
MATH 11010: Linear Functions and Slope

Section 1.3

- **Linear functions:** A function f is a linear function if it can be written as

$$f(x) = mx + b$$

where m and b are constants. The graph of a linear function is always a straight line.

- **Horizontal lines:** Horizontal lines are given by equations of the type $y = b$, or $f(x) = b$, for some constant b .
- **Vertical lines:** Vertical lines are given by equations of the type $x = c$ for some constant c .
- **Slope:** The **slope** of a line measures its steepness. The slope, denoted by m , measures the vertical change and the horizontal change as we move along the line. The vertical change, also called the **rise**, is the difference between the y -coordinates. Therefore, rise is an up and down change. The horizontal change, also called the **run**, is the difference between the x -coordinates. Thus, run is a left and right change.
- **Slope formula:** If the coordinates of two points on the line are known then we can use the slope formula to find the slope of the line.

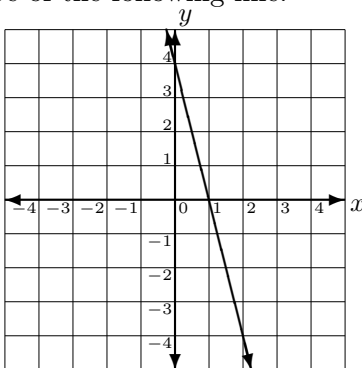
The slope of the line through the points (x_1, y_1) and (x_2, y_2) is given by

$$m = \frac{y_1 - y_2}{x_1 - x_2} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{change in } y}{\text{change in } x} = \frac{\text{rise}}{\text{run}}$$

Note that it does not matter if you start with y_1 or y_2 in the numerator. However, you must start with its corresponding x in the denominator.

Example 1: Find the slope of the line connecting $(-3, 7)$ and $(5, -4)$.

Example 2: Determine the slope of the following line.



The following table summarizes information concerning the slope of a line.

- If the slope is positive ($m > 0$), then the line slants up ↗
- If the slope is negative ($m < 0$), then the line slants down ↘
- If the slope is zero ($m = 0$), then the line is horizontal →
- If the slope is undefined, then the line is vertical ↑

- **Slope-Intercept form** of the line can be used to identify the slope and y -intercept.

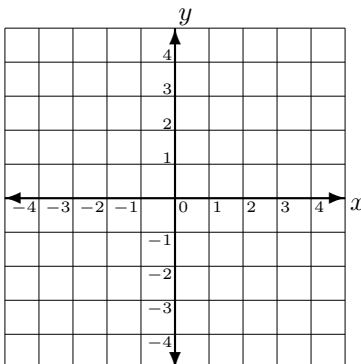
The **slope-intercept form** of an equation with slope m and y -intercept b is given by

$$y = mx + b.$$

When identifying the slope and y -intercept using the slope-intercept form, remember to divide each term by the coefficient on y . The slope and y -intercept can only be identified once you have isolated y .

Example 3: Determine the slope and y -intercept of $4x + 3y = 7$.

Example 4: Graph $3x - 2y = 4$.



Example 5: Superior Cable Television charges \$65 installation fee and \$80 per month for deluxe service.

- (a) Write an equation that can be used to determine the total cost, $C(t)$, for t months of deluxe cable television service.

- (b) Find the total cost for 8 months of service.

- (c) Calculate $C(4)$ and interpret its meaning in the context of the problem.