8th Grade Math Week 1

Dear Parent/Guardian,

During Week 1, we will review and support standards mastery of Equations and Expressions. Your child will work towards understanding the connections between proportional relationships, lines and linear equations. The table below lists this week's tasks and practice problems. Each student task ends with a 'Lesson Summary' section; there, your child can find targeted support for the lesson.

Additionally, students can access the HMH GoMath textbook through ClassLink. The site offers instructional support through links in the online textbook. By selecting embedded links, students can access the Personal Math Trainer for step-by-step examples, Math on the Spot for real-world connections and more examples, and Animated Math to help support conceptual understanding.

We also suggest that students have an experience with math each day. Practicing at home will make a HUGE difference in your child's school success! Make math part of your everyday routine. Choose online sites that match your child's interests. Online math games, when played repeatedly, can encourage strategic mathematical thinking, help develop computational fluency, and deepen their understanding of numbers.

Links for additional resources to support students at home are listed below:
https://www.adaptedmind.com/index.php
https://www.engageny.org/educational-activities-for-parents-and-students
https://www.khanacademy.org/resources/teacher-essentials
https://www.multiplication.com/games/all-games
https://www.prodigygame.com/

Week 1 At A Glance	
Day 1	Unit 3, Lesson 1 - Understanding Proportional Relationships ☐ Student Tasks 1.1, 1.2, 1.3, and Lesson 1 Summary ☐ Practice Problems
Day 2	Unit 3, Lesson 3 - Representing Proportional Relationships ☐ Student Tasks 3.1, 3.2, and Lesson 3 Summary ☐ Practice Problems
Day 3	Unit 3, Lesson 4 - Comparing Proportional Relationships ☐ Student Tasks 4.1, 4.2 and Lesson 4 Summary ☐ Practice Problems
Day 4	Unit 3, Lesson 5 - Introduction to Linear Relationships ☐ Student Tasks 5.1, 5.2, 5.3, and Lesson 5 Summary ☐ Practice Problems
Day 5	Unit 3, Lesson 6 - More Linear Relationships ☐ Student Tasks 6.1, 6.3, and Lesson 6 Summary ☐ Practice Problems

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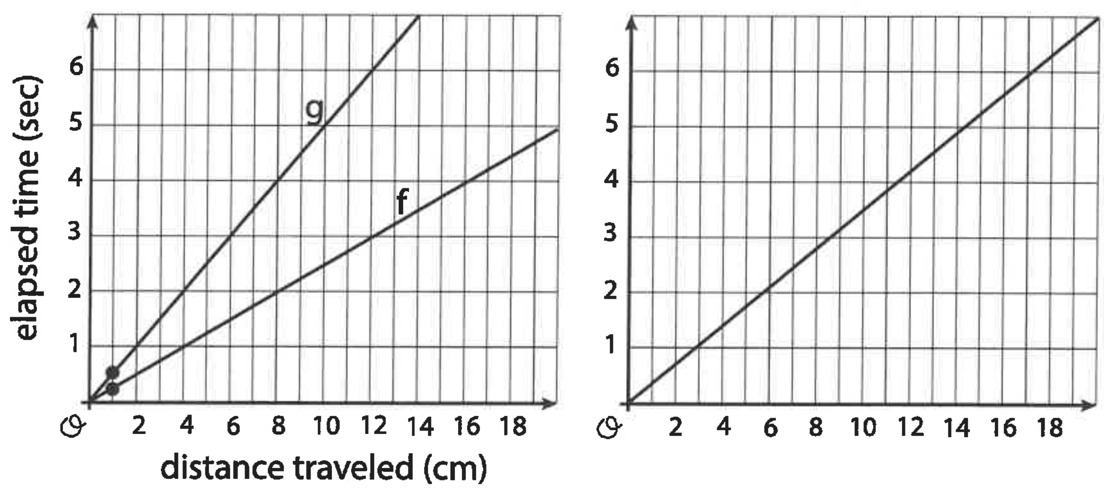
Unit 3, Lesson 1

Understanding Proportional Relationships

Let's study some graphs.

1.1 Notice and Wonder: Two Graphs



What do you notice? What do you wonder?

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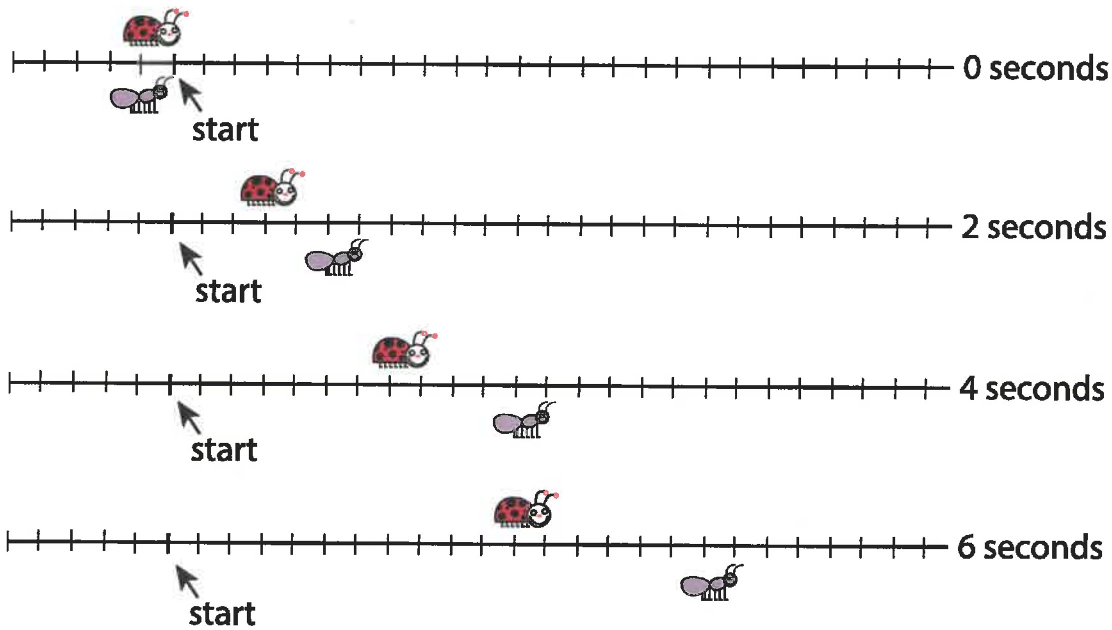
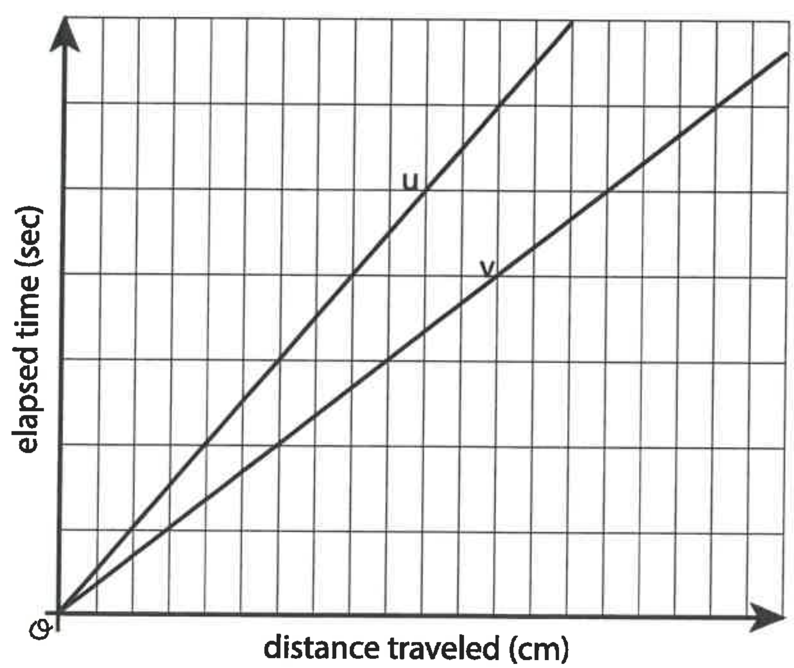
1.2 Moving Through Representations

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.





