Lesson 5: Graphs of Functions and Equations

Classwork

Exploratory Challenge/Exercises 1–3

1. The distance that Giselle can run is a function of the amount of time she spends running. Giselle runs 3 miles in 21 minutes. Assume she runs at a constant rate.

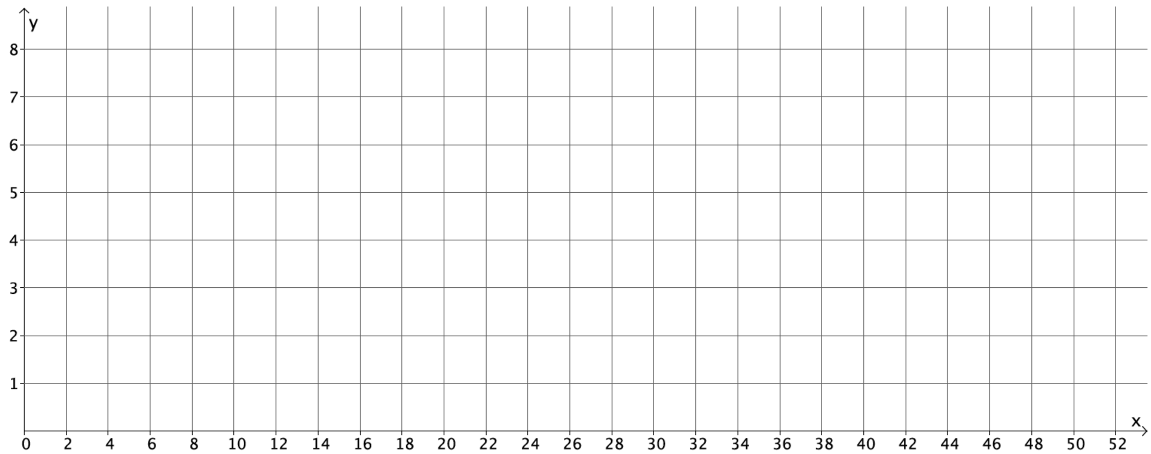
   a. Write an equation in two variables that represents her distance run, y, as a function of the time, x, she spends running.

   b. Use the equation you wrote in part (a) to determine how many miles Giselle can run in 14 minutes.

   c. Use the equation you wrote in part (a) to determine how many miles Giselle can run in 28 minutes.

   d. Use the equation you wrote in part (a) to determine how many miles Giselle can run in 7 minutes.

e. For a given input x of the function, a time, the matching output of the function, y, is the distance Giselle ran in that time. Write the inputs and outputs from parts (b)–(d) as ordered pairs, and plot them as points on a coordinate plane.



f. What do you notice about the points you plotted?

g. Is the function discrete?

h. Use the equation you wrote in part (a) to determine how many miles Giselle can run in 36 minutes. Write your answer as an ordered pair, as you did in part (e), and include the point on the graph. Is the point in a place where you expected it to be? Explain.

i. Assume you used the rule that describes the function to determine how many miles Giselle can run for any given time and wrote each answer as an ordered pair. Where do you think these points would appear on the graph?

j. What do you think the graph of all the input/output pairs would look like? Explain.

