Algebra 2

Preparation Packet

Complete this packet while watching the corresponding videos and taking notes. For extra practice, try the HW assignments (answers included)

Graphing Linear Functions

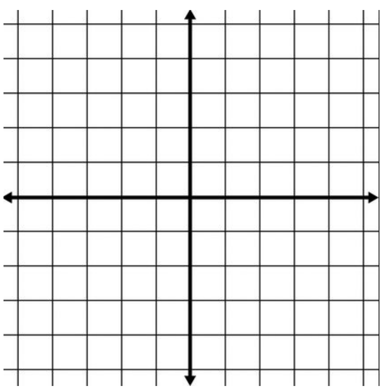
Linear functions are functions in the form of ___________. All linear function graphs are ______________________________.

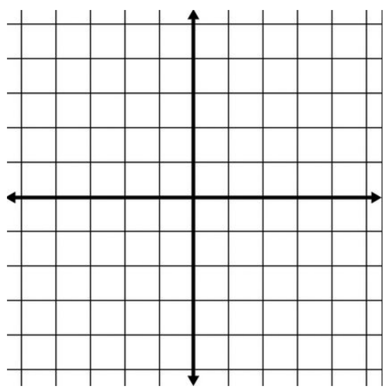
How to Graph a Linear Function
1. Rewrite your equation in slope intercept form [$y = mx + b$] 2. Plot your y-intercept at $(0, b)$ 3. Use the slope [$m = \frac{rise}{run}$] to plot additional points

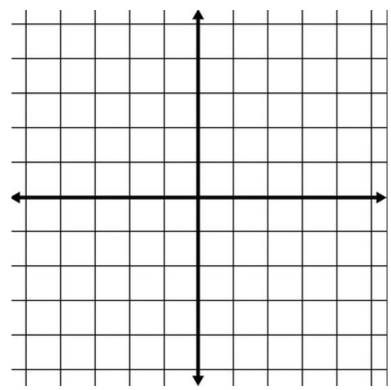
Ex. 1 $2y + 4 = 3x$

Ex. 2 $y - 3 = -2x$

Ex. 3 $y = 1$





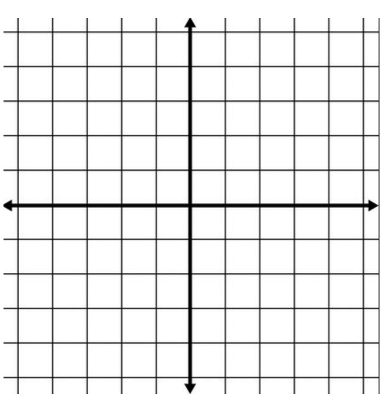


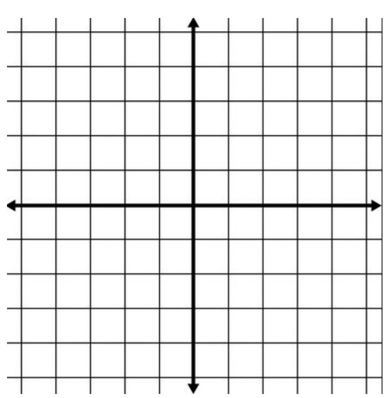
Your Turn!

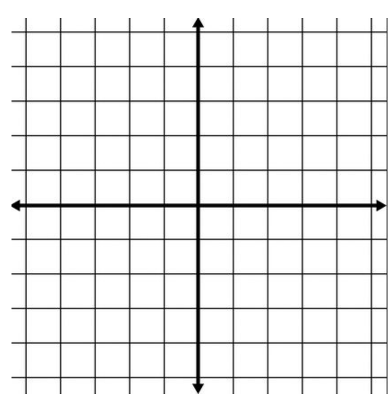
1) $y = -\frac{1}{2}x$

2) $3y - 5 = x + 1$

3) $-4y = 4x + 8$







Creating Linear Functions Using Point-Slope Formula

Slope-Intercept Formula	Point-Slope Formula
$y = mx + b$	$y - y_1 = m(x - x_1)$

How to Use Point-Slope Formula
1. Substitute slope for m 2. Substitute a given point for x_1 and y_1 3. Rewrite your equation in slope-intercept form

Ex. 1 $m = -2,\ (10,\ -1)$

Ex. 2 $m = \frac{2}{3},\ (-6,\ 5)$

Ex. 3 $m = -\frac{1}{2},\ (4,\ -3)$

Your Turn!

