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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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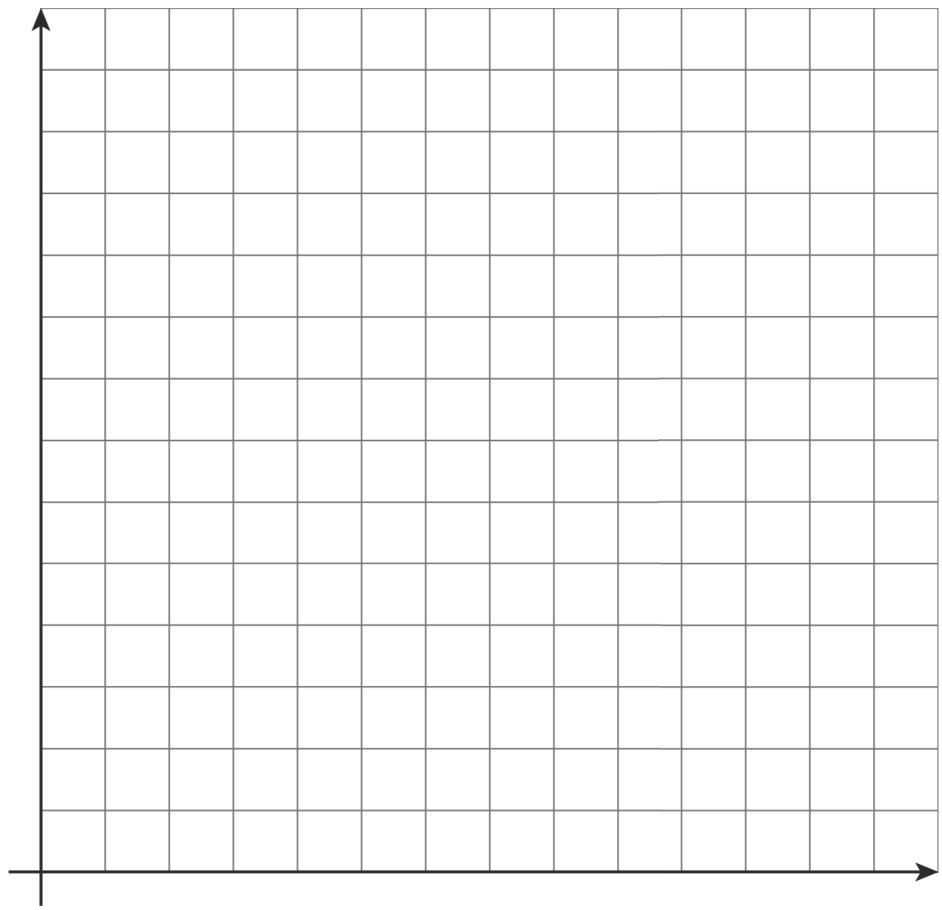
b. Graph this relationship and label the axes.



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.

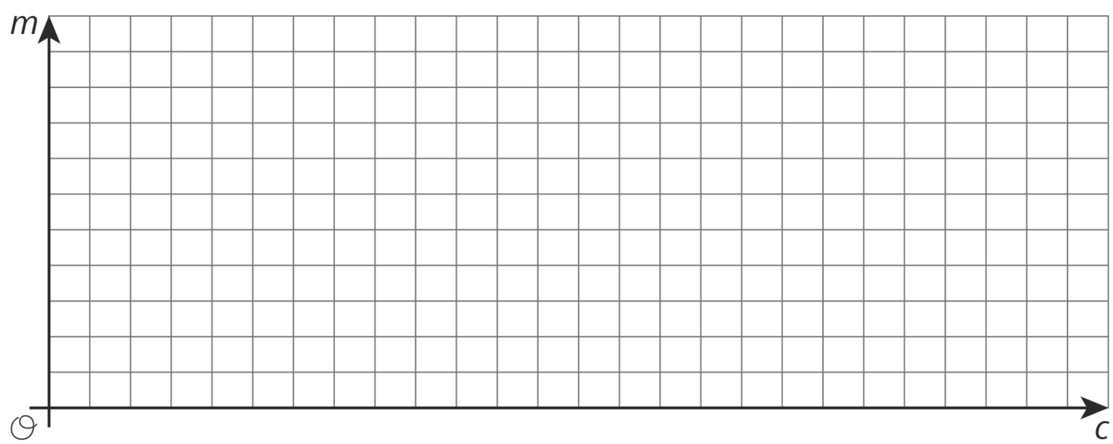
Description: The Origami Club is doing a car wash fundraiser to raise money for a trip. They charge the same price for every car. After 11 cars, they raised a total of $93.50. After 23 cars, they raised a total of $195.50.

