# **Mini-Lecture 1.7**

Parallel and Perpendicular Lines

### **Learning Objectives:**

- 1. Define parallel lines.
- 2. Find equations of parallel lines.
- 3. Define perpendicular lines.
- 4. Find equations of perpendicular lines.

### **Preparing for Parallel and Perpendicular Lines:**

- *i*) Determine the reciprocal of  $-\frac{1}{5}$ .
- *ii*) Identify the slope of the line whose equation is 4x 3y = 1.

## DEFINITION

Two nonvertical lines are **parallel** if and only if their slopes are equal and they have different *y*-intercepts. Vertical lines are parallel if they have different *x*-intercepts.



### DEFINITION

Two nonvertical lines are **perpendicular** if and only if the product of their slopes is -1. Alternatively, two nonvertical lines are perpendicular if their slopes are negative reciprocals of each other. Any vertical line is perpendicular to any horizontal line.



#### **Examples:**

1. Determine whether the two lines are parallel, perpendicular, or neither. a)  $L_1$ : 2x + 3y = 9  $L_2$ : 6x = 9y + 4

b) 
$$L_1: y = -\frac{7}{2}x + 3$$
  $L_2: 4x - 14y = -5$ 

c) 
$$L_1: \frac{8}{3}x - 6y = 0$$
  $L_2: 4x - 9y = 2$ 

d)  $L_1$ : contains (-2, 3) and (4, -9)  $L_2$ : contains (-3, -6) and (1, -4)

2. Find the equation of the line with the given properties. Express the answer in slope-intercept form.

a) Parallel to y = -3x - 2 through the point (5, -1).

b) Parallel to 12x + 10y = 5 through the point (-15, 0).

c) Perpendicular to  $y = -\frac{4}{5}x - 3$  through the point (10, 2).

d) Perpendicular to 7x - 2y = 6 through the point (0, -3).