Unit 2, Lesson 13

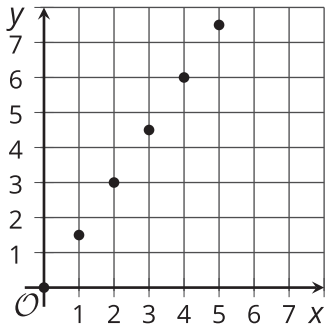
# Two Graphs for Each Relationship

Let's use tables, equations, and graphs to answer questions about proportional relationships.

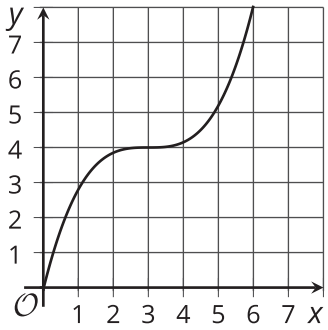
## 13.1 Which Three Go Together: Graphs

Which three go together? Why do they go together?

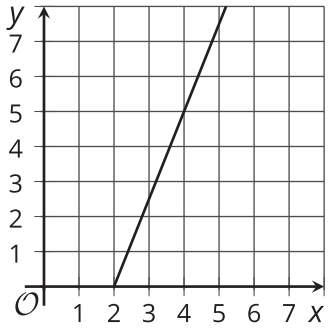
**A**



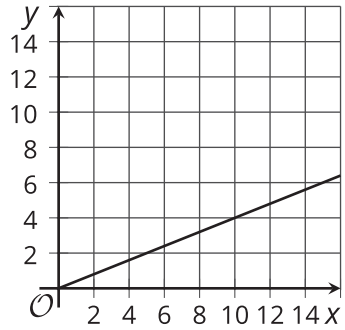

**B**




**C**




**D**





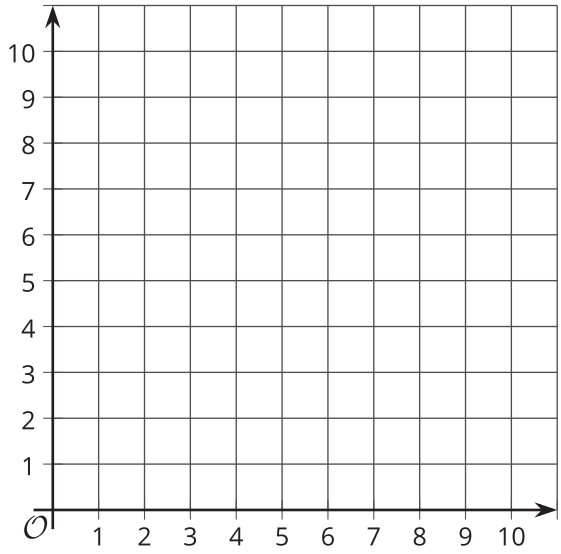
CC BY NC Illustrative Mathematics, based on IM 6–8 Math, CC BY Open Up Resources.

# 13.2 Tables, Graphs, and Equations

Your teacher will assign you *one* of these three points:

$$A(5, 2),\ B(4, 5),\ C(8, 5).$$

1. On the coordinate plane, plot and label only your assigned point.




2. Graph the proportional relationship that is defined by your point. That is, use a ruler to draw a line that starts at the origin, goes through your point, and continues to the edge of the grid.
3. Use your graph to find the $y$-value that goes with each of these $x$-values.

| $x$ | $y$ |
|---|---|
| 2 | |
| 6 | |

Your teacher will give you a completed table. Use it to check your values.


CC BY NC Illustrative Mathematics, based on IM 6–8 Math, CC BY Open Up Resources.

4. Choose three rows, other than the row that represents the origin, from the completed table. Record the values and compute $\frac{y}{x}$ for each row. What do you notice about these values?

| $x$ | $y$ | $\frac{y}{x}$ |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

5. Write an equation that represents the relationship between $x$ and $y$.

6. What is the $y$-coordinate of your graph when the $x$-coordinate is 1? Plot and label this point on your graph.

7. Based on your observations, describe any connections you see between the graph, the table, and the equation.

8. Compare your representations with the rest of your group. Discuss what is the same and what is different about:
   a. Your graphs.
   b. Your tables.
   c. Your equations.

## Are you ready for more?

The graph of an equation of the form $y = kx$, where $k$ is a positive number, is a line through $(0, 0)$ and the point $(1, k)$.

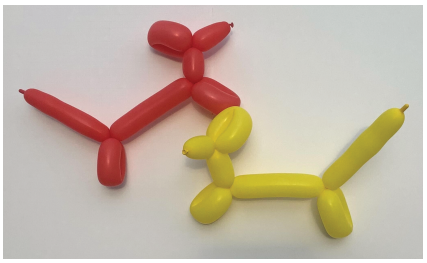
1. Name at least one line through $(0, 0)$ that cannot be represented by an equation like this.

2. If you could draw the graphs of *all* of the equations of this form in the same coordinate plane, what would it look like?

