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# MATH 11010: Equations of lines

## Section 1.4

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- **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  $f(x) = b$ .
- **Vertical lines:** Vertical lines are given by equations of the type  $x = c$ .
- **To find the equation of a line:** In order to find the equation of any line (that is not horizontal or vertical) we will always need two items: the slope and a point on the line. Once we have these two items, we need to use either the **slope-intercept form** or the **point-slope formula** to find the equation of the line. Although we have already discussed the slope-intercept form, it is stated here again for convenience.

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

$$y = mx + b.$$

**Point-slope formula:** The equation of the line with slope  $m$  and passing through  $(x_1, y_1)$  can be found using

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

**Example 1:** Find the equation of the line with slope  $m = \frac{2}{3}$  and which passes through  $(4, -1)$ .

**Example 2:** Find the equation of the line passing through  $(9, -2)$  and  $(1, 4)$ .

- **Parallel lines:** Parallel lines are two lines in the same plane that never intersect.
- **Perpendicular Lines:** Two lines are **perpendicular lines** if they intersect to form a  $90^\circ$  angle.

**Parallel and Perpendicular Lines**

- **Parallel lines** have the same slope. So,  $m_1 = m_2$ .
- **Perpendicular lines** have negative reciprocal slopes. In other words,  $m_1 \cdot m_2 = -1$ .

**Example 3:** Determine whether the following lines are parallel, perpendicular, or neither.

$$3x - 5y = 10 \quad \text{and} \quad 5x + 3y = 7$$

**Example 4:** Find the equation of the line that is parallel to  $5x - 3y = 2$  and which passes through  $(1, 3)$ .

**Example 5:** Find the equation of the line that is perpendicular to  $3x + 2y = 1$  and which passes through  $(4, -2)$ .

**Example 6:** Given  $P = (\frac{1}{2}, -7)$ .

(a) Find the equation of the horizontal line passing through  $P$ .

(b) Find the equation of the vertical line passing through  $P$ .

**Homework:** pp 115–116; #1–67 every other odd (eoo)