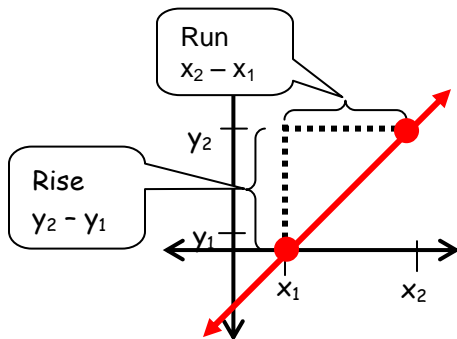


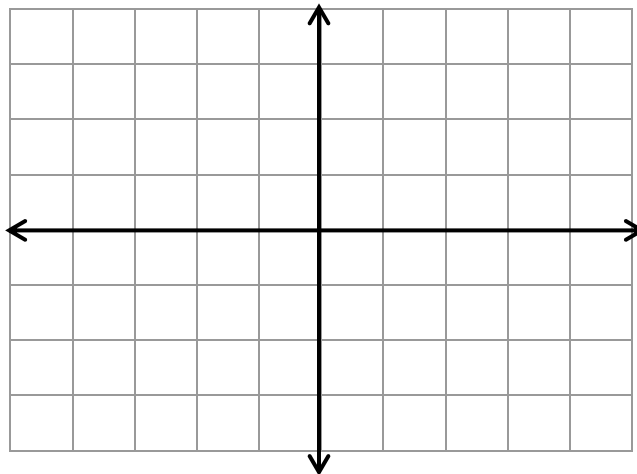
Section 1.4 (Linear Functions and Slope)

The steepness of a line (or linear function) can be described by the **slope** of the line
We measure the slope of a line as a ratio of vertical change to horizontal change. Consider a sample graph.



The slope of a graph (line) is defined by $\text{slope} = m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$ where $x_2 \neq x_1$

Example: Find the slope of the line containing (-2,4) and (1,-2). Do the same with the line containing (3,2) and (6,4), then points (-1,3) and (1,3). Graph the lines.



The slope of a graph and how it slants are related as follows (sketch)

- Slants up left to right => Positive slope (positive change in y, positive change in x)
- Slants downward from left to right => Negative slope (negative change in y, positive change in x)
- Horizontal => 0 slope (change in y is 0)
- Vertical => Undefined slope (change in x is 0)

A non-vertical line with slope m that passes through point (x_1, y_1) can be described by the **point-slope** equation $y - y_1 = m(x - x_1)$

Example: Write an equation in point-slope form for the line...

With slope 2 and passing through (-1,-2)

Passing through the points (-1,2) and (4,-3)

Another useful form to describe a line is the **slope-intercept** form $y = mx + b$, where the slope is m and the y-intercept of the line is $(0,b)$.

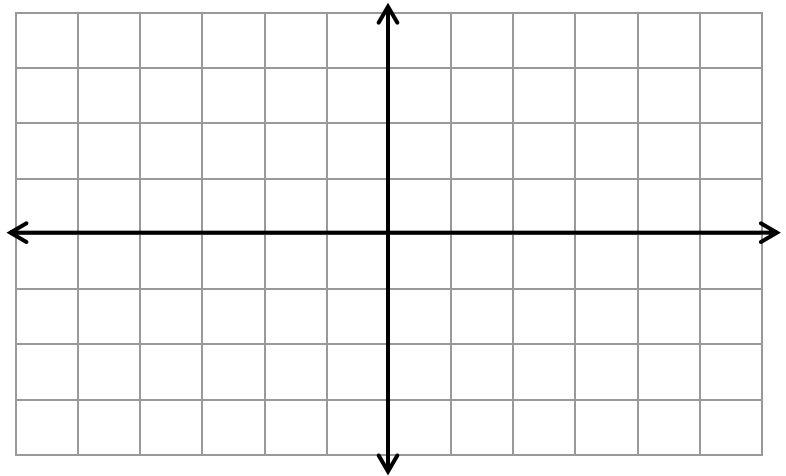
Example: Write an equation in slope-intercept form of the line...

With y-intercept of $(0,2)$ and slope of -3 Passing through the points $(-1,2)$ and $(4,-3)$

Example: Write the equation of the line that has an x-intercept of 2 and y-intercept of 6 .

It is often easier and much less time consuming to graph linear functions that are in slope-intercept form

Example: Graph $f(x) = \frac{2}{3}x - 1$ and $g(x) = -2x + 3$



While not all lines can be described in slope-intercept form (think about the slope of vertical lines), every line has an equation in **general** form (standard form) $Ax + By + C = 0$ where A and B are not both 0 .

We can still find the slope and y-intercept by solving general linear equations for y (isolating y).

Example: Find the slope and y-intercept for

$$y = -2x$$

$$y = \frac{1}{2}x - 3$$

$$y = -8$$

$$4x + 2y = -8$$

$$3x - 9y = 18$$

Example: Describe the graphs of $y = -2$ and $x = 3$.

Note: For a line with positive slope m , as m increases, the line becomes steeper.