8 **Inequalities**

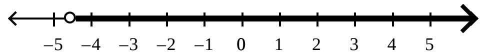
Graphing: closed dot = includes (≥,≤); open dot = excludes (>,<);

When dividing or multiplying by a negative number you must reverse the inequality.

$-x < 4.5$

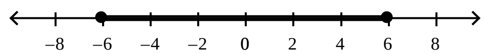
$(-1)(-x) > (-1)(4.5)$

$x > -4.5$

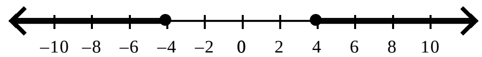



Absolute value:

(<,≤) is AND (between) $|x| \le 6 \text{ is } -6 \le x \le 6$




(>, ≥) is OR $|x| \ge 4 \text{ is } x \le -4 \text{ or } x \ge 4$




10 **Functions** $f(x) = 2x$

Functions can only have one output for every input (*however an output can have more than one input*). This can be determined by drawing vertical lines on the graph of the function. If a vertical line crosses the curve more than once, it is not a function.

functions can be shown by verbal, equation, table or graph

*x*-axis: domain, input, independent variable

*y*-axis: range, output, dependent variable

continuous data: numbers between data points have meaning (i.e. temperature, length, weight…) graph will show a continuous curve

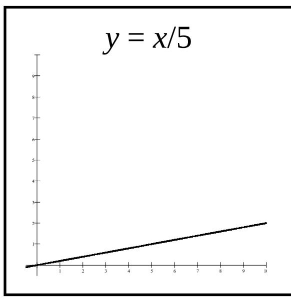
discrete data: involve a count of items (i.e. people, cars, shoes…) graph will show discrete points that are not connected

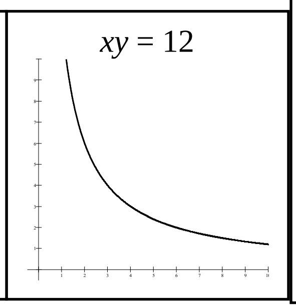
direct variation: $y = kx$

*y* varies directly with *x*; if *x* increases then *y* increases *k* is the constant variation.

inverse variation: $xy = k$

*y* varies inversely with *x*; if *x* increases then *y* decreases *k* is the constant variation




*direct example:* Your distance from lightning varies directly with the time it takes you to hear thunder. If you hear thunder 10 seconds after you see lightning, you are about2 miles from the lightning.

$x = 10; y = 2$

$y = kx$

$2 = k10$

$k = \frac{1}{5}$

$y = \frac{x}{5}$

*inverse example:* If 4 people can paint a house in 3 days, how long will it take 5 people to paint the house.

$x = 4; y = 3$

$xy = k$

$(4)(3) = k$

$k = 12$

$xy = 12$

$5y = 12$

$y = 2.4\, days$

12 **Linear Equations**

two points will define a straight line *or* linear equation (a linear equation must be a straight line)

*rate of change* is the relationship between two quantities that are changing.

$$rate\ of\ change = \frac{change\ of\ the\ dependent\ variable}{change\ of\ the\ independent\ variable}$$

slope: *the rise over the run;* $m = \frac{y_2 - y_1}{x_2 - x_1}$ *or* $m = \frac{\Delta y}{\Delta x}$

**note:** It does not matter which point you choose for $y_1$ and $x_1$. The sign will remain the same.

Slope intercept form: $y = mx + b$

*m* is the slope and *b* is the *y* intercept.

***Example**: The cost of bowling is $3 for shoes and $2.50 per game.*

$y = 2.5x + 3$

Graphing:

1. find the *x* and *y* intercepts, draw a straight line (-1.5,0) & (0,2)
2. find the slope and the y intercept

*y* intercept: can by found by setting *x* = 0.

*x* intercept: can by found by setting *y* = 0.

horizontal line: *y* = *k* (i.e. *y* = 3)

vertical line: *x* = *k* (i.e. x = 3)

Standard form: $Ax + By = C$ where *A*,*B* and *C* are real numbers (generally integers).

to graph find the x-intercept (*when y = 0*) and the y-intercept (*when x = 0);* draw a line through the two lines

Point-Slope form: $y - y_1 = m(x - x_1)$

if you know two points on a line; use them to find the slope than use one point to create the equation

