For example, say two water tanks are filled at different constant rates. The relationship between time in minutes t and volume in liters v of tank A is given by $v = 2.2t$. For tank B the relationship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

Lesson 3

Lesson 3: Representing Proportional Relationships

Representations of Proportional Relationships

Here are two ways to represent a situation.

Description: Jada and Noah counted the number of steps they took to walk a set distance. To walk the same distance,

- Jada took 8 steps
- Noah took 10 steps

Then they found that when Noah took 15 steps, Jada took 12 steps.

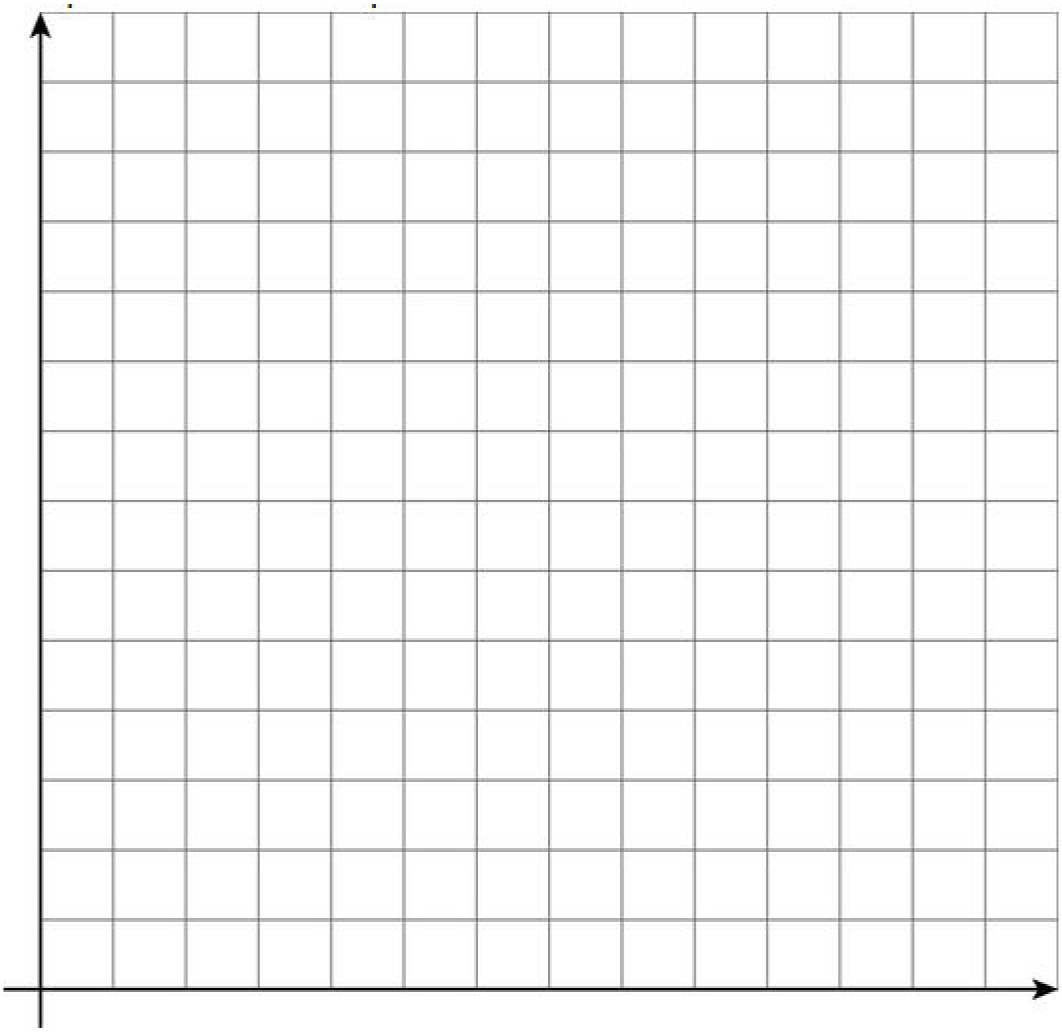
Equation:Let *x* represent the number of steps Jada takes and let *y* represent the number of steps Noah takes.

$$y = \frac{5}{4}x$$

Create a table represents this situation with at least 3 pairs of values.

x	**y**

Graph this relationship and label the axes.



How can you see or calculate the constant of proportionality in each representation? What does it mean?

Explain how you can tell that the equation, description, graph, and table all represent the same situation.

Here are two ways to represent a situation.

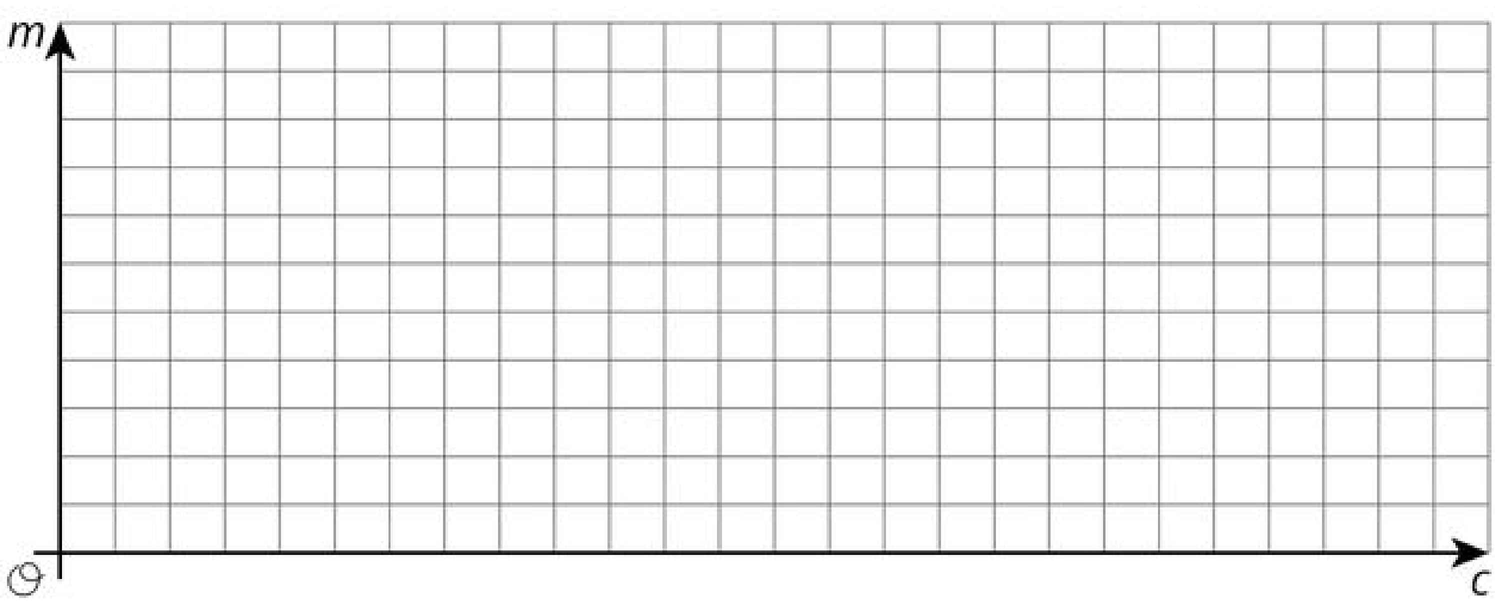
Description: The Origami Club is doing a car wash fundraiser to raise money for a trip. They charge the same price for every car. After 11 cars, they raised a total of $93.50. After 23 cars, they raised a total of $195.50.

Table:

number of cars	amount raised in dollars
11	93.50
23	195.50

Write an equation that represents this situation. (Use *c* to represent number of cars and use *m* to represent amount raised in dollars.)

Create a graph that represents this situation.



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.

Lesson 4

Lesson 4: Comparing Proportional Relationships

Comparing Two Different Representations

Elena babysits her neighbor's children. Her earnings are given by the equation $y = 8.40x$, where x represents the number of hours she worked and y represents the amount of money she earned. Jada earns $7 per hour mowing her neighbors' lawns.

a. Who makes more money after working 12 hours? How much more do they make?

a. What is the rate of change for each situation and what does it mean?

a. How long would it take each person to earn $150? Explain or show your reasoning.

Clare and Han have summer jobs stuffing envelopes for two different companies.
Clare's earnings can be seen in the table.

Han earns $15 for every 300 envelopes he finishes.

number of envelopes	money in dollars
400	40
900	90

a. Who would make more money after stuffing 1500 envelopes?

a. How much more money would they make? Explain how you know.

a. Who gets paid more in their job? Explain or show your reasoning.

Tyler plans to start a lemonade stand and is trying to perfect his recipe for lemonade. He wants to make sure the recipe doesn't use too much lemonade mix (lemon juice and sugar) but still tastes good.

Lemonade Recipe 1 is given by the equation $y = 4x$ where x represents the amount of lemonade mix in cups and y represents the amount of water in cups.

Lemonade Recipe 2 is given in the table.

lemonade mix (cups)	water (cups)
10	50
13	65
21	105

a. If Tyler had 16 cups of lemonade mix, how many cups of water would he need for each recipe? Explain how you know.

a. What is the rate of change for each situation and what does it mean?

a. Tyler has a 5-gallon jug (which holds 80 cups) to sue for his lemonade stand and 16 cups of lemonade mix. Which lemonade recipe should he use? Explain or show your reasoning.

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.

