

Section 1.2: Linear Functions and Models

Linear Functions

A function f is a **Linear Function** if it is in the form $f(x) = mx + b$ (Note, the book writes this as $f(x) = ax + b$) where m is the slope of the line and b is the y-intercept.

Slope of a Line

The **Slope** (m) describes the rate at which the line is rising or falling.

$$m = \frac{\text{rise}}{\text{run}}$$

If you have two points (x_1, y_1) and (x_2, y_2) on a line then the slope m of a line is given by:

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

A positive slope indicates that the graph is rising as you move from left to right. A negative slope indicates that the graph is falling from left to right.

y-intercept: This is the place where a line crosses the y-axis. Usually indicated by the initial value of something.

Example 1

The number of U.S. dial-up Internet households was 42 million at the beginning of 2004 and is projected to decline at the rate of 3.9 million households per year for the next 4 years. Find a linear function f giving the projected U.S. dial-up Internet households (in millions) in year t where $t = 0$ is the beginning of 2004.

What is the projected size of U.S. dial-up Internet Households at the beginning of 2008?

Example 2

A house sells for \$97,000 at the end of 2000, and sells for \$112,000 at the end of 2005.

If the market value increased linearly from 2000 to 2005, what was the rate of change of the market value?

Find an equation to model the value of the house after x years from the year 2000.

What will be the market value of the house at the end of 2010 if the linear increase continues?

In what year will the house have a market value of \$150,000?

First Differences

First differences are a way to see if data that you have can be modeled with a linear function. They are calculated by taking the difference between successive points. If the differences are constant (or nearly constant) then the data can be modeled using a linear function.

Example 3

The following data describes the percent of US companies that are still in business after a given number of years in operation. Find the first differences to see if the data can be described as a linear function.

Years	5	6	7	8
Companies (percent)	50	47	44	41