1) $m = -3,\ (-2,\ 5)$

2) $m = \frac{1}{3},\ (12,\ -4)$

3) $m = 1,\ (0,\ 7)$

Slope Formula

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

How to Use the Slope Formula
1. Label your coordinates (x_1, y_1) and (x_2, y_2) 2. Substitute values into your formula 3. Simplify the fraction, if necessary

Ex. 1 $(-2, 3)$ $(1, 1)$

Ex. 2 $(2, 3)$ $(-5, 3)$

Ex. 3 Create an equation that goes through the points $(3, -4)$ $(7, -6)$

Your Turn!

1) $(2, 1)$ $(5, -2)$

2) $(0, -3)$ $(5, 7)$

3) Create an equation that goes through the points $(-3, -4)$ $(-1, -6)$

Solving Systems of Equations: The Substitution Method

How to Use the Substitution Method
1. Pick one equation and solve for either variable 2. Substitute this expression into the other equation 3. Solve for the remaining variable 4. Substitute this value into either equation.

Ex. 1 $y = -3x + 4$
$y = 4x - 10$

Ex. 2 $y = 2x$
$-6x + 3y = 16$

Ex. 3 $y - 2 = -4x$
$y = 6x - 8$

Your Turn!

1) $y = x - 4$
$-4x - 6y = -16$

2) $x - 1 = 3y$
$2x + 4y = 12$

3) $x = 3y$
$x - 3y = 0$

Solving Systems of Equations: The Elimination Method

How to Use the Elimination Method
1. Line up x and y terms vertically 2. Multiply one or both equations, when necessary, to create coefficients for x or y that are opposites (positive/negative) 3. Add the equations vertically (one of your variables should cancel out) 4. Solve for the remaining variable 5. Substitute this value into either original equation

Ex 1. $2x + 2y = -2$
$3x - 2y = 12$

Ex 2. $2x + 3y = 6$
$x + 2y = 5$

Ex 3. $4x + 5y = 6$
$6x - 7y = -20$

Your Turn!

1) $x - y = 2$
$x + y = -3$

2) $3x - y = 2$
$x + 2y = 3$

3) $4x + 2y = 8$
$16x - y = 14$

Solving Systems of Three Equations

How to Solve a System of Three Equations
1. Use two equations to eliminate one variable 2. Use two different equations to eliminate the same variable 3. Solve the systems of two equations 4. Substitute these two values into any original equation

Ex. 1

$$\begin{aligned} x + y + z &= 5 \\ 2x - y + z &= 9 \\ x - 2y + 3z &= 16 \end{aligned}$$

Your Turn!

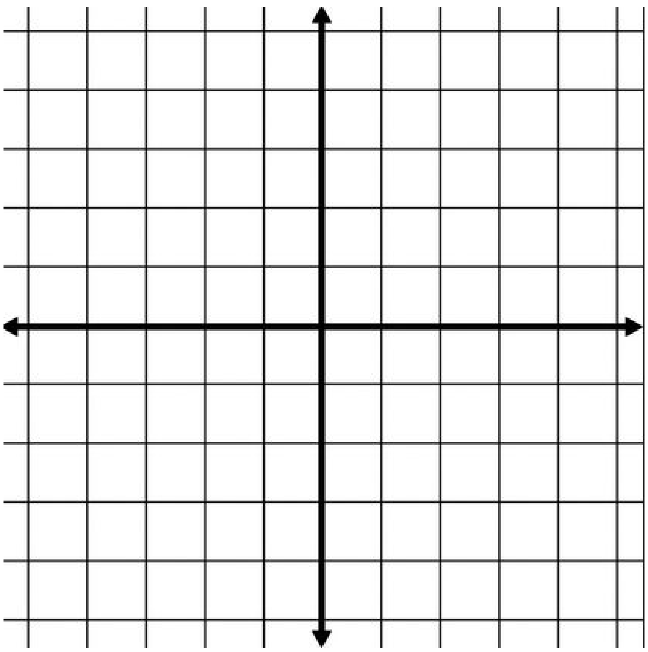
1)

