



Solving Quadratic Equations

SOLVE THE EQUATION

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

Note: Equation must be in standard form, $ax^2 + bx + c = 0$

1. BY FACTORING

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

Set the equation equal to zero, making sure trinomial is in standard form.

$$(x - 1)(x + 7) = 0$$

Factor the trinomial.

$$x - 1 = 0 \quad x + 7 = 0$$

Set each binomial factor equal to zero.

$$x = 1 \quad x = -7$$

Solve each equation.

2. BY COMPLETING THE SQUARE

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

To use this method the coefficient of x^2 must be 1.

$$x^2 + 6x = 7$$

Rearrange the equation placing the constant on the right-hand side.

$$x^2 + 6x = 7$$

Find one-half of the coefficient of x and square it ($1/2$ of 6 is 3. 3^2 is 9.)

$$x^2 + 6x + 9 = 7 + 9$$

Add the square to both sides. The resulting trinomial on the left hand side of the equation is a perfect square.

$$(x + 3)^2 = 16$$

[Note the perfect square is $(x + \frac{1}{2} \text{ of the coefficient of } x \text{ from the step above})^2$]

$$\sqrt{(x + 3)^2} = \sqrt{16}$$

Use the square root property on both sides of the equation.

$$x + 3 = \pm 4$$

Note: the resulting square root is both positive and negative. [plus or minus]

$$x + 3 = 4 \quad x + 3 = -4$$

Solve for both the positive and negative result.

$$x = 1 \quad x = -7$$

3. BY USING THE QUADRATIC FORMULA

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad ax^2 + bx + c = 0$$

The formula is based on using the coefficients and constant, a , b and c , from the standard form of the equation.

$$x^2 + 6x - 7 = 0 \quad a = 1 \quad b = 6 \quad c = -7 \quad a \text{ is the coefficient of } x^2, b \text{ is the coefficient of } x, c \text{ is the constant.}$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{6^2 - 4(1)(-7)}}{2(1)} = \frac{-6 \pm \sqrt{36 + 28}}{2} = \frac{-6 \pm \sqrt{64}}{2} = \frac{-6 \pm 8}{2}$$

*Plug in the appropriate numbers. Note: If the work under the square root sign, $b^2 - 4ac$ [the discriminant], is less than zero [a negative number], then the equation has **no real solution**.*

$$x = \frac{-6 + 8}{2}$$

$$x = \frac{-6 - 8}{2}$$

Solve for both the positive and negative result.

$$x = 1$$

$$x = -7$$

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Choosing a Method for Solving Quadratic Equations

- Simplify both sides of the equation and put it into standard form, set equal to 0.

$$x(x + 3) = 28$$

$$x^2 + 3x = 28$$

Distribute

$$x^2 + 3x - 28 = 28 - 28$$

Subtract 28 from both sides in order to set equation equal to 0

$$x^2 + 3x - 28 = 0$$

Simplified, in standard form, and set equal to 0.

Proceed to solve using method from other side of this handout.

- Factor out any common factors and divide both sides of the equation by any common numerical factor. This will eliminate it [zero divided by anything is zero]

$$2x^2 - 8x - 10 = 0$$

$$2(x^2 - 4x - 5) = 0$$

Factor out the common factor of 2.

$$\frac{2(x^2 - 4x - 5)}{2} = \frac{0}{2}$$

Divide by 2 on both sides in order to eliminate it.

$$x^2 - 4x - 5 = 0$$

Factored, in standard form and set equal to 0.

Proceed to solve using method from other side of this handout.

- If no constant appears in the equation, then $c = 0$ and there should be a common variable factor. If so, use the factoring method.

$$x^2 - 4x = 0$$

$$x(x - 4) = 0$$

Factor out the common x .

$$x = 0 \quad (x - 4) = 0$$

Set each factor equal to 0.

$$\frac{x}{x} = \frac{4}{4}$$

Solve.

$$x = 0 \quad x = 4$$

- If there is no first degree term [where there is no x and therefore $b = 0$], use the square root method:

$$x^2 - 4 = 0$$

$$\frac{x^2 - 4}{x^2} = \frac{0}{x^2}$$

Isolate the x^2 .

$$x^2 = 4$$

$$\sqrt{x^2} = \sqrt{4}$$

Take square roots of each side of the equation.

$$x = \pm 2$$

Solve. Remember: A square root always has a positive and negative answer.