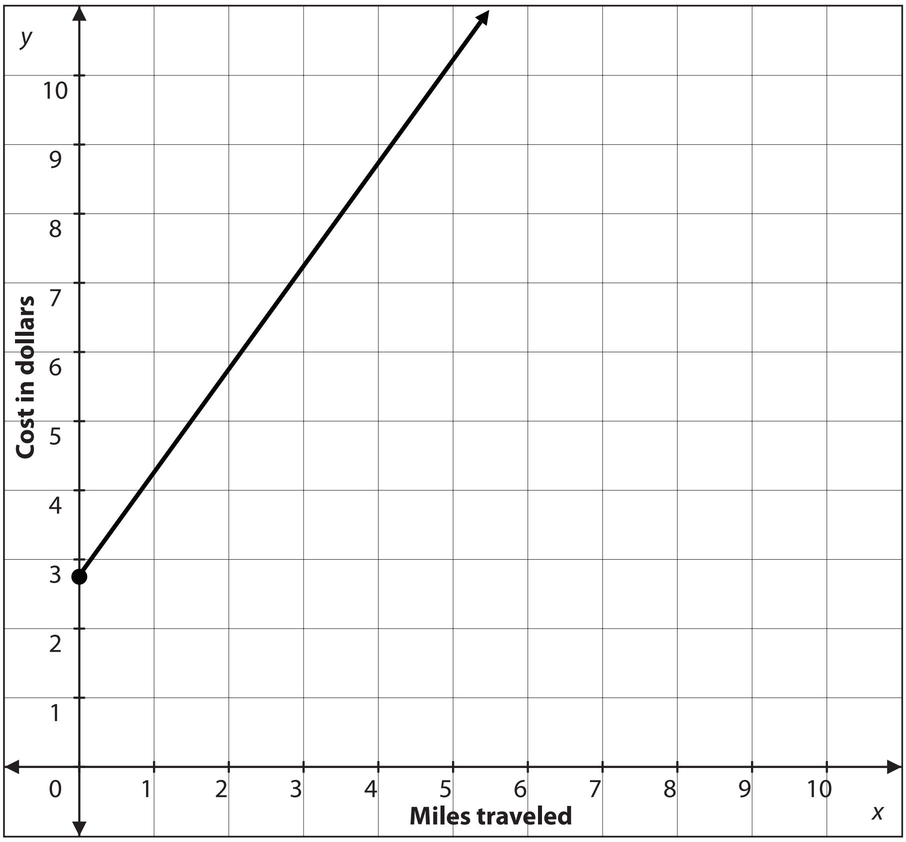
Guided Practice 3.3.1

Example 1

A taxi company in Atlanta charges $2.75 per ride plus $1.50 for every mile driven. Determine the key features of this function.



1. Identify the type of function described.

   We can see by the graph that the function is increasing at a constant rate.

   The function is linear.

2. Identify the intercepts of the graphed function.

   The graphed function crosses the *y*-axis at the point (0, 2.75).

   The *y*-intercept is (0, 2.75).

   The function does not cross the *x*-axis.

   There is not an *x*-intercept.

3. Determine whether the graphed function is increasing or decreasing.

   Reading the graph left to right, the y-values are increasing.

   The function is increasing.

4. Determine where the function is positive and negative.

   The y-values are positive for all x-values greater than 0.

   The function is positive when $x > 0$.

   The y-values are never negative in this scenario.

   The function is never negative.

5. Determine the relative minimum and maximum of the graphed function.

   The lowest y-value of the function is 2.75. This is shown with the closed dot at the coordinate (0, 2.75).

   The relative minimum is 2.75.

   The values increase infinitely; therefore, there is no relative maximum.

6. Identify the domain of the graphed function.

   The lowest x-value is 0 and it increases infinitely.

   x can be any real number greater than or equal to 0.

   The domain can be written as $x \geq 0$.

7. Identify any asymptotes of the graphed function.

   The graphed function is a linear function, not an exponential; therefore, there are no asymptotes for this function. ✓

Example 2

A pendulum swings to 90% of its height on each swing and starts at a height of 80 cm. The height of the pendulum in centimeters, y, is recorded after x number of swings. Determine the key features of this function.

Number of swings (x)	Height in cm (y)
0	80
1	72
2	64.8
3	58.32
5	47.24
10	27.89
20	9.73
40	1.18
60	0.14
80	0.02

1. Identify the type of function described.

   The scenario described here is that of an exponential function.

   We can be certain of this because the pendulum swings at 90% of its height in each swing; also, we can see from the table that the values for y do not decrease at a constant rate.

2. Identify the intercepts of the function based on the information in the table.

   The function crosses the y-axis at the point (0, 80) as indicated in the table.

   The y-intercept is (0, 80).

   As the x-values increase, the y-values get closer and closer to 0, but do not seem to reach 0; therefore, there is not an x-intercept.

3. Determine whether the function is increasing or decreasing.

   As the x-values increase, the y-values decrease.

   The function is decreasing.

4. Determine where the function is positive and negative.

   The y-values are positive for all x-values greater than 0.