$$\begin{aligned} 4x - 4y + 4z &= -4 \\ 4x + y - 2z &= 5 \\ -3x - 3y - 4z &= -16 \end{aligned}$$

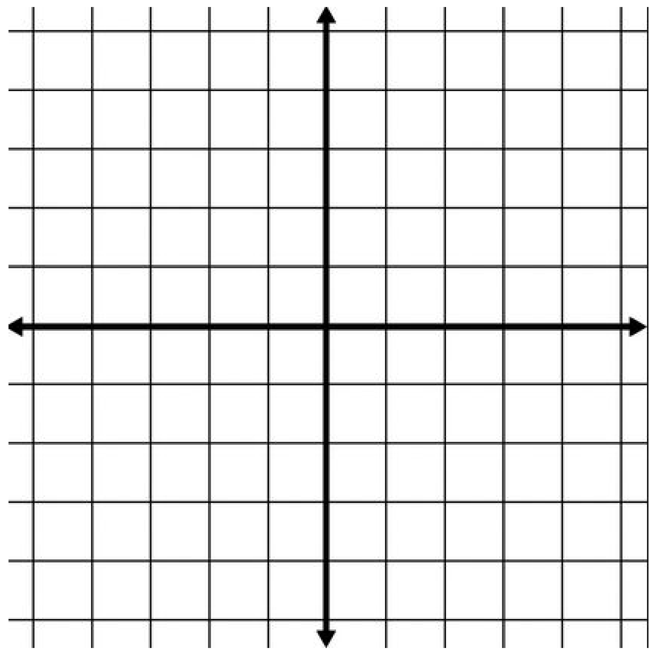
Solving Systems of Inequalities: Graphing

How to Solve a System of Inequalities by Graphing
1. Graph the linear equations *[solid line for $\geq$ or $\leq$, dashed line for $<$ or $>$]*
2. Shade above your line for $>$ or $\geq$
3. Shade below your line for $<$ or $\leq$
4. The solution of your system is where the shading overlaps