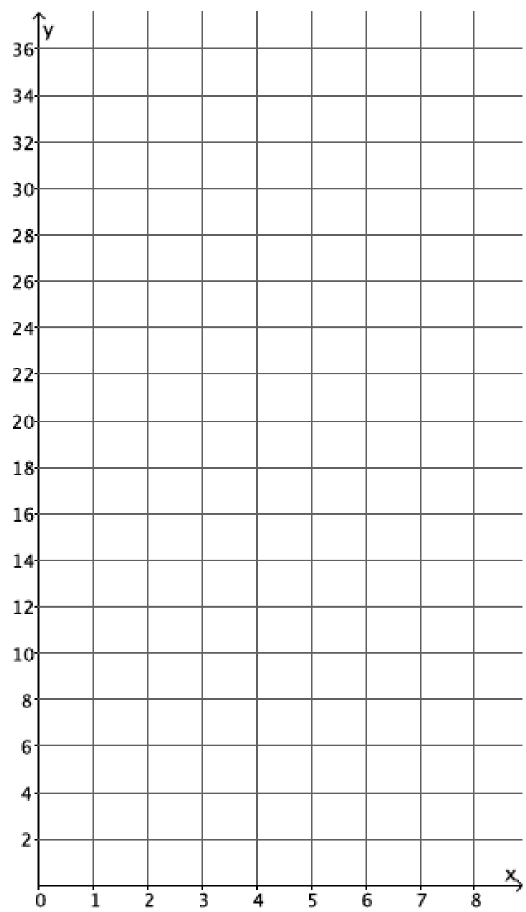
k. Connect the points you have graphed to make a line. Select a point on the graph that has integer coordinates. Verify that this point has an output that the function would assign to the input.

l. Sketch the graph of the equation $y = \frac{1}{7}x$ using the same coordinate plane in part (e). What do you notice about the graph of all the input/output pairs that describes Giselle's constant rate of running and the graph of the equation $y = \frac{1}{7}x$?

2. Sketch the graph of the equation $y = x^2$ for positive values of x. Organize your work using the table below, and then answer the questions that follow.

x	y
0	
1	
2	
3	
4	
5	
6	

a. Plot the ordered pairs on the coordinate plane.



b. What shape does the graph of the points appear to take?

c. Is this equation a linear equation? Explain.

d. Consider the function that assigns to each square of side length s units its area A square units. Write an equation that describes this function.

e. What do you think the graph of all the input/output pairs (s, A) of this function will look like? Explain.

f. Use the function you wrote in part (d) to determine the area of a square with side length 2.5 units. Write the input and output as an ordered pair. Does this point appear to belong to the graph of $y = x^2$?

3. The number of devices a particular manufacturing company can produce is a function of the number of hours spent making the devices. On average, 4 devices are produced each hour. Assume that devices are produced at a constant rate.

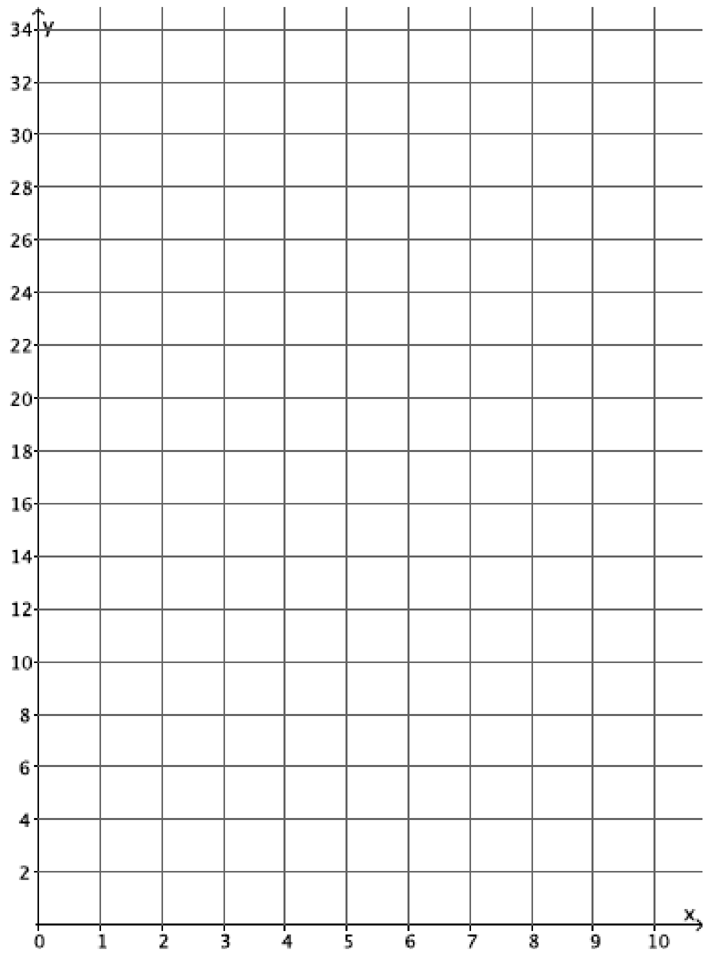
   a. Write an equation in two variables that describes the number of devices, y, as a function of the time the company spends making the devices, x.

