

## Essential Question 3/11/2021

- How can I solve quadratic equations by using the Quadratic Formula?



## Learning Target

**Solve Quadratic Equations by Quadratic Formula**

## Opening: Solving by Quadratic Formula

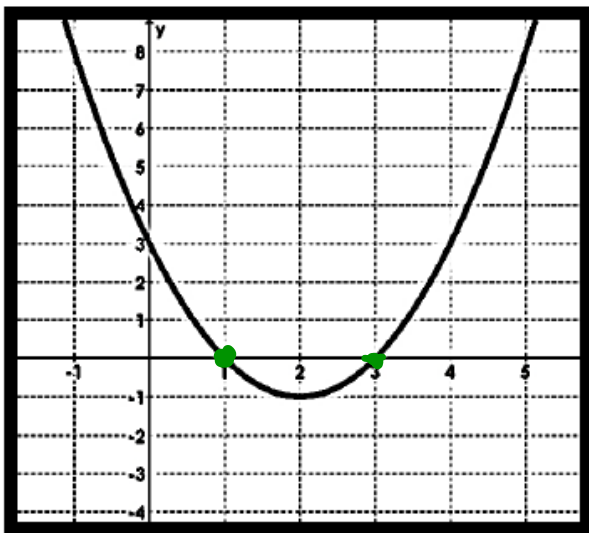
### Exploring the Nature of Roots

In this task you will investigate the number of real solutions to a quadratic equation.

**Standard(s): MGSE9–12.A.REI.4b** Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).

Determine the number of real solutions (roots/x-intercepts) for the following graphs:

1.  $f(x) = x^2 - 4x + 3$

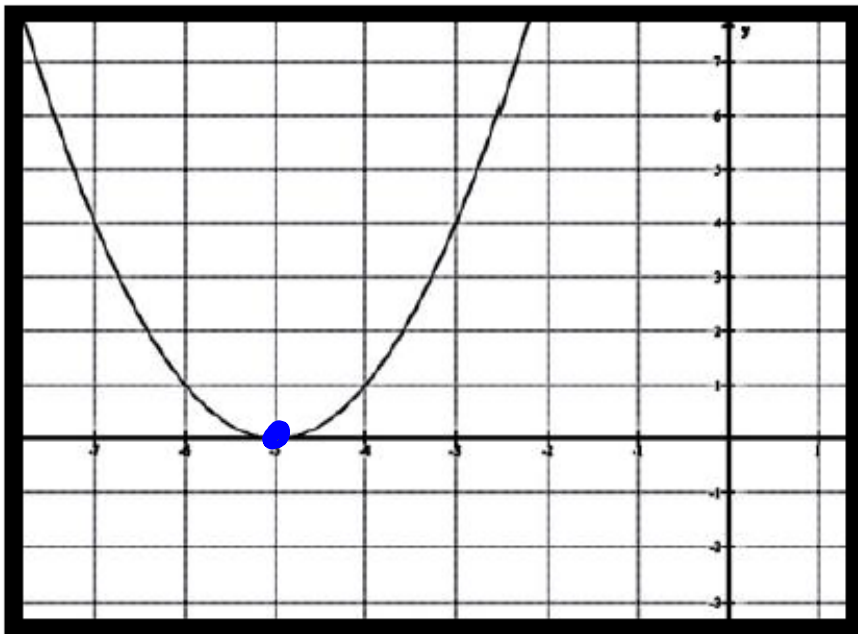


How many x-intercepts:

2

Roots:  $x=1; x=3$

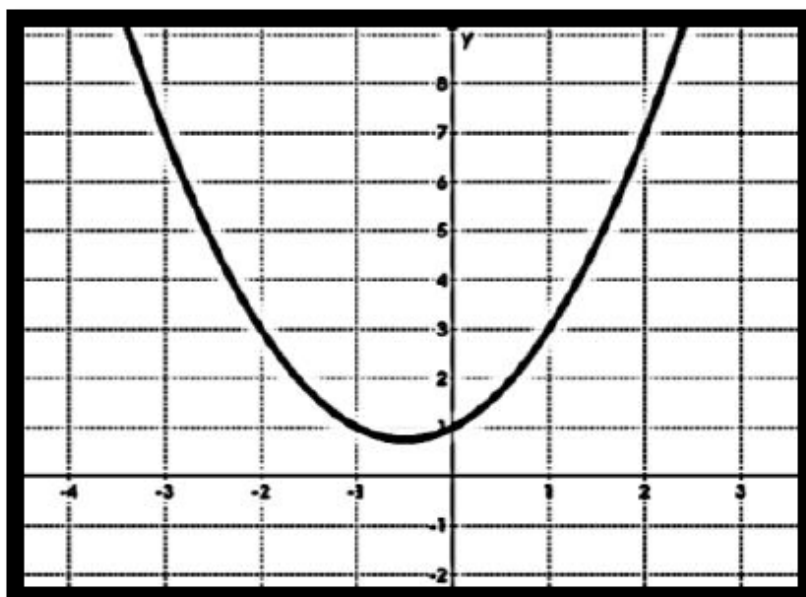
$$2. f(x) = x^2 + 10x + 25$$



How many x-intercepts: 1

Roots:  $x = -5$

3.  $f(x) = x^2 + x + 1$



How many x-intercepts: None

Roots: None

# The Quadratic Formula

We have learned **three methods** for solving quadratics:

- **Factoring** (Only works if the equation is factorable)
- **Taking the Square Roots** (Only works when equations are not in Standard Form)
- **Completing the Square** (Only works when  $a$  is 1 and  $b$  is even)

What method do you use when your equations are not factorable, but are in standard form, and  $a$  may not be 1 and  $b$  may not be even?

