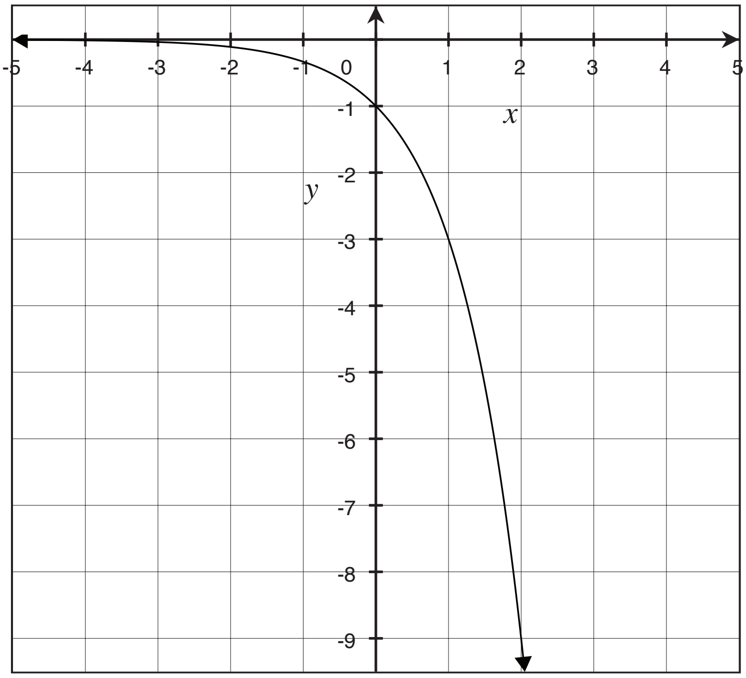
Guided Practice 3.6.2

Example 1

Determine the equation that represents the relationship between x and y in the graph below.



1. Determine which type of equation, linear or exponential, will fit the graph.

   The graph of a linear equation is a straight line, and a graph of an exponential equation is a curve. An exponential equation can be used to represent the graph.

2. Identify at least three points from the graph, with one of the points at $x = 0$.

   From the graph, three points are: (0, –1), (1, –3), and (2, –9).

3. Find the common ratio between the terms, ensuring that the x-values are one unit apart.

   The three points are at the x-values 0, 1, and 2, so the x-values are each one unit apart. Look at the pattern of the y-values: –1, –3, and –9. Each value is multiplied by 3 to find the next value, so the common ratio is 3.

4. Use the value of the equation at $x = 0$ and the common ratio to write an equation to represent the graph.

   When $x = 0$, $f(0) = -1$. The exponential equation is: $f(x) = f(0) \bullet b^x$, where $f(0)$ is the value of the equation at $x = 0$ and b is the common ratio. The equation of the graph is: $f(x) = (-1) \bullet 3^x$. Check the equation by evaluating it at the values of x from previously identified points.

   $x = 0, f(0) = (-1) \bullet 3^0 = -1$

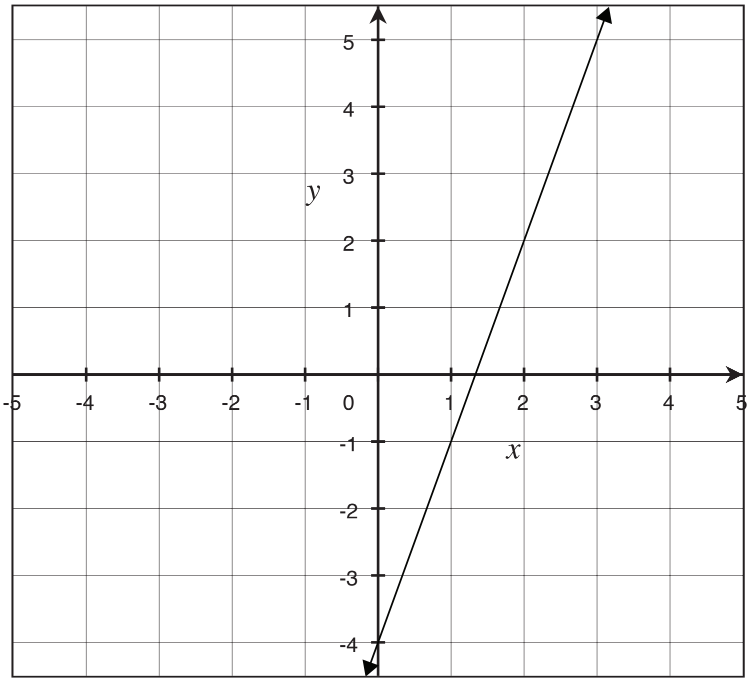
   $x = 1, f(1) = (-1) \bullet 3^1 = -3$

   $x = 2, f(2) = (-1) \bullet 3^2 = -9$

   The relationship between x and y can be represented using the equation $f(x) = (-1) \bullet 3^x$. ✓

Example 2

Determine the equation that represents the relationship between x and y in the graph below.