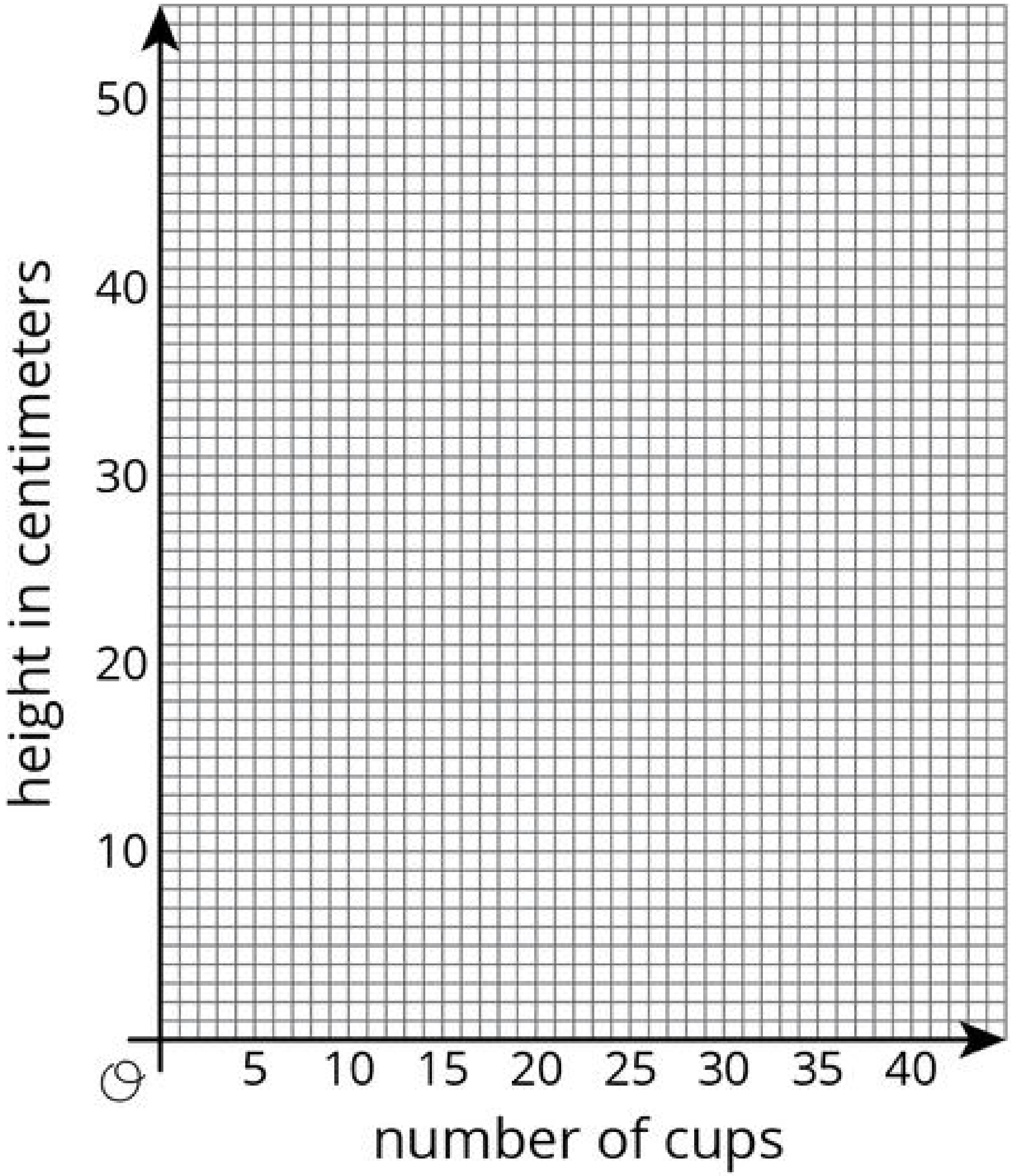
Lesson 5

Lesson 5: Introduction to Linear Relationships

Stacking Cups

We have two stacks of styrofoam cups. One stack has 6 cups, and its height is 15 cm. The other one has 12 cups, and its height is 23 cum. How many cups are needed for a stack with a height of 50 cm?

Connecting Slope to Rate of Change



Create a graph if you didn't already.

What are some ways you can tell that the number of cups is not proportional to the height of the stack?

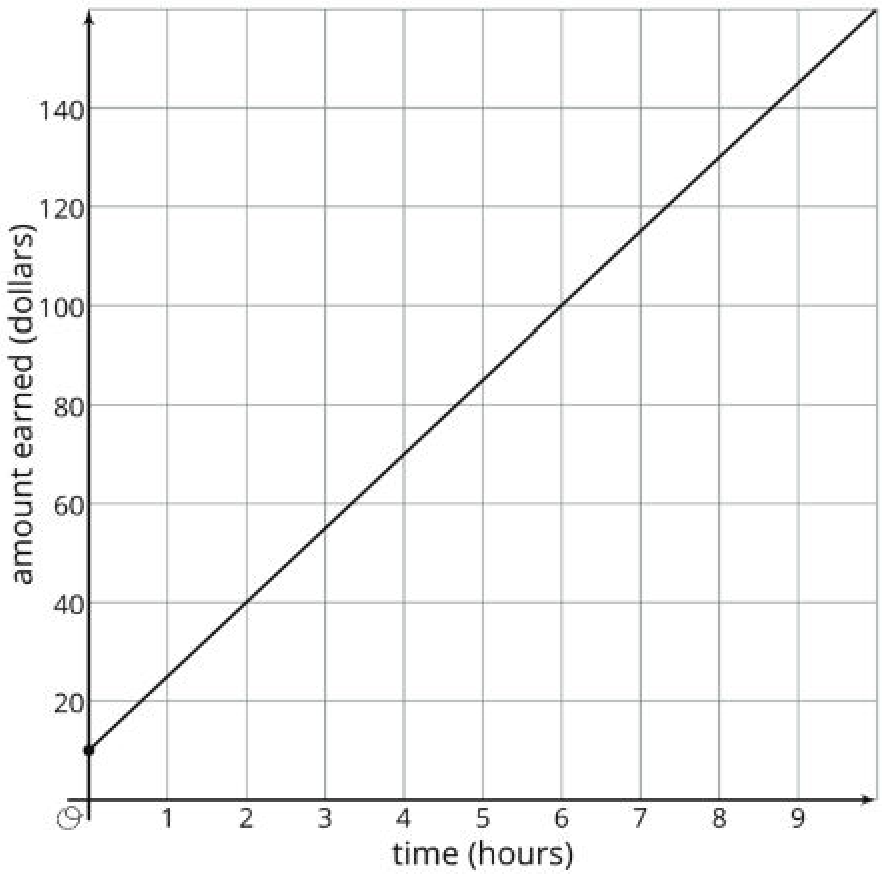
What is the slope of the line in your graph? What does the slope mean in this situation?

At what point does your line intersect the vertical axis? What do the coordinates of this point tell you about he cups?

How much height does each cup after the first add to the stack?

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

Lesson 5 Summary

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.

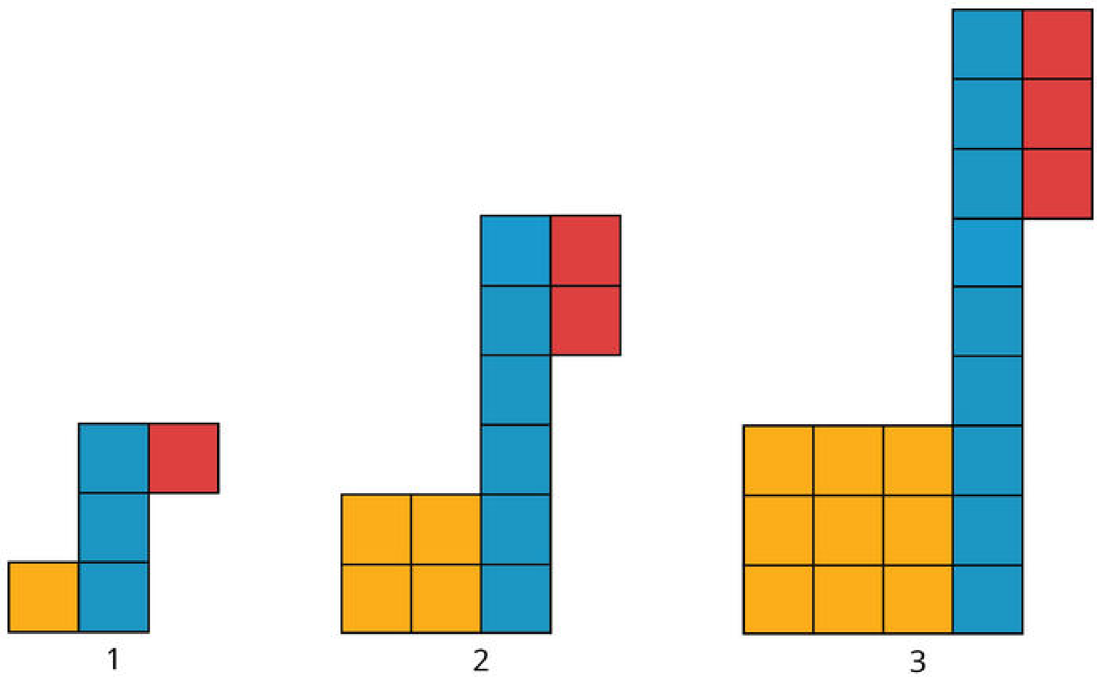
With proportional relationships we are used to graphs that contain the point $(0, 0)$. But proportional relationships are just one type of linear relationship. In the following lessons, we will continue to explore the other type of linear relationship where the quantities are not both 0 at the same time.

Lesson 6

Lesson 6: More Linear Relationships

Growing

Look for a growing pattern. Describe the pattern you see.



If your pattern continues growing in the same way, how many tiles oif each color will be in the 4th and 5th diagram? The 10th diagram?

How many tiles of each color will be in teh *n*th diagram? Be prepared to explain how your reasoning.

Slopes, Vertical Intercepts, and Graphs

Match each situation to a graph.

Pick one proportional relationship and one non-proportional relationship and answer the following questions about them.