***Example**: Write the equation of line that has a slope of 2 and passes through the line (2,5).* $y - 5 = 2(x - 2)$ ***Note:** you can do a quick graph on the calculator by subtracting 5 from both sides.* $y = 2(x - 2) + 5$

parallel lines have the same slope

perpendicular lines occur when the product of the slopes = -1

absolute value equations

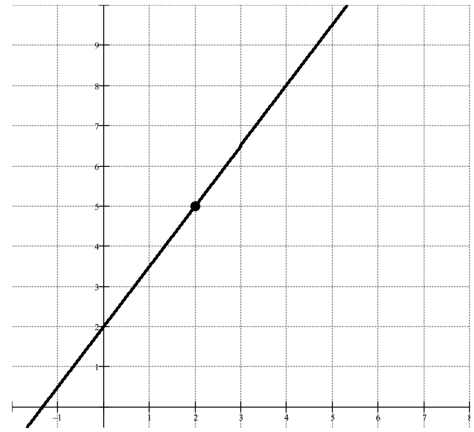
vertical translations: *example* $y = |x| + 5$ (five units above origin)

horizontal translations: *example* $y = |x + 5|$ (five units left of origin)

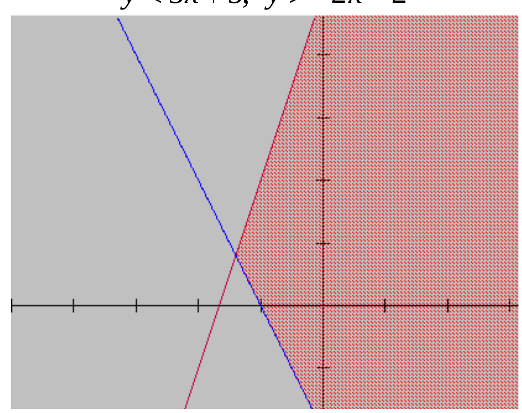
slope intercept form: $y = \frac{3}{2}x + 2$;

standard form: $-3x + 2y = 4$;

point-slope form: $y - 5 = \frac{3}{2}(x - 2)$



$y < 3x + 5; \; y > -2x - 2$



16 **System of Equations and Inequalities**

The intersection of a two lines is the common solution for both equations (one solution).

If the lines are parallel there is no solution.

If the lines are the same line there is infinite solutions (i.e. $2x + 4y = 8$ *and* $y = -.5x + 2$)

Methods of solving systems of equations

1 – graphing (*find the location where the two lines intersect*)

2 – substitution (*solve for one variable and substitute it in the other equation*)

3 – elimination (*adjust the variables so when they are added or subtracted one set of variable is eliminated.*)

**Linear Inequalities**

Graph the equation(s). Test a point on both sides of the line. Shade the location where the point is true. On functions of f(x) or y, when y is > or ≥ then you would shade above the line. For ≥ and ≤ use a solid line and for < and > use a dotted line.

19 **Exponents**

$x^0 = 1$ $\qquad x^{-n} = \frac{1}{x^n}$ $\qquad \frac{1}{x^{-n}} = x^n$ $\qquad$ ***Example***: $\frac{a^{-2}c^4}{b^{-5}d^2} = \frac{b^5c^4}{a^2d^2}$

*for scientific notation see 8th grade notes*

$(a^m)(a^n) = a^{m+n}$ Note: must have the same base ***Example:*** $4^5(4^3) = 4^8 \quad 3^{-2}(3^7) = 3^5$

*multiply numbers for scientific notation*

$(3.2\times10^3)(2.4\times10^6) = 3.2\times2.4\times10^{3+6} = 7.68\times10^9$

$(a^m)^n = a^{mn}$ ***Example:*** $(3^2)^3 = 3^6 \qquad (2^{-5})^2 = 2^{-10}$

$\frac{a^m}{a^n} = a^{m-n}$ ***Example:*** $\frac{3^4}{3^3} = 3^{4-3} = 3^1$

30 **Arithmetic Sequence:** *The difference between consecutive terms is constant.* 4, 7, 10, 13; $1+3n$

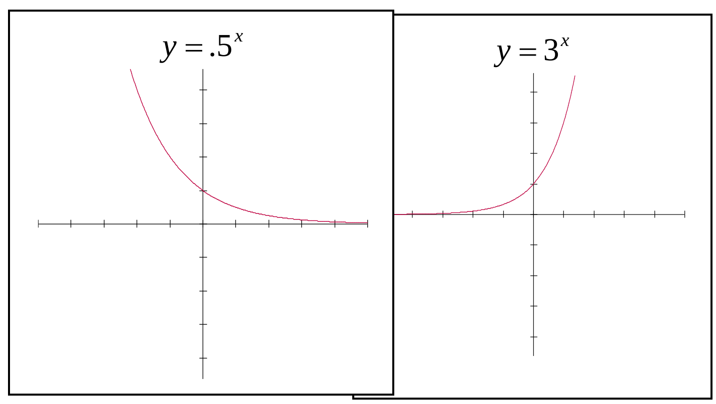
**Geometric Sequence:** *The ratio between consecutive terms is constant.* 3, 6, 12, 24; $3(2^{n-1})$

