## 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 $4 x-3 y=1$.

## 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) $L_{1}: 2 x+3 y=9$
$L_{2}: 6 x=9 y+4$
b) $L_{1}: y=-\frac{7}{2} x+3$
$L_{2}: 4 x-14 y=-5$
c) $L_{1}: \frac{8}{3} x-6 y=0 \quad L_{2}: 4 x-9 y=2$
d) $L_{1}$ : contains $(-2,3)$ and $(4,-9) \quad L_{2}:$ contains $(-3,-6)$ and $(1,-4)$
2. Find the equation of the line with the given properties. Express the answer in slopeintercept form.
a) Parallel to $y=-3 x-2$ through the point $(5,-1)$.
b) Parallel to $12 x+10 y=5$ through the point $(-15,0)$.
c) Perpendicular to $y=-\frac{4}{5} x-3$ through the point $(10,2)$.
d) Perpendicular to $7 x-2 y=6$ through the point $(0,-3)$.