Ex. 1 $y \geq 2x - 3$
$y \leq -\frac{1}{2}x + 1$

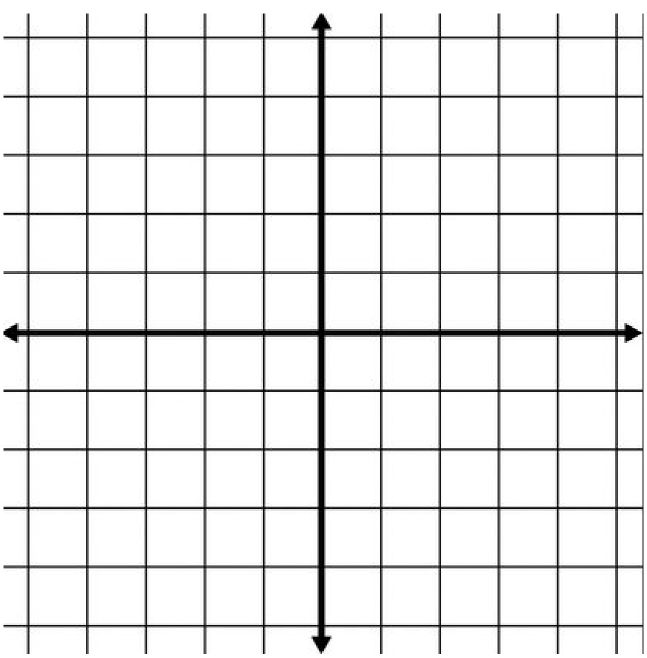


Ex. 2 $y < -\frac{2}{3}x + 4$
$y < -x + 3$

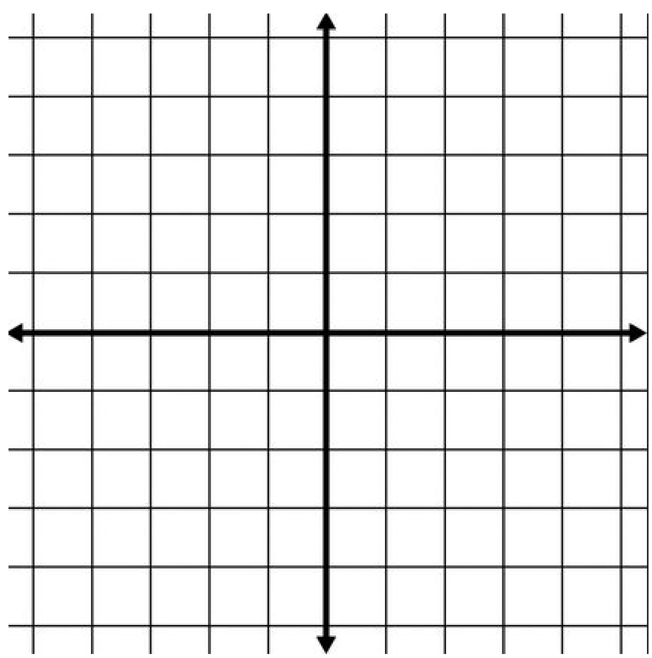


Your Turn!

1) $y < -3x + 2$
$y > \frac{1}{2}x$



2) $y \geq x - 2$
$y \leq 2$



Introduction To Transformations

Transformations of Functions

$$y = -a(bx - h) + k$$

Symbol	Transformation
$-$	Reflection over the x-axis
a	Vertical stretch or shrink by a factor of a
b	Horizontal stretch or shrink by a factor of $\frac{1}{b}$
h	Horizontal shift
k	Vertical shift

Ex. 1 Describe the transformations of $g(x) = 3|x + 2| - 4$ compared to its parent function, $f(x) = |x|$

Ex. 2 Describe the transformations of $g(x) = -(2x - 4)^2 + 1$ compared to its parent function, $f(x) = x^2$

Ex. 3 Write a new function, $g(x)$, for $f(x) = |x|$ transformed in the following ways: Reflection over the x-axis, vertical shrink by a factor of $\frac{1}{2}$, horizontal shift right 2, vertical shift up 5

Your Turn!

1) Describe the transformations of $g(x) = -5(x + 5)^2$ compared to its parent function, $f(x) = x^2$

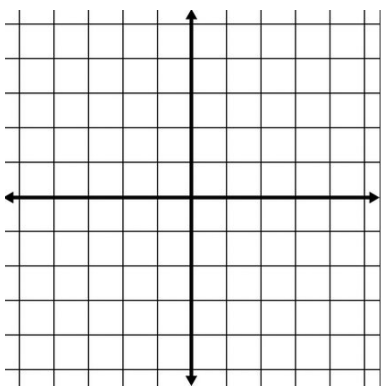
2) Write a new function, $g(x)$, for $f(x) = x^2$ transformed in the following ways: Vertical stretch by a factor of 2, horizontal shift left 7, vertical shift down 4

3) Describe the transformations of $g(x) = \left|\frac{1}{3}x - 8\right| + 1$ compared to its parent function $f(x) = |x|$

