Graphing Proportional Relationships
A Closer Look at the Video

After watching the *Graphing Proportional Relationships* video, make sense of the mathematics by taking a closer look at the problem situation and solutions. Use the comments and questions in bold to help you use a graph to solve the problem.

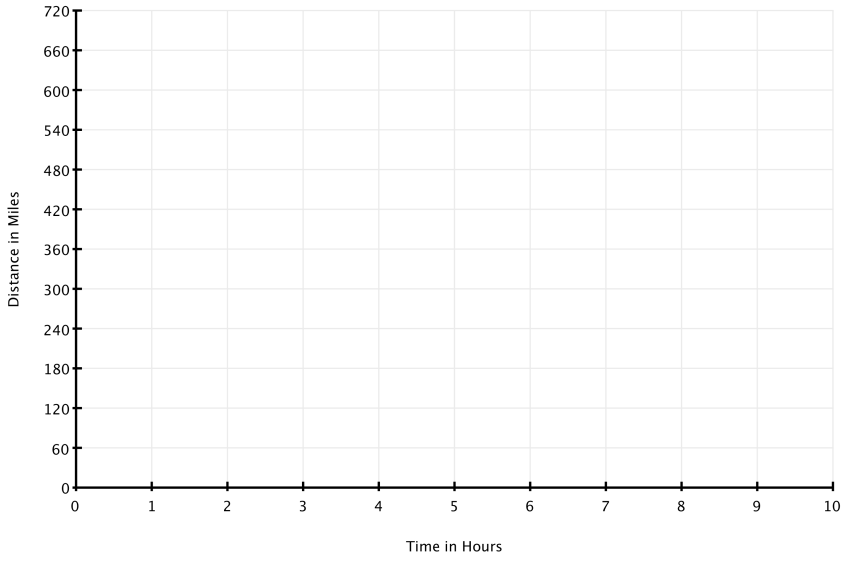
Problem: If a helicopter travels at an average speed of 120 miles per hour, how long will it take to travel by helicopter to my hometown, which is 420 miles away?

The relationship between the miles traveled and the time it takes is proportional. One hundred twenty miles per hour is a ratio. It means the helicopter can travel 120 miles in one hour. Complete the following table to display the number of miles you can travel in two, three, and four hours.

Hours	Miles
1	120

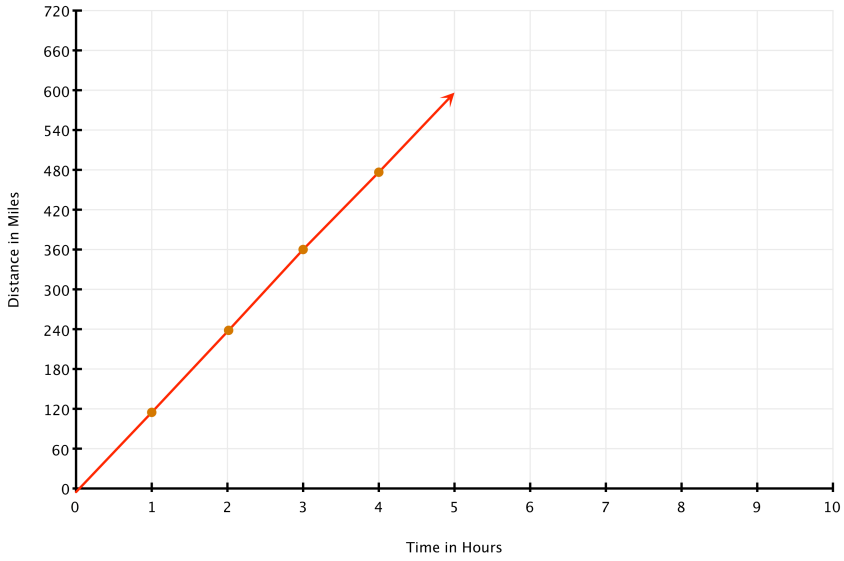
In one hour the helicopter can travel 120 miles; in two hours – 240 miles; in three hours - 360 miles; and in four hours - 480 miles. For every hour traveled, you add another 120 miles.