$A(n) = ar^{n-1}$ *a =first term; r = common ratio; n = term number*

33 **Exponential function** $y = ab^x$

**Exponential Growth and Decay** $y = ab^x$

*when b is greater than one it is the growth factor*
*when b is between zero and one it is the decay factor*




22 **Polynomials**

**Monomial:** *an expression that is a number, variable or product of number and one or more variables. (i.e. $3x^2$ or 2x or 3xy)*

**Degree of a monomial:** *the sum of the exponents of its variables. (i.e. $7x^2y^3$ is 5)*

**Polynomial:** *is a monomial or the sum (or difference) of multiple monomials. (i.e. $3x^3+4x^2-2x-3$)*

**Binomial:** *two monomials (i.e. $3x^3-2x$)*

**Trinomial:** *three monomials (i.e. $3x^3+4x^2-3$)*

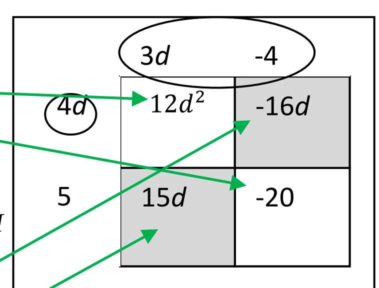
**Add Polynomials** *by combining like terms. Put the polynomial in* ***standard form*** *ordering from highest degree to lowest degree from left to right. (i.e. $3x^3+4x^2-2x-3$)*

| F – First<br>O – Outer<br>I – Inner<br>L - Last | FOIL Method<br>$(3x-5)(2x+7)$<br>$3x(2x)+3x(7)+-5(2x)+-5(7)$<br>$6x^2+21x-10x-35$<br>$6x^2+11x-35$ |
|---|---|

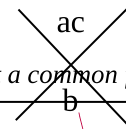
**Multiply Polynomials** *by using the distributive property. This is also a* ***FOIL*** *(**F**irst **I**nner **O**uter **L**ast) when multiplying two binomials.*

25 **Factoring Polynomials** *(i.e.* $12d^2 - d - 20$ *) is equal to* $(3d-4)(4d+5)$

1. *Put first term in quadrant II and last term in quadrant IV.*
2. *Multiply first and second term (* $12d^2 \cdot 20 = 240d^2$ *)*
3. *Find the sum of the factors of step 2 that equal the middle term. (X-box)*
   *(i.e.* $-16d \cdot 15d = 240d^2$; $-16d + 15d = -d$ *)Put these in quadrant I & III*

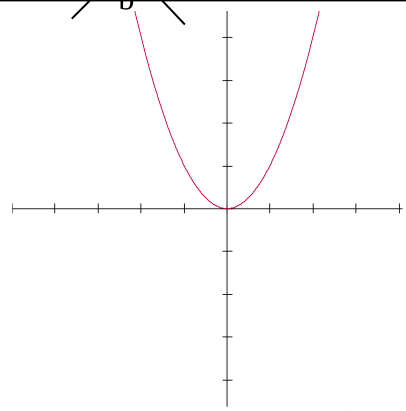


4. *Find the greatest common factor for each line. (answer is GCF's)*
   *(i.e. 4d is GCF for* $12d^2$ *and* $-16d$ *)*




26 **Factoring by Grouping:** *you can use the distributive property to factor out a common factor*

$$y^3+3y^2+4y+12 = y^2(y+3)+4(y+3) = (y^2+4)(y+3)$$



Parent function $f(x)=x^2$

**Quadratics**

**Quadratic Function:** *is a function that can be written in the form* $y=ax^2+bx+c$*, where* $a\neq 0$*. This is called the standard form.*

**Parabola:** *the U shape curve that is made by a quadratic function.*

**Axis of symmetry:** *the fold or line that divides the parabola into matching halves.*

**Vertex:** *the lowest or highest point of a parabola. It is on the axis of symmetry.*

**Minimum:** *lowest point or vertex of the parabola.*

**Maximum:** *highest point or vertex of the parabola.*

**Roots of the equation and zeros of the function:** *where the equation crosses the x-axis*

**Completing the square:** *making* $x^2+bx$ *to a perfect trinomial by adding* $\left(\frac{b}{2}\right)^2$.

**Quadratic Equation** *can be used to solve all quadratic equations*, $ax^2+bx+c$. $\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$

***Discriminant*** *is the expression under the radical in the quadratic equation.* $\sqrt{b^2-4ac}$

*If* $b^2-4ac>0$ *, there are two solutions* $x^2-4$

*If* $b^2-4ac=0$ *, there is one solutions* $x^2$

*If* $b^2-4ac<0$ *, there are no solutions* $x^2+4$