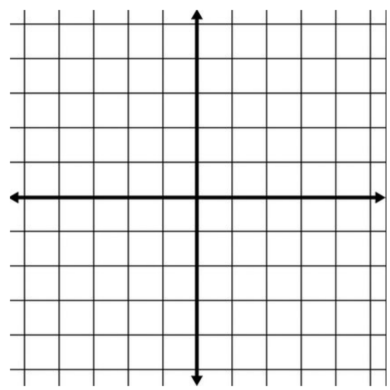
Graphing Absolute Value Functions

How to Graph an Absolute Value Function
1. Plot the vertex $(h,\ k)$ 2. Use a t-chart to find additional coordinates to the left and right of your vertex   3. All absolute value functions will make a v-shaped graph   *Short Cut - use a as the "slope" of your line*

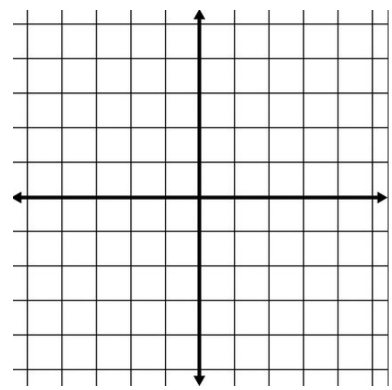
Ex. 1 $y = \frac{1}{2}|x + 3| + 2$



Ex. 2 $-2|x| + 4$

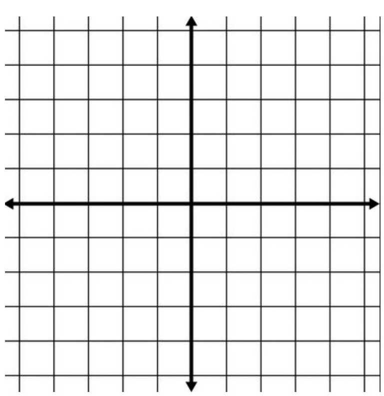


Ex. 3 $y = \frac{2}{3}|x - 1| - 3$

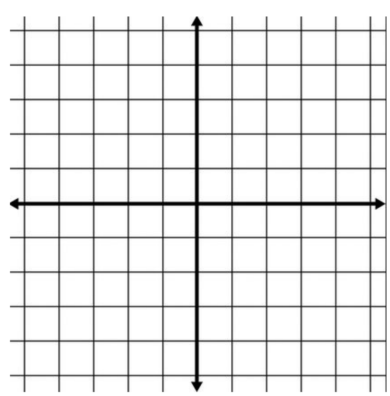


Your Turn!

