Name: Period: Date:

Math Lab: Investigating the Quadratic Formula

Standard form of a quadratic equation is $ax^2 + bx + c = 0$. We just learned that any quadratic equation can be solved by completing the square. So we will complete the square using standard form to create a formula that will solve any quadratic equation!

Work
$ax^2 + bx + c = 0$
$\left(\underline{\quad} \cdot \frac{1}{2}\right)^2 = \left(\underline{\quad}\right)^2 = \underline{\quad}$
$x^2 + \frac{b}{a}x + \underline{\quad} = \underline{\quad} + \frac{-c}{a}$
$\left(x + \underline{\quad}\right)^2 = \underline{\quad} + \frac{-c}{a}$
$\left(x + \underline{\quad}\right)^2 = \frac{b^2}{4a^2} + \frac{-c}{a}\left(\underline{\quad}\right)$
$\left(x + \underline{\quad}\right)^2 = \frac{\quad}{4a^2}$
$\sqrt{\left(x + \underline{\quad}\right)^2} = \sqrt{\frac{\quad}{4a^2}}$
$x + \underline{\quad} = \pm\frac{\sqrt{\quad}}{\sqrt{4a^2}}$
$x = \frac{-}{\quad} \pm \frac{\sqrt{\quad}}{\quad}$
$x = \underline{\quad}$

Steps in the process
Isolate the variable terms; move the constant to the right.
Divide every term by the leading coefficient.
Find the value to complete the square by taking half the coefficient of x and squaring it.
Complete the square. Don't forget to add the same value to both sides of the equation!
Factor the perfect square trinomial on the left.
Find a common denominator on the right.
Combine the two fractions with a common denominator into one fraction by adding the numerators.
Take the square root of both sides.
Use the quotient of radicals property to separate the right side into two radicals.
Solve for x by subtracting $\left(\underline{\quad}\right)$ from both sides. Simplify the radical in the denominator on the right.
Combine the two fractions with a common denominator into one. This is the **Quadratic Formula**!

The quadratic formula is used to find the solutions to **any** quadratic equation.

$$x = \frac{-b \pm \sqrt{\boldsymbol{b^2 - 4ac}}}{2a}$$

The **discriminant** is the part of the quadratic formula that is **<u>under</u>** the radical sign, and can help you determine the number and type of solutions of the quadratic equation. You can use this as a way to verify your solutions.

Investigate the Discriminant

Graph the function on a graphing calculator to determine the number of solutions.

Function	Rough sketch of the graph	Number of Real Solutions (x-intercpets)	Discriminant $b^2 - 4ac$
a. $y = 6x^2 + x - 2$			
b. $y = -2x^2 + 4x + 1$			
c. $y = x^2 + 4x + 4$			
d. $y = -2x^2 + 8x - 8$			
e. $y = 4x^2 - 2x + 5$			
f. $y = -3x^2 - 4x - 6$			

Draw Conclusions

$(b^2 - 4ac) > 0$	$(b^2 - 4ac) = 0$	$(b^2 - 4ac) < 0$
When the discriminant is ________________________, the quadratic equation will have _____ real solutions and _____ imaginary solutions.	When the discriminant is ________________________, the quadratic equation will have _____ real solutions and _____ imaginary solutions.	When the discriminant is ________________________, the quadratic equation will have _____ real solutions and _____ imaginary solutions.