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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.

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

3. Scale the vertical and horizontal axes by labeling each grid line with a number. You will need to use the time and distance information shown in the tick-mark diagrams.

4. Mark and label the point on line u and the point on line v that represent the time and position of each bug after traveling 1 cm.

Are you ready for more?

1. How fast is each bug traveling?
2. Will there ever be a time when the purple bug (ant) is twice as far away from the start as the red bug (ladybug)? Explain or show your reasoning.

1.3 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. On 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.

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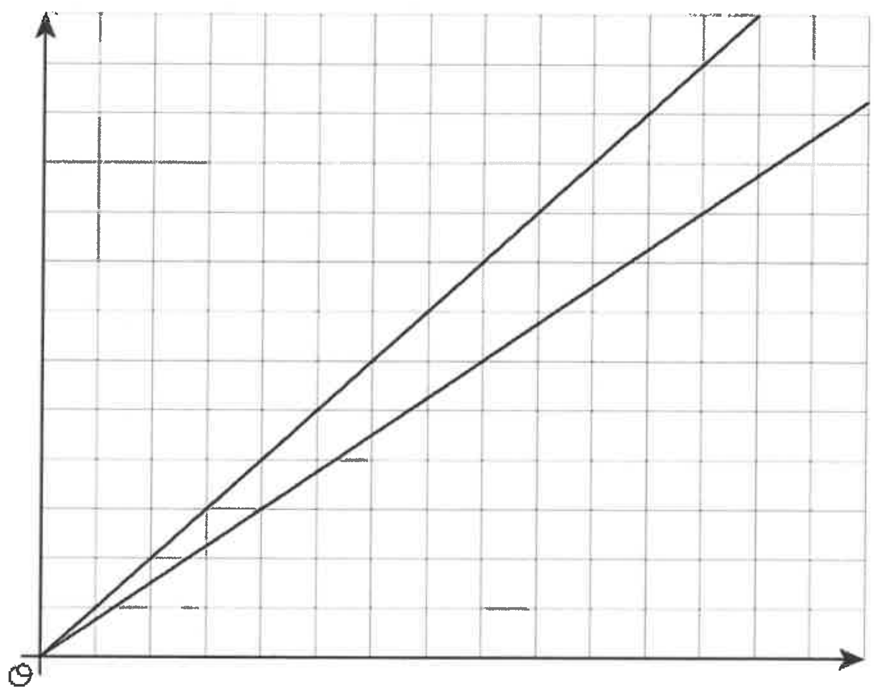
3. Write an equation for each of the three lines.

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:

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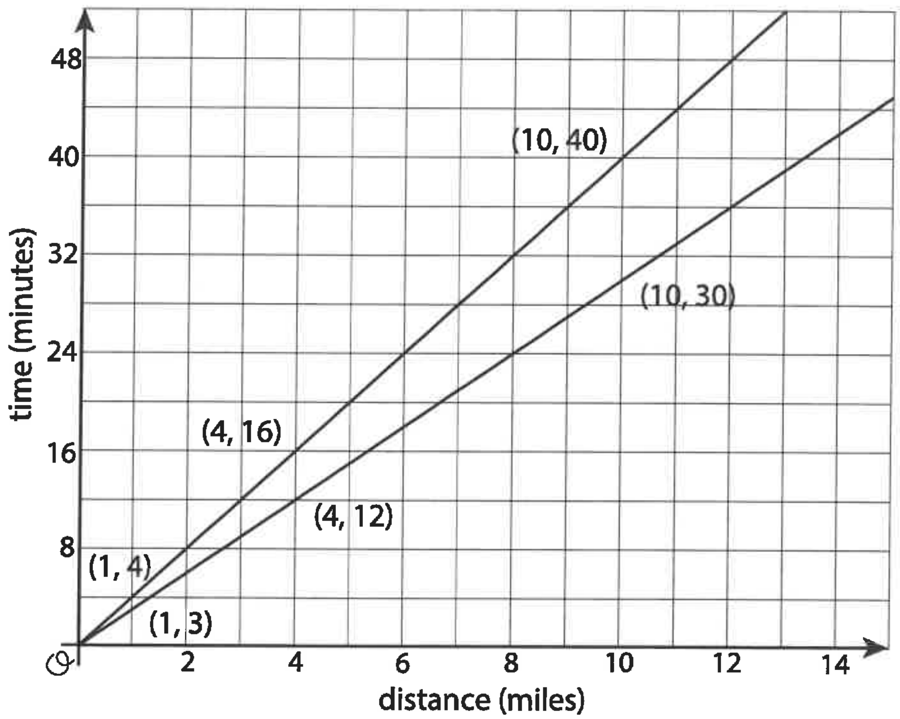

Revisiting the questions from earlier:

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!)

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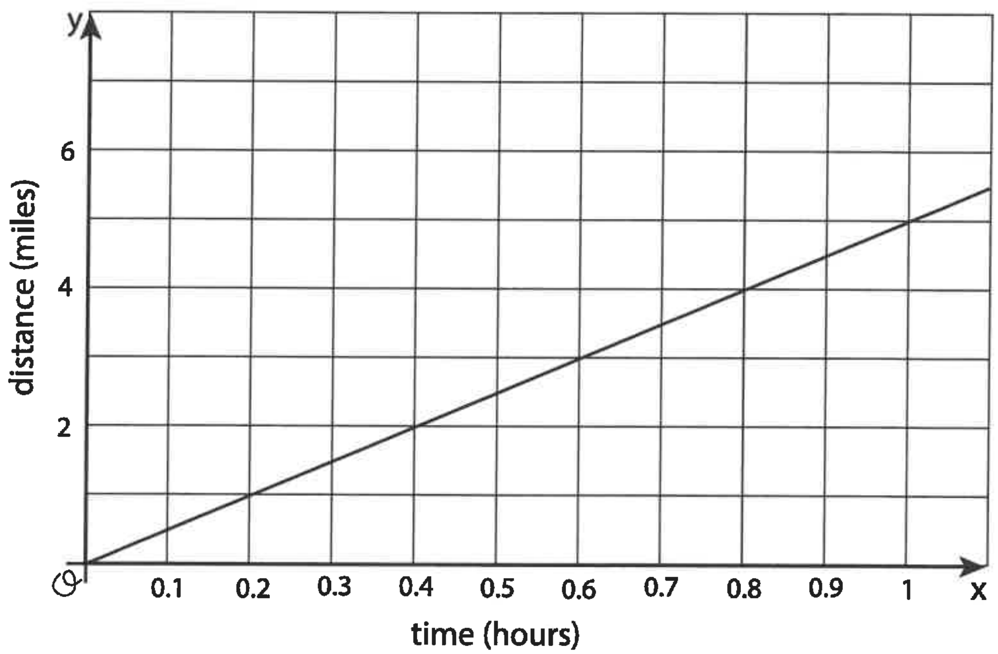
Unit 3, Lesson 1
Practice Problems

1. Priya jogs at a constant speed. The relationship between her distance and time is shown on the graph. Diego bikes at a constant speed twice as fast as Priya. Sketch a graph showing the relationship between Diego's distance and time.



