

NOTES: QUADRATIC FORMULA

DAY 14

Textbook Chapter 4.8

OBJECTIVE: Today you will learn about the quadratic formula and discriminant!

The Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ (a, b, c are real #'s) ($a \neq 0$)

The Quadratic Formula can be used any time you are asked to find the **Roots, Zeros, or Solutions** of a quadratic equation.

I. Quadratic Equations with 2 Real Solutions

- 1) Put into standard form: $Ax^2 + Bx + C = 0$
- 2) Identify $a, b,$ and $c.$
- 3) Plug a, b and c into the quadratic formula. Solve for $x.$ Reduce your square roots!

Use the Quadratic Formula to solve the Quadratic Equation!

$$2x^2 + x - 5 = 0 \quad A = \underline{2} \quad B = \underline{1} \quad C = \underline{-5}$$

$$X = \frac{-1 \pm \sqrt{1^2 - 4(2)(-5)}}{2(2)}$$

$$X = \frac{-1 \pm \sqrt{1 + 40}}{4}$$

$$X = \frac{-1 \pm \sqrt{41}}{4}$$

II. Quadratic Equations with 1 Real Solutions

Use the Quadratic Formula to solve the Quadratic Equation!

$$x^2 - 6x + 9 = 0 \quad A = \underline{1} \quad B = \underline{-6} \quad C = \underline{9}$$

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

$$X = \frac{6 \pm \sqrt{36 - 36}}{2}$$

$$X = \frac{6 \pm \sqrt{0}}{2}$$

$$X = \frac{6 \pm 0}{2}$$

$$X = \frac{6}{2}$$

$$X = 3$$

III. Quadratic Equations with 2 imaginary Solutions

Use the Quadratic Formula to solve the Quadratic Equation!

$$-x^2 + 2x - 2 = 0 \quad A = \underline{-1} \quad B = \underline{2} \quad C = \underline{-2}$$

$$x = \frac{-2 \pm \sqrt{2^2 - 4(-1)(-2)}}{2(-1)}$$

$$x = \frac{-2 \pm \sqrt{4 - 8}}{-2}$$

$$x = \frac{-2 \pm \sqrt{-4}}{-2}$$

$$x = \frac{-2 \pm 2i}{2}$$

$x = -1 \pm i$

The Discriminant
 $b^2 - 4ac$

...is used to determine the equation's **number** and **type of solutions**.
 = x-intercepts
 = Roots
 = Zeros

	$-x^2 + 2x = 2$	$x^2 - 2x = 4x - 9$	$2x^2 + 3x = 2x + 5$
Put in Standard Form	$-x^2 + 2x - 2 = 0$ $A = -1 \quad B = 2 \quad C = -2$	$x^2 - 6x + 9 = 0$ $A = 1 \quad B = -6 \quad C = 9$	$2x^2 + x - 5 = 0$ $A = 2 \quad B = 1 \quad C = -5$
Find the Discriminant	$B^2 - 4AC$ $2^2 - 4(-1)(-2)$ $4 - 8$ -4 Pos <u>Neg</u> Zero	$B^2 - 4AC$ $(-6)^2 - 4(1)(9)$ $36 - 36$ 0 Pos Neg <u>Zero</u>	$B^2 - 4AC$ $1^2 - 4(2)(-5)$ $1 + 40$ 41 <u>Pos</u> Neg Zero
Number and type of solutions	2 imaginary	1 Real	2 Real
Sketch of graph			