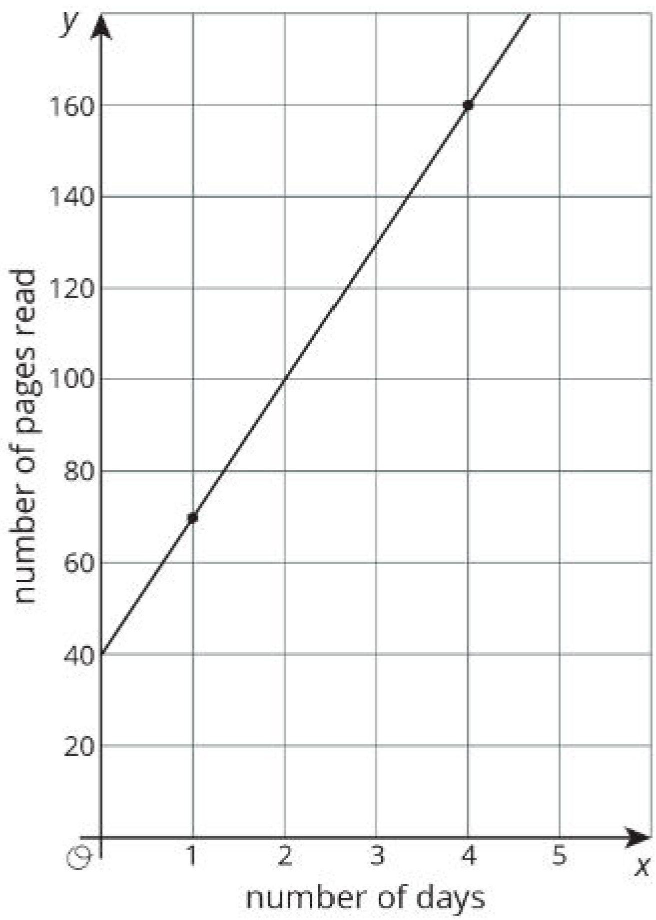
a. How can you find the slope from the graph? Explain or show your reasoning.

a. Explain what the slope means in the situation.

a. Find the point where the line crosses the vertical axis. What does that point tell you about the situation?

Summer Reading

Lin has a summer reading assignment. After reading teh first 30 pages of the book, she plans to read 40 pages each day until she finishes. Lin makes the graphs shwon here to track how many total pages she'll read over the next few days.



After day 1, Line reaches page 70, which matches t point (1, 70) she made on her graph. After day 4, Lin reaches page 190, which does not match the point (4, 160) she made or her graph. Lin is not sure what went wrong since she knows she followed her reading plan.

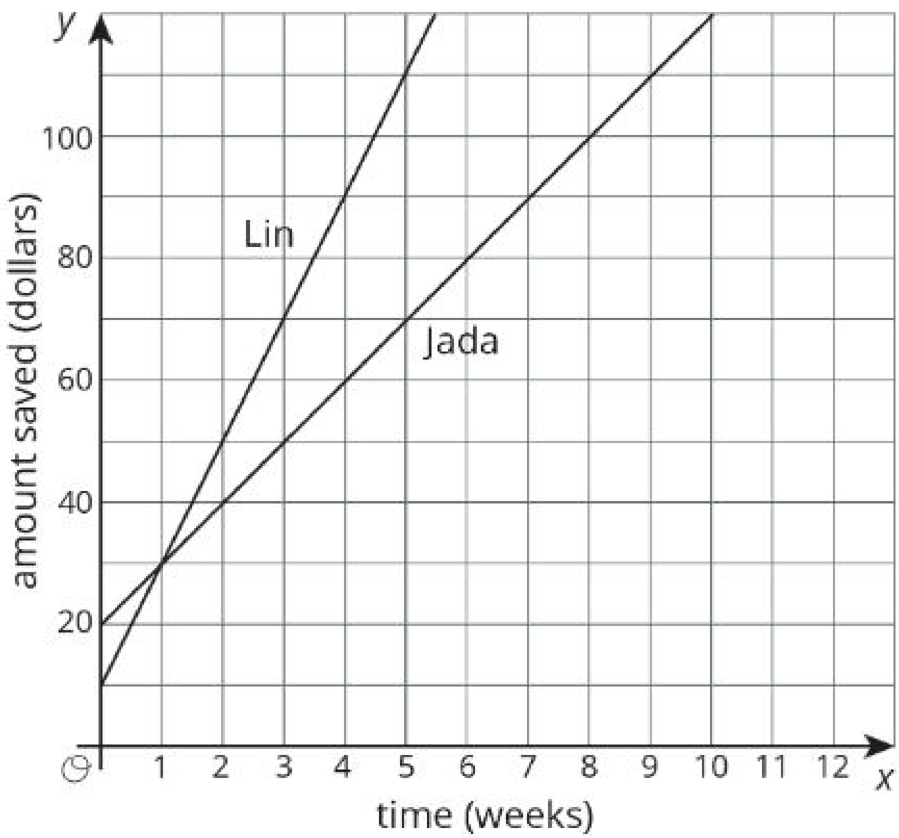
Sketch a line showing Lin's original plan on the axes.

What does the **vertical intercept** mean in this situation? How do the vertical intercepts of the two lines compare?

What does the slope mean in this situation? How do the slopes of the two lines compare?

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:



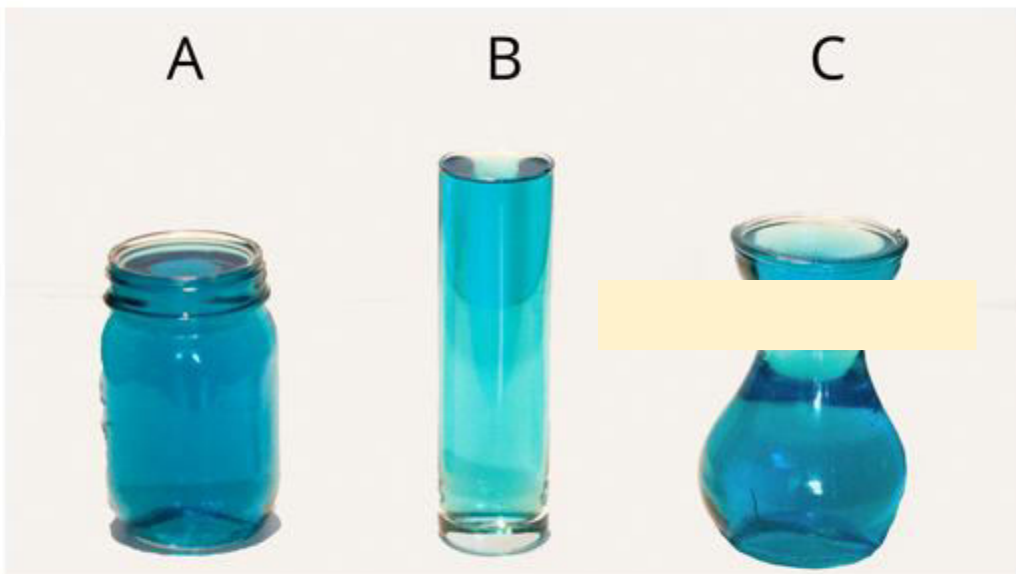
The value where a line intersects the vertical axis is called the **vertical intercept**. When the vertical axis is labeled with a variable like y, this value is also often called the y-*intercept*. Jada's graph has a vertical intercept of $20 while Lin's graph has a vertical intercept of $10. These 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 7

Lesson 7: Representations of Linear Relationships

Which Holds More?

Which glass will hold the most water? The least?



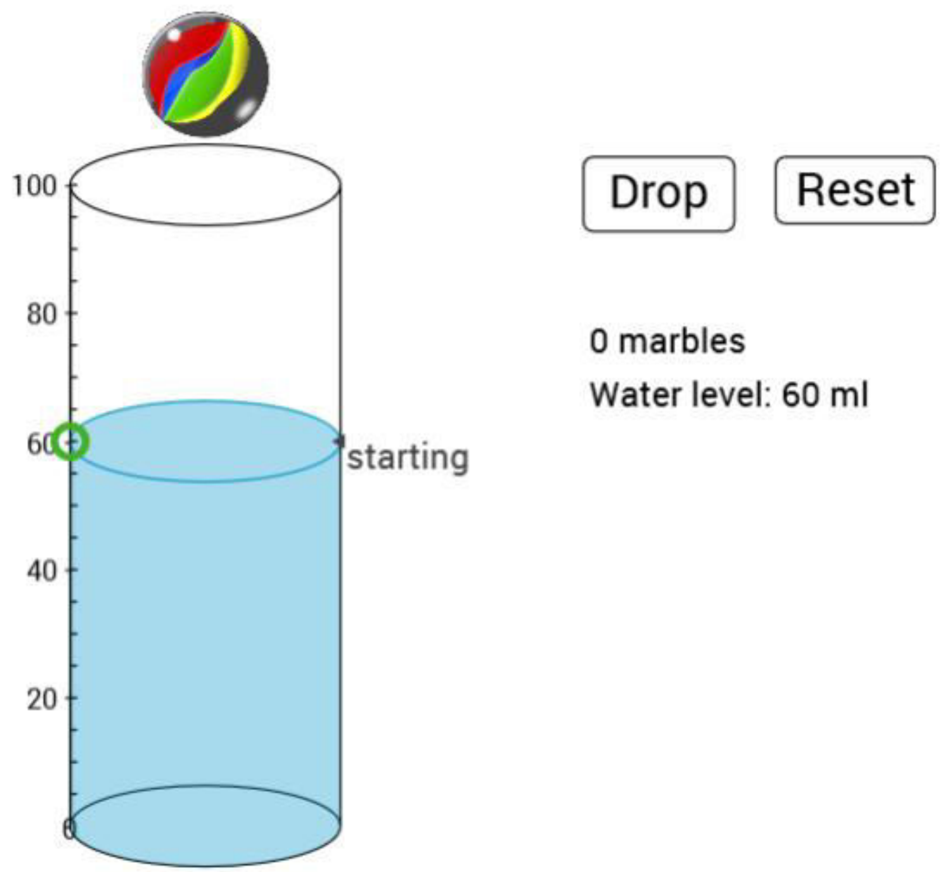
Click the link to watch the demonstration.