2. A you-pick blueberry farm offers 6 lbs of blueberries for $16.50.

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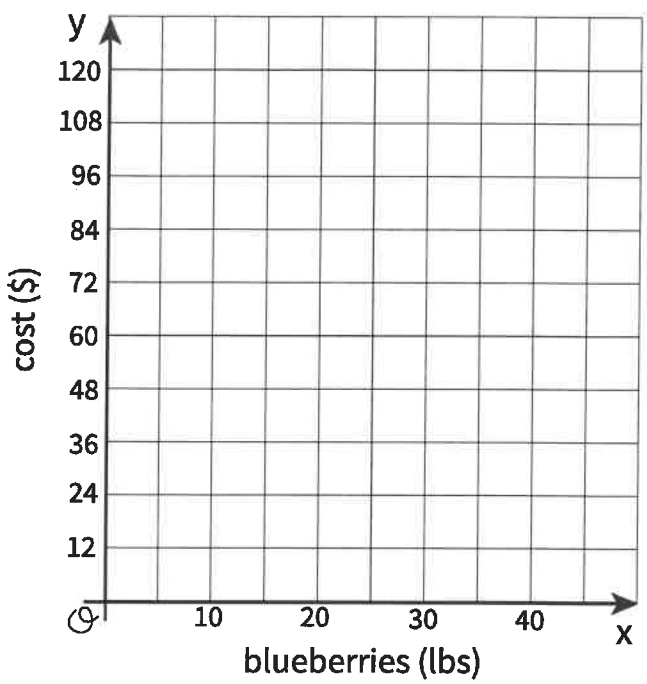
Sketch a graph of the relationship between cost and pounds of blueberries.



3. A line contains the points $(-4, 1)$ and $(4, 6)$. Decide whether or not each of these points is also on the line:

   a. $(0, 3.5)$

   b. $(12, 11)$

   c. $(80, 50)$

   d. $(-1, 2.875)$

4. The points $(2, -4)$, (x, y), A, and B all lie on the line. Find an equation relating x and y
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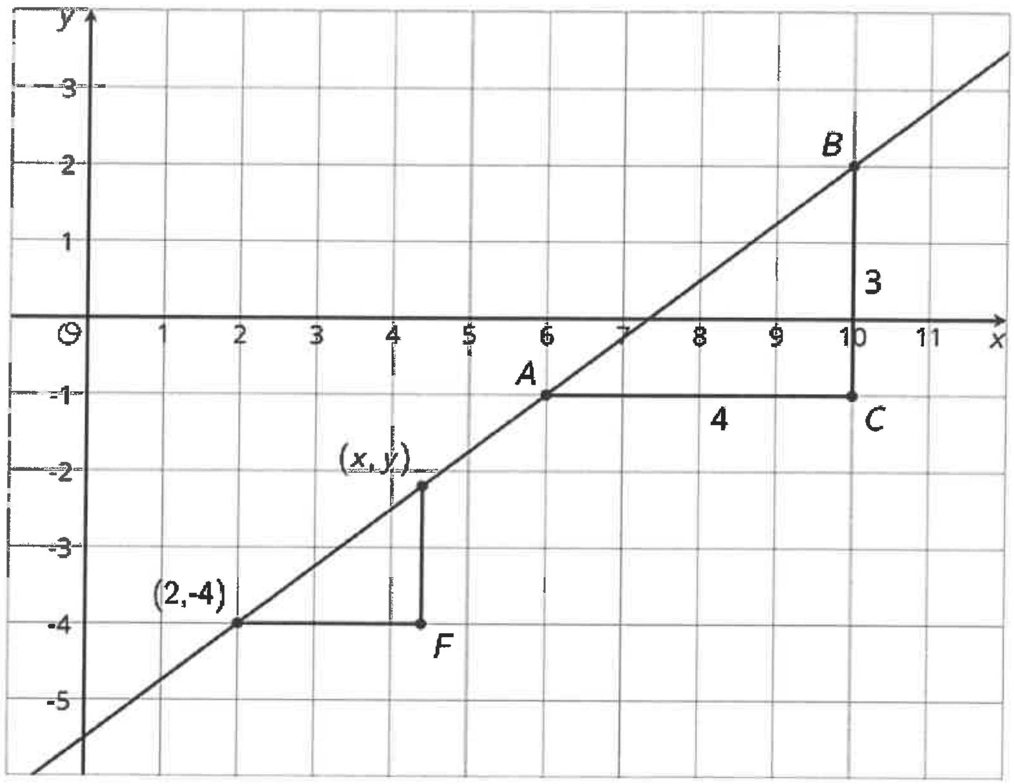

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Unit 3

Lesson 3: Representing Proportional Relationships

Let's graph proportional relationships.

3.1: Number Talk: Multiplication

Find the value of each product mentally.

$15 \cdot 2$

$15 \cdot 0.5$

$15 \cdot 0.25$

$15 \cdot (2.25)$

3.2: Representations of Proportional Relationships

1. 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.

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

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

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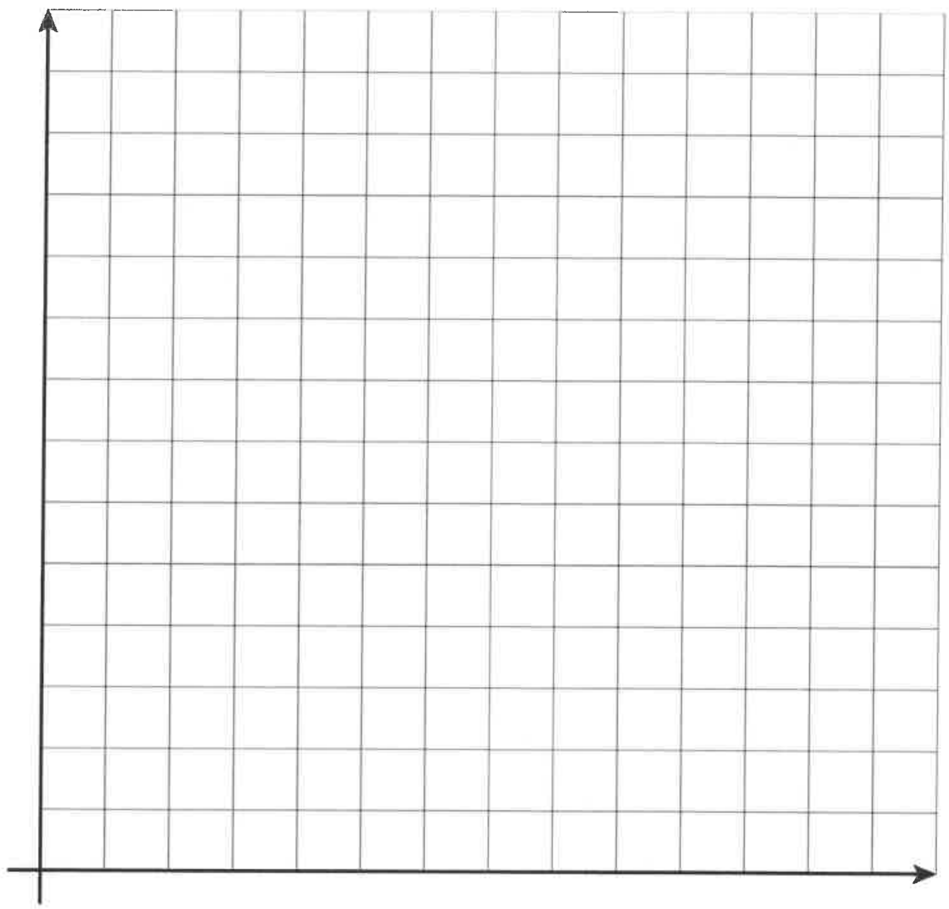
b. Graph this relationship and label the axes.