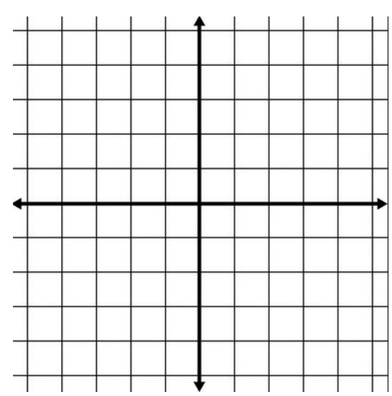
Ex. 1 $y = \frac{1}{3}|x| + 1$



Ex. 2 $y = -3|x - 1| + 2$



Ex. 3 $y = -\frac{1}{2}|x + 2| + 5$

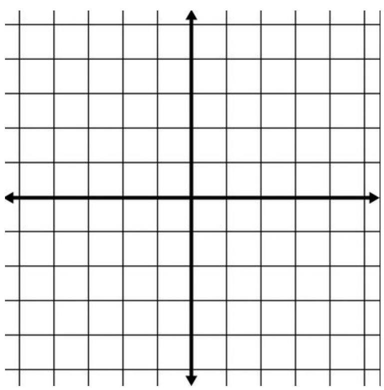


Graphing Quadratic Functions from Vertex Form

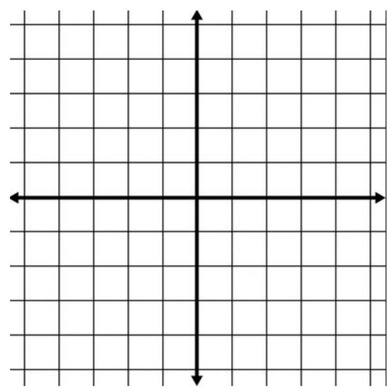
Vertex Form	Standard Form
$y = a(x - h)^2 + k$	$y = ax^2 + bx + c$

How to Graph a Quadratic Function in Vertex Form
1. Plot your vertex (h, k) 2. Use a t-chart to find coordinates to the left and right of your vertex 3. All quadratic functions will make a u-shaped graph *Short-Cut - Use* $a(1 - 3 - 5)$ *ratio to plot additional points*

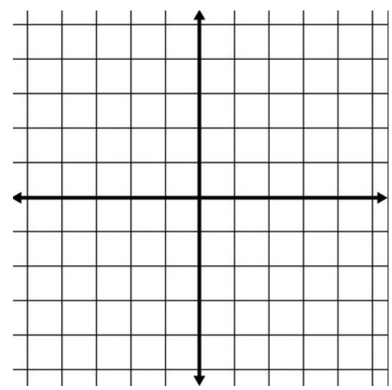
Ex. 1 $y = (x - 2)^2 - 3$



Ex. 2 $-2x^2 + 5$

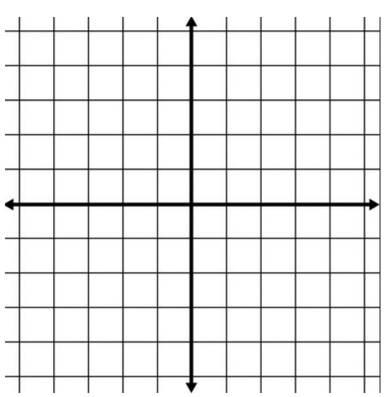


Ex. 3 $y = \frac{1}{2}(x + 1)^2 - 4$

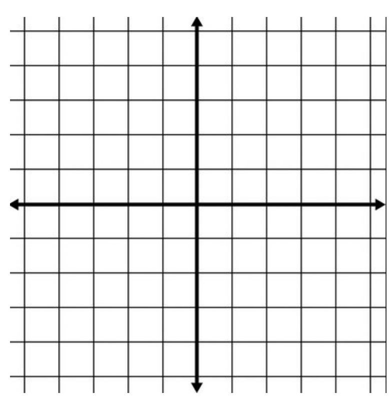


Your Turn!

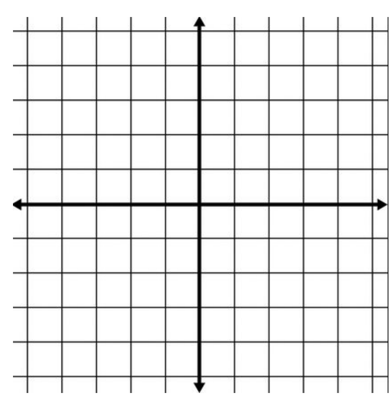
Ex. 1 $y = -(x - 2)^2$



Ex. 2 $y = 2x^2 - 3$



Ex. 3 $y = (x + 3)^2 + 2$

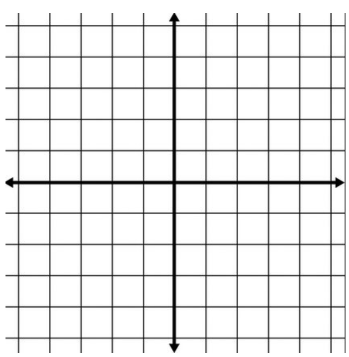


Graphing Quadratic Equations from Standard Form

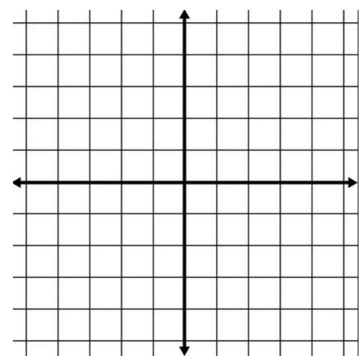
Vertex Form	Standard Form
$y = a(x - h)^2 + k$	$y = ax^2 + bx + c$