Rising Water Levels

Have you noticed that when you put ice cubes in your drink, the level of liquid goes up?

Today, we want to investigate what happens when we drop objects into a container with water.

Click on the picture to use the applet.



What is the volume *V*, in the cylinder after you add:

3 objects?

7 objects?

x objects? Explain your reasoning.

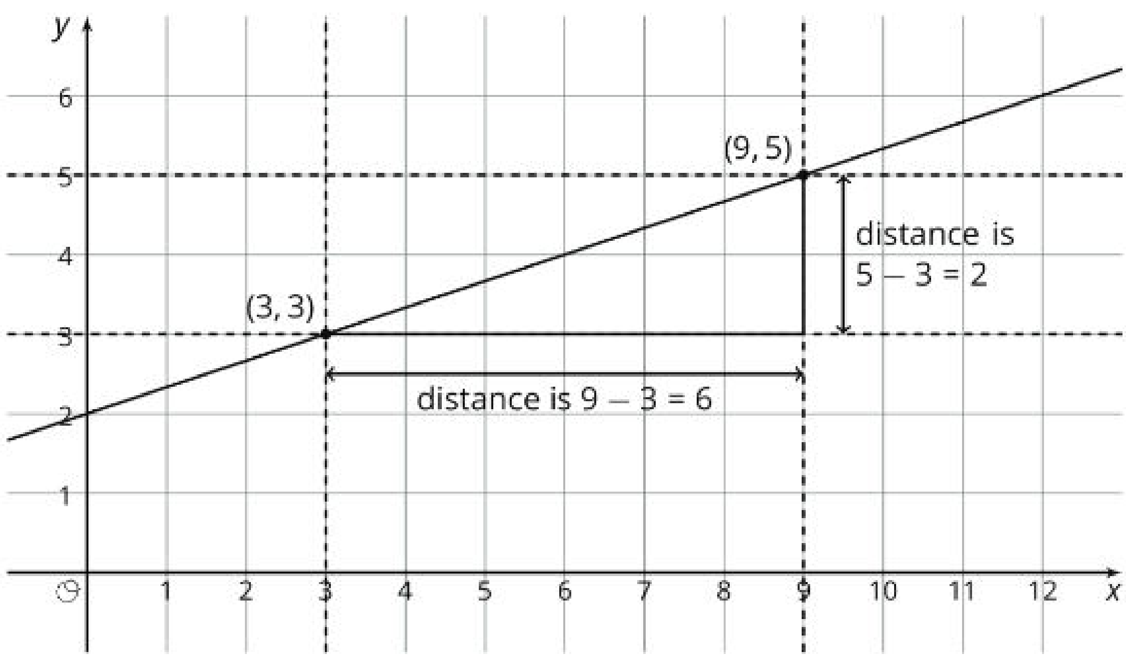
If you wanted to make the water reach the highest mark on the cylinder, how many objects would you need?

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:

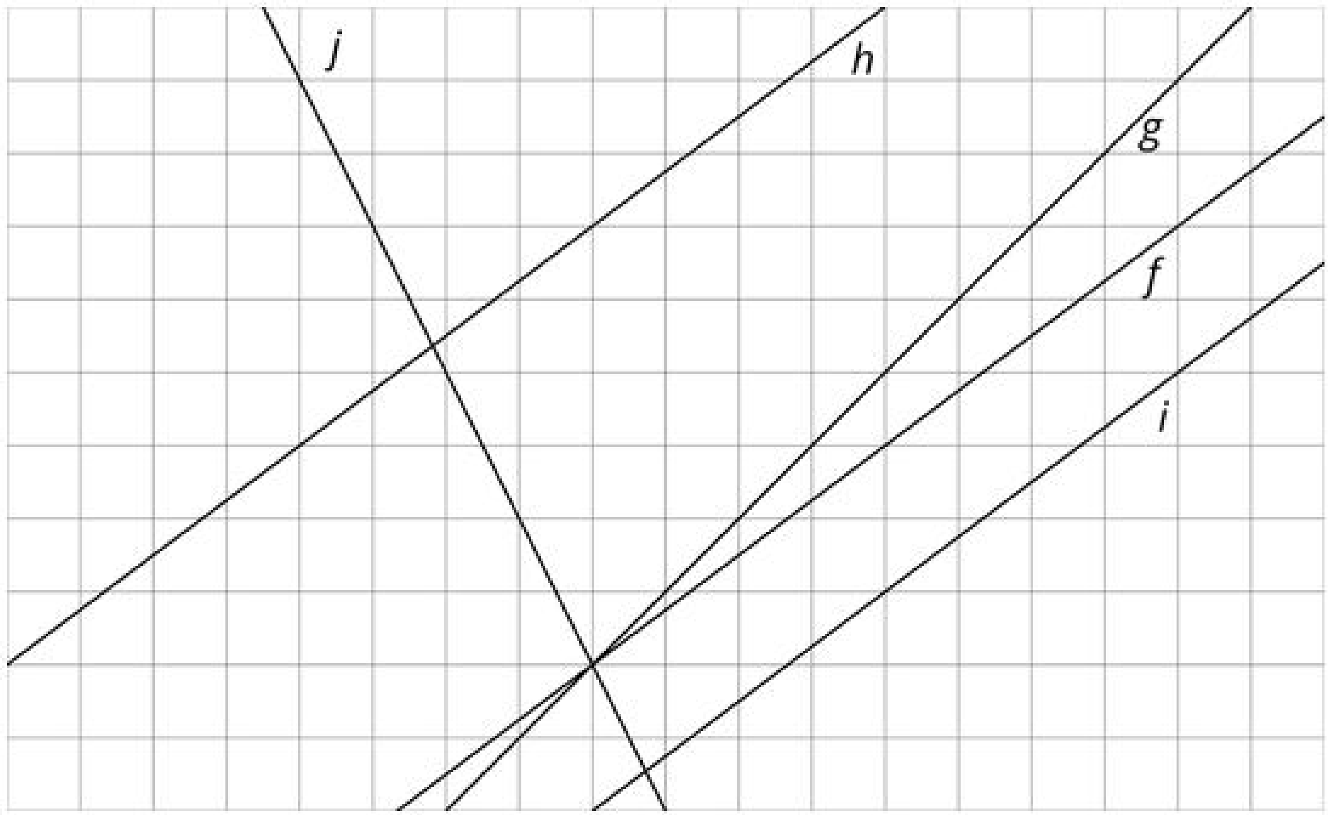


The slope of this line is the quotient of the length of the vertical side of the slope triangle and the length of the horizontal side of the slope triangle. So the slope, m, is $\frac{\text{vertical change}}{\text{horizontal change}} = \frac{2}{6} = \frac{1}{3}$. We can also see from the graph that the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

Lesson 8

Lesson 8: Translating to $y = mx + b$

Lines that Are Translations

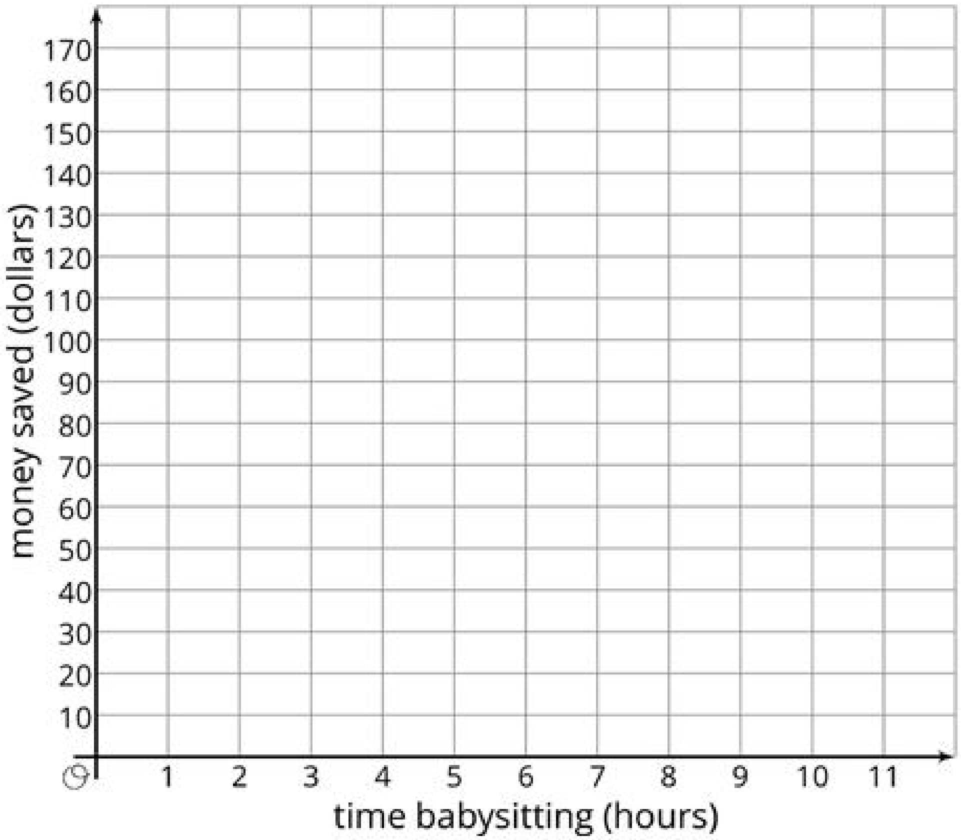


The diagram shows several lines. You can ony see part of the lines, but they actually continue forever in both directions.