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

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

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2. Here are two ways to represent a situation.

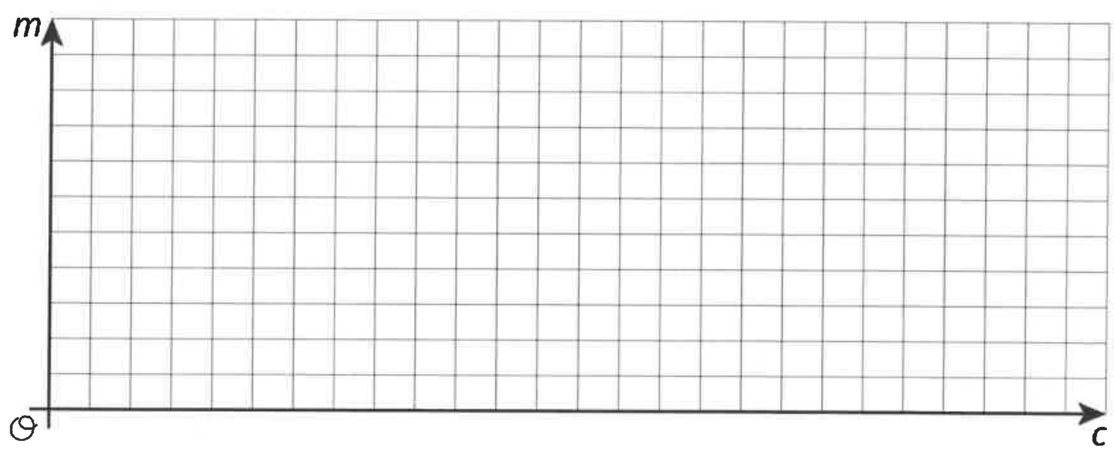
Description: The Origami Club is doing a car wash fundraiser to raise money for a trip. They charge the same price for every car. After 11 cars, they raised a total of $93.50. After 23 cars, they raised a total of $195.50.

Table:

number of cars	amount raised in dollars
11	93.50
23	195.50

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

b. Create a graph that represents this situation.



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

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

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Are you ready for more?

Ten people can dig five holes in three hours. If n people digging at the same rate dig m holes in d hours:

1. Is n proportional to m when $d = 3$?
2. Is n proportional to d when $m = 5$?
3. Is m proportional to d when $n = 10$?

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.

Or if the recipe is used in a food factory that produces very large quantities and the potatoes come in bags of 150, we might just make a table of values showing the number of carrots needed for different multiplies of 150.

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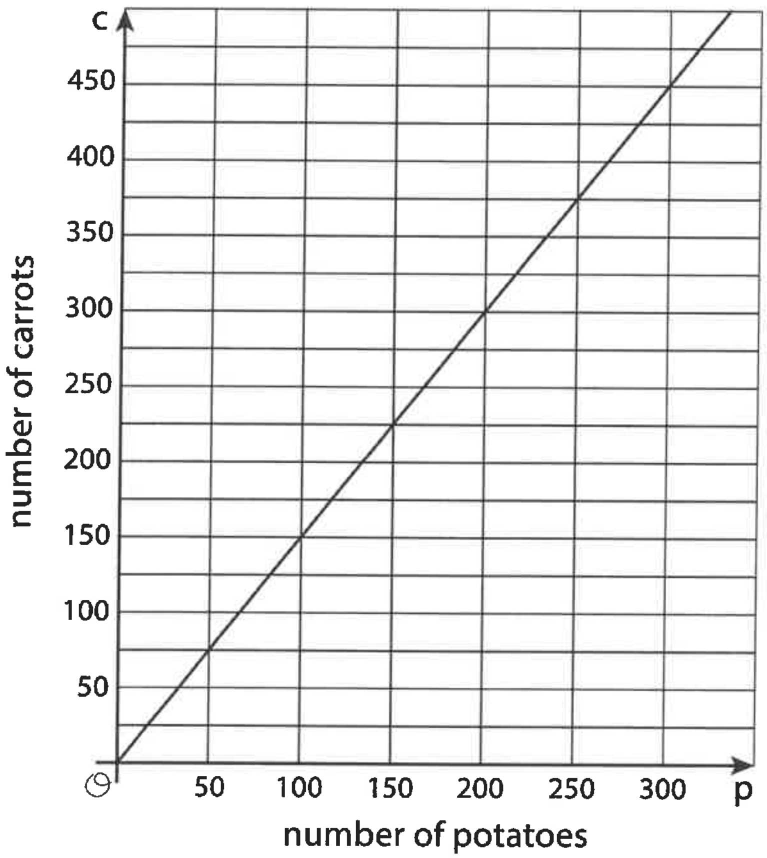

number of potatoes	number of carrots
150	225
300	450
450	675
600	900

No matter the representation or the scale used, the constant of proportionality, $\frac{3}{2}$, is evident in each. In the equation it is the number we multiply p by; in the graph, it is the slope; and in the table, it is the number we multiply values in the left column to get numbers in the right column. We can think of the constant of proportionality as a **rate of change** of c with respect to p. In this case the rate of change is $\frac{3}{2}$ carrots per potato.

Glossary Terms

- rate of change

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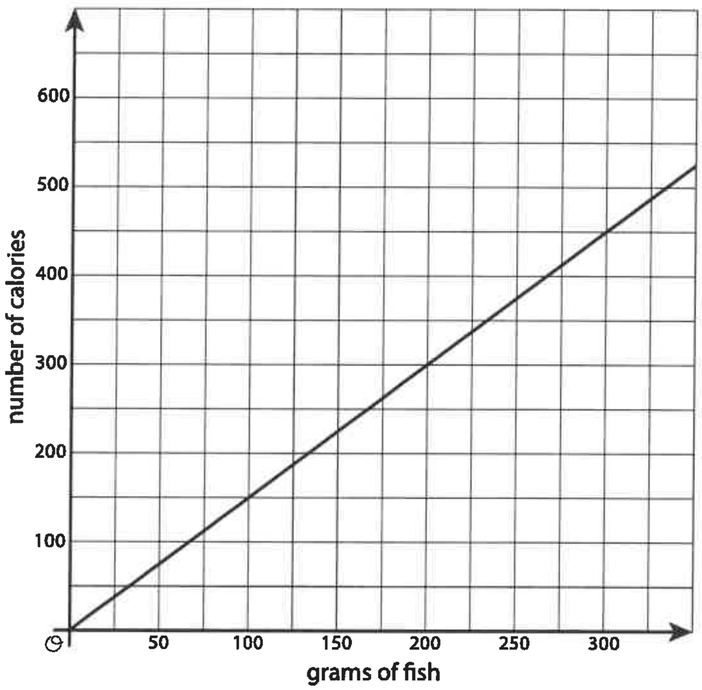
Unit 3, Lesson 3
Practice Problems

1. Here is a graph of the proportional relationship between calories and grams of fish:



   a. Write an equation that reflects this relationship using x to represent the amount of fish in grams and y to represent the number of calories.