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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3.3: Info Gap: Proportional Relationships

Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.

If your teacher gives you the *problem card*:

1. Silently read your card and think about what information you need to answer the question.
2. Ask your partner for the specific information that you need.
3. Explain to your partner how you are using the information to solve the problem.
4. Solve the problem and explain your reasoning to your partner.

If your teacher gives you the *data card*:

1. Silently read the information on your card.
2. Ask your partner "What specific information do you need?" and wait for your partner to *ask* for information. *Only* give information that is on your card. (Do not figure out anything for your partner!)
3. Before telling your partner the information, ask "Why do you need that information?"
4. After your partner solves the problem, ask them to explain their reasoning and listen to their explanation.

Pause here so your teacher can review your work. Ask your teacher for a new set of cards and repeat the activity, trading roles with your partner.

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 $n = 10$?

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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.

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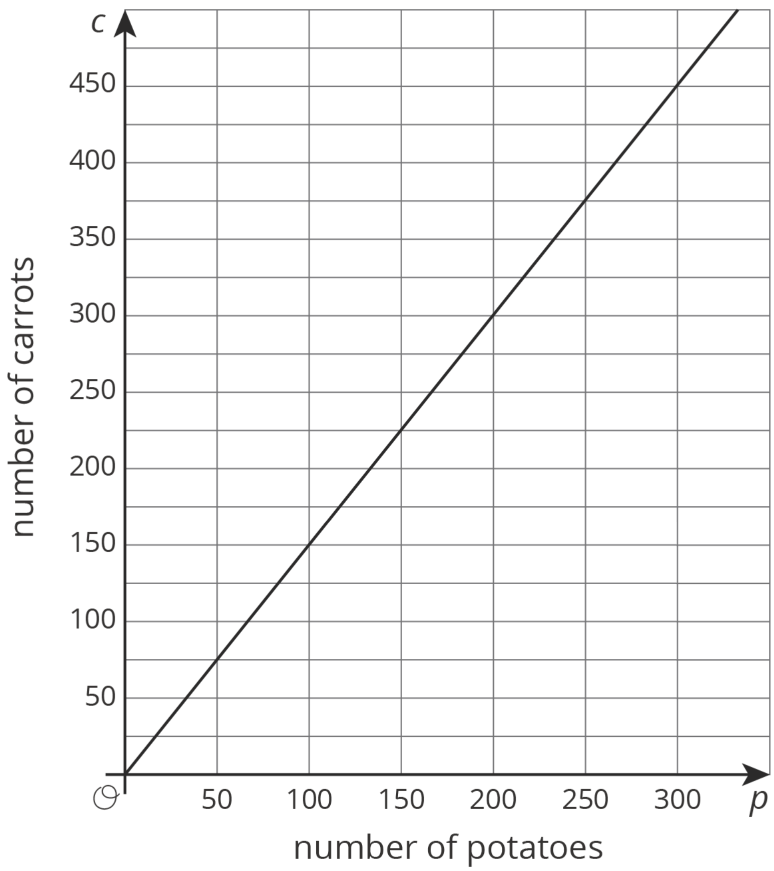
Or if the recipe is used in a food factory that produces very large quantities and the potatoes come in bags of 150, we might just make a table of values showing the number of carrots needed for different multiplies of 150.



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.