1. Which lines are images of line *f* under a translation?

1. For each line that is a translations of *f*, draw an arrow on the grid that shows the vertical translation distance.

Increased Savings



Diego earns $10 per hour babysitting. Assume that he has no money saved before he starts babysitting and plans to save all of his earnings. Graph how much money, *y*, he has after *x* hours of babysitting.

Now imagine that Diego started with $30 saved before he starts babysitting. On the same set of axes, graph how much money, *y*, he would have after *x* hours of babysitting.

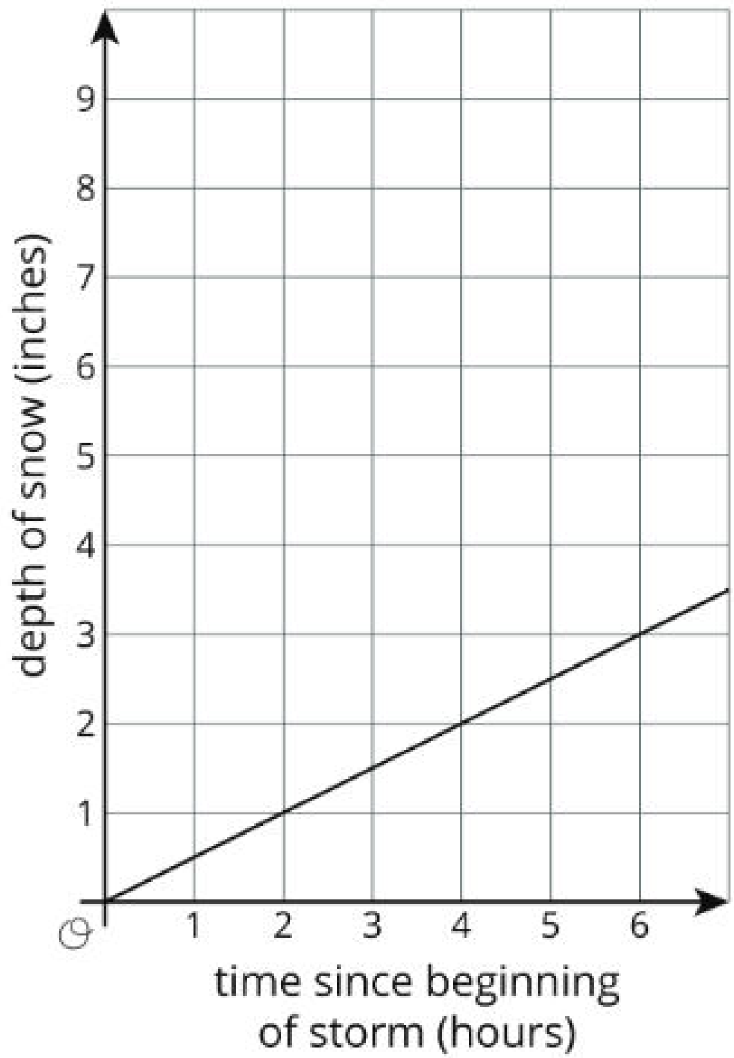
Compare the second lien with the first line. How much *more* money does Diego have after 1 hour of babysitting? 2 hours? 5 hours? *X* hours?

Write an equation for each line.

Lesson 8 Summary

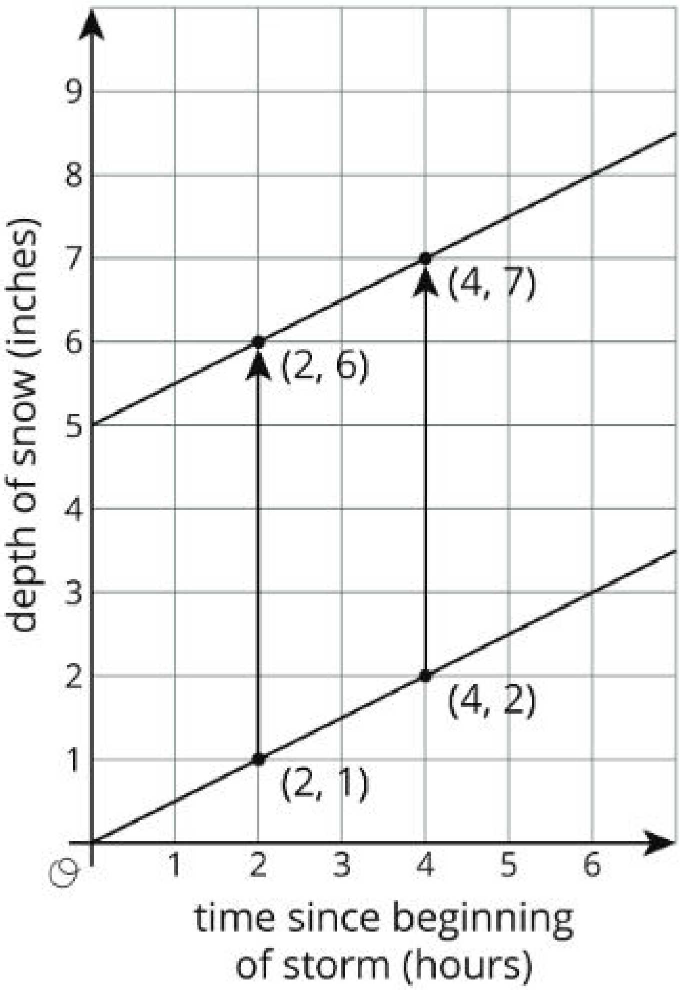
During an early winter storm, the snow fell at a rate of $\frac{1}{2}$ inches per hour. We can see the rate of change, $\frac{1}{2}$, in both the equation that represents this storm, $y = \frac{1}{2}x$, and in the slope of the line representing this storm.

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.

Lesson 8 Summary



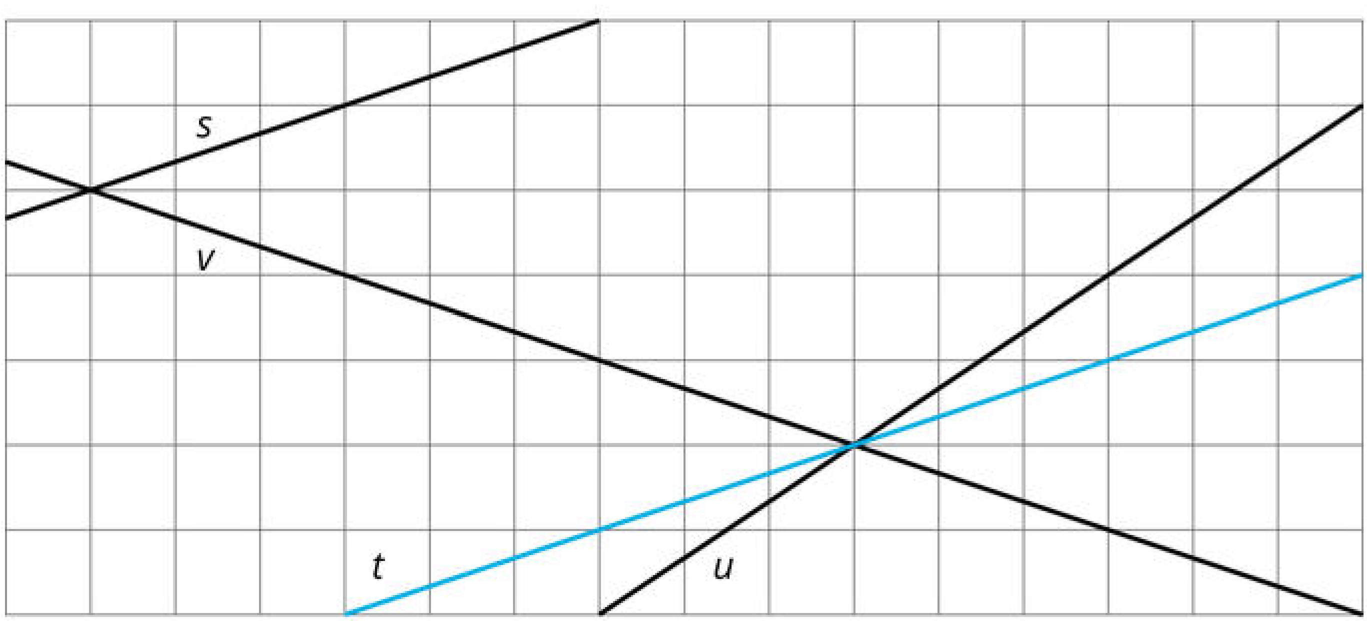
2 hours after each storm begins, 1 inch of new snow has fallen. For the first storm, this means there is now 1 inch of snow on the ground. For the second storm, this means there are now 6 inches of snow on the ground. Unlike the first storm, the second is not a proportional relationship since the line 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.

Lesson 9

Lesson 9: Slopes Don't Have to be Positive

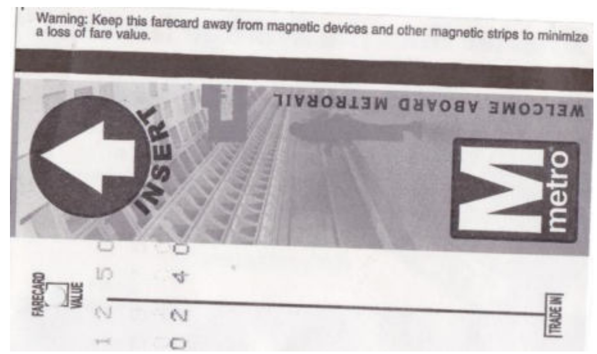
Which One Doesn't Belong

Which line doesn't belong?