   b. Use the equation you wrote in part (a) to determine how many devices are produced in 8 hours.

   c. Use the equation you wrote in part (a) to determine how many devices are produced in 6 hours.

   d. Use the equation you wrote in part (a) to determine how many devices are produced in 4 hours.

e. The input of the function, x, is time, and the output of the function, y, is the number of devices produced. Write the inputs and outputs from parts (b)–(d) as ordered pairs, and plot them as points on a coordinate plane.



f. What shape does the graph of the points appear to take?

g. Is the function discrete?

h. Use the equation you wrote in part (a) to determine how many devices are produced in 1.5 hours. Write your answer as an ordered pair, as you did in part (e), and include the point on the graph. Is the point in a place where you expected it to be? Explain.

i. Assume you used the equation that describes the function to determine how many devices are produced for any given time and wrote each answer as an ordered pair. Where do you think these points would appear on the graph?

j. What do you think the graph of all possible input/output pairs will look like? Explain.

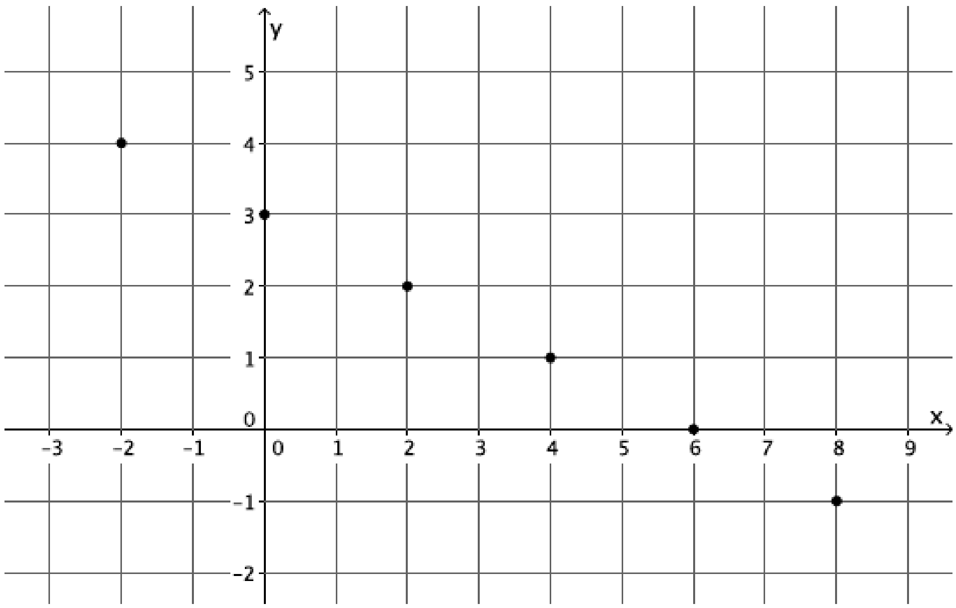
k. Connect the points you have graphed to make a line. Select a point on the graph that has integer coordinates. Verify that this point has an output that the function would assign to the input.

l. Sketch the graph of the equation $y = 4x$ using the same coordinate plane in part (e). What do you notice about the graph of the input/out pairs that describes the company's constant rate of producing devices and the graph of the equation $y = 4x$?

