Name ____ **Hour** _______

Lesson 5.2: Solving Quadratic Equations by Factoring

Quadratic Function: has the form $y = ax^2 + bx + c$ where $a \neq 0$

I. Factoring $-x^2 + bx + c$

** To make x^2 term positive, factor out a _______.

a. $-x^2 + 10x - 9$

b. $7x - x^2 - 12$

II. Difference of Two Squares – Higher Powers

** ___________ powers are perfect squares

a. $x^4 - 16$

b. $3x^4 - 243$

III. Mixed Factoring

** Steps for Factoring:

1. Factor out ___________
2. Binomial (2 terms): ___________________
3. Trinomial (3 terms): ____________________

a. $4x(x - 2) - 3(x - 2)$

IV. Solving Equations by Factoring

** Equation must first be set equal to __________.

a. $x^2 = 25$

b. $x^4 - 81 = 0$

V. Find the Zeros of a Function

** _______________, __________________, and __________________ all refer to the solutions to a quadratic equation!

a. $y = x^2 - 9x + 18$

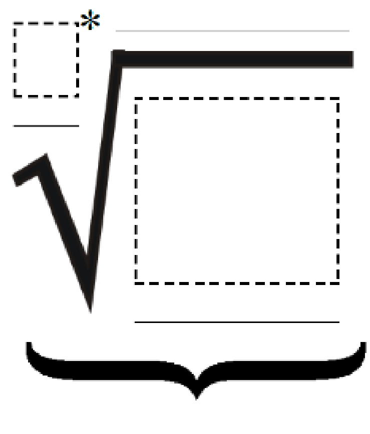
b. $y = x^2 - 4$

Lesson 5.3: Solving Quadratic Equations by Finding Square Roots

Parts of a Radical

* If the ____________ is not written,

it is automatically a ________.



Properties of Square roots:

$\sqrt{ab} =$ _____________, where a and b are positive

$\sqrt{\frac{a}{b}} =$ ____________, where a and b are positive and $b \neq 0$

****** When simplifying radicals, find the ____.

Example 1: Simplify

a. $\frac{\sqrt{8}}{\sqrt{2}}$

b. $\sqrt{8}$

c. $\sqrt{24}$

d. $\sqrt{6} \cdot \sqrt{15}$

Rationalizing the Denominator:

To be completely simplified, there _______________ be a radical in the _________________.

1. Multiplying a fraction by _____ does not change the value.
2. Any expression divided by itself is equal to ________.
3. To get rid of a ____________ in the __________________, multiply the numerator and denominator by the _____________ in the denominator.
4. Simplify

Example 2: Simplify.

a. $\sqrt{\frac{2}{3}}$

b. $\frac{\sqrt{2}}{\sqrt{11}}$

Methods of Solving Quadratics:

1. **Factoring**: Must be in the form ___________________; will ________ work for all polynomials
2. **Square Roots**: Must be in the form _________________; will ______ work if _______ is not 0

Example 3: Solve

a. $2x^2 + 3 = 27$

b. $\frac{1}{4}(x-8)^2 = 7$

Lesson 5.4: Complex/Imaginary Numbers

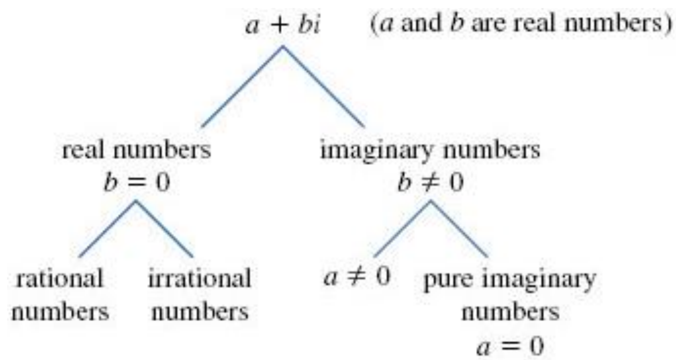
<u>Complex (Imaginary) Numbers</u>: "i" represents the imaginary number $\sqrt{-1}$, so that negative radicals may be used.

$$i = \sqrt{-1}$$
$$i^2 = (\sqrt{-1})^2 = -1$$
$$i^3 = (\sqrt{-1})^2(\sqrt{-1}) = -i$$
$$i^4 = (\sqrt{-1})^2(\sqrt{-1})^2 = (-1)(-1) = 1$$

Example 1: Simplify

a. $\sqrt{-4}$ b. $\sqrt{-9}$ c. $\sqrt{-28}$

<u>Complex Numbers</u>



Example 2: Categorize the numbers below.