**The Quadratic Formula**  
for equations in standard form:  $y = ax^2 + bx + c$

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

$x$  represents the zeros and  $b^2 - 4ac$  is the discriminant

## Note:

- If the discriminant is positive - 2 roots
- If the discriminant is zero - 1 root
- If the discriminant is negative - no root

Practice with Quadratic Formula - 1 do

For the quadratic equations below, use the quadratic formula to find the solutions. Write your answer in simplest radical form.

$$ax^2 + bx + c = 0$$

1)  $4x^2 - 13x + 3 = 0$   $a = \underline{4}$   $b = \underline{-13}$   $c = \underline{3}$

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

$$X = \frac{-(-13) \pm \sqrt{(-13)^2 - (4 \times 4 \times 3)}}{2(4)}$$

Discriminant:  $\underline{121}$  - 2 solutions

Solutions:  $\underline{x = 3 \text{ and } 1/4}$

$$\boxed{\frac{n}{d}}$$

$$X = \frac{13 \pm 11}{8}$$

$$\boxed{X = 3 \text{ and } 1/4}$$

Practice with Quadratic Formula - You do

$$2) 9x^2 + 6x + 1 = 0 \quad a = \underline{9} \quad b = \underline{6} \quad c = \underline{1}$$

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

$$X = \frac{-6 \pm \sqrt{6^2 - (4 \cdot 9 \cdot 1)}}{2(9)}$$

$$X = \frac{-6 \pm 0}{18}$$

Discriminant: 0 - 1 solution

Solutions:  $x = -1/3$

Practice with Quadratic Formula - You do

3)  $7x^2 + 8x + 3 = 0$     $a = \underline{7}$     $b = \underline{8}$     $c = \underline{3}$

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

$$x = \frac{-8 \pm \sqrt{8^2 - (4 \times 7 \times 3)}}{2(7)}$$

$$x = \frac{-8 \pm \sqrt{-20}}{14}$$

Discriminant: -20 - None

Solutions: No Solution



Practice with Quadratic Formula - You do

4)  $-3x^2 + 2x = -8$        $a = \underline{-3}$     $b = \underline{2}$     $c = \underline{8}$

$$-3x^2 + 2x + 8 = 0$$

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

$$x = \frac{-2 \pm \sqrt{2^2 - (4 \times -3 \times 8)}}{2(-3)}$$

$$x = \frac{-2 \pm 10}{-6}$$

Discriminant: 100 - 2 solutions

Solutions:  $-\frac{4}{3}$  and 2

# How do we know what method to use?

## Decision Making:

I have a non-factorable trinomial where a is 1 and b is odd, which method am I going to use?

**Quadratic Formula**  $x^2 + x + 1 = 0$

I have a factorable trinomial where a is NOT 1 and b is odd, which method am I going to use?

**Big X & Area Model (Box)**

I have a non-factorable trinomial where a is 1 and b is even, which method am I going to use?

**Completing the Squares**

I have a binomial squared and its equal to some number, which method am I going to use?

**Take square root of both sides**

$$ax^2 + bx + c = 0$$

---

**Determining the Best Method**


---

<b>Non-Factorable Methods</b>	
<b>Completing the Square</b>	<b>Finding Square Roots</b>
$ax^2 + bx + c = 0$ , when $a = 1$ and $b$ is an even #  <b>Examples</b> $x^2 - 6x + 11 = 0$ $x^2 - 2x - 20 = 0$	$ax^2 - c = 0$ Parenthesis in equation  <b>Examples</b> $2x^2 + 5 = 9$ $5(x + 3)^2 - 5 = 20$ $x^2 - 36 = 0$
<b>Quadratic Formula</b>	
$ax^2 + bx + c = 0$ Any equation in standard form Large coefficients  <b>Examples</b> $3x^2 + 9x - 1 = 0$ $20x^2 + 36x - 17 = 0$	
<b>Factorable Methods</b>	
<b>A = 1 &amp; A Not 1 (Factor into 2 Binomials)</b>	<b>GCF</b>
$ax^2 + bx + c = 0$ , when $a = 1$ $ax^2 \pm bx \pm c = 0$ , when $a > 1$ $x^2 - c = 0$  <b>Examples</b> $3x^2 - 20x - 7 = 0$ $x^2 - 3x + 2 = 0$ $x^2 + 5x = -6$ $x^2 - 25 = 0$	$ax^2 + bx = 0$  <b>Examples</b> $5x^2 + 20x = 0$ $x^2 - 6x = 8x$

# Error Analysis

## Error Analysis:

Describe and correct the error Jaya made when attempting to solve using the quadratic formula.

