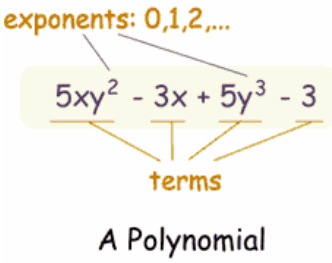
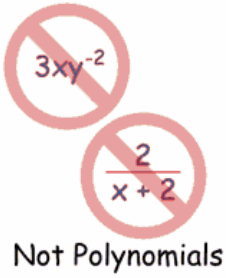
Unit 1 Cheat Sheet (Real Numbers, Solving, Linear, Graphing) Name _____

Word	Definition	Examples
Natural Numbers	Counting numbers, positive only	$\mathbf{1, 2, 3, \ldots}$
Whole Numbers	Natural numbers including 0	$\mathbf{0, 1, 2, 3, \ldots}$
Integers	Positive and negative whole numbers	$\mathbf{\ldots -2, -1, 0, 1, 2, \ldots}$
Rational Numbers	Expressed in fraction form Decimals that terminate or repeat	$\mathbf{\frac{1}{2}, .25, .\overline{6}, \sqrt{4} \ldots}$
Irrational Numbers	Non-terminating or repeating decimals	$\mathbf{.3257492 \ldots, \sqrt{20}, \pi \ldots}$
Real Numbers	All of the above	

Properties of Addition		
Property	**Words**	**Algebra**
Commutative Property of Addition	Switch order	$\boldsymbol{a + b = b + a}$
Associative Property of Addition	Switch grouping (change parentheses)	$\boldsymbol{(a + b) + c = a + (b + c)}$
Identity Property of Addition	Add what value to not change original?	$\boldsymbol{a + 0 = a}$
Inverse Property of Addition	Add what value to return to zero?	$\boldsymbol{a + (-a) = 0}$

Properties of Multiplication		
Property	**Words**	**Algebra**
Commutative Property of Multiplication	Switch order	$\boldsymbol{ab = ba}$
Associative Property of Multiplication	Switch grouping (change parentheses)	$\boldsymbol{a(bc) = (ab)c}$
Distributive Property	Multiply each inside by the outside	$\boldsymbol{a(b + c) = ab + ac}$
Identity Property of Multiplication	Multiply by what value to not change original?	$\boldsymbol{a * 1 = a}$
Inverse Property of Multiplication	Multiply by what value to get back to 1?	$\boldsymbol{a * \left(\frac{1}{a}\right) = 1}$
Property of Zero	Anything multiplied by zero is zero	$\boldsymbol{a * 0 = 0}$

Vocabulary Word	Definition	Representation
Monomial	A monomial is a polynomial expression generated using only the multiplication operator. Can be • A number • A variable • A combination of a number and variables using only multiplication	Monomials $-5, 3, 21x, -2x^2y^3, 1a^2b^5$ **Not a monomial:** **$x - y$, $\frac{p}{q}$, $x + 4$**

Polynomial Expression	A polynomial expression is either: 1. a numerical expression or variable symbol OR 2. the result of placing two previously generated polynomial expressions into the blanks of the addition operator (___+___) or the multiplication operator (___x___) Specific Polynomial Terminology: Binomial = two terms Trinomial = three terms		

Multiplying Polynomials:

1. If adding or subtracting variables the exponents __stay the same___.
2. If multiplying variables ___add_____ the exponents.
3. If dividing variables ____subtract___ the exponents.

Solving Literal Equations

Goal: Get the variable alone!!

Use the strategies we used to solve equations → use inverse operations!

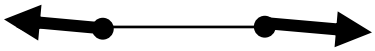
Vocabulary	*Definition*	
Set-Builder Notation	Mathematical shorthand for precisely stating all numbers of a specific set that possess a specific property	$\{x \mid 2 \le x \le 6\}$ Is set-builder notation for "all values of *x* such that *x* is between 2 and 6 inclusive
Interval Notation	An interval is a connected subset of numbers. Interval notation is an alternative to expressing your answer as an inequality.	$2 \le x < 6$ as inequality $[2, 6)$ in interval notation (means "not included" or "open" [means "included" or "closed"

Symbol	Name
$>$	Greater than
$<$	Less than
$\ge$	Greater than or equal to
$\le$	Less than or equal to

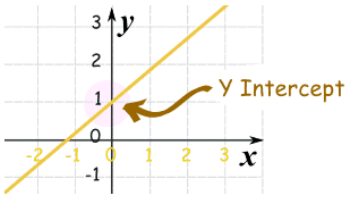
Inequalities Containing *AND*

- A compound inequality containing *AND* is true only if both inequalities are true.
- The graph of an *AND* inequality is the intersection of the graphs of the two inequalities. The intersection can be found by graphing each inequality and then determining where the graphs overlap.

