NAME DATE PERIOD

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 $2\frac{5}{8} \div \frac{1}{2}$.

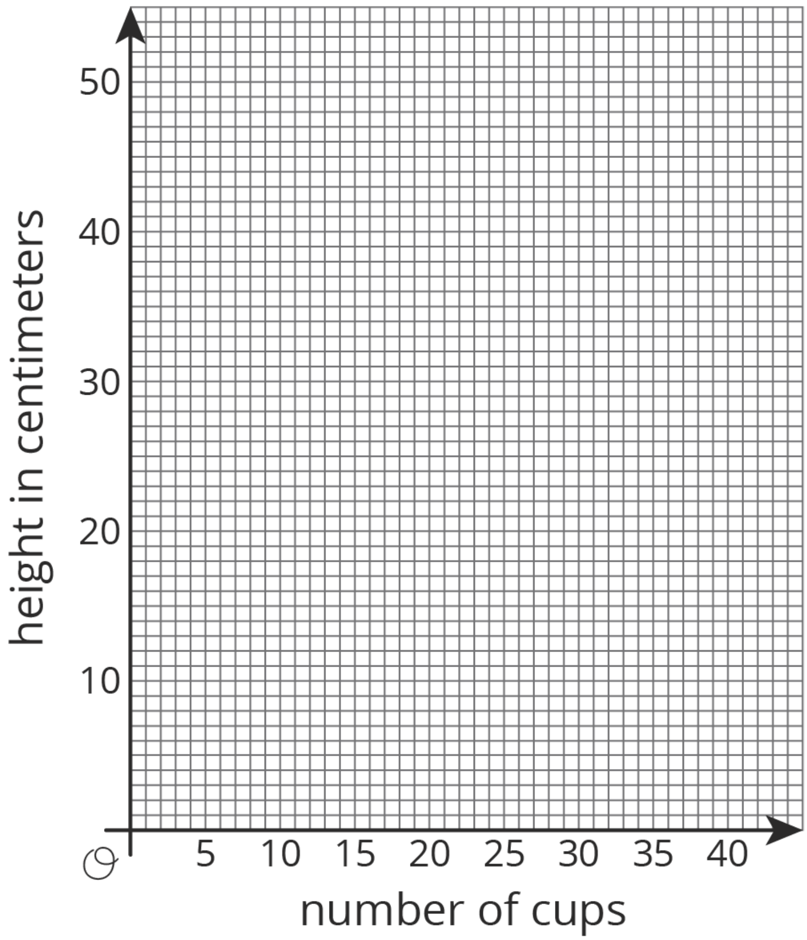
5.2: Stacking Cups

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?

NAME DATE PERIOD

NAME DATE PERIOD

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?

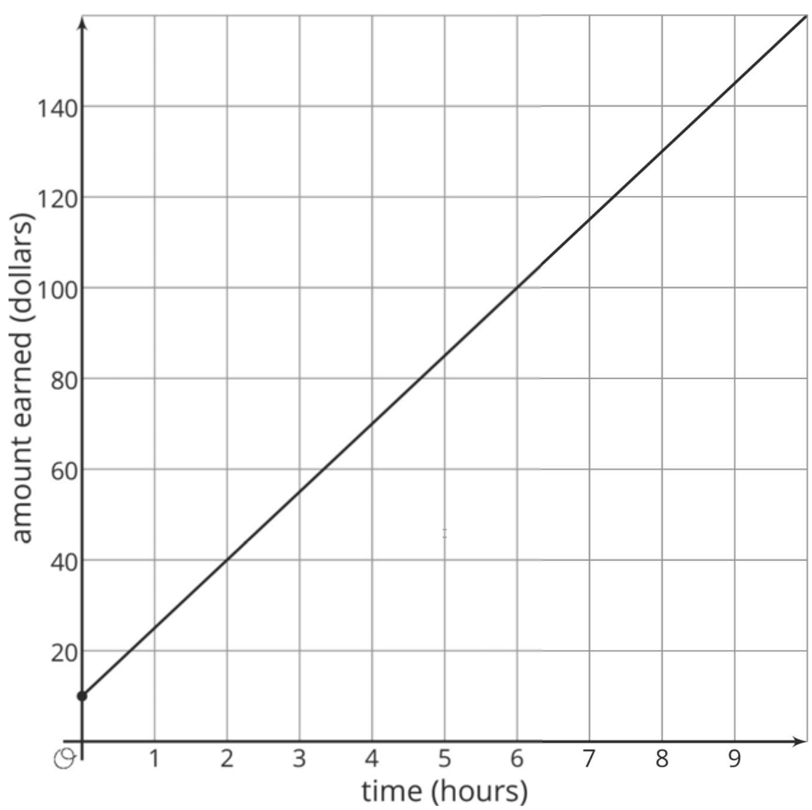
NAME DATE PERIOD

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.



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

NAME DATE PERIOD

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

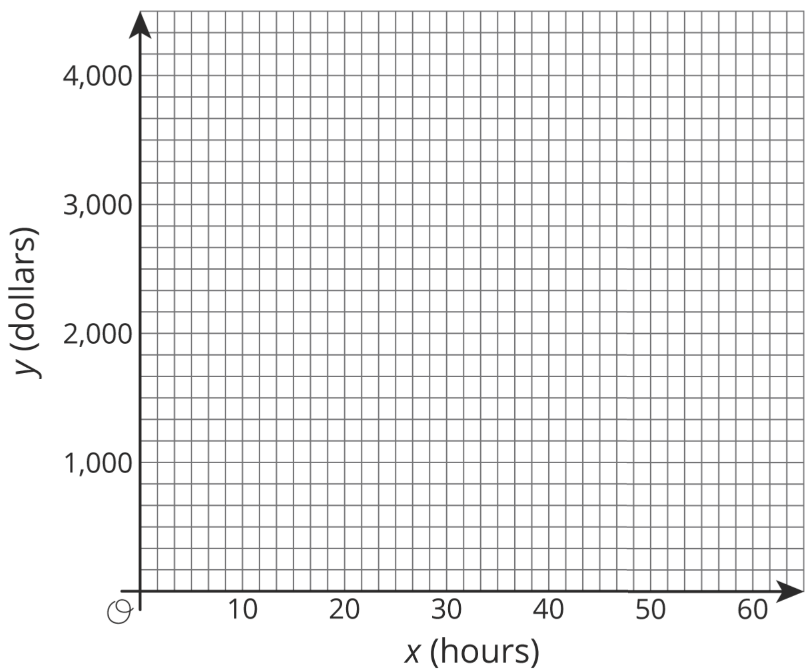
- slope
- rate of change
- linear relationship

NAME DATE PERIOD

Unit 3, Lesson 5: Introduction to Linear Relationships

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?

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

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

NAME DATE PERIOD

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.

(from Unit 3, Lesson 4)

NAME DATE PERIOD

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

   (from Unit 2, Lesson 12)