PRACTICE: QUADRATIC FORMULA

DAY 14

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

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(2)}}{2(1)}$$

$$\begin{aligned} A &= 1 \\ B &= 4 \\ C &= 2 \end{aligned}$$

$$x = \frac{-4 \pm \sqrt{16 - 8}}{2}$$

$$x = \frac{-4 \pm \sqrt{8}}{2}$$

$$x = \frac{-4 \pm \sqrt{4}\sqrt{2}}{2}$$

$$x = \frac{-4 \pm 2\sqrt{2}}{2}$$

$$x = -2 \pm \sqrt{2}$$

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

$$x = \frac{-1 \pm \sqrt{1^2 - 4(3)(-3)}}{2(3)}$$

$$\begin{aligned} A &= 3 \\ B &= 1 \\ C &= -3 \end{aligned}$$

$$x = \frac{-1 \pm \sqrt{1 + 36}}{6}$$

$$x = \frac{-1 \pm \sqrt{37}}{6}$$

3. $x^2 - x - 20 = 0$

$$x = \frac{+1 \pm \sqrt{(-1)^2 - 4(1)(-20)}}{2(1)}$$

$$\begin{aligned} A &= 1 \\ B &= -1 \\ C &= -20 \end{aligned}$$

$$x = \frac{1 \pm \sqrt{1 + 80}}{2}$$

$$x = \frac{1 \pm \sqrt{81}}{2}$$

$$x = \frac{1 \pm 9}{2}$$

$$x = \frac{1+9}{2}, \frac{1-9}{2}$$

$$x = \frac{10}{2}, \frac{-8}{2}$$

$$x = 5, -4$$

4. $-x^2 + 3x = 5$

$$-x^2 + 3x - 5 = 0$$

$$\begin{aligned} A &= -1 \\ B &= 3 \\ C &= -5 \end{aligned}$$

$$x = \frac{-3 \pm \sqrt{(-3)^2 - 4(-1)(-5)}}{2(-1)}$$

$$x = \frac{-3 \pm \sqrt{9 - 20}}{2}$$

$$x = \frac{-3 \pm \sqrt{-11}}{2}$$

$$x = \frac{-3 \pm i\sqrt{11}}{2}$$

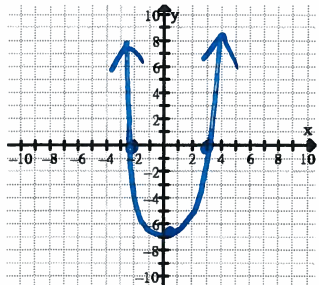
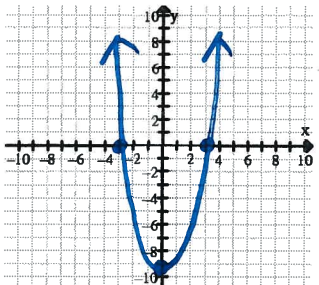
OR

$$x = \frac{-3}{2} \pm \frac{i}{2}\sqrt{11}$$

SOLVING QUADRATIC EQUATIONS: STANDARD FORM

Solving a quadratic function means to find the...

Solutions , Zeros , x-intercepts , Roots ,

Quadratic Function (standard form)	$y = x^2 - x - 6$	$y = x^2 - 9$	$y = -x^2 + 3x + 6$
<p>SOLVE: Find the Solutions</p>	$0 = x^2 - x - 6$ $0 = (x-3)(x+2)$ $x-3=0 \quad x+2=0$ $x=3 \quad x=-2$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> $(3,0), (-2,0)$ </div>	$0 = x^2 - 9$ $0 = (x-3)(x+3)$ $x-3=0 \quad x+3=0$ $x=3 \quad x=-3$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> $(3,0), (-3,0)$ </div>	$0 = -x^2 + 3x + 6$ $x = \frac{-3 \pm \sqrt{3^2 - 4(-1)(6)}}{2(-1)}$ $x = \frac{-3 \pm \sqrt{9 + 24}}{-2}$ $x = \frac{-3 \pm \sqrt{33}}{-2}$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> $x = \frac{3}{2} \pm \frac{\sqrt{33}}{2}$ </div>
<p>Solve by Graphing on Calculator!</p> <p>(use separate instructions)</p>	<p>Vertex: $(0.5, -6.25)$</p> <p>Zeros: $(3,0)$ $(-2,0)$</p> 	<p>Vertex: $(0, -9)$</p> <p>Zeros: $(3,0)$ $(-3,0)$</p> 	<p>Vertex: $(1.5, 8.25)$</p> <p>Zeros: $(-1.37, 0)$ $(4.37, 0)$</p> 