   The function is positive when $x > 0$.

   The y-values are never negative in this scenario.

   The function is never negative.

5. Determine the relative minimum and maximum of the function.

   The data in the table do not change at a constant rate; therefore, the function is not linear.

   Based on the information given in the problem and the values in the table, we know that this is an exponential function.

   Exponential functions do not have a relative minimum because the graph continues to become infinitely smaller.

   The height of the pendulum never goes higher than its initial height; therefore, the relative maximum of this function is (0, 80).

6. Identify the domain of the function.

   The lowest x-value is 0 and it increases infinitely.

   x can be any real number greater than or equal to 0, but cannot be a partial swing.

   The domain is all whole numbers.

7. Identify any asymptotes of the function.

   The points approach 0, but never actually reach 0.

   The asymptote of this function is $y = 0$.

Example 3

A ringtone company charges \$15 a month plus \$2 for each ringtone downloaded. Create a graph and then determine the key features of this function.

1. Create a function to represent this scenario.

   Let x represent the number of ringtones downloaded and $f(x)$ represent the total monthly fee.

   $f(x) = 15 + 2x$

2. Graph the function.

   When creating the graph of the function, consider the domain of the function.

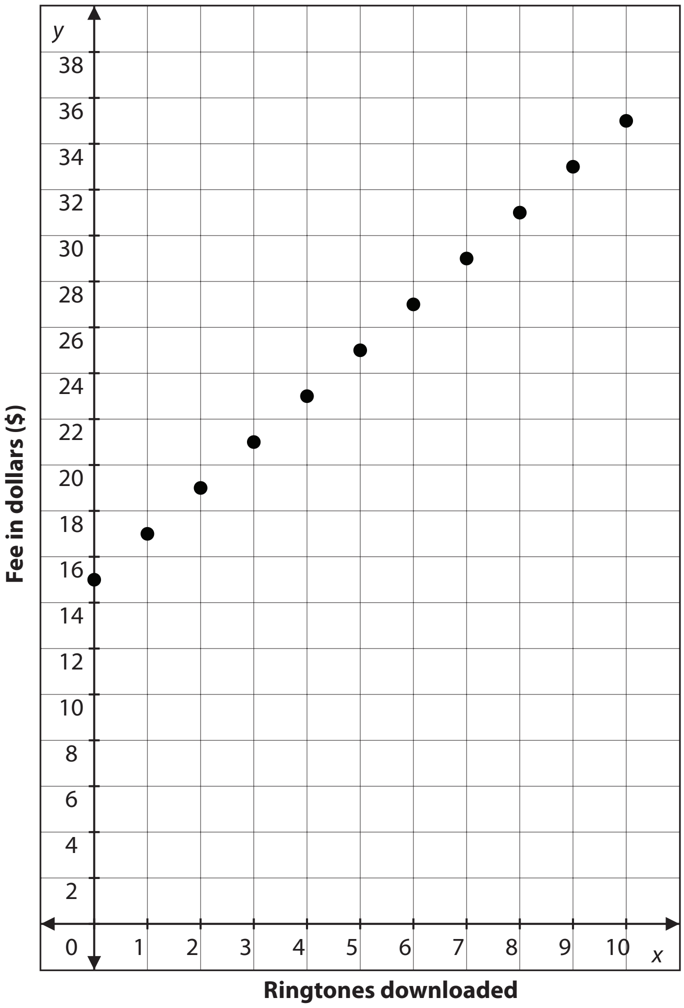
   In past lessons, we have graphed the equations of functions. In this lesson, and in the future, we want to consider the function as it relates to the scenario.

   We can't download a partial ringtone, and can't be charged for a partial download.

   It does not make sense to consider values for x other than those that are whole numbers.

   (*continued*)

Notice the points in the graph are not connected.



3. Identify the type of function described.

The function is still a linear function; it just has a restricted domain. We can see this in the function $f(x) = 15 + 2x$ and in the graph of the function.

4. Identify the intercepts of the graphed function.

   The graphed function crosses the y-axis at the point (0, 15).

   The y-intercept is (0, 15).

   The function does not cross the x-axis.

   There is no x-intercept.

5. Determine whether the graphed function is increasing or decreasing.

   Reading the graph left to right, the y-values are increasing.

   The function is increasing.

6. Determine where the function is positive and negative.

   The y-values are positive for all x-values greater than or equal to 0.

   The function is positive when $x \geq 0$.

   The y-values are never negative in this scenario.

   The function is never negative.

7. Determine the relative minimum and maximum of the graphed function.

   The lowest y-value of the function is 15. This is shown with the dot at the coordinate (0, 15).

   The relative minimum is 15.

   The x-values increase infinitely; therefore there is not a relative maximum.

8. Identify the domain of the graphed function.

   The lowest *x*-value is 0 and it increases infinitely, but for only whole-number values.

   x can be any whole number greater than or equal to 0.

9. Identify any asymptotes of the graphed function.

   The graphed function is a linear function, not an exponential; therefore, there are no asymptotes for this function. ✓