Problem:  $7x + 2x^2 - 4 = 3$

Jaya's Process:

$$7x + 2x^2 - 4 = 3$$

$$7x + 2x^2 - 7 = 0$$

$$\frac{-2 \pm \sqrt{2^2 - 4(7)(-7)}}{2(7)}$$

$$\frac{-2 \pm \sqrt{200}}{14}$$

$$x = \frac{-2 \pm 10\sqrt{2}}{14}$$

$$x = \frac{-1 + 5\sqrt{2}}{7} \text{ and } \frac{-1 - 5\sqrt{2}}{7}$$

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

$$2x^2 + 7x - 7 = 0$$

$$x \quad a=2 \quad b=7 \quad c=-7$$

$$x = \frac{-7 \pm \sqrt{7^2 - (4 \cdot 2 \cdot -7)}}{2 \cdot 2}$$

Calculator

$$2^{\text{nd}} \quad x^2$$

$$x = \frac{-7 \pm \sqrt{105}}{4}$$

## Unit 3A Test Review 3/12/2021

Solve using GCF

1.  $5x^2 + 20x = 0$       GCF =  $5x$

$$\frac{5x^2 + 20x}{5x}$$

$$5x(x+4) = 0$$

$$\frac{5x}{5} = \frac{0}{5}$$

$$x = 0$$

$$x + 4 = 0$$

$$x = -4$$

# Unit 3A Test Review 3/12/2021

## Solve Quadratic Equation $a=1$

$$2. x^2 + 5x = -6$$

$$x^2 + 5x + 6 = 0$$

$$\begin{array}{c} 6 \\ 2 \quad 3 \\ 5 \end{array}$$

$$(x+2)(x+3) = 0$$

$$x+2=0 \quad x+3=0$$

$$x = -2 \quad x = -3$$

## Unit 3A Test Review 3/12/2021

Solve Quadratic Equation  $a > 1$ 

$$3. \quad 3x^2 - 20x - 7 = 0$$

$$a = 3 \quad b = -20$$

$$c = -7$$

$$(3x + 1)(x - 7) = 0$$

$$3x + 1 = 0$$

$$\begin{array}{r} +1 \quad -1 \\ \hline 3x = -1 \\ \hline \frac{3}{3} \quad \frac{-1}{3} \end{array}$$

$$x = -\frac{1}{3}$$

$$x - 7 = 0$$

$$\begin{array}{r} +7 \quad +7 \\ \hline \end{array}$$

$$x = 7$$

## Unit 3A Test Review 3/12/2021

Solve Quadratic Equation  $a > 1$   
and GCF

$$4. \ x^3 - 12x^2 + 36x = 0$$

$$\text{GCF} = x$$

$$\underline{\hspace{10em}}$$
$$x$$

$$x(x^2 - 12x + 36) = 0$$

$$\begin{array}{c} \diagup 36 \diagdown \\ -6 \quad -6 \\ \diagdown 6 \diagup \end{array}$$

$$x(x-6)^2 = 0$$

$$x = 0$$

$$x = 6$$



## Unit 3A Test Review 3/12/2021

### Solve Quadratic Equation by Taking Square Roots

$$5. x^2 + 5 = 21$$

$$x^2 = 21 - 5$$

$$\sqrt{x^2} = \sqrt{16}$$

$$x = \pm 4$$

## Unit 3A Test Review 3/12/2021

### Solve Quadratic Equation by Completing the Square

$$6. x^2 - 8x = 9$$

$$\frac{-b}{2a} = \frac{-(-8)}{2} = 4 \Rightarrow 4^2 = 16$$

$$x^2 - 8x + 16 = 9 + 16$$

$$\sqrt{(x-4)^2} = \sqrt{25}$$

$$x - 4 = \pm 5$$

$$x = 4 \pm 5$$

$$x = 9 \text{ and } -1$$

# Unit 3A Test Review 3/12/2021

Solve Quadratic Equation by  
Using the Quadratic Formula.

$$7.5x^2 + 3x - 2 = 0$$

$$a = 5 \quad b = 3 \quad c = -2$$

$$X = \frac{-b \pm \sqrt{b^2 - 4 \cdot a \cdot c}}{2 \cdot a}$$

$$X = \frac{-3 \pm \sqrt{3^2 - (4 \cdot 5 \cdot -2)}}{2 \cdot 5}$$

*Calculator*

$$X = \frac{-3 \pm 7}{10}$$

$$X = 2/5 \text{ and } -1$$

## Closing:

1. How prepared are you for this test?
2. What will you do to make sure your pass this test?

## Attachments

---

Functions notation.ppt

Functions Practice HW.docx

Functions notation notes.ppt