1. Determine which type of equation, linear or exponential, will fit the graph.

   The graph of a linear equation is a straight line, and a graph of an exponential equation is a curve. A linear equation can be used to represent the graph.

2. Identify at least three points from the graph.

   From the graph, three points are: (0, –4), (1, –1), and (2, 2).

3. Find the slope of the line, using any two of the points.

   The slope of the line is $\frac{(y_2 - y_1)}{(x_2 - x_1)}$ for any two points (x_1, y_1) and (x_2, y_2).
   Using the points (0, –4) and (1, –1), the slope is $\frac{(-1-(-4))}{(1-0)} = 3$.

4. Find the y-intercept of the line.

   The y-intercept can either be found by solving the equation $f(x) = mx + b$ for b, or by finding the value of y when $x = 0$. On the graph, we can see the point (0, –4). The y-intercept is –4.

5. Use the slope and y-intercept to find an equation of the line.

   The general form of the linear function is $f(x) = mx + b$, where m is the slope and b is the y-intercept. The equation to represent the line is $f(x) = 3x - 4$. Check the equation by evaluating it at the values of x from previously identified points.

   $x = 0, f(0) = 3(0) - 4 = -4$

   $x = 1, f(1) = 3(1) - 4 = -1$

   $x = 2, f(2) = 3(2) - 4 = 2$

   The relationship can be represented using the equation $f(x) = 3x - 4$.

Example 3

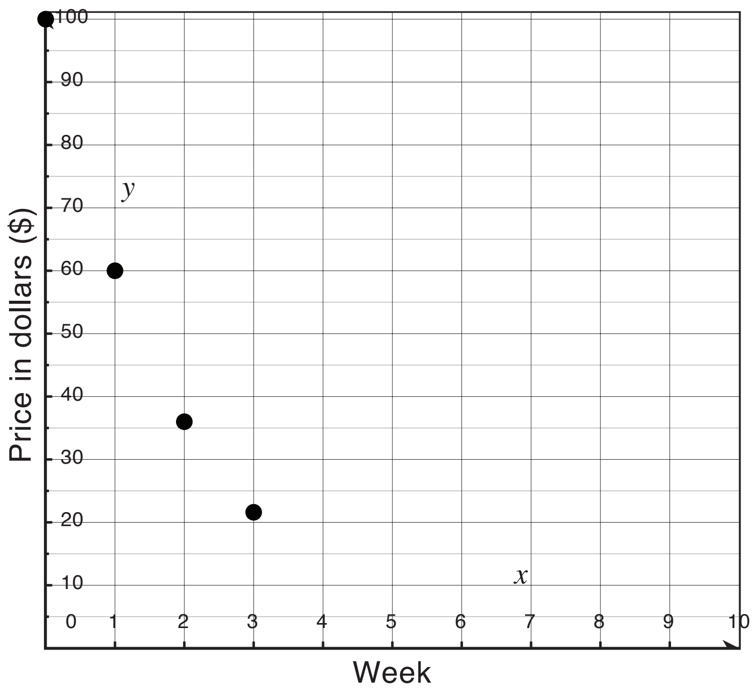
A clothing store discounts items on a regular schedule. Each week, the price of an item is reduced. The prices for one item are in the table below. Week 0 is the starting price of the item.

Week	Price in dollars ($)
0	100.00
1	60.00
2	36.00
3	21.60

Determine a linear or exponential equation that represents the relationship between the week and the price of the item.

1. Create a graph of the data.

   Let the x-axis represent the week, and the y-axis represent the price in dollars.



2. Determine if a linear or exponential equation could represent the data.

   The x-values of the points vary by 1. Look at the vertical distance between each pair of points. It appears to be decreasing, and is not remaining constant. An exponential equation could represent the data.

3. Find the common ratio between the terms.

   The four points are at the x-values 0, 1, 2, and 3, so the x-values are each one unit apart. Look at the pattern of the y-values: 100, 60, 36, and 21.60. Divide each y-value by the previous y-value to identify the common ratio.

y	Ratio
100	
60	$\frac{60}{100}=0.60$
36	$\frac{36}{60}=0.60$
21.6	$\frac{21.6}{36}=0.60$

   The common ratio is 0.60.

4. Use the value of the equation at $x = 0$ and the common ratio to write an equation to represent the relationship.

   At week 0, the price is \$100. The common ratio is 0.60. An equation to represent the relationship is $f(x) = 100 \bullet (0.60)^x$. Evaluate the equation at the given values of x to check the equation.

   $x = 0, f(0) = 100 \bullet (0.60)^0 = 100$

   $x = 1, f(1) = 100 \bullet (0.60)^1 = 60$

   $x = 2, f(2) = 100 \bullet (0.60)^2 = 36$

   $x = 3, f(3) = 100 \bullet (0.60)^3 = 21.6$

   The price of the clothing item, y, at any week, x, can be represented by the equation $f(x) = 100 \bullet (0.60)^x$.