Another way to represent this information is with a graph. Graph the information from the table. The vertical axis (y-axis) represents the distance traveled in miles. The horizontal axis (x-axis) represents the time in hours.



How can you use the graph to determine how long it will take the helicopter to fly 420 miles?

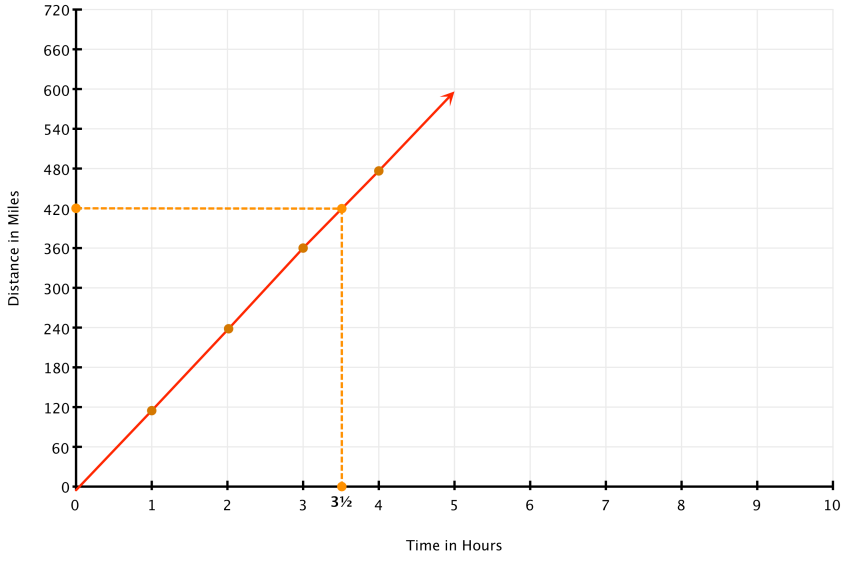
Hours	Miles
1	**120**
2	240
3	360
4	480



As you can see from the graph, 420 miles lies between 3 and 4 hours. From the graph, it appears it is halfway between 3 and 4 hours. That would put it at 3½ hours.

Does this answer make sense when you look at the table?
You can see that the time it would take to travel 420 miles is between 3 and 4 hours. 420 miles is 60 miles more than 360 miles. If the helicopter travels 120 miles in 1 hour, it can travel 60 miles in ½ hour. A trip of 420 miles, which is 360 + 60, would take 3 hours + ½ hour or 3½ hours.

Hours	Miles
1	**120**
2	240
3	360
$3\frac{1}{2}$	420
4	480



Study the graph. What characteristics of this graph are true of all graphs of proportional relationships?

- The graph of this relationship is linear, which means the graph is a straight line.
- The line passes through the origin or (0, 0). It makes sense that the graph would pass through the origin because in 0 hours the helicopter travels 0 miles.
- The slope of the line is the constant of proportionality—in this case, it is the helicopter's rate of 120 miles per hour.

A third way to represent and solve this problem is with an equation. Write and solve an equation to determine the time it takes the helicopter to travel 420 miles. What expression represents the relationship between time and distance traveled?
Every hour the helicopter travels 120 miles. In 1 hour it travels 1 times 120 miles or 120 miles, in 2 hours it travels 2 times 120 miles or 240 miles. For n hours it travels n times 120 miles or 120n miles. The following expression represents the distance the helicopter travels in n hours.

$n \cdot 120 = 120 \cdot n$ 120•n is the same as 120n.

Use this expression to write an equation to represent the problem. In order to determine how many hours it will take to travel 420 hours, 120n must equal 420 hours.

$$120n = 420$$

Solve the equation to determine the time it takes the helicopter to travel 420 miles.

$$120n = 420$$

$$\frac{120n}{120} = \frac{420}{120}$$ Divide both sides of the equation by 120.

$$n = 3\frac{1}{2}$$

It will take the helicopter 3½ hours to travel 420 miles.

You can solve problems involving proportional relationships using tables, graphs, and equations. The following characteristics are true of the graph of all proportional relationships.

- The graph is linear.
- The line of the graph passes through the origin.
- The slope of the line is the constant of proportionality.