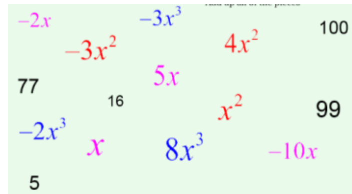
Honors 1 Name: ____________________________________

Quadratics Unit 1 Notes

8.1 – Add and Subtract Polynomials

Warning: How is $x^3 + x^3$ and $x^3 \cdot x^3$ different?

Example: Add up the following numbers: 1304.25 + 821.391	**Example**: Add up all the following pieces. 

Example: Use the vertical align technique to add or subtract the following polynomials.

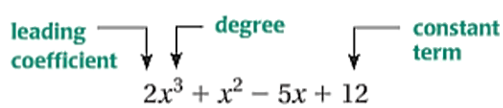
$(-3x^2 - 8x + 5) + (x^2 - 6x + 2)$	$(q^3 - 7q^2 - 3q) - (q^3 + 10q^2 - 4)$

Vocabulary

Polynomial: the addition or subtraction of variable terms with ________________________ integer exponents

Binomial/Trinomial: ____ (binomial) or three (trinomial) term polynomials

Degree of a Polynomial: greatest _________ of any term in the polynomial



Leading Coefficient: coefficient of the __________ term when written in standard form (highest power to lowest)

Example: Write $3x^3 - 4x^4 + x^2$ in standard form. Identify the degree, leading coefficient of the polynomial, and state whether it is a monomial, binomial or trinomial.

Tell whether the expression is a polynomial. If it is a polynomial find its degree and leading coefficient. Otherwise, tell why it is not a polynomial.

$5x + 4$	$\frac{9}{m}$
$x^4 + 3x^3 - x$	$3 \cdot \left(\frac{1}{2}\right)^x$

<u>8.3 – Multiply Polynomials</u>

<u>Tools to Multiply</u>: To multiply polynomials there are two techniques: 1) area model and 2) distribution.

<u>Example</u>: Find the product of $(x+3)(2x+1)$ using the tile model

Table Method	**Distribution Method**

<u>Example</u>: Find the product of $(x+1)(2x+2)$

Table Method	**Distribution Method**

<u>Example:</u> A contractor is building a deck around a pool (see image). He doesn't know what the deck's size will be yet, so he calls it *x*. Write an expression for the area of the deck. Then, he could use this expression to substitute different deck sizes in and find the total area required for the project.

<u>Example:</u> Find the product of $(a^2+3a-4)(2a+3)$

8.4/8.5 – Find Special Products of Polynomials and Factoring out Greatest Common Factor

Examples

$Find\ the\ product\ of\ (x+2)^2$	$Find\ the\ product\ of\ (2x-3)^2$

KEY CONCEPT *For Your Notebook*

Square of a Binomial Pattern

Algebra
$(a+b)^2 = a^2 + 2ab + b^2$

Example
$(x+5)^2 = x^2 + 10x + 25$

Examples

$Find\ the\ product\ of\ (r+3)(r-3)$	$Find\ the\ product\ of\ (x+10)(x-10)$

KEY CONCEPT *For Your Notebook*

Sum and Difference Pattern

Algebra
$(a+b)(a-b) = a^2 - b^2$

Example
$(x+3)(x-3) = x^2 - 9$

Introduction to the Next Section: Factoring out the Great Common Factor

Example: What is the greatest common factor of the following pairs?

1. 12 and 18	2. $x^2y\ and\ xy$	3. $12x^2y\ and\ 18xy$

Factoring Out: To factor out means ____

Example: Factor out the greatest common factor from the following polynomials.

$4x^4 + 24x^3$	$9x^7 - 6x^5$	$-12xy^2 + 6x^2y + 2x^2y^2$

8.6 – Factor $x^2 + bx + c$

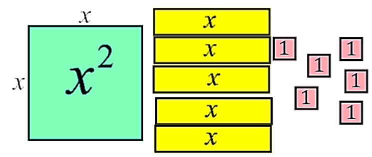
Review Example -Why do we get the final answer we do? How does it connect to the original statement?

$(x+3)(x+5)$ = ______________________ = ___________

$(x+1)(x-5)$ = ______________________ = ___________

Instead of me giving you the dimensions of the rectangle, if I gave you the pieces could you work backwards to get the dimensions? This is called factoring the polynomial.