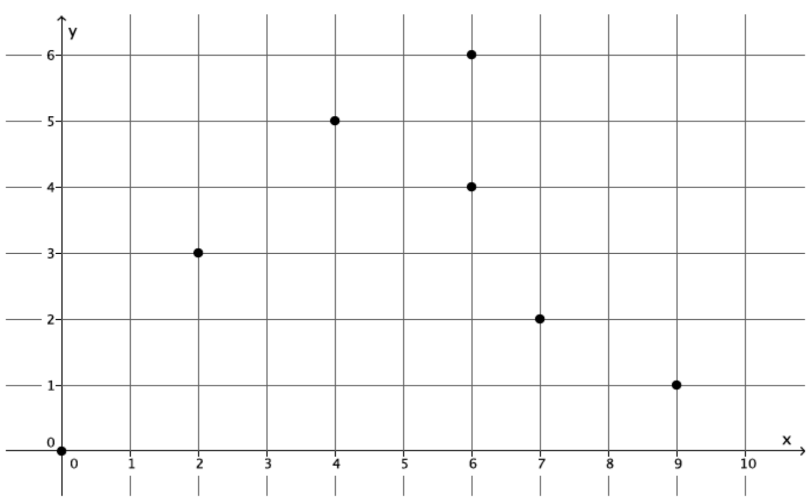
Exploratory Challenge/Exercise 4

4. Examine the three graphs below. Which, if any, could represent the graph of a function? Explain why or why not for each graph.

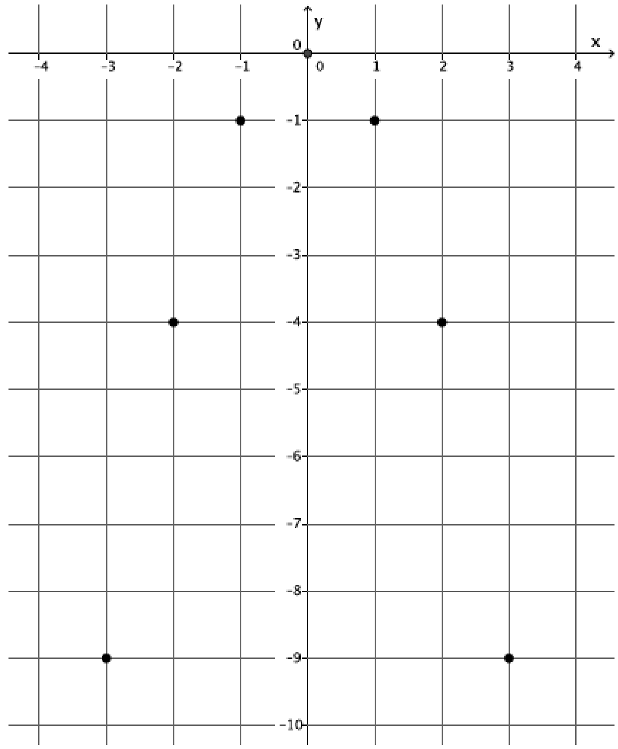
Graph 1:



Graph 2:



Graph 3:



Lesson Summary

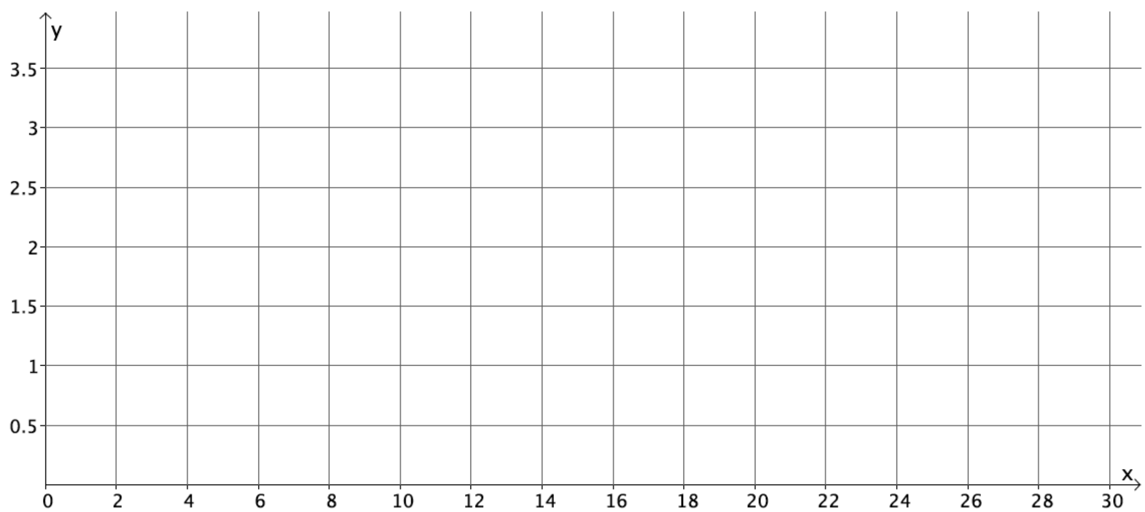
The graph of a function is defined to be the set of all points (x, y) with x an input for the function and y its matching output.

If a function can be described by an equation, then the graph of the function is the same as the graph of the equation that represents it (at least at points which correspond to valid inputs of the function).

It is not possible for two different points in the plot of the graph of a function to have the same x-coordinate.

Problem Set

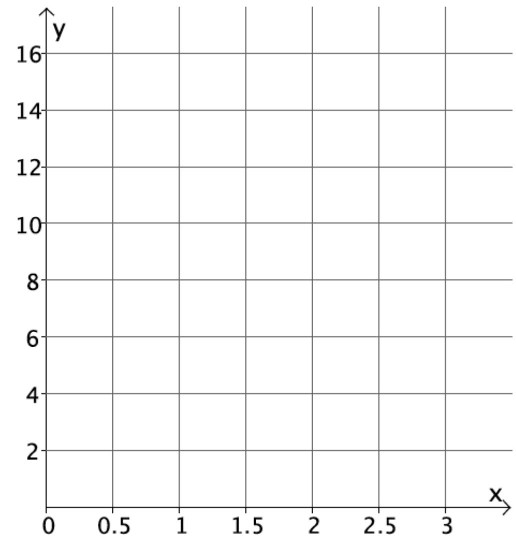
1. The distance that Scott walks is a function of the time he spends walking. Scott can walk $\frac{1}{2}$ mile every 8 minutes. Assume he walks at a constant rate.
   a. Predict the shape of the graph of the function. Explain.
   b. Write an equation to represent the distance that Scott can walk in miles, y, in x minutes.
   c. Use the equation you wrote in part (b) to determine how many miles Scott can walk in 24 minutes.
   d. Use the equation you wrote in part (b) to determine how many miles Scott can walk in 12 minutes.
   e. Use the equation you wrote in part (b) to determine how many miles Scott can walk in 16 minutes.
   f. Write your inputs and corresponding outputs as ordered pairs, and then plot them on a coordinate plane.



   g. What shape does the graph of the points appear to take? Does it match your prediction?
   h. Connect the points to make a line. What is the equation of the line?

2. Graph the equation $y = x^3$ for positive values of x. Organize your work using the table below, and then answer the questions that follow.

x	y
0	
0.5	
1	
1.5	
2	
2.5	



a. Plot the ordered pairs on the coordinate plane.

b. What shape does the graph of the points appear to take?

