

## Math 150 Lecture Notes Lines

The **slope**,  $m$ , of a nonvertical line that passes through the points  $A(x_1, y_1)$  and  $B(x_2, y_2)$  is

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y^2 - y^1}{x^2 - x^1}$$

The slope of a vertical line is undefined.

### Point-Slope Form of the Equation of a Line:

An equation of the line that passes through the point  $(x_1, y_1)$  and has slope  $m$  is

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

### Slope-Intercept Form of the Equation of a Line:

An equation of the line that has slope  $m$  and  $y$ -intercept  $b$  is  $y = mx + b$ .

An **equation of the vertical line** through  $(a, b)$  is  $x = a$ .

An **equation of the horizontal line** through  $(a, b)$  is  $y = b$ .

### General Equation of a Line:

The graph of every **linear equation**  $Ax + By + C = 0$  ( $A, B$  not both zero) is a line. Conversely, every line is the graph of a linear equation.

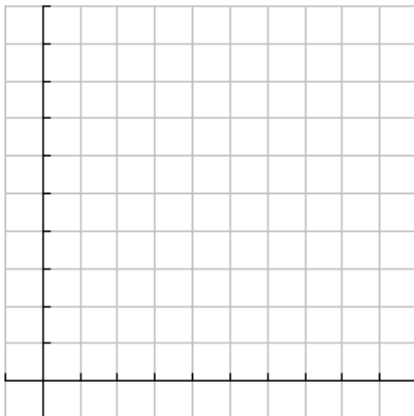
Two nonvertical lines are **parallel** iff they have the same slope.

Two lines with slopes  $m_1$  and  $m_2$  are perpendicular iff  $m_1 m_2 = -1$ , that is, their slopes are negative reciprocals.

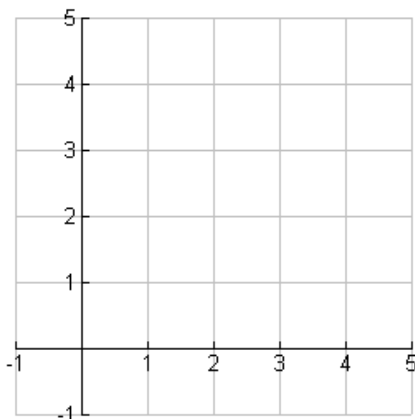
A horizontal line (slope = 0) is perpendicular to a vertical line (undefined slope).

When a line is used to model the relationship between two quantities, the slope of the line is the **rate of change** of one quantity with respect to the other.

Example 1: A dam is built on a river to create a reservoir. The water level  $w$  in the reservoir is given by the equation  $w = 4.5t + 28$ , where  $t$  is the number of years since the dam was constructed, and  $w$  is measured in feet. Sketch a graph of this equation. What do the slope and  $w$ -intercept of this graph represent?



Example 2: Find the area of the triangle formed by the coordinate axes and the line  $2y + 3x - 6 = 0$



Example 3: Find an equation for the line tangent to the circle  $x^2 + y^2 = 25$  at the point  $(3, -4)$ . At what other point on the circle will a tangent line be parallel to the tangent line given?