(   )(   ) = ______________________ = $x^2 + 5x + 6$



Factored Form:

Standard Form:

Steps to factoring $x^2 + bx + c$

1. GCF factoring (distributive property backwards), factor out any common factors
2. If in standard form find two factors of c that add up to b.
3. Check!!!

Examples: Factor the following polynomials to put them into factored form.

1. $x^2 + 6x + 5$

Check:

2. $2x^2 + 6x - 20$

Check:

3. $-x^2 + 3x + 28$

Check:

Critical Thinking Example

Based on the following information, what are the possible values of b in the quadratic function

$$x^2 - bx + 12$$

8.6 Day 2 – Solve Polynomial Equations in Factored Form

Lead-In Ideas

KEY CONCEPT *For Your Notebook*

Zero-Product Property

Let a and b be real numbers. If $ab = 0$, then $a = 0$ or $b = 0$.

1. If $x \cdot y \cdot z = 0$ and x = 2 and y =3, what is the value of z? How do you know?

2. Solve for x if $(x+2) \cdot y = 0$ and y = 3.

3. Solve for x if $(x+5)(x-3) = 0$.

Examples: Solve the following factored quadratic equations by using the zero product property.

$(x+3)(x-5)=0$	$(x+14)(x-3)=0$	$(2x-1)(3x+1)=0$

Examples: By guessing and checking, find values of x that make the left side also equal 0.

$$x^2 - 15x + 54 = 0$$

Is it difficult? Can you think of a better strategy?

Examples: Solve the following quadratic equations by factoring first.

$x^2 - x - 42 = 0$	$x^2 - 10x = 24$

Applied Example: Path of Projectile Motion

Vertical motion can be modeled by a quadratic equation of the form stated below. Use this to determine how long Clyde Drexler, former NBA player, stayed in the air if he took off with a velocity upwards of 16 ft/sec.

Vertical Motion Model

The height h (in feet) of a projectile can be modeled by

$$h = -16t^2 + vt + s$$

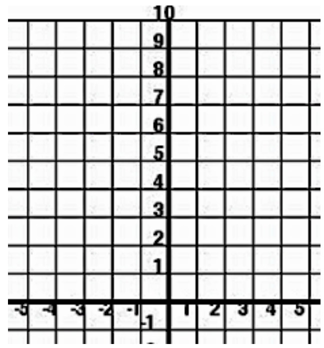
where t is the time (in seconds) the object has been in the air, v is the initial vertical velocity (in feet per second), and s is the initial height (in feet).

9.3a – Graph Quadratic Equations of the Form $y = ax^2$ *and* $y = ax^2 + c$

Quadratic Equation/Function:

Example: Make a table to sketch a graph of the parent function $y = x^2$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

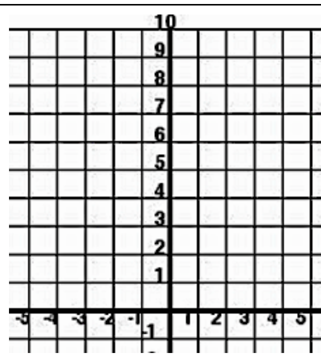


Parabola:	
Vertex:	**Axis of Symmetry:**

Example: Make a table to sketch a graph of each and compare it to the parent function: $y = x^2$

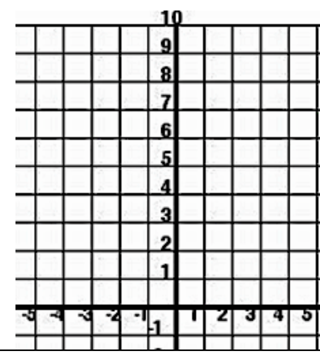
$y = 2x^2$

x	y
-3	
-2	
-1	
0	
1	
2	
3	



$y = 0.5x^2$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

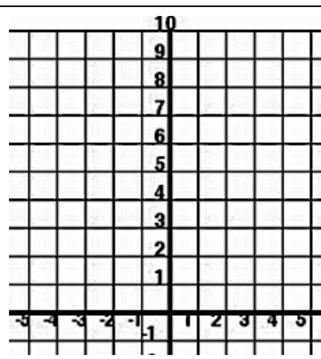


For a quadratic function, $y = ax^2$, *a* makes the graph:

Example: Make a table to sketch a graph of each and compare it to the parent function: $y = x^2$

