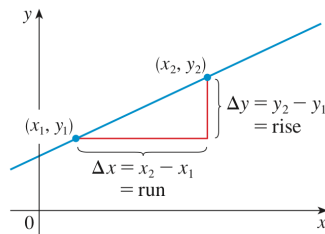## §1.3 Linear Models & Rates of Change

## Geometry : Slope

■ **Review of Lines**



**(1) ■ Definition** The **slope** of the line that passes through the points $(x_1, y_1)$ and $(x_2, y_2)$ is

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

**(2) ■ Point-Slope Form of the Equation of a Line** An equation of the line passing through the point $(x_1, y_1)$ and having slope $m$ is

$$y - y_1 = m(x - x_1)$$

**(3) ■ Slope-Intercept Form of the Equation of a Line** An equation of the line with slope $m$ and $y$-intercept $b$ is

$$y = mx + b$$

■ **EXAMPLE 1** **A Line through Two Points**

Find an equation of the line through the points $(-1, 2)$ and $(3, -4)$ and write the equation in slope-intercept form. **+ Sketch the line.**

## Functions : Rate of Change

The line $y = mx + b$ is the graph of the function

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

**Def:** Functions with this form are called **Linear Functions**.

The slope of the graph = the **Rate of Change** of the linear function.

$$\text{Slope} = m = \frac{\Delta y}{\Delta x} = \boxed{\frac{y_2 - y_1}{x_2 - x_1}} = \boxed{\frac{f(x_2) - f(x_1)}{x_2 - x_1}} = \text{Rate of Change}$$

change in y over change in x

change in output of change in input

**38. Manufacturing cost** The manager of a furniture factory finds that it costs \$2200 to manufacture 100 chairs in one day and \$4800 to produce 300 chairs in one day.

(a) Express the cost as a function of the number of chairs produced, assuming that it is linear. Then sketch the graph.

(b) What is the slope of the graph and what does it represent?

(c) What is the $y$-intercept of the graph and what does it represent?

<u>ex.</u> FIND A LINEAR FUNCTION $f$ SUCH THAT $f(10) = 150$ AND $f(80) = 360$.

WHAT IS $f(120)$?