   b. Use your equation to complete the table:

grams of fish	number of calories
1000	
	2001
1	

2. Students are selling raffle tickets for a school fundraiser. They collect $24 for every 10 raffle tickets they sell.

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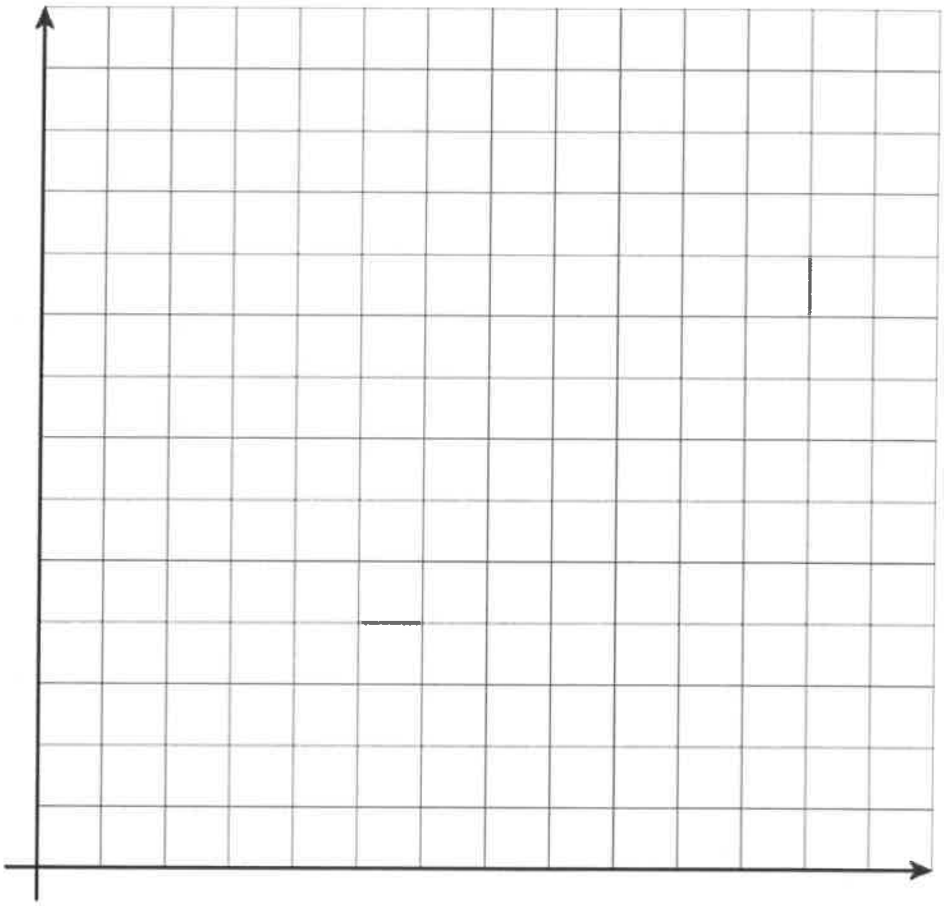
a. Suppose M is the amount of money the students collect for selling R raffle tickets. Write an equation that reflects the relationship between M and R.

b. Label and scale the axes and graph this situation with M on the vertical axis and R on the horizontal axis. Make sure the scale is large enough to see how much they would raise if they sell 1000 tickets.



3. Describe how you can tell whether a line's slope is greater than 1, equal to 1, or less than 1.

4. A line is represented by the equation $\frac{y}{x-2} = \frac{3}{11}$. What are the coordinates of some points that lie on the line? Graph the line on graph paper.

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Unit 3, Lesson 4

Comparing Proportional Relationships

Let's compare proportional relationships.

4.1 What's the Relationship?

The equation $y = 4.2x$ could represent a variety of different situations.

1. Write a description of a situation represented by this equation. Decide what quantities x and y represent in your situation.

2. Make a table and a graph that represent the situation.

4.2 Summer Jobs

1. Elena and Jada each make money by helping out their neighbors.

   Elena babysits. Her earnings are given by the equation $y = 8.40x$, where x represents how many hours she works and y represents how much money she earns.

   Jada earns $7 per hour mowing her neighbors' lawns.

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

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

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

2. Han and Clare have summer jobs stuffing envelopes for two different companies.

Han earns $15 for every 300 envelopes he finishes.

Clare's earnings:

number of envelopes	money in dollars
400	40
900	90

a. Who would make more money after stuffing 1,500 envelopes? How much more money would they make? Explain how you know.

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

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

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

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

Recipe 2:

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.

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

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

Are you ready for more?

Han and Clare are still stuffing envelopes. Han can stuff 20 envelopes in a minute, and Clare can stuff 10 envelopes in a minute. They start working together on a pile of 1,000 envelopes.

1. How long does it take them to finish the pile?
2. Who earns more money?

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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 the amount of money she earns, in dollars, for working x hours.

The table shows some information about Jada's pay.

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

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

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.

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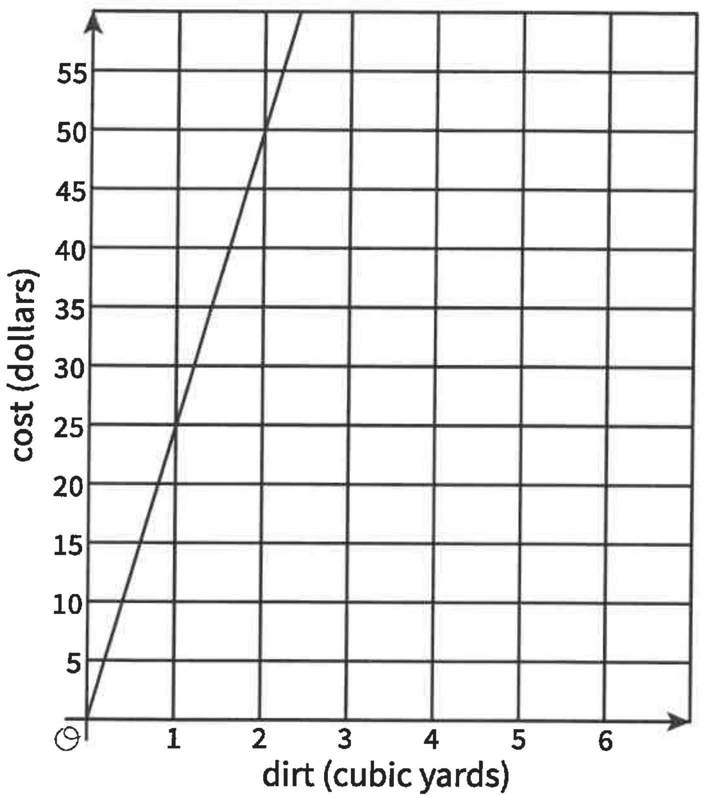
Unit 3, Lesson 4
Practice Problems

1. A contractor must haul a large amount of dirt to a work site. She collected information from two hauling companies. EZ Excavation gives its prices in a table. Happy Hauling Service gives its prices in a graph.

dirt (cubic yards)	cost (dollars)
8	196
20	490
26	637



a. How much would each hauling company charge to haul 40 cubic yards of dirt? Explain or show your reasoning.

b. Calculate the rate of change for each relationship. What do they mean for each company?

c. If the contractor has 40 cubic yards of dirt to haul and a budget of $1000, which hauling company should she hire? Explain or show your reasoning.

