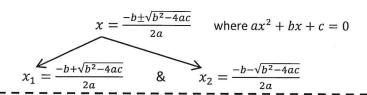
Solving Quadratic Equations Using the Quadratic Formula

Key Concepts

- Some polynomial expressions are unfactorable with integers, such as $x^2 + 3x 7 = 0$. [Try it, I dare you. =)]
- The Quadratic Formula can be used to solve EVERY quadratic equation, whether it has 0, 1, or 2 solutions.



Example: Solve for $x, x \in R$.

a)
$$4x^{2}-9=0$$

$$4x^{2}+0x-9=0$$

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

$$=-0\pm (0)^{2}-4(4)(-9)^{2}$$

$$=0\pm (144)$$

$$=\pm 12^{2}4$$

$$=\pm 1$$

b)
$$\frac{1}{2} = \frac{6x + 7 = 0}{6}$$
 $x = -\frac{1}{6} + \frac{1}{6} = \frac{1}{2}$
 $= \frac{1}{6} + \frac{1}{3} = \frac{1}{2}$
 $= \frac{6 + \frac{1}{3} = \frac{1}{2}}{2}$
 $= \frac{6 + \frac{1}{2} = \frac{1}{2}}{2}$
 $= \frac{1}{2} = \frac{1}{2$

c)
$$x^{2} + 2x + 10 = 0$$

 $x = -b \pm b^{2} - 4ac$
 $= -2 \pm \sqrt{2} - 4(1)(10)$
 $= -2 \pm \sqrt{4 - 40}$

The Discriminant

Remember the Quadratic Formula??? $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

et's have a closer look at 3 different cases that the radicand, otherwise known as $\underline{The\ Discriminant\ D=b^2-4ac}$, can take on for real numbers. We can use The Discriminant to determine "Nature of the Real Roots" (type/number of real roots).

Case 1: $b^2 - 4ac < 0$ (less than 0)

How many real roots can we find using the Quadratic Formula if $b^2 - 4ac < 0$?

"there exists"

o cannot Treatnumber 7 "no real roots"

Case 2:
$$b^2 - 4ac = 0$$

How many real roots can we find using the Quadratic Formula if $b^2 - 4ac = 0$?

" 2 real and equal roots" 2 real and equal roots" 2 real and equal roots" 2 real and equal roots

$1 \text{ Case } 3: b^2 - 4ac > 0$

How many real roots can we find using the Quadratic Formula if $b^2 - 4ac > 0$?

": b2-4ac>0 => different x, x, 7 7 2 real and distinct roots

<u>Example:</u> Describe "Nature of the Real Roots" for the following polynomial without solving the equation. (Note: Solving means to calculate the actual value of the real roots.)

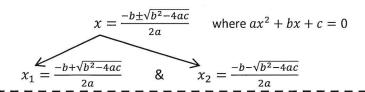
 $D = b^{2} - 4ac$ $= (-6)^{2} - 4(4)(9)$ = 36 - 144 D = -108

there are no real roots.

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Example: Solve for $x, x \in R$.

a)
$$4x^2 - 9 = 0$$

b)
$$x^2 - 6x + 7 = 0$$

c)
$$x^2 + 2x + 10 = 0$$

The Discriminant

Remember the Quadratic Formula??? $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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Case 2:
$$b^2 - 4ac = 0$$

How many real roots can we find using the Quadratic Formula if $b^2 - 4ac = 0$?

I Case 3: $b^2 - 4ac > 0$

How many real roots can we find using the Quadratic Formula if $b^2 - 4ac > 0$?

<u>Example:</u> Describe "Nature of the Real Roots" for the following polynomial without solving the equation. (Note: Solving means to calculate the actual value of the real roots.)

$$4x^2 - 6x + 9$$