MA 180 Lecture Chapter 2 College Algebra and Calculus by Larson/Hodgkins Functions and Graphs

2.1) Lines in the Plane

Definition of the Slope of a line

The **slope** *m* of the nonvertical line passing through the points (x_1, y_1) and (x_2, y_2) is $m = \frac{y_2 - y_1}{x_2 - x_1}$

where $x_1 \neq x_2$.

We also refer to $y_2 - y_1$ as the *change in y* or Δy or as the rise. Similarly the *change in x* is also refered to as the run. Note it is important to keep the same order of subtraction. The slope of the line is also interpreted as the steepness of the line, as a ratio, or as a rate.

Example: Find the slope of the line that passes through the following points. Then plot the points and interpret the results.

(2,5) and (-3,-1)

(3,7) and (0,7)

(4,-1) and (4,9)

The Conclusion

Slope of a Line			
1.	A line with positive slope rises from left to right.		
2.	A line with negative slope falls from left to right.		
3.	A line with zero slope is horizontal.		
4.	A line with undefined slope is vertical.		

If you know the slope of a line and the coordinates of one point on the line, you can find an equation for that line.

Point-Slope Form of the Equation of a Line

The **point-slope form** of the equation of the line that passes through the point (x_1, y_1) and has slope *m* is $y - y_1 = m(x - x_1)$.

Example:

Find the point-slope form of the equation of a line that passes through the point (4,-2) and has a slope of 6.

Find the point-slope form of the equation of a line that passes through the points (-1,3) and (0,5).

Our second way to express the equation of a line is the slope-intercept form. This is particularly helpful in sketching the graph.

Slope-Intercept Form of the Equation of a Line

The graph of the equation y = mx + b is a line whose slope is *m* and whose *y*-intercept is (0, b).

Example:

Find the equation of the line in slope-intercept form, given the slope is 7 and it passes through the point (0,-2).

Sketch the graph of each linear equation.

y = 3x + 1

y = 3

2x + y = 3

Note: Sometimes the equation of a line is expressed in the general form: Ax + By + C = 0 where *A*,*B*,*C* are all constants.

Summary of Equations of Lines			
1.	General Form	Ax + By + C = 0	
2.	Vertical Line	x = a	
3.	Horizontal Line	y = b	
4.	Slope-intercept fo	y = mx + b	
5.	Point-slope form	$y - y_1 = m(x - x_1)$	

Parallel Lines

Two distinct non-vertical lines are **parallel** if and only if their slopes are equal.

Find an equation of the line that passes through the point (3,-2) and is parallel to the line 2x-3y=5.

Perpendicular Lines

Two non-vertical lines are **perpendicular** if and only if their slopes are negative reciprocals of each other.

That is $m_1 = -\frac{1}{m_2}$.

Find an equation of the line that passes through the point (1,7) and is perpendicular to the line 2x-5y=15.