Stand Clear of the Closing Doors, Please

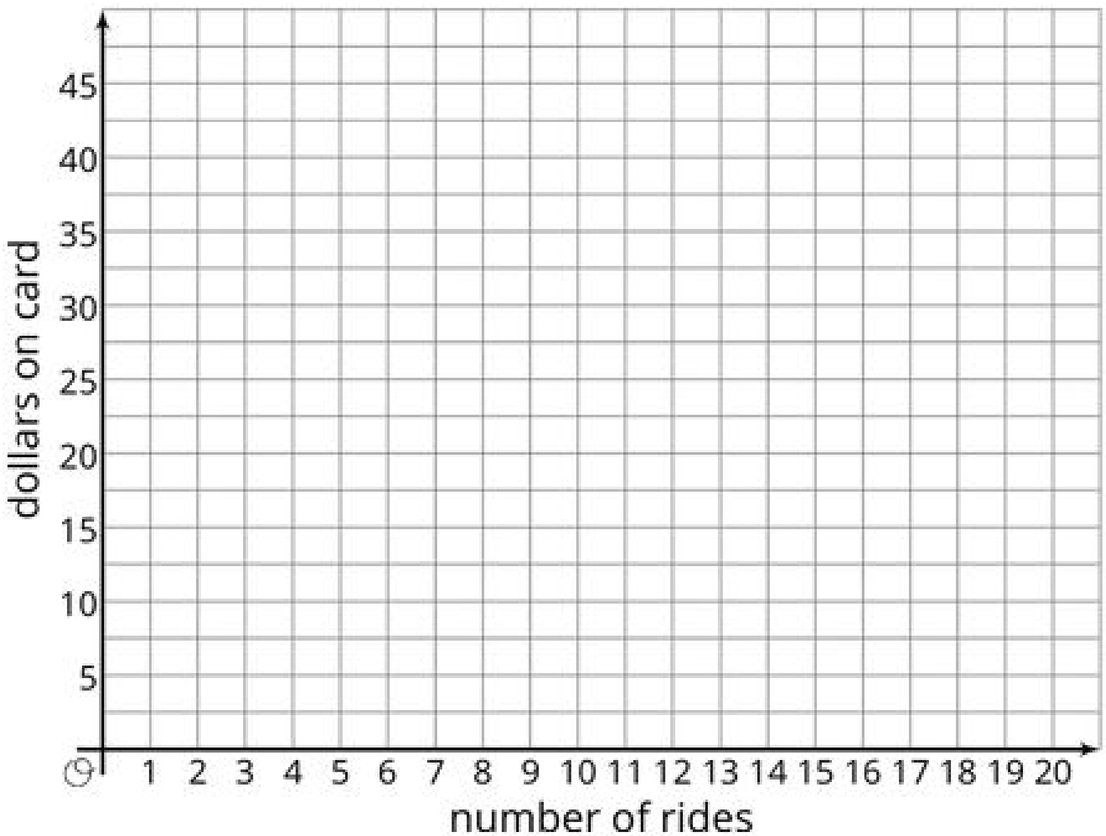
Someone who wants to ride the bus or subway in a city often uses a card like this. The rider pays money which a computer system associates with the card. Every time the rider want to ride, they swipe the card and the cost of the ride is subtracted in the computer system from the balance on the card. Eventually, the amount available on the card runs out, and the rider must spend more money to increase the amount available on the card.



Noah put $40 on his fare card. Every time he rides public transportation, $2.50 is subtracted from the amount available on his card.

How much money, in dolars, is available on his card after he takes
0 rides?
1 ride?
2 rides?
x rides?

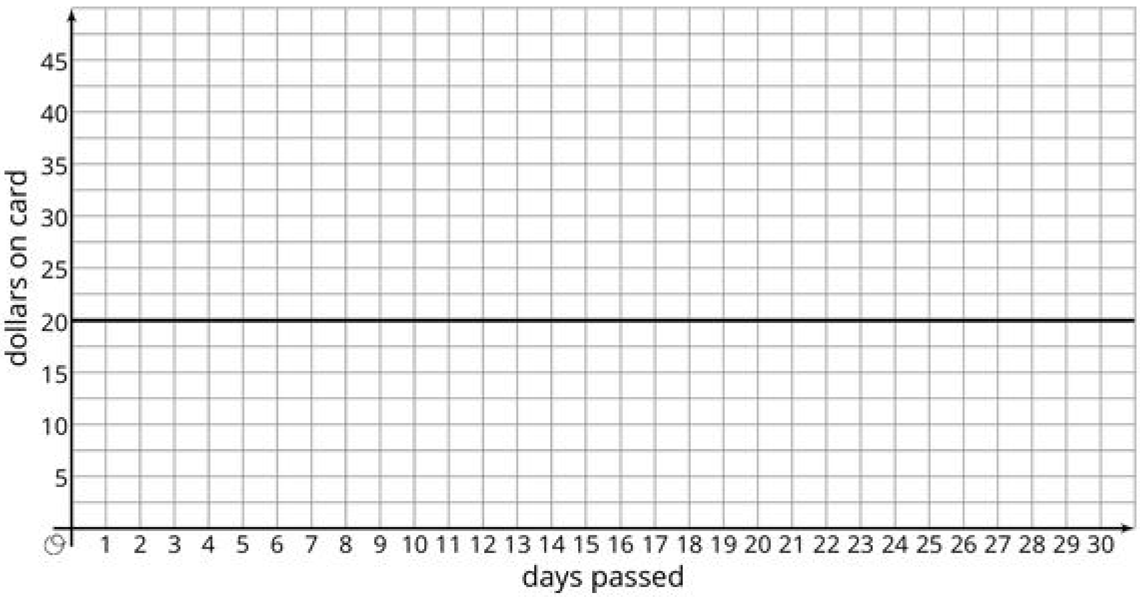
Graph the relationship between amount of money on the card and number of rides.



How many rides can Noah take before the card runs out of money? Where do you see this number of rides on your graph?

Travel Habits in July

Here is a graph that shows the amount on Han’s fare card for every day of last July.



Describe what happened with the amount on Han’s fare card in July.

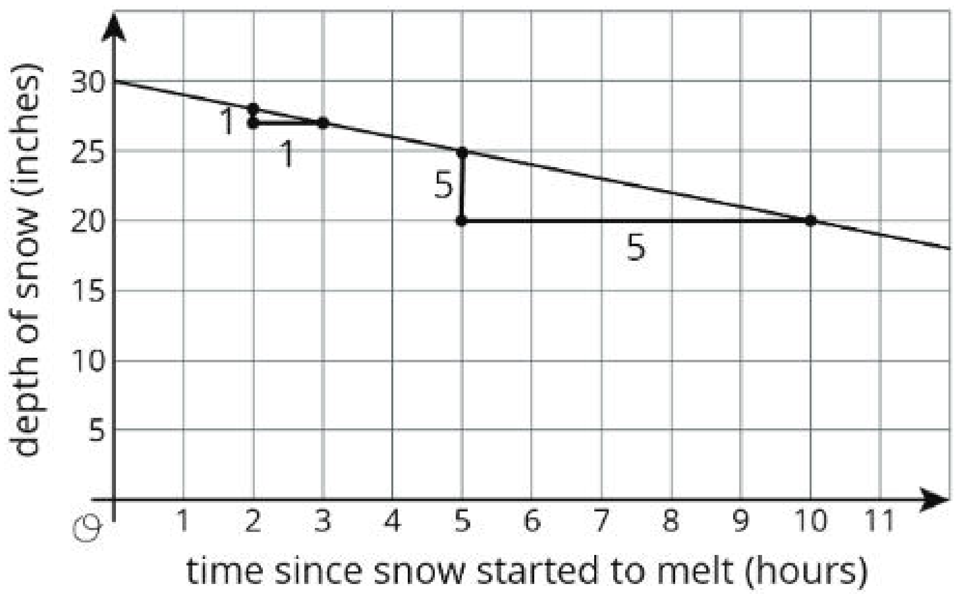
Plot and label 3 different points on the line.

Write an equation that represents the amount on the card in July, *y*, after *x* days.

What value makes sense for the slope of teh line that represents the amounts on Han’s fare card in July?

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.