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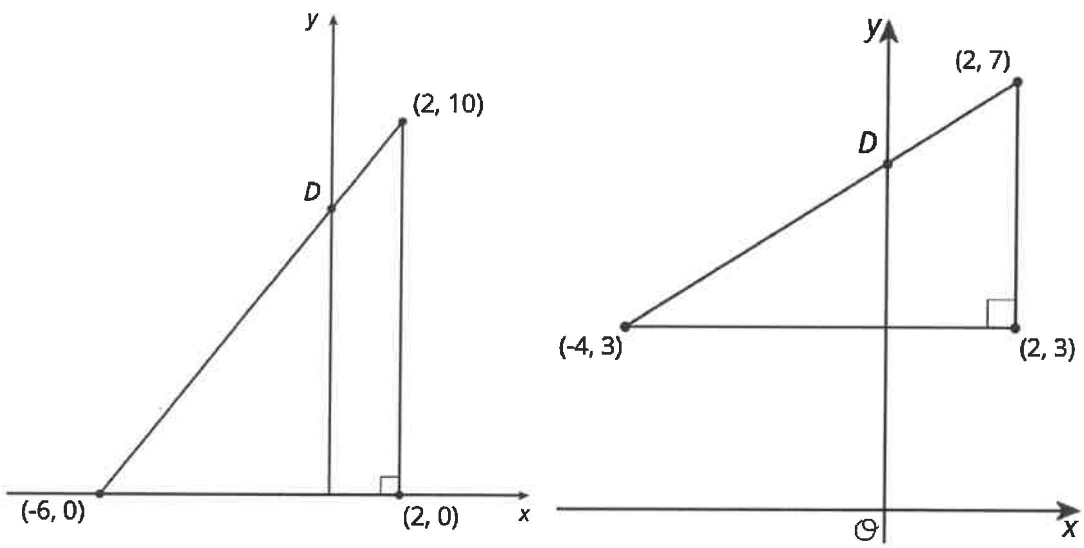
2. Andre and Priya are tracking the number of steps they walk. Andre records that he can walk 6000 steps in 50 minutes. Priya writes the equation $y = 118x$, where y is the number of steps and x is the number of minutes she walks, to describe her step rate. This week, Andre and Priya each walk for a total of 5 hours. Who walks more steps? How many more?

3. Find the coordinates of point D in each diagram:



4. Select **all** the pairs of points so that the line between those points has slope $\frac{2}{3}$.

A. $(0,0)$ and $(2,3)$

B. $(0,0)$ and $(3,2)$

C. $(1,5)$ and $(4,7)$

D. $(-2,-2)$ and $(4,2)$

E. $(20,30)$ and $(-20,-30)$

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Unit 3, Lesson 5

Introduction to Linear Relationships

Let's explore some relationships between two variables.

5.1 Number Talk: Fraction Division

Find the value of $2\frac{5}{8} \div \frac{1}{2}$.

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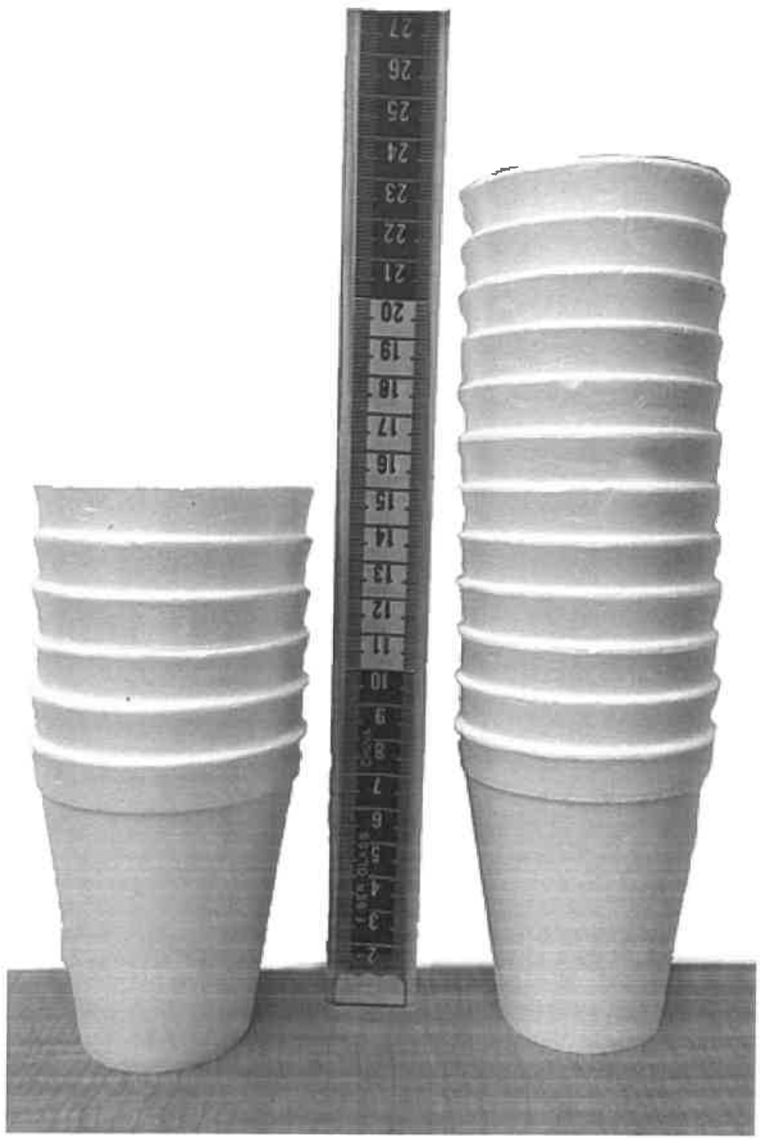
5.2 Stacking Cups

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 cm. How many cups are needed for a stack with a height of 50 cm?



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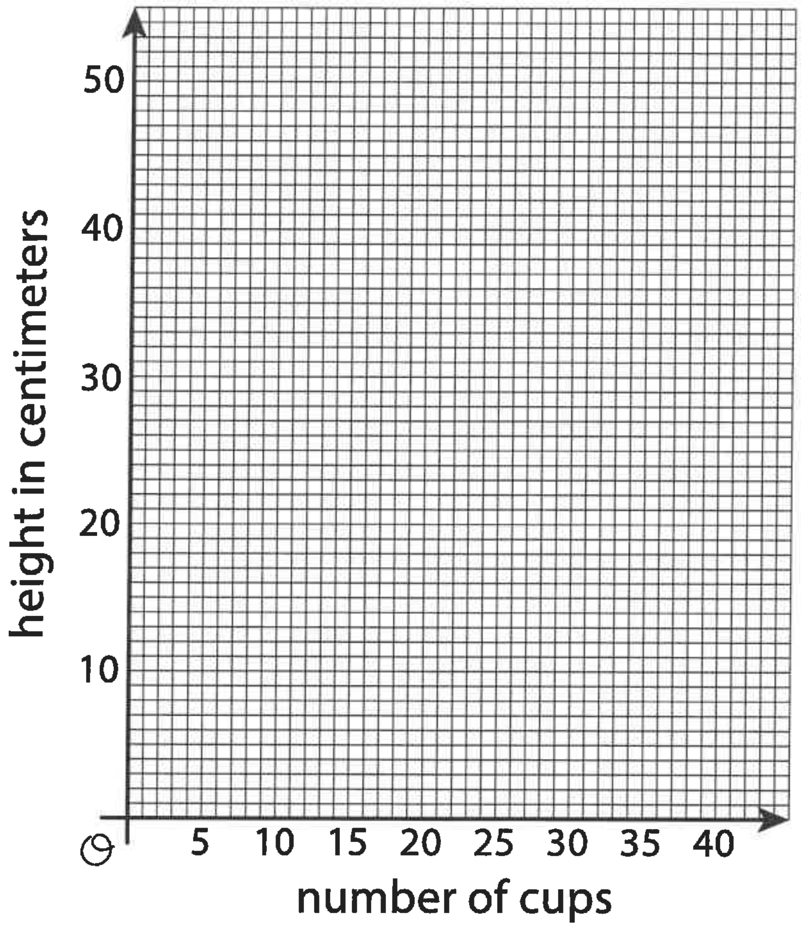
5.3 Connecting Slope to Rate of Change



