Using the Quadratic Formula

Quadratic Formula

If $ax^2 + bx + c = 0$ and $a \neq 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

where a is the coefficient of the second-degree term, b is the coefficient of the first-degree term, and c is the constant.

To Solve Quadratic Equations Using the Quadratic Formula
1. Write the quadratic equation in **standard form** with a leading *positive* coefficient.
2. Identify the values of a, b, and c.
3. Substitute these values into the quadratic formula.
4. Simplify the resulting expression.

Keeping the formula handy.... $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$4 + 20x = -25x^2$	$\dfrac{1}{4}p^2 + \dfrac{3}{2}p + 3 = 0$ Mult. By 4	$-4x^2 + 12x - 9 = 0$ Multiply by = -1
$25x^2 + 20x + 4 = 0$ Standard form.	$p^2 + 6p + 12 = 0$ Standard form.	$4x^2 - 12x + 9 = 0$ Standard Form.
a = 25 b = 20 c = 4	a = 1 b = 6 c = 12	a = 4 b = -12 c = 9
$x = \dfrac{-(20) \pm \sqrt{(20)^2 - 4(25)(4)}}{2(25)}$	$p = \dfrac{-(6) \pm \sqrt{(6)^2 - 4(1)(12)}}{2(1)}$	$x = \dfrac{-(-12) \pm \sqrt{(-12)^2 - 4(4)(9)}}{2(4)}$
$x = \dfrac{-20 \pm \sqrt{400 - 200}}{50}$	$p = \dfrac{-6 \pm \sqrt{36 - 48}}{2}$	$x = \dfrac{12 \pm \sqrt{144 - 144}}{8}$
$x = \dfrac{-20 \pm \sqrt{200}}{50}$	$p = \dfrac{-6 \pm \sqrt{-12}}{2}$ Bring out i.	$x = \dfrac{12 \pm \sqrt{0}}{8}$
$x = \dfrac{-20 \pm 10\sqrt{2}}{50}$ Factor out a 10.	$p = \dfrac{-6 \pm 2i\sqrt{3}}{2}$ Factor out a 2.	$x = \dfrac{12}{8}$
$x = \dfrac{10(-2 \pm \sqrt{2})}{10 \cdot 5}$	$p = \dfrac{2(-3 \pm i\sqrt{3})}{2}$	$x = \dfrac{3}{2}$
$x = \dfrac{-2 \pm \sqrt{2}}{5}$	$p = -3 \pm i\sqrt{3}$	$\left\{ \dfrac{3}{2} \right\}$
$\left\{ \dfrac{-2 - \sqrt{2}}{5}, \dfrac{-2 + \sqrt{2}}{5} \right\}$	$\{-3 - i\sqrt{3}, -3 + i\sqrt{3}\}$	

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TRY:

$$3z^2 - 8z + 2 = 0 \qquad\qquad -8q^2 - 2q + 1 = 0 \qquad\qquad 2y^2 + 1 = 2y$$

Sometimes one method is easier than another for solving a quadratic equation.

Solving a Quadratic Equation – in General

1. Write the quadratic equation in <u>standard form</u> with a leading *positive* coefficient.

2. <u>Clear fractions</u> if necessary.

3. Solve using an appropriate method:

   a. Check to see if the polynomial can be factored. If so – **solve by factoring**.

   b. If $b = 0$ or the quadratic equation has the form $(px + q)^2 = k$, **solve by extracting the roots**, using the even-root property.

   c. **Solve by using the quadratic formula**. (One can also use completing the square, but using the quadratic formula is usually faster.)

Once the 'a', 'b', and 'c' values have been identified, one can determine how many solutions and what type (real or imaginary) of solution one should have to the problem.