Outline for Linear Equations and Inequalities of 2 variables
Sections 3.1-3.4

A **Graphing** a line by **Plotting Points**

1. **Substitute** any value for x in the equation and **solve** for y. This results in a point (x, y). OR
   Substitute any value for y in the equation and **solve** for x. This results in a point (x, y).
2. **PLOT** a minimum of 2 points (3 preferable) and connect with a line.

B **Finding x and y intercepts**

1. To find the x-intercept: Let y equal zero and solve for x.
   This point $(x, 0)$ is the x-intercept, where the line crosses the x-axis.
2. To find the y-intercept: Let x equal zero and solve for y.
   This point $(0, y)$ is the y-intercept, where the line crosses the y-axis.
3. If $x = 0$ when $y = 0$, then the origin is both the x-intercept and the y-intercept.
4. Intercepts are often used as points to help graph a line.

C Finding **slope** of a line **from 2 given points**

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

1. If two points (x_1, y_1) and (x_2, y_2) are known, the slope can be found using the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$
2. If the result is $\frac{0}{\text{nonzero \#}}$, the slope is 0.
   If the result is $\frac{\text{nonzero \#}}{0}$, the slope is undefined.

D Finding the **slope** from an **equation of the line**

1. Solve the equation for y, $y = mx + b$ form. The coefficient of the x term is the slope.
2. If an equation has only a y variable, it is a horizontal line and the slope is 0.
3. If an equation has only an x variable, it is a vertical line and the slope is undefined.

E

Slope-intercept form of an equation of a line

$y = mx + b$

1. Solve the equation for y, $y = mx + b$ form.
2. The slope of the line is the coefficient of x and the point $(0, b)$ is the y-intercept.
3. If given the slope m and the y-intercept $(0, b)$, substitute those number directly in this form.
   a) If the slope needs to be found first (from two points), use the slope formula.
   b) Note: **If the point's x-coordinate is not zero, the y-coordinate is not b.** You must then use point-slope form.

F

Graphing a line **using Slope** and a **Point**

1. Begin at the point given; for example, the y-intercept.
2. Use rise over run to locate a second point on the line.
   a) If the slope is positive, move up numerator number of units, then right denominator number of units (or down then left).
   b) If the slope is negative, move down numerator number of units, then right denominator number of units (or up then left).

G

Point-Slope Form of an equation of a line,

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

1. Substitute the slope of the line for m, the x coordinate of the point for x_1, and the y coordinate of the point for y_1.
2. This form can be converted to slope-intercept form or standard form.

H

Standard Form of an equation of a line,

$Ax + By = C$ $\quad A > 0$, A, B, and C are integers

1. Always clear denominators (clear fractions) from the equation first by multiplying each term of the equation by the LCD.
2. Move the terms with x and y to one side (x term in front) and the constant to the other side.
3. If the x term coefficient if negative, multiply each term by -1 so A is positive.

I

4 types of **Slopes**

1. Positive Slope: line rises from left to right
2. Negative Slope: line falls from left to right
3. Zero Slope: line is horizontal
4. Undefined Slope: line is vertical

J

Equations **of Horizontal** and **Vertical Lines**
$x = k$ and $y = k$

1. A vertical line through a point (k, h) has the equation $x = k$. (x = x-coordinate)
2. A horizontal line through a point (h, k) has the equation $y = k$. (y = y-coordinate)

K

Slopes of **Parallel** $\parallel$ and **Perpendicular** $\perp$ **Lines**

1. Parallel lines have the same slope. If $m = \frac{c}{d}$, then the slope of any parallel line is also $\frac{c}{d}$
2. Perpendicular lines have slopes that are opposite reciprocals. If $m = \frac{c}{d}$, then $m_{\perp} = -\frac{d}{c}$.

L

Graphing a **Linear Inequality**

1. Convert the Inequality to slope-intercept form (if not already).
2. If the inequality sign is $\leq$ or $\geq$, make the line **solid.**
   If the inequality sign is < or >, make the line **dashed.**
3. If the sign is $\leq$ or <, shade **below** the line.
   If the sign is $\geq$ or >, shade **above** the line.
4. You can also use a 'test point' to determine which side to shade. If the original inequality is true after substituting x and y, shade that side. If the original inequality is false, shade the opposite side.