

Lesson 2: Interpreting Rate of Change and Initial Value

Classwork

Linear functions are defined by the equation of a line. The graphs and the equations of the lines are important for understanding the relationship between the two variables represented in the following example as x and y .

Example 1: Rate of Change and Initial Value

The equation of a line can be interpreted as defining a linear function. The graphs and the equations of lines are important in understanding the relationship between two types of quantities (represented in the following examples by x and y).

In a previous lesson, you encountered an MP3 download site that offers downloads of individual songs with the following price structure: a \$3 fixed fee for monthly subscription PLUS a fee of \$0.25 per song. The linear function that models the relationship between the number of songs downloaded and the total monthly cost of downloading songs can be written as

$$y = \underset{m}{0.25}x + 3,$$

where x represents the number of songs downloaded, and y represents the total monthly cost (in dollars) for MP3 downloads.

- a. In your own words, explain the meaning of 0.25 within the context of the problem.

\$0.25 per song, for every song you download

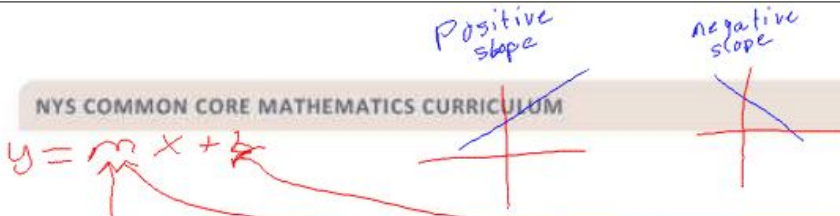
- b. In your own words, explain the meaning of 3 within the context of the problem.

Initial fee per month, no matter how many songs you download.

The values represented in the function can be interpreted in the following way:

$$y = \underbrace{0.25}_m x + \underbrace{3}_b$$

rate of change initial value



$y = mx + b$

The coefficient of x is referred to as the **rate of change**. It can be interpreted as the change in the values of y for every one-unit increase in the values of x . When the rate of change is positive, the linear function is **increasing**. In other words, **increasing** indicates that as the x -value increases, so does the y -value. When the rate of change is negative, the linear function is **decreasing**. **Decreasing** indicates that as the x -value increases, the y -value decreases.

The constant value is referred to as the **initial value** or y -intercept and can be interpreted as the value of y when $x = 0$.

initial = Starting

b y -int

Exercises 1–6: Is It a Better Deal?

Another site offers MP3 downloads with a different price structure: a **\$2 fixed fee** for monthly subscription PLUS a fee of **\$0.40 per song**.

- Write a linear function to model the relationship between the number of songs downloaded and the total monthly cost. As before, let x represent the number of songs downloaded and y represent the total monthly cost (in dollars) of downloading songs.

$y = mx + b$
 $y = 0.40x + 2$

- Determine the cost of downloading 0 songs and 10 songs from this site.

0 songs \rightarrow \$2 $(0, 2)$ | 10 songs \rightarrow \$6 $(10, 6)$
 $y = 0.40(0) + 2$
 $y = 2$ | $y = 0.40(10) + 2$
 $y = 4.0 + 2$
 $y = 6$

- The graph below already shows the linear model for the first subscription site (Company 1): $y = 0.25x + 3$. Graph the equation of the line for the second subscription site (Company 2) by marking the two points from your work above (for 0 songs and 10 songs) and drawing a line through those two points.