How to Graph a Quadratic Equation from Standard Form
1. Use the formula $x = -\frac{b}{2a}$ to find the x-value of your vertex 2. Substitute x to find the y-value of your vertex 3. Plot your Vertex 4. Use a t-chart to find coordinates to the left and right of your vertex *Short-Cut - Use* $a(1 - 3 - 5)$ *ratio to plot additional points*

Ex. 1 $y = x^2 + 6x - 1$

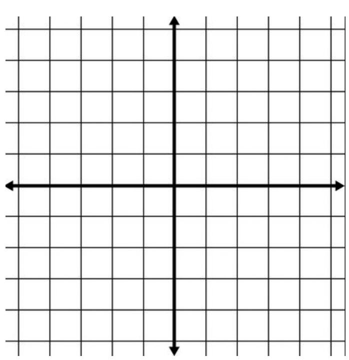


Ex. 2 $y = -2x^2 - 4x + 2$

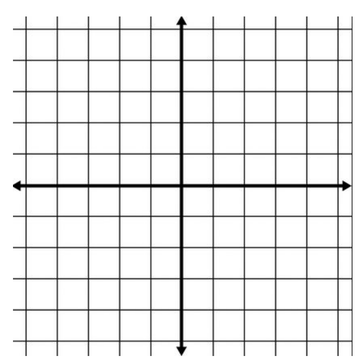


Your Turn!

Ex. 1 $y = -x^2 + 4x + 3$



Ex. 2 $y = 2x^2 - 8x - 1$



Solving Equations Using the Square Root Method

The Square Root Method
1. Isolate x^2 2. Take the $\pm\sqrt{}$ of both sides 3. Simplify your radical, when necessary 4. When taking the square root of a negative number, use $\sqrt{-1} = i$ Restriction: does not work when the equation includes an "x-term"

Ex. 1 $x^2 - 32 = 0$

Ex. 2 $\frac{1}{3}x^2 - 7 = 2$

Ex. 3 $2x^2 + 12 = 0$

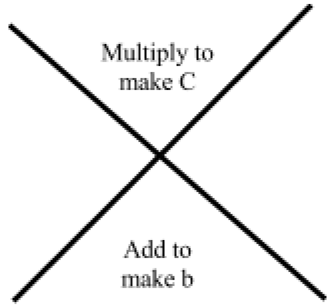
Your Turn!

1) $5x^2 = 100$

2) $\frac{1}{2}x^2 - 12 = 0$

3) $3x^2 + 30 = 0$

Factoring: GCF, Magic X, Difference of Two Squares

GCF	Magic X	Difference of Two Squares
1. Find the greatest common factor (GCF) of each term 2. Divide every term by the GCF 3. Place the GCF on the outside of your parentheses	$x^2 + bx + c$  $(x \pm \#)(x \pm \#)$ Restriction: a must equal 1	If you are subtracting two perfect squares, use the D.O.T.S formula $a^2 - b^2$ $(a + b)(a - b)$
Ex. 1 $5x^2 - 15x$	Ex. 2 $x^2 - 4x - 12$	Ex. 3 $4x^2 - 121y^2$

Your Turn!

