Pre-Calculus 11

4.4 The Quadratic Formula (Part 1)

So far, we have solved quadratic equations graphically, by factoring, and by completing the square. The final method uses the **quadratic formula** to solve quadratic equations in the form

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

The solution(s) to $ax^2 + bx + c = 0$ (where $a \neq 0$) is given by:

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

Example #1: Determine the roots of each equation.

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

$a = 1$
$b = -6$
$c = 7$

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4(1)(7)}}{2(1)}$$

$$x = \frac{6 \pm \sqrt{36 - 28}}{2}$$

$$x = \frac{6 \pm \sqrt{8}}{2}$$

$$x = \frac{6 \pm 2\sqrt{2}}{2}$$

$$x = 3 \pm \sqrt{2}$$

b) $3x^2 + x - 2 = 0$

$a = 3, b = 1, c = -2$

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

$$x = \frac{-1 \pm \sqrt{1 + 24}}{6}$$

$$x = \frac{-1 \pm \sqrt{25}}{6}$$

$$x = \frac{-1 \pm 5}{6}$$

$$x = \frac{-1 - 5}{6} \qquad x = \frac{-1 + 5}{6}$$

$$x = -1 \qquad x = \frac{4}{6} = \frac{2}{3}$$

$$x = -1, \frac{2}{3}$$

c) $x^2 - 5x + 7 = 0$

$a=1, b=-5, c=7$

$$x = \frac{5 \pm \sqrt{(-5)^2 - 4(1)(7)}}{2(1)}$$

$$x = \frac{5 \pm \sqrt{25-28}}{2}$$

$$x = \frac{5 \pm \sqrt{-3}}{2} \leftarrow \text{not possible}$$

No solution.

Think: This is a parabola that opens upwards, its vertex must be above the x-axis

d) $4x^2 - 7x - 1 = 0$

$a=4, b=-7, c=-1$

$$x = \frac{7 \pm \sqrt{(-7)^2 - 4(4)(-1)}}{2(4)}$$

$$x = \frac{7 \pm \sqrt{49+16}}{8}$$

$$x = \frac{7 \pm \sqrt{65}}{8}$$