Lesson 3 Glossary Terms

- rate of change

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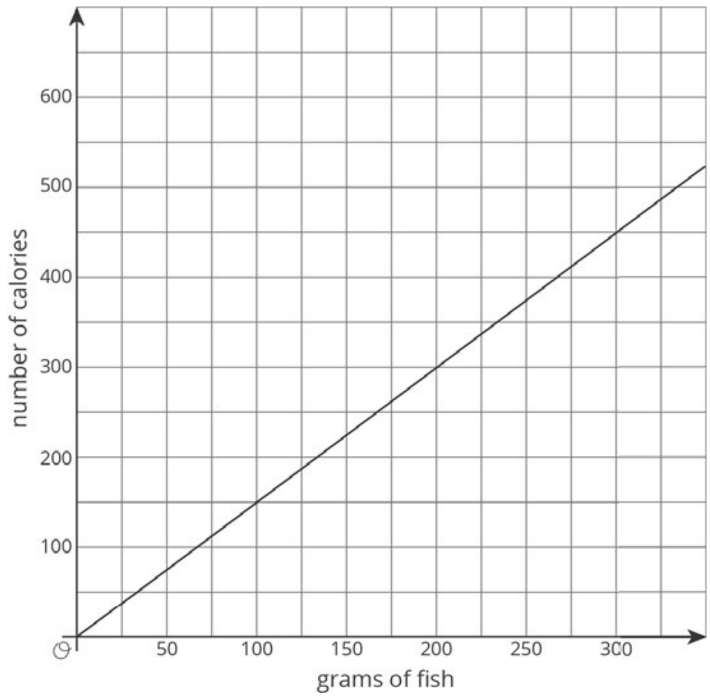
Unit 3, Lesson 3: Representing Proportional Relationships

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.

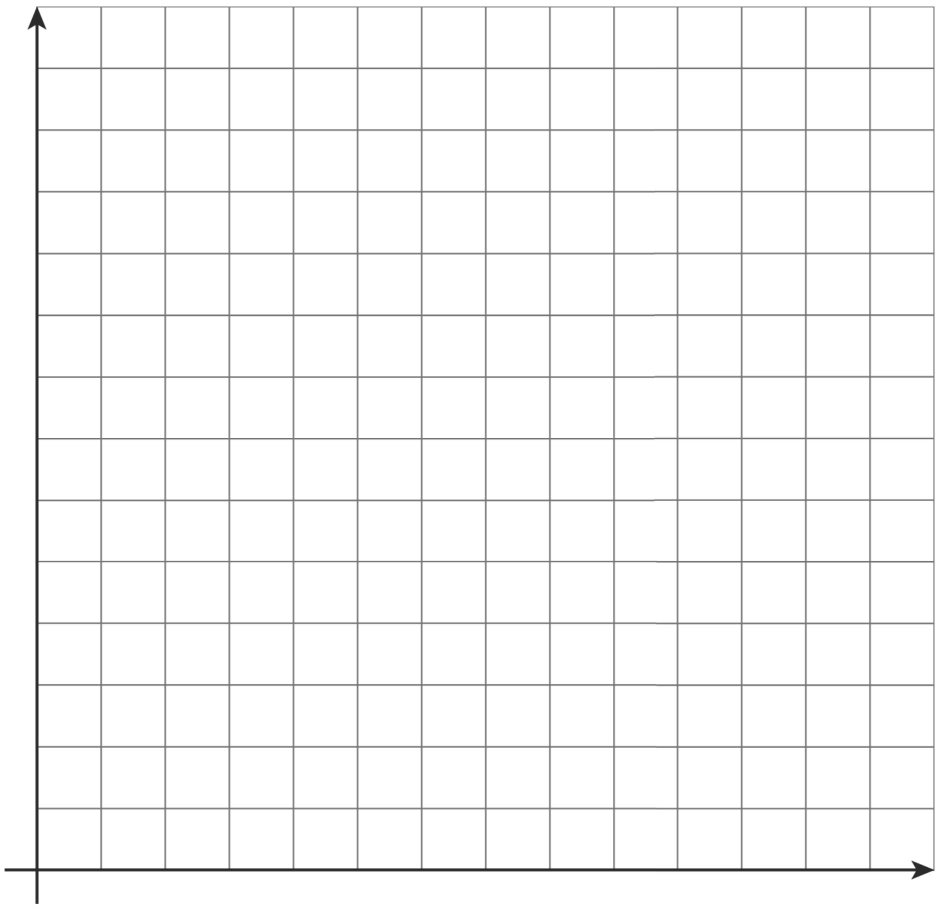
   b. Use your equation to complete the table:

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.

   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.

   (from Unit 2, Lesson 10)

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.

   (from Unit 2, Lesson 12)