1. If you didn't create your own graph of the situation before, do so now.

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

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

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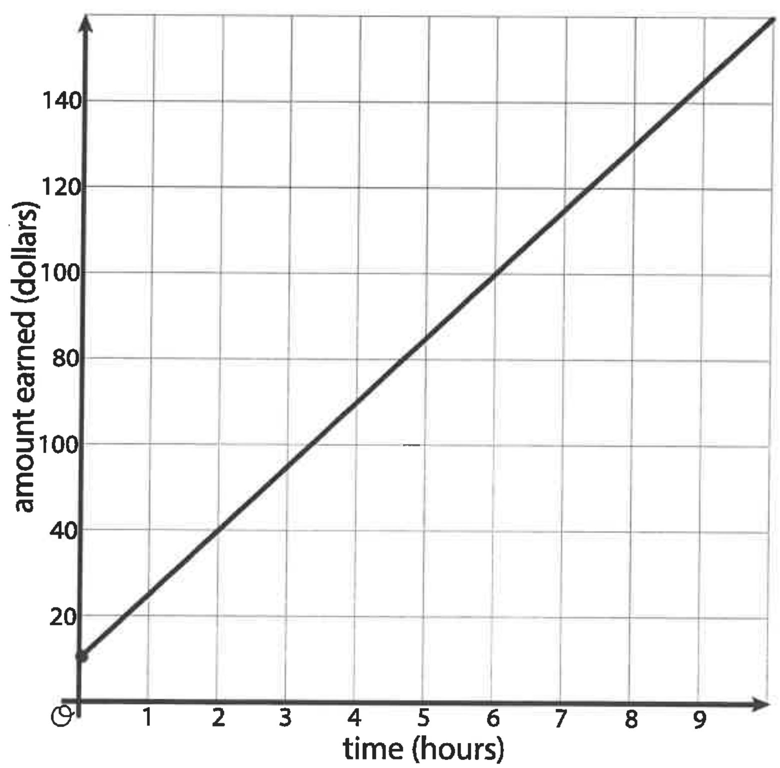
4. At what point does your line intersect the vertical axis? What do the coordinates of this point tell you about the cups?

5. 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.



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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.

Glossary Terms

linear relationship

rate of change

slope

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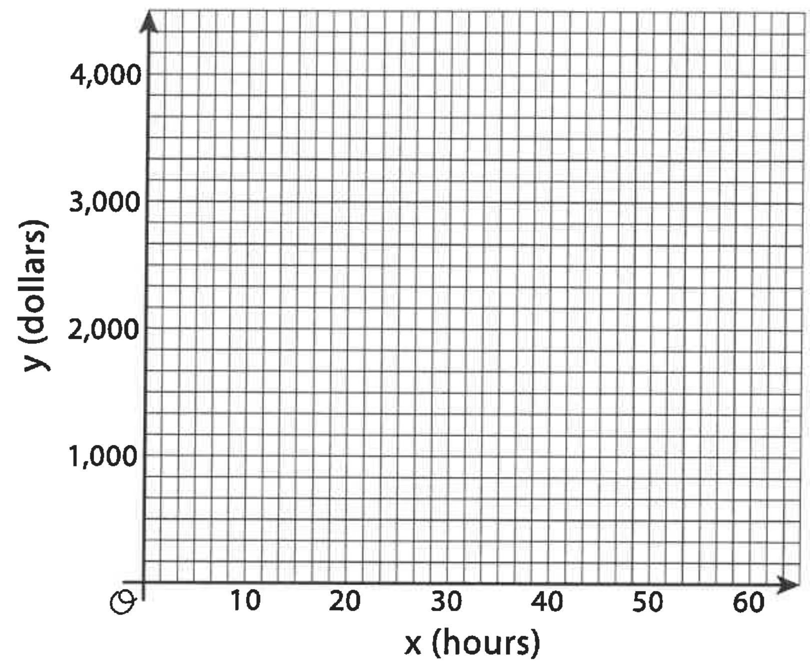
Unit 3, Lesson 5
Practice Problems

1. A restaurant offers delivery for their pizzas. The total cost is a delivery fee added to the price of the pizzas. One customer pays $25 to have 2 pizzas delivered. Another customer pays $58 for 5 pizzas. How many pizzas are delivered to a customer who pays $80?

2. To paint a house, a painting company charges a flat rate of $500 for supplies, plus $50 for each hour of labor.



   a. How much would the painting company charge to paint a house that needs 20 hours of labor? A house that needs 50 hours?

   b. Draw a line representing the relationship between x, the number of hours it takes the painting company to finish the house, and y, the total cost of painting the house. Label the two points from the earlier question on your graph.

   c. Find the slope of the line. What is the meaning of the slope in this context?

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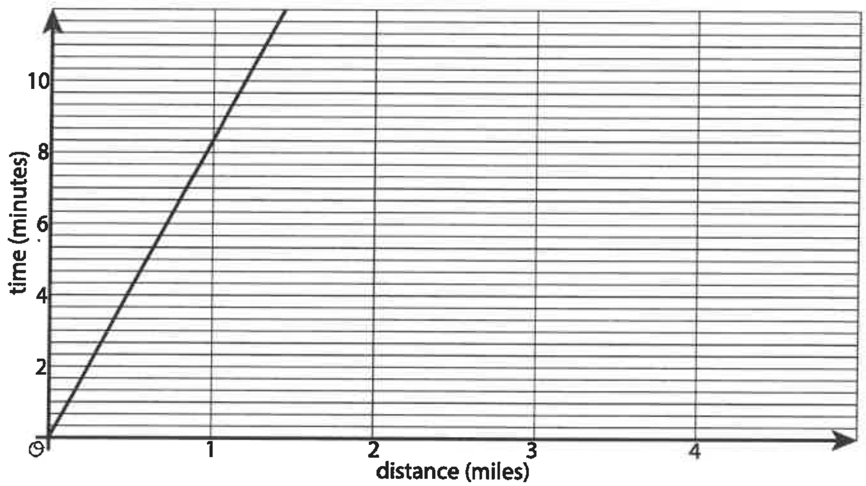
3. Tyler and Elena are on the cross country team.

   Tyler's distances and times for a training run are shown on the graph.



   Elena's distances and times for a training run are given by the equation $y = 8.5x$, where x represents distance in miles and y represents time in minutes.

   a. Who ran farther in 10 minutes? How much farther? Explain how you know.

   b. Calculate each runner's pace in minutes per mile.

   c. Who ran faster during the training run? Explain or show your reasoning.