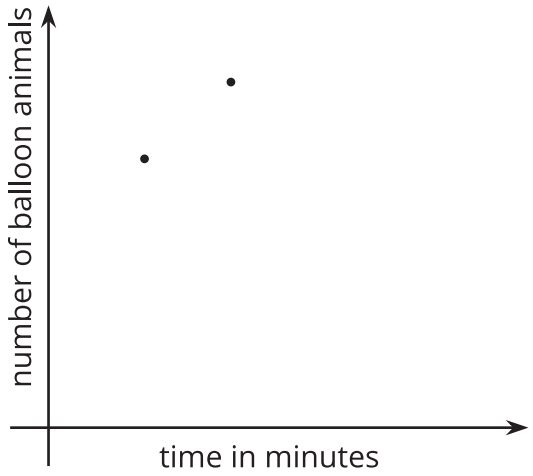
# 13.3 Balloon Animal Contest

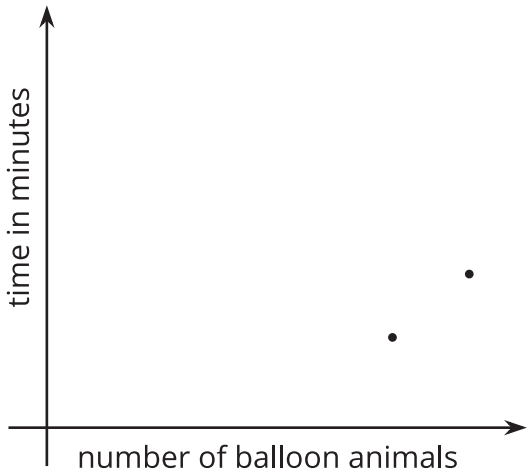
Andre and Jada had a contest making balloon animals.

- Andre made 10 balloon animals in 3 minutes.
- Jada made 12 balloon animals in 5 minutes.



Here are two different graphs that both represent this situation.




1. On the first graph, which point shows Andre's work and which shows Jada's work? Label them.
2. Draw two lines: one through the origin and Andre's point, and one through the origin and Jada's point.
3. Write an equation for each line. Use $t$ to represent time in minutes and $b$ to represent the number of balloon animals.
   a. Andre:
   b. Jada:
4. For each equation, what does the constant of proportionality tell you?

5. Repeat the previous steps for the second graph.
   a. Andre:
   b. Jada:

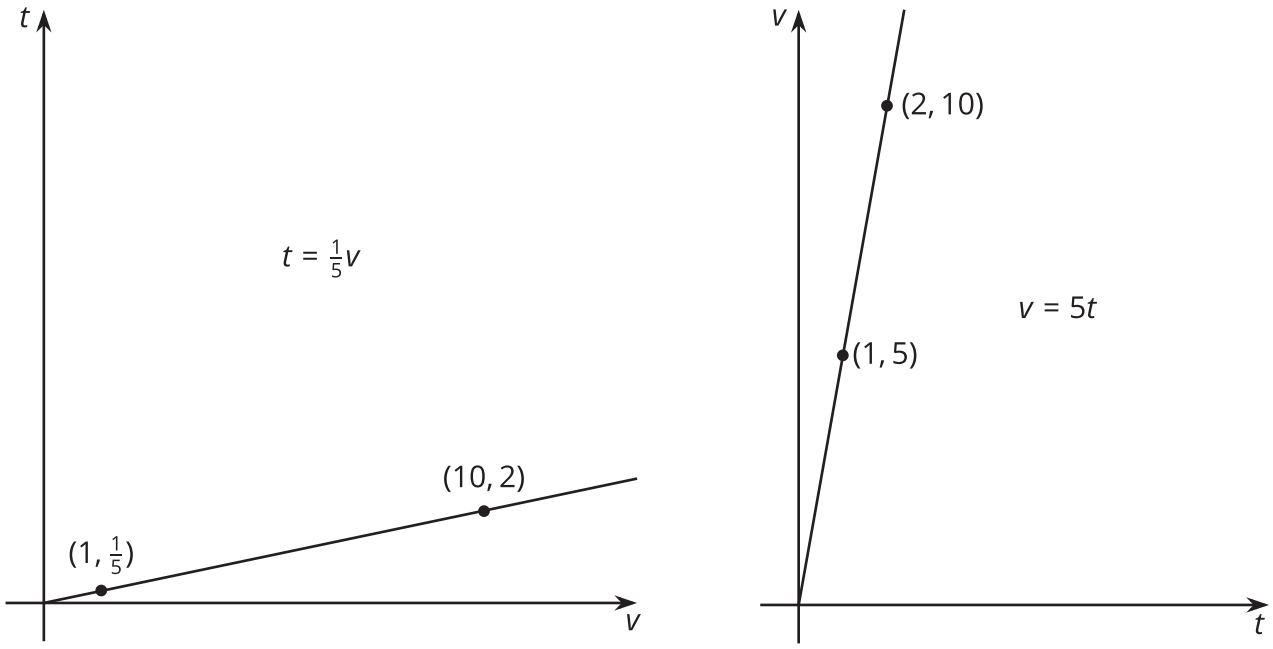

CC BY NC Illustrative Mathematics, based on IM 6–8 Math, CC BY Open Up Resources.

## Lesson 13 Summary

Imagine that a faucet is leaking at a constant rate and that every 2 minutes, 10 milliliters of water leaks from the faucet. There is a proportional relationship between the volume of water and elapsed time.

- We could say that the elapsed time is proportional to the volume of water. The corresponding constant of proportionality tells us that the faucet is leaking at a rate of $\frac{1}{5}$ of a minute per milliliter.
- We could say that the volume of water is proportional to the elapsed time. The corresponding constant of proportionality tells us that the faucet is leaking at a rate of 5 milliliters per minute.

Let's use $v$ to represent volume in milliliters and $t$ to represent time in minutes. Here are graphs and equations that represent both ways of thinking about this relationship:




Even though the relationship between time and volume is the same, we are making a different choice in each case about which variable to view as the independent variable. The graph on the left has $v$ as the independent variable, and the graph on the right has $t$ as the independent variable.