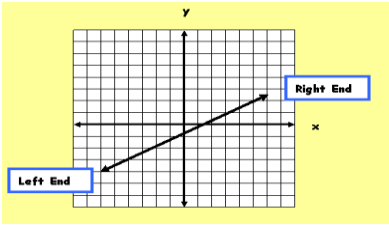
Inequalities Containing *OR*



- A compound inequality containing *OR* is true if one or more of the inequalities are true
- The graph of an *AND* inequality is the union of the graphs of the two inequalities.

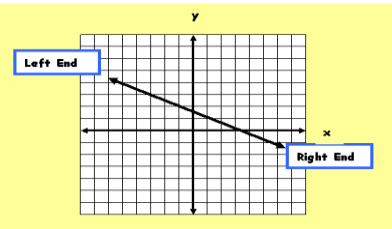
Vocabulary Word	Definition	Representation
Linear Equations	Only have x and y, without exponents. Graphs as a straight line.	*Slope-Intercept Form:* $y = mx + b$ *Point-Slope Form:* $y - y_1 = m(x - x_1)$ *Standard Form:* $Ax + By = C$
Slope	The slope of a line measures the steepness of the line. Slope measures the ratio of the change in the y-value of a line to a given change in its x-value.	$Slope = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$
y-intercept	The y-intercept is where the graph crosses the y-axis.	
Ordered Pair	Two numbers that describe the location of the corresponding point on the coordinate plane.	(x,y) Ordered Pair

Positive Slope



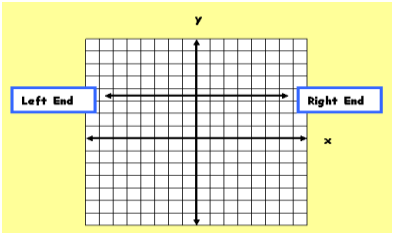
If a line has positive slope then as you move along the line from left to right, the line is

Negative Slope



If a line has negative slope then as you move along the line from left to right, the line is

Zero Slope

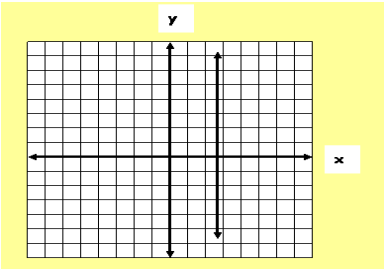


If a line has zero slope then as you move along the line from left to right, the line is

Horizonta

Horizontal lines
0 slope
Y: equation is $y = \#$

Undefined Slope



If a line has no slope then there is no left or right

Vertica

Vertical lines
Undefined slope
X: equation is $x = \#$

Horizontal and Vertical Lines

EQUATIONS OF HORIZONTAL LINES

$y = mx + b$ where $m = 0$ (or simply $y = b$)

H: Horizontal
O: Zero Slope
Y: *y* = # equations

EQUATIONS OF VERTICAL LINES

$x = a$ where *a* is the *x-intercept* of the line

V: Vertical
U: Undefined Slope
X: *x*= # equations

GRAPHING AN INEQUALITY

1. Solve the equation for y (if necessary)
2. Graph the equation as if it contained an = sign.
3. Draw the line SOLID if the inequality is $\leq$ or $\geq$
4. Draw the line DASHED if the inequality is $<$ or $>$
5. If the inequality is $>$ or $\geq$ shade ABOVE the line
6. If the inequality is $<$ or $\leq$ shade BELOW the line

1. Treat the inequality as an equal sign and solve for y (if necessary).
2. Graph the inequality using the slope and y-intercept.

   $<$ or $>$ ➔ dotted line

   $\leq$ or $\geq$ ➔ solid line

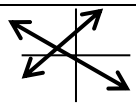
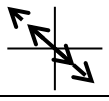
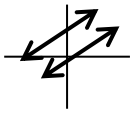
3. Choose a point that is clearly on one side of the line.
4. Plug the point into the inequality.

