4.4 Solving Quadratic Formula

The last algebraic method we will use to solve quadratic equations is using the quadratic formula. It is used when the quadratic is in standard form meaning: $ax^2 + bx + c = 0$.

YOU NEED TO MEMORIZE THIS!!	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

On homework:

For the problems that we've done so far, when have you been able to tell if you'll have rational, irrational, or imaginary solutions? When you simplify the square root

Discriminant: Radicand of quadratic formula ($b^2 - 4ac$)

1. *Solve each equation using the quadratic formula*

a) $x^2 + x - 110 = 0$

$a=1 \quad b=1 \quad c=-110$

$$x = \frac{-1 \pm \sqrt{(1)^2 - 4(1)(-10)}}{2(1)} = \frac{-1 \pm \sqrt{441}}{2}$$

$$= \frac{-1 \pm 21}{2} \quad \frac{-1+21}{2} = \frac{20}{2} = \boxed{10} \qquad \frac{-1-21}{2} = \frac{-22}{2} = \boxed{-11}$$

b) $x^2 + 11x + 18 = 0$

$a=1 \quad b=11 \quad c=18$

$$x = \frac{-11 \pm \sqrt{(11)^2 - 4(1)(18)}}{2(1)} = \frac{-11 \pm \sqrt{49}}{2}$$

$$= \frac{-11 \pm 7}{2} \quad \frac{-11+7}{2} = \frac{-4}{2} = \boxed{-2} \qquad \frac{-11-7}{2} = \frac{-18}{2} = \boxed{-9}$$

A lot of the time the struggle can be knowing the order of what to simplify. Here is something that might help you if you choose to use it:

How to use the Quadratic Formula

Identify a, b, c

Plug a, b, c into quadratic formula

Discriminant & denominator

Radical

Reduce (3 musketeers)

Split & solve

"Are you ready to use quadratic formula?"

I'm Pretty Darn Ready, Rico Suave

c) $4x^2 + 10x + 6 = 0$

$a=4 \quad b=10 \quad c=6$

$$x = \frac{-10 \pm \sqrt{(10)^2 - 4(4)(6)}}{2(4)}$$

$$= \frac{-10 \pm \sqrt{4}}{8} = \frac{-10 \pm 2}{8} \ *$$

$$= \frac{-5 \pm 1}{4} \quad \frac{-5+1}{4} = \frac{-4}{4} = \boxed{-1} \qquad \frac{-5-1}{4} = \frac{-6}{4} = \boxed{\frac{-3}{2}}$$

* Be sure to type Minus 4ac in calculator instead of negative 4ac

* All numbers outside the radical are like the 3 musketeers – they reduce all together or not at all

* We cannot divide numbers unless they are all outside of the $\sqrt{\ }$

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d) $x^2 - 4x + 10 = 0$

$\sqrt{24}$ → $4 \wedge 6$ → $(2\ 2)$ → $2\ \sqrt{3}$

$a=1 \quad b=-4 \quad c=10$

$$x = \frac{4 \pm \sqrt{(-4)^2 - 4(1)(10)}}{2(1)} = \frac{4 \pm \sqrt{-24}}{2}$$

$$= \frac{4 \pm 2i\sqrt{6}}{2} = \frac{2 \pm 1i\sqrt{6}}{1}$$

$$= 2 \pm i\sqrt{6} \quad \boxed{2 + i\sqrt{6}} \quad \boxed{2 - i\sqrt{6}}$$

e) $2x^2 - 6x + 5 = 0$

$a=2 \quad b=-6 \quad c=5$

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4(2)(5)}}{2(2)} = \frac{6 \pm \sqrt{-4}}{4}$$

$$= \frac{6 \pm 2i}{4} = \boxed{\frac{3 \pm i}{2}}$$

f) $5x^2 = 8 - 5x$ *standard form

$+5x \quad -8 \quad -8 \quad +5x$

$5x^2 + 5x - 8 = 0$

$a=5 \quad b=5 \quad c=-8$

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4(5)(-8)}}{2(5)}$$

$$= \boxed{\frac{-5 \pm \sqrt{185}}{10}}$$

$\sqrt{185}$ → $5\ 37$

Since $\sqrt{185}$ doesn't break down, we're done.

g) $3x^2 - 8 = 0$

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

$a=3 \quad b=0 \quad c=-8$

$$x = \frac{-0 \pm \sqrt{(0)^2 - 4(3)(-8)}}{2(3)}$$

$$= \frac{\pm \sqrt{96}}{6}$$

$\sqrt{96}$ → $16 \wedge 6$ → $(4\ 4)$

$$= \frac{\pm 4\sqrt{6}}{6} = \boxed{\frac{\pm 2\sqrt{6}}{3}}$$

Tip

If you are missing a term, you can replace it with 0.

The best part about quadratic formula is that it always works for any quadratic in standard form.