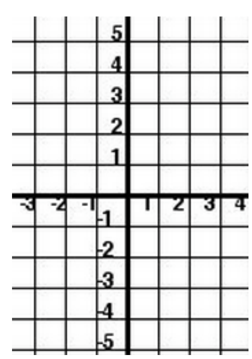
$y = x^2 + 3$

x	y
-3	
-2	
-1	
0	
1	
2	
3	



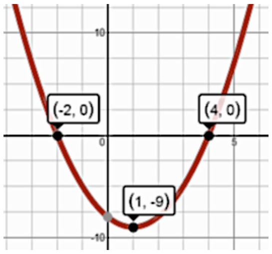
$y = x^2 - 4$

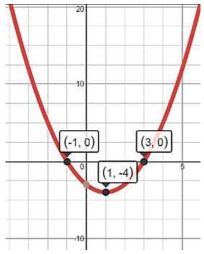
x	y
-3	
-2	
-1	
0	
1	
2	
3	



For a quadratic function, $y = x^2 + c$, *c* makes the graph:

9.2 Day 1 – Graph Quadratic Equations of the Form $y = x^2 + bx + c$ by Factoring to Find Zeros





1) What is true about the y-coordinates of the x-intercepts?

2) Where is the vertex located in relation to the x-intercepts?

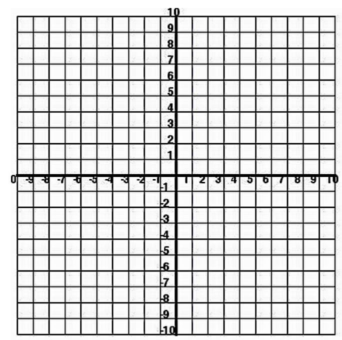
Goal: In order to graph a quadratic equation, we must first find the x-intercepts.

X-intercepts, **zeros,** or **roots of a function**: all mean the same thing, which is: ______________________________

____.

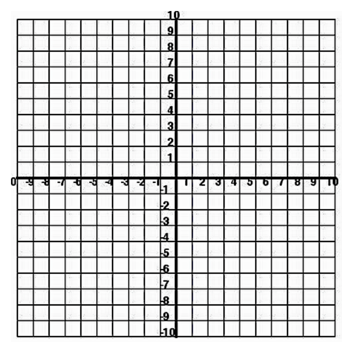
Example: Graph $y = x^2 - 2x - 8$

Step 1: Factor the equation	Step 2: Find the zeros
Step 3: Find the vertex	Step 4: Find the y-int and its reflection



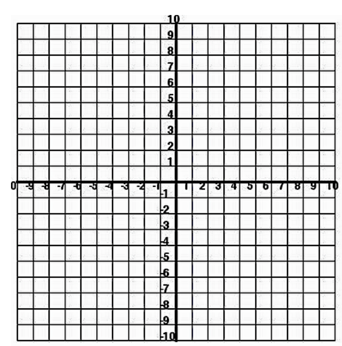
Example: Graph $y = x^2 - x - 6$

Step 1: Factor the equation	Step 2: Find the zeros
Step 3: Find the vertex	Step 4: Find the y-int and its reflection



Example: Graph $y = -2x^2 + 4x$

Step 1: Factor the equation	Step 2: Find the zeros
Step 3: Find the vertex	Step 4: Find the y-int and its reflection



9.2 Day 2 – Graph Quadratic Equations of the Form $y = x^2 + bx + c$ by Factoring to Find Zeros

Example: I have already factored the following quadratic function. Use it to pick out the key pieces of information.

$$f(x) = x^2 - 4x - 12 = (x-6)(x+2)$$

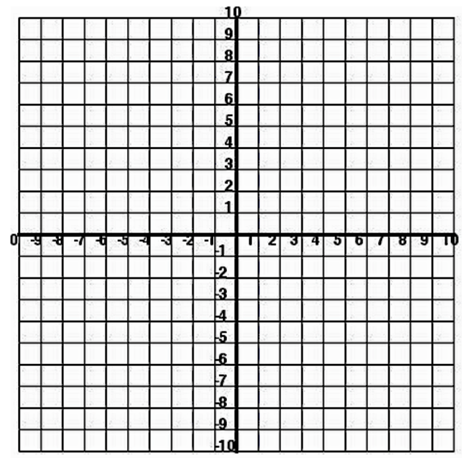
Zeros:

Vertex:

Y-int:

Example: Graph $y = x^2 + 8x + 12$

Step 1: Factor the equation	Step 2: Find the zeros
Step 3: Find the vertex	Step 4: Find the y-int and its reflection



Example: Graph $y = -x^2 - 3x$

Step 1: Factor the equation	Step 2: Find the zeros
Step 3: Find the vertex	Step 4: Find the y-int and its reflection