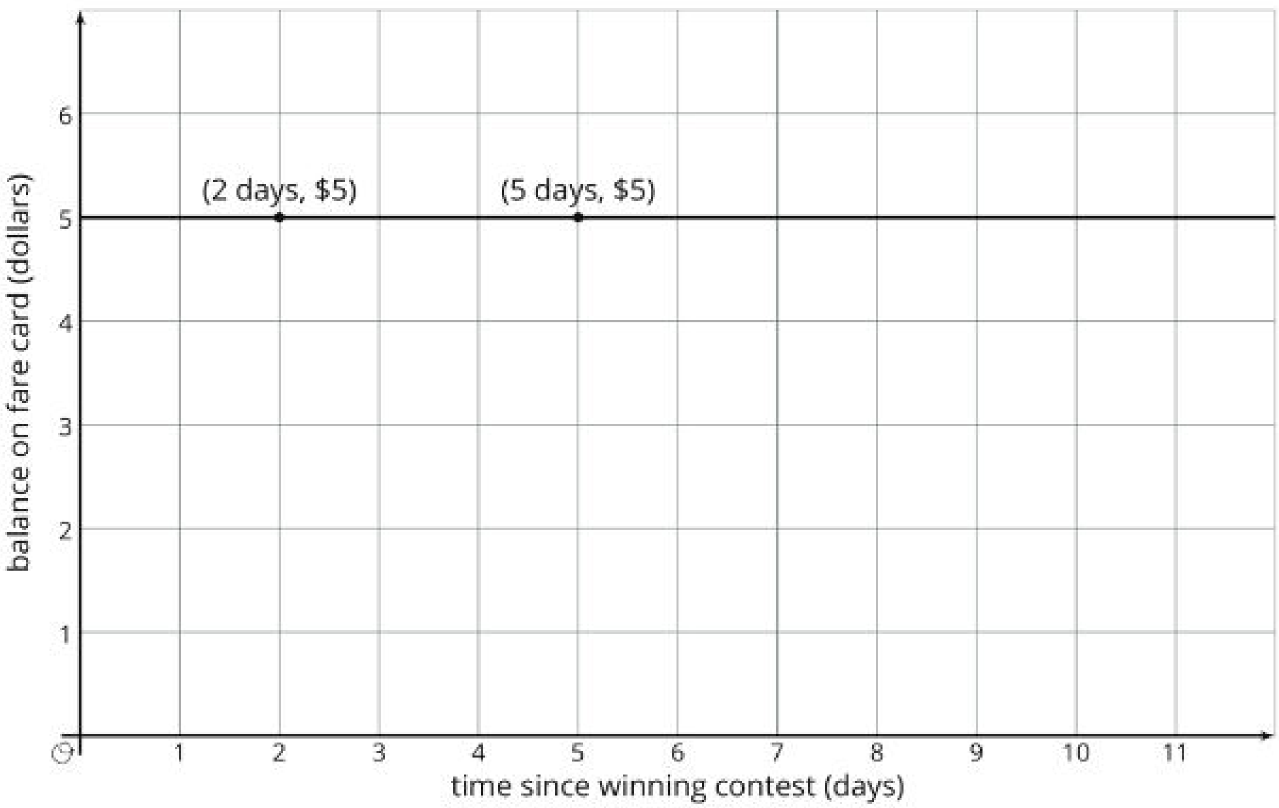


The slope of the graph is -1 since the rate of change is -1 inch per hour. That is, the depth goes *down* 1 inch per hour. The vertical intercept is 30 since the snow was 30 inches deep when the warmth started to melt the snow. The two slope triangles show how the rate of change is constant. It just 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.

Lesson 9 Summary

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:



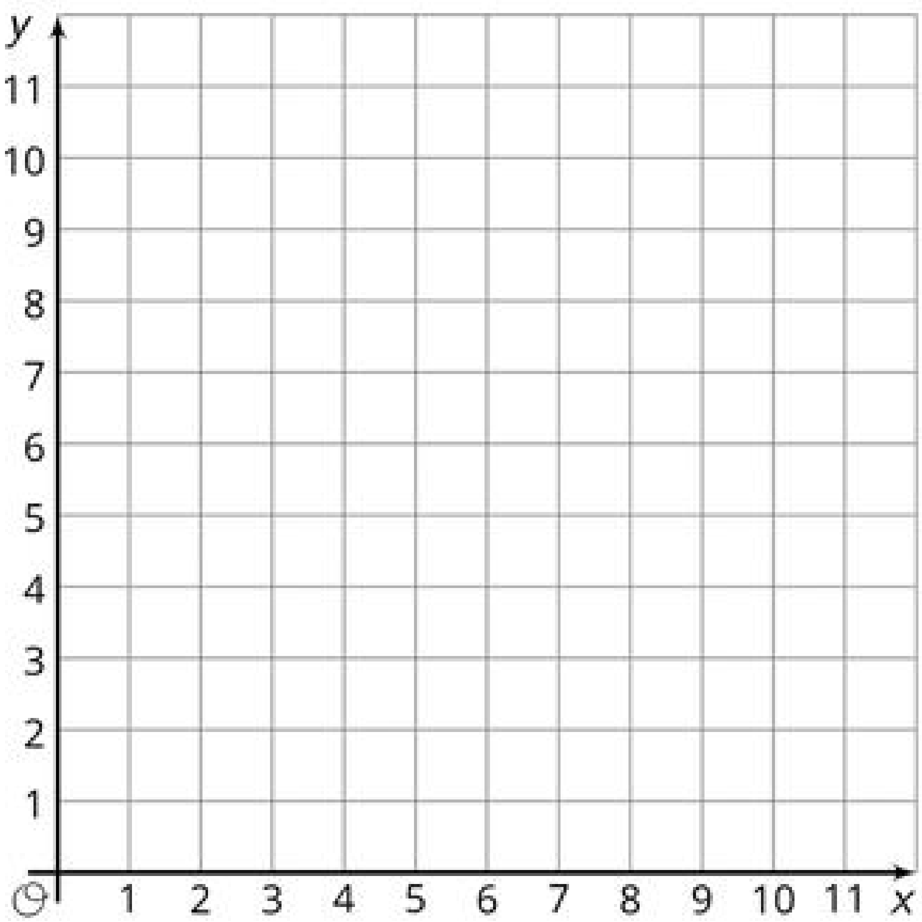
The vertical intercept is 5, since the graph starts when she has $5 on her fare card. The slope of the graph is 0 since she doesn't use her fare card for the next year, meaning the amount on her fare card doesn't change for a year. In fact, all graphs of linear relationships with slopes equal to 0 are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

Lesson 10

Lesson 10: Calculating Slope

Toward a More General Slope Formula

Plot the points (1, 11) and (8, 2), and draw the line that passes through them.

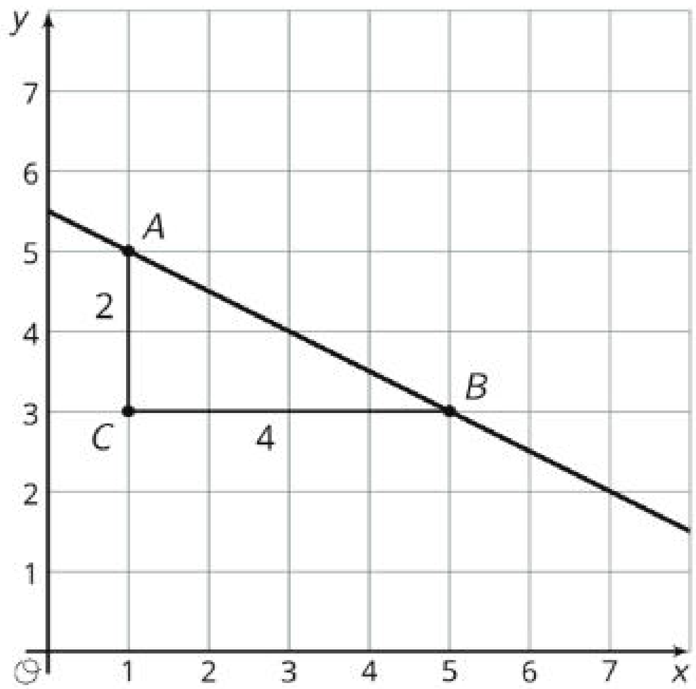


Without calculating, do you expect the slope of the line through (1, 11) and (8, 2) to be positive or negative? How can you tell?

Calculate the slope of the line.

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.

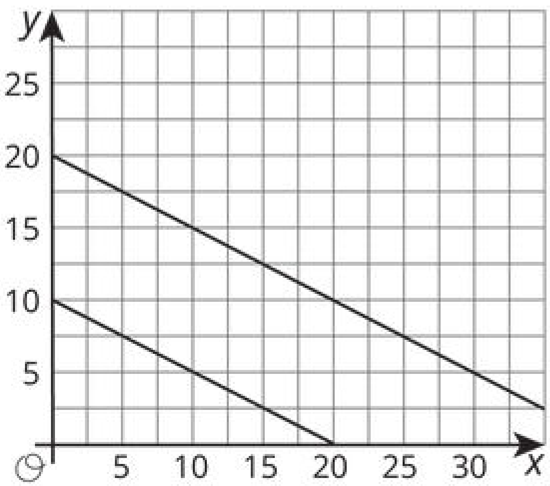
Lesson 11

Lesson 11: Equations of All Kinds of Lines

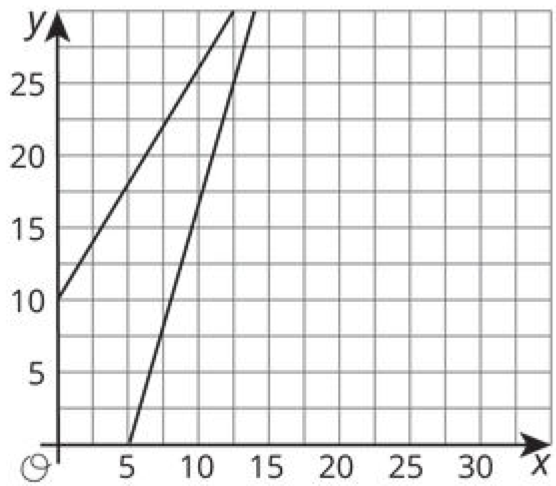
Which One Doesn't Belong

Which one doesn't belong?