a. $-4i$

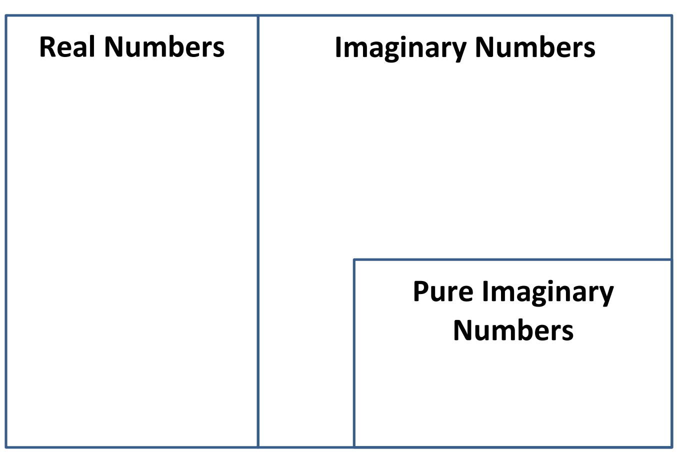
b. $\frac{3}{5}$

c. $2 + 4i$

d. 45

e. i

Complex Numbers
$a + bi$



Properties of Complex Numbers:

Example 3: Write the expression as a complex number in standard form.

a. $(2 + 3i) + (4 - 5i) =$

b. $(2 + 3i) - (4 - 5i) =$

c. $(2 + 3i)(4 - 5i) =$

d. $(3 + 2i)^2 =$

Solving Equations with Imaginary Numbers

Example 4: Solve each equation. Give all real and imaginary solutions.

a. $x^2 = -1$

b. $x^2 = -16$

c. $3x^2 - 10 = -34$

d. $-6(x + 5)^2 = 120$

Lesson 5.4: Complex/Imaginary Numbers – Part 2

Conjugates:

To find the conjugate of a binomial, __________ the sign between the 2 terms.

Example 1: Give the conjugate of each.

a. $a + b$
b. $2 + 3i$
c. $5 - \sqrt{2}$
d. $5 - 6x$

Why are conjugates useful?

$(a + b)(a - b) =$ _______________

Conjugates allow us to:

- Get rid of ___________________ in the _____________________
- Get rid of ___________________ in the _____________________

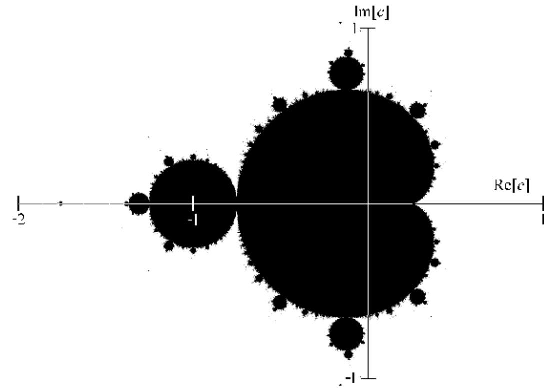
Example 2: Write each expression as a complex number in standard form.

** Always be sure to multiply the _________________ and ___________________ by the conjugate!

a. $\frac{2+3i}{4-5i}$

b. $\frac{1}{3+2i}$

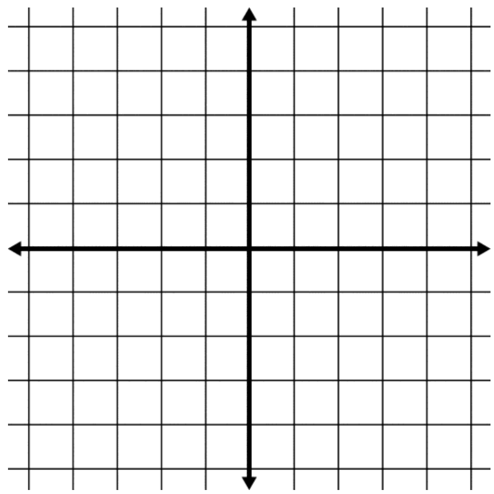
<u>Using Complex Numbers in Fractal Geometry</u>:



<u>Graphing in the Complex Plane</u>:

Example 1: Plot the following points

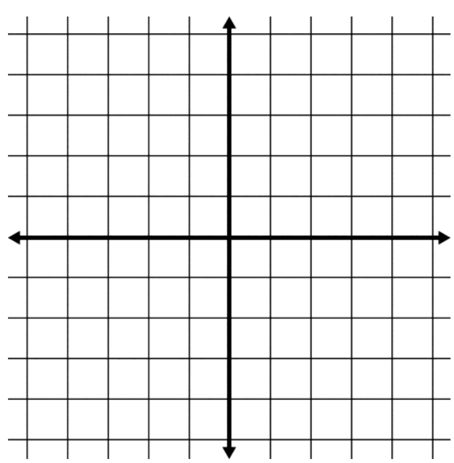
a. $1 - 2i$
b. $-2 + 3i$
c. $4i$
d. 4



<u>Absolute Value of Complex Numbers</u>:

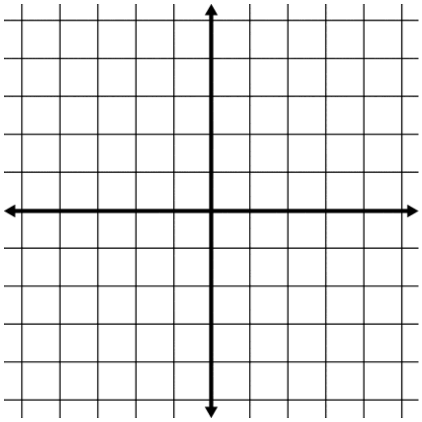
If $z = a + bi$, then $|z| =$ ________________________

** The absolute value of a complex number is the number's ________________________________ in the complex plane.

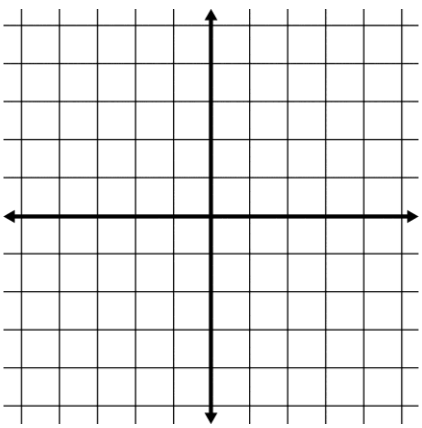


Example 2: Find the absolute value of each complex number.

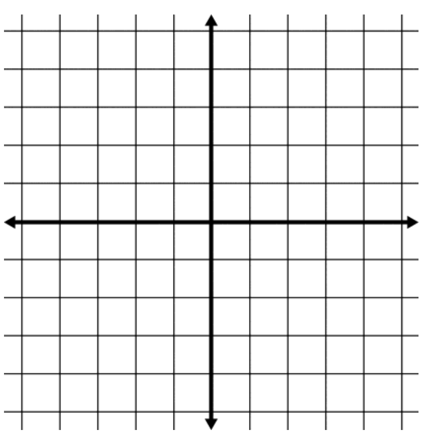
a. $3+4i$



b. $-3i$



c. $-1+5i$



Lesson 5.5: Completing the Square

Factor: $x^2 + 6x + 9$ $x^2 - 8x + 16$

What would cause $x^2 + 6x +$ _______ to be a perfect square?

Complete the $\square$ **:**

$$x^2 \pm bx + \left(\frac{b}{2}\right)^2 = \left(x \pm \frac{b}{2}\right)^2$$

WHY?

This method allows us to use the square root method to solve quadratics that cannot be rewritten as _________________.

HOW?

1. Rearrange the equation so it looks like:

2. If $x \neq 1$, divide every term by a

3. In the squares, write _____________.

4. Now, you can rewrite the left side as ____________________.

5. Take the square root of both sides. Don't forget the ________.

Example #3: Solve by completing the square.

a. $x^2 + 10x - 3 = 0$

b. $x^2 - 12x + 5 = 0$

c. $2x^2 + 12x + 9 = 0$

Methods for Solving Quadratic Functions:

1.

2.

3.

Lesson 5.6: The Quadratic Formula/Discriminant

In English:

x equals the opposite of b plus or minus the square root of b squared minus 4ac all over 2a

Quadratic Formula		Example: Discriminant:	$x^2 + 10x + 25 = 0$ Solution(s):
How and why does the discriminant work?		Means:	Graph:
Example: Discriminant:	$6x^2 + x - 15 = 0$ Solution(s):	Example: Discriminant:	$x^2 + 2x + 5 = 0$ Solution(s):
Means:	Graph:	Means:	Graph:

<u>Methods for Solving Quadratic Equations</u>:

1.

2.

3.

4.

Example 4: Solve using any method.

a. $4x^2 + 28x = -49$

b. $3(x+4)^2 = -27$