1) $6x^2 - 8x$

2) $x^2 - 8x + 15$

3) $25x^2 - 1$

Factoring: The Bottom Up Method

The Bottom Up Method	
Use this method when $a \neq 1$	$2x^2 + 9x + 4$
1. "Move" a by multiplying it to c	$x^2 + 9x + 8$
2. Factor using Magic X	$(x + 8)(x + 1)$
3. Divide each factor by a	$(x + \frac{8}{2})(x + \frac{1}{2})$
4. Simplify when possible, bring number from bottom-up when not possible	$(x + 4)(2x + 1)$

Ex. 1 $3x^2 + 10x + 8$

Ex. 2 $2x^2 - x - 10$

Ex. 3 $2x^2 - 9x + 9$

Your Turn!

1) $2x^2 + 7x + 6$

2) $3x^2 - 7x - 6$

3) $2x^2 - 8x + 8$

Solving Quadratic Equations by Factoring

Solve by Factoring
1. Set your equation equal to zero 2. Factor your equation 3. Set each factor equal to zero and solve (Zero Product Property)

Ex. 1 $9x^2 = 16$

Ex. 2 $x^2 + 7x = -10$

Ex. 3 $2x^2 = 9x - 7$

Your Turn!

1) $x^2 - x - 30 = 0$

2) $36x^2 = 1$

3) $2x^2 + 11x = -14$

Solving Quadratic Equations Using the Quadratic Equation

The Quadratic Equation
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
$y = ax^2 + bx + c$

Using the Quadratic Equation
1. Set your equation equal to zero 2. Substitute a, b, and c into the quadratic equation 3. Simply, using $i = \sqrt{-1}$

Ex. 1 $x^2 + 5x = -4$

Ex. 2 $2x^2 - 4x + 5 = 0$

Your Turn!

1) $x^2 - 6x = -9$

2) $2x^2 + x - 2 = 0$

Solving Quadratic Equations by Completing the Square

Completing the Square
1. Move your constant, c, to the other side of the equation 2. Use the C.T.S. formula to find the "magic number" $\left(\frac{b}{2}\right)^2$ 3. Add your "magic number" to both sides of your equation 4. Factor your equation using Magic X 5. Take the $\pm\sqrt{\ }$ of both sides 6. Solve for x

Ex. 1 $x^2 + 4x + 3 = 0$

Ex. 2 $x^2 - 6x - 10 = 0$

Your Turn!

1) $x^2 + 8x + 12 = 0$

2) $x^2 - 4x - 7 = 0$

Properties of Exponents

Product Property	Quotient Property	Power Property	Negative Exponents
When multiplying terms with exponents, add the exponents $x^a \bullet x^b = x^{(a+b)}$	When dividing terms with exponents, subtract the exponents $\frac{x^a}{x^b} = x^{(a-b)}$	When raising a power to a power, multiply the exponents $(x^a)^b = x^{a \bullet b}$	To clear a negative exponent, flip the term $x^{-1} = \frac{1}{x}$ $\frac{1}{x^{-1}} = x$

Ex. 1 $\frac{4x^6 \bullet 3x^5}{6x^3}$

Ex. 2 $\frac{x^8y^2}{x^5y^7}$

Ex. 3 $\left(\frac{x^9}{x^4}\right)^3$

Your Turn!

1) $\frac{(3y^2)(8y^2)}{4y^3}$

2) $\frac{(x^3)(x)}{x^6}$

3) $\left(\frac{x^{12}}{x^{10}}\right)^4$

Multiplying Polynomials

FOIL	Box Method
First, Outside, Inside, Last	Useful when multiplying larger polynomials
1. Multiply all terms together, following the properties of exponents 2. Combine like terms	

Ex. 1 $(x - 3)(x + 9)$

Ex. 2 $(x + 2)(x^2 - 2x + 4)$

Ex. 3 $(x^2 + 3x + 1)(x^2 + x - 5)$

Your Turn!

1) $(x + 7)(x - 12)$

2) $(x - 6)(x^2 + x - 8)$

3) $(x^2 + 2x - 3)(x^2 + 3x - 2)$