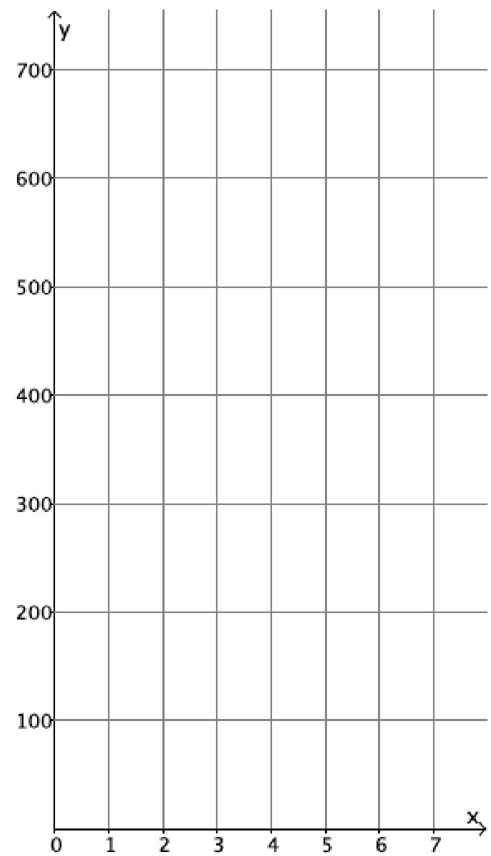
c. Is this the graph of a linear function? Explain.

d. Consider the function that assigns to each positive real number s the volume V of a cube with side length s units. An equation that describes this function is $V = s^3$. What do you think the graph of this function will look like? Explain.

e. Use the function in part (d) to determine the volume of a cube with side length of 3 units. Write the input and output as an ordered pair. Does this point appear to belong to the graph of $y = x^3$?

3. Sketch the graph of the equation $y = 180(x - 2)$ for whole numbers. Organize your work using the table below, and then answer the questions that follow.

x	y
3	
4	
5	
6	



a. Plot the ordered pairs on the coordinate plane.

b. What shape does the graph of the points appear to take?

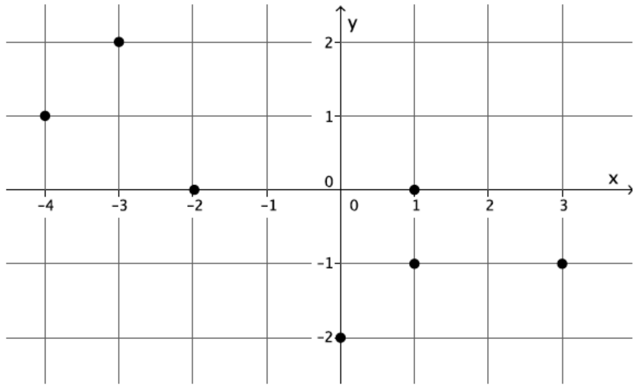
c. Is this graph a graph of a function? How do you know?

d. Is this a linear equation? Explain.

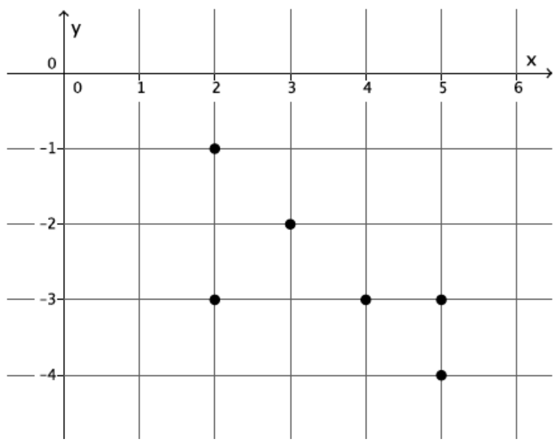
e. The sum S of interior angles, in degrees, of a polygon with n sides is given by $S = 180(n - 2)$. If we take this equation as defining S as a function of n, how do think the graph of this S will appear? Explain.

f. Is this function discrete? Explain.

4. Examine the graph below. Could the graph represent the graph of a function? Explain why or why not.



5. Examine the graph below. Could the graph represent the graph of a function? Explain why or why not.



6. Examine the graph below. Could the graph represent the graph of a function? Explain why or why not.