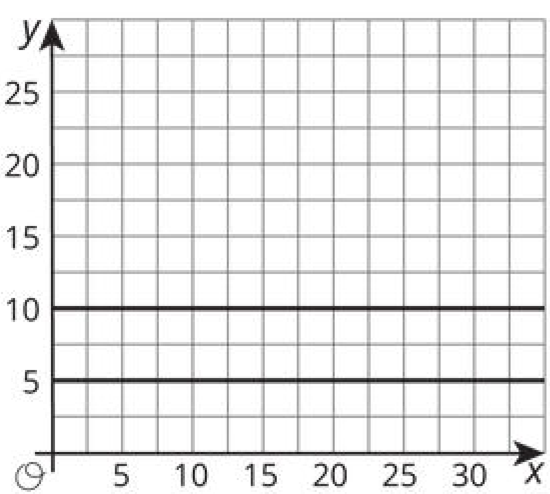
A



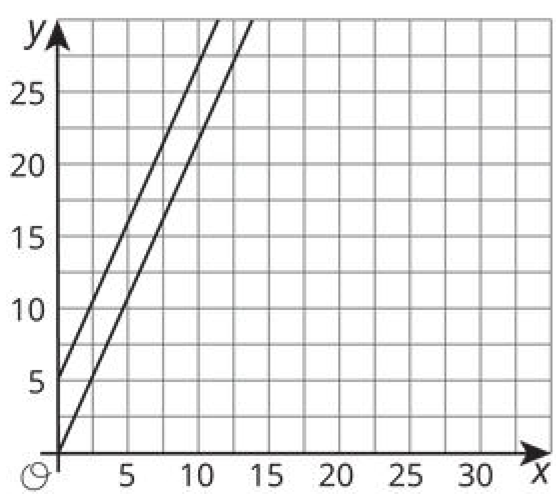
B



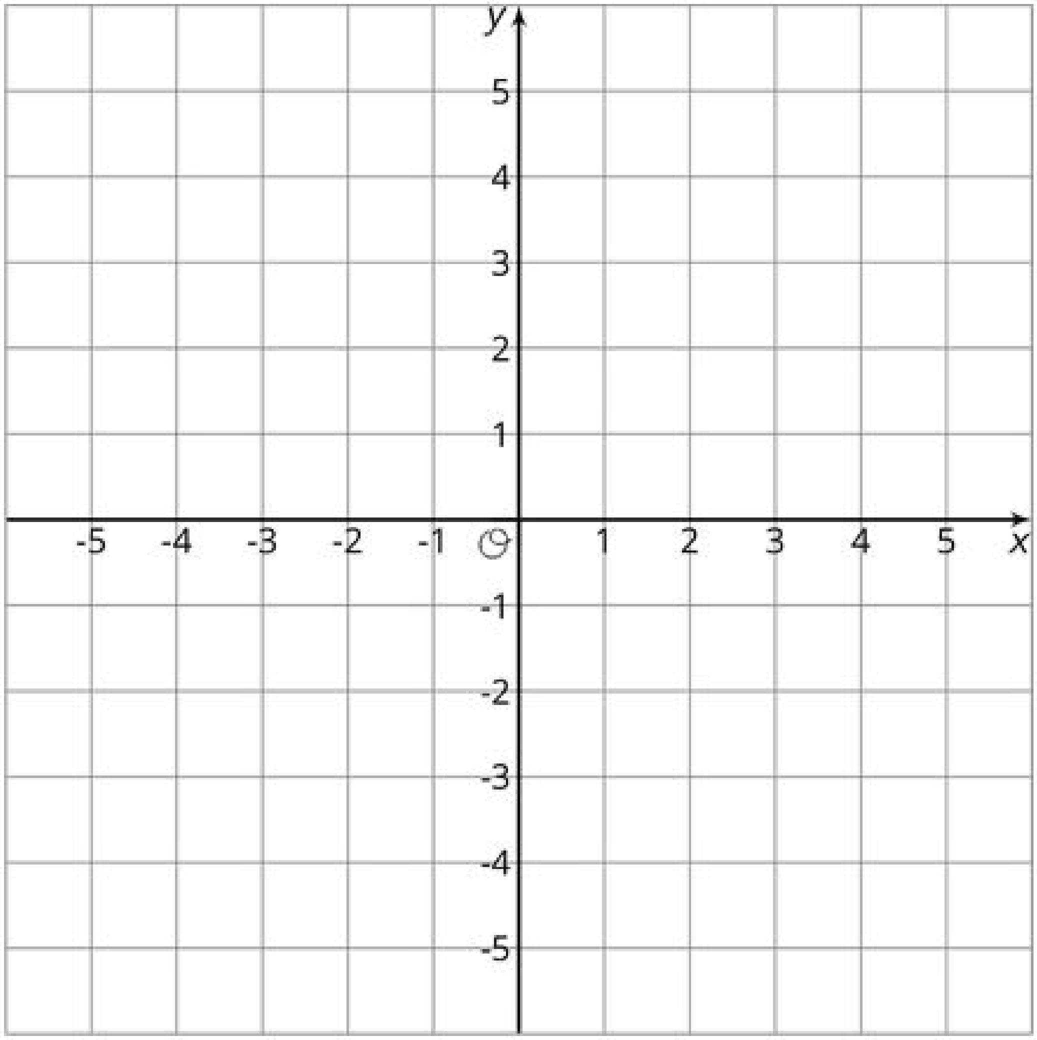
C



D



All the Same



Plot at least 10 points whose y-coordinates is -4. What do you notice about them?

Which equation makes the most sense to represent all of the points with y-coordinate -4?

$x = -4$

$y = -4x$

$y = -4$

$x + y = -4$

Plot at least 10 points whose x-coordinate is 3. What do you notice about them?

Which equation makes the most sense to represent all of the points with x-coordinate 3? Explain how you know.

$x = 3$

$y = 3x$

$y = 3$

$x + y = 3$

Graph the equation x = -2.

Graph the equation y = 5.

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 $(-4, 0)$.

Lesson 12

Lesson 12: Solutions to Linear Equations

Apples and Oranges

At the corner produce market, apples cost $1 each and oranges cost $2 each.

Find the cost of:

6 apples and 3 oranges

4 apples and 4 oranges

5 apples and 4 oranges

8 apples and 2 oranges

Noah has $10 to spend at the produce market. Can he buy 7 apples and 2 oranges? Explain or show your reasoning.

What combinations of apples and oranges can Noah buy if he spends all of his $10?

Use two variables to write an equation that represents $10-combinations of apples and oranges. Be sure to say what each variable means.

What are 3 combination of apples and oranges that make your equation true? What are three combinations of apples and oranges that make it false?

Lesson 12 Summary

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

$$2x + 2y = 8$$

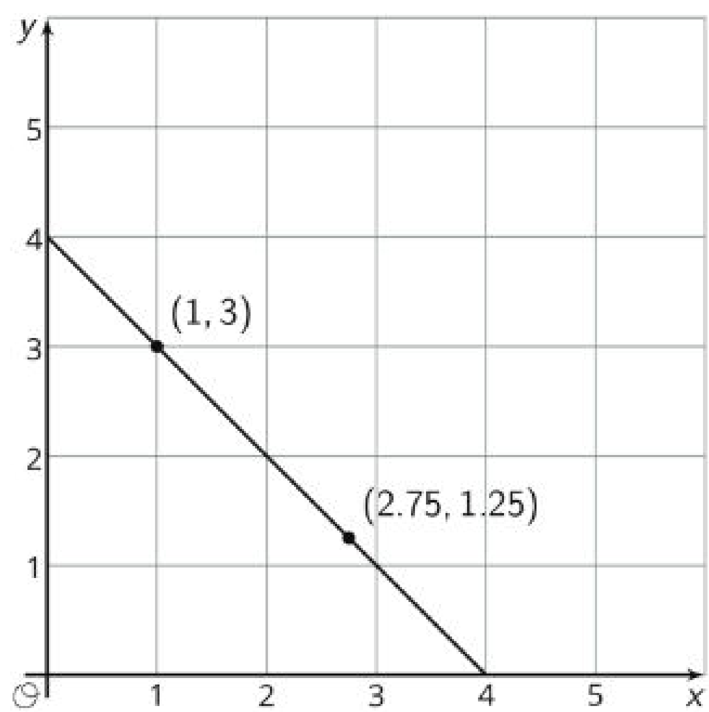
expresses the relationship between the width and length for all such rectangles.

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 $2x + 2y = 8$.

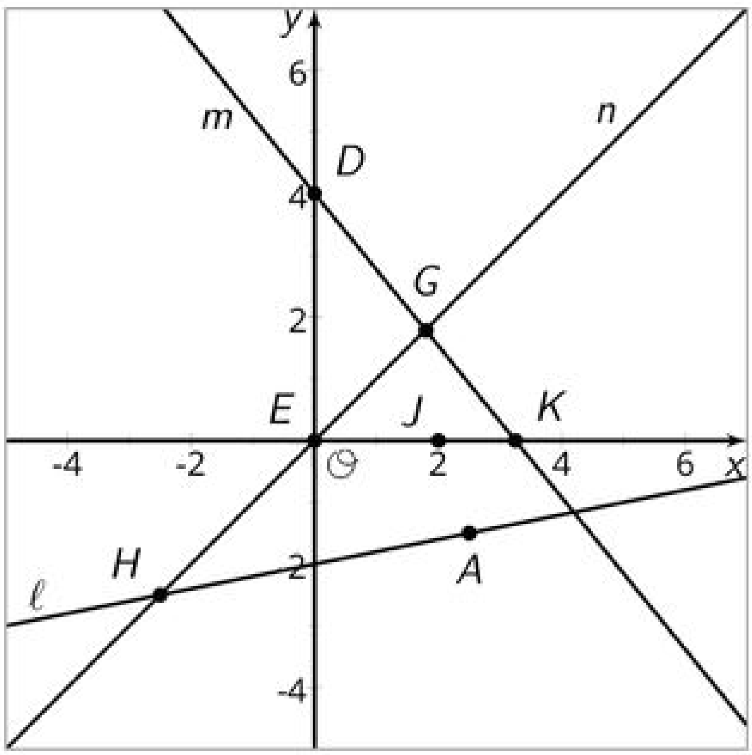


Lesson 13

Lesson 12: More Solutions to Linear Equations

True or False: Solutions in the Coordinate Plane

Here are graphs representing three linear relationships. These relationships could also be represented with equations.



For each statement below, decide if it is true or false. Explain your reasoning.

(4,0) is a solution of the equation for line *m*.

The coordinates of the point *G* make both the equations for line *m* and the equation for line *n* true.

x = 0 is a solution of the equation for line *n*.

(2, 0) makes both the equation for line *m* and the equation for line *n* true.

There is no solution for the equation for line *l* that has y = 0.

The coordinates of point *H* are solutions to the equation for line *l*.

There are exactly two solutions of the equation for line *l.*

There is a point whose coordinates make the equations of all three lines true.

I’ll Take an X, Please

You will work with a partner. One of you will have 6 cards labeled A through F and the other will have 6 cards labeled a through f.

In each pair of cards (for example, Cards A and a), there is an equation on one card and a coordinate pair (x, y), that makes the equation true on the other card.

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.