4. Write an equation for the line that passes through $(2, 5)$ and $(6, 7)$.

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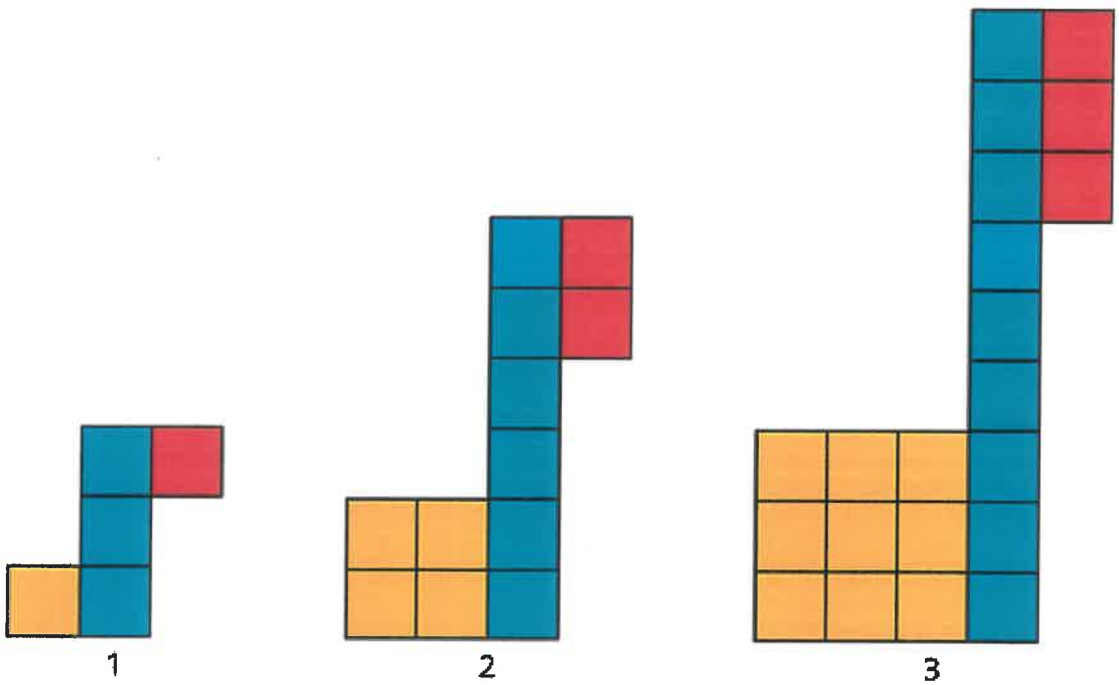
Unit 3, Lesson 6

More Linear Relationships

Let's explore some more relationships between two variables.

6.1 Growing

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



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

2. How many tiles of each color will be in the nth diagram? Be prepared to explain how your reasoning.

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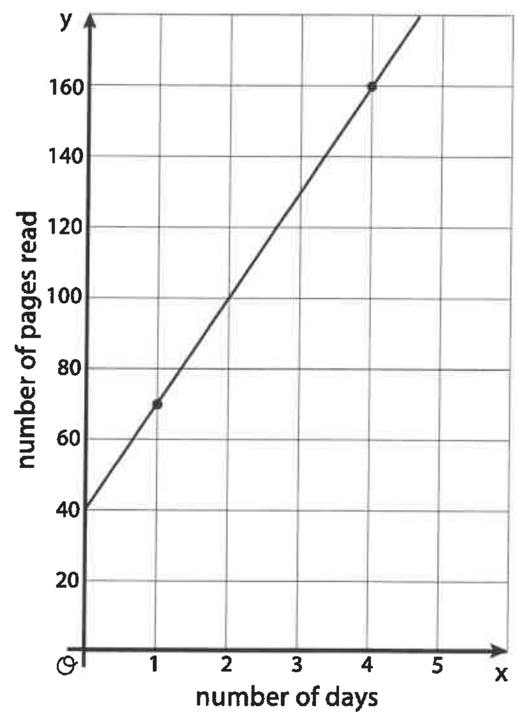
6.3 Summer Reading

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



After day 1, Lin reaches page 70, which matches the 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 on her graph. Lin is not sure what went wrong since she knows she followed her reading plan.

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

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

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

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Are you ready for more?

Jada's grandparents started a savings account for her in 2010. The table shows the amount in the account each year.

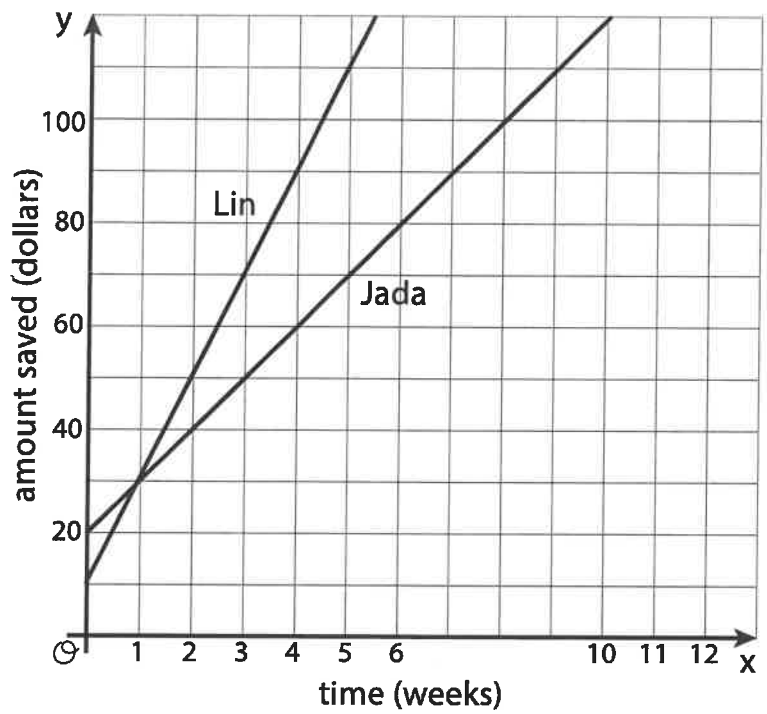
year	amount in dollars
2010	600
2012	750
2014	900
2016	1050

If this relationship is graphed with the year on the horizontal axis and the amount in dollars on the vertical axis, what is the vertical intercept? What does it mean in this context?

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:

NAME DATE PERIOD



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.

Glossary Terms

vertical intercept

NAME DATE PERIOD

Unit 3, Lesson 6
Practice Problems

1. Explain what the slope and intercept mean in each situation.

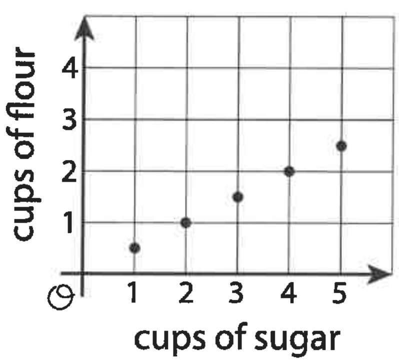
   a. A graph represents the perimeter, y, in units, for an equilateral triangle with side length x units. The slope of the line is 3 and the y-intercept is 0.

   b. The amount of money, y, in a cash box after x tickets are purchased for carnival games. The slope of the line is $\frac{1}{4}$ and the y-intercept is 8.

   c. The number of chapters read, y, after x days. The slope of the line is $\frac{5}{4}$ and the y -intercept is 2.

   d. The graph shows the cost in dollars, y, of a muffin delivery and the number of muffins, x, ordered. The slope of the line is 2 and the y-intercept is 3.

2. The graph shows the relationship between the number of cups of flour and the number of cups of sugar in Lin's favorite brownie recipe.



The table shows the amounts of flour and sugar needed for Noah's favorite brownie recipe.

NAME DATE PERIOD

amount of sugar (cups)	amount of flour (cups)
$\frac{3}{2}$	1
3	2
$4\frac{1}{2}$	3

a. Noah and Lin buy a 12-cup bag of sugar and divide it evenly to make their recipes. If they each use all their sugar, how much flour do they each need?

b. Noah and Lin buy a 10-cup bag of flour and divide it evenly to make their recipes. If they each use all their flour, how much sugar do they each need?

3. Customers at the gym pay a membership fee to join and then a fee for each class they attend. Here is a graph that represents the situation.

NAME DATE PERIOD

a. What does the slope of the line shown by the points mean in this situation?

b. What does the vertical intercept mean in this situation?