   True? ➔ Shade that side of the line

   False? ➔ Shade the other side of the line

System of Equations:

- **A set of 2 or more equations that share the same variables and are solved simultaneously is called a system of equations**
- **A system of equations can be solved by: graphing or algebraically.**
- **The solution to a system of linear equations is a point where the lines intersect.**
- **Sometimes the lines intersect at all points (lines coincide), therefore there are infinitely many solutions (∞).**
- **Sometimes the lines do not intersect (lines parallel) and therefore there is no solution (∅).**

Graphs of Equations		Slopes of Lines	Type	Number of Solutions
Lines Intersect		DIFFERENT slopes	Consistent and independent	One (x, y)
Lines Coincide		SAME slope, SAME y-intercepts	Consistent and dependent	Infinitely many (∞)
Lines Parallel		SAME slope, DIFFERENT y-intercepts	Inconsistent	None (∅)

To solve a system of linear equations using a graphing calculator:

- Put each equation in slope-intercept form. **(y = mx + b)**
- Press **y=** and enter the equations into Y_1 and Y_2
- Press **ZOOM 6** to see the graph. If you CAN'T see two intersecting lines, press **ZOOM** 3 **ENTER**
- To have the calculator find the intersection,
  Press **2nd TRACE 5:Intersect ENTER ENTER ENTER**
- The point of intersection **(x,y)** is the <u>solution.</u>

Beware!!! The calculator can mislead you if the solution is <u>infinite or none.</u>
(So, compare the slopes and y-intercepts first before typing the equations)

Solving a of a system of equations by ***<u>substitution</u>***

In the system of equations at the right, $\boldsymbol{y}$ is given in terms of $\boldsymbol{x}$ in each equation. Although you can solve this system graphically, there are times and algebraic solution will be needed.

$$\begin{cases} \boldsymbol{y + x = 4} \\ \boldsymbol{y - 2x = 7} \end{cases}$$

To use the substitution method, you transform a pair of equations in two variables into one equation in one variable. *In other words you solve both equations for* $\boldsymbol{y}$.

$$\boldsymbol{y = -x + 4}$$
$$\boldsymbol{y = 2x + 7}$$

Once both equations are solved for $\boldsymbol{y}$, set both equations equal to each other

$$\boldsymbol{-x + 4 = 2x + 7}$$

Solve for $\boldsymbol{x}$

$$\boldsymbol{x = -1}$$

Substitute the value found for $\boldsymbol{x}$, in either equation to find $\boldsymbol{y}$

$$\boldsymbol{y = -(-1) + 4}$$
$$\boldsymbol{y = 5}$$

The solution is the ordered pair you just found

$$\boldsymbol{(-1, 5)}$$

Solving a system of equations by ***<u>elimination</u>***

In the system of equations at the right, $\boldsymbol{y}$ is given in terms of $\boldsymbol{x}$ in each equation. Although you can solve this system graphically, there are times and algebraic solution will be needed.

$$\begin{cases} \boldsymbol{3x + 4y = 6} \\ \boldsymbol{5x + 2y = -4} \end{cases}$$

To use the elimination method, ensure the equations are in column form and add. In this case neither variable was eliminated.

$$\begin{array}{r} \boldsymbol{3x + 4y = 6} \\ \underline{\boldsymbol{(+)5x + 2y = -4}} \\ \boldsymbol{8x + 6y = 2} \end{array}$$

You need to multiply one or both of the equations by a value so that the coefficients of one of the variables are additive inverses. Then add the equations

$$\begin{array}{r} \boldsymbol{3x + 4y = 6} \\ \boldsymbol{(-2)5x + 2y = -4} \end{array}$$

$$\begin{array}{r} \boldsymbol{3x + 4y = 6} \\ \boldsymbol{-10x - 4y = 8} \\ \boldsymbol{-7x \qquad = 14} \\ \boldsymbol{x = -2} \end{array}$$

Substitute -2 in for $\boldsymbol{x}$ into either equation to find the value of $\boldsymbol{y}$

$$\begin{array}{r} \boldsymbol{3(-2) + 4y = 6} \\ \boldsymbol{-6 + 4y = 6} \\ \boldsymbol{y = 3} \end{array}$$

$$\boldsymbol{(-2, 3)}$$

The solution is the ordered pair you just found