

Solving Quadratic Equations

Equations such as $x^2 = 64$, $x^2 - 5x = 0$, and $x^2 + 4x = 5$ are called quadratic equations. This is because in each of these equations the greatest exponent of any variable is 2.

Standard Form of Quadratic Equations: $ax^2 + bx + c = 0$

Before you select the method that you will use to solve a quadratic, you must use inverse operations to get the equation to equal **zero** (if necessary).

When solving quadratic equations, we can use two methods:

- 1) Factoring
- 2) Quadratic Formula

Solving Quadratic Equations Using Factoring:

To Solve a Quadratic Using Factoring:

- 1) Put the quadratic equation into standard form (above).
- 2) Factor the quadratic expression.
- 3) Set each factor equal to zero.
- 4) Solve each equation.
- 5) Check each **root** in the original equation.

For example:

$$\begin{array}{r} x^2 + 4x = 5 \\ \underline{-5 \quad -5} \\ x^2 + 4x - 5 = 0 \\ (x + 5)(x - 1) = 0 \\ x + 5 = 0 \quad x - 1 = 0 \\ \underline{-5 \quad -5 \quad +1 \quad +1} \\ x = 5 \quad \text{or} \quad x = 1 \end{array}$$

Now, check in the original!!!

Solve each quadratic equation using factoring:

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

2) $z^2 - 5z + 4 = 0$

3) $x^2 - 8x + 16 = 0$

4) $r^2 - 12r + 35 = 0$

5) $c^2 + 6c + 5 = 0$

6) $m^2 + 10m + 9 = 0$

7) $x^2 - 49 = 0$

8) $z^2 - 4 = 0$

9) $m^2 - 64 = 0$

10) $3x^2 - 12 = 0$

11) $d^2 - 2d = 0$

12) $s^2 - s = 0$

13) $2x^2 - 5x + 2 = 0$

14) $3x^2 - 10x + 3 = 0$

15) $3x^2 - 8x + 4 = 0$

16) $5x^2 + 11x + 2 = 0$

17) $y^2 = 8y + 20$

18) $x^2 = 9x - 20$

19) $x^2 = 30 + x$

20) $2x^2 - x = 15$

21) $x^2 + 3x - 4 = 50$

22) $2x^2 + 7 = 5 - 5x$

23) $x(x - 2) = 35$

24) $y(y - 3) = 4$

25) $\frac{x+2}{2} = \frac{12}{x}$

26) $\frac{y+3}{3} = \frac{6}{y}$

27) $\frac{x}{3} = \frac{12}{x}$

28) $10x^2 - 5x + 11 = 9x^2 + x + 83$

29) $4x^2 + 3x - 12 = 6x^2 - 7x - 60$

Solving Quadratics Using the Quadratic Formula:

Not every quadratic equation can be solved by factoring. In this case, we need to use the quadratic formula.

Quadratic Formula: $x = \frac{- (b) \pm \sqrt{b^2 - 4ac}}{2a}$

To Solve a Quadratic Using the Quadratic Formula:

- 1) Put the quadratic equation into standard form (above).
- 2) Write out the formula and what a, b, & c stand for.
- 3) Substitute for each variable.
- 4) Split into two separate equations (setting each equal to zero) and solve.
- 5) Check each **root** in the original equation.

For example:

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

$$\frac{-6 -6}{2x^2 + x - 6} = 0$$

***Can't be factored, use the formula.

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

$$a = 2, b = 1, c = -6$$

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

$$x = \frac{-1 \pm \sqrt{1+48}}{4}$$

$$x = \frac{-1 \pm \sqrt{49}}{4}$$

$$x = \frac{-1 \pm 7}{4}$$

$$x = \frac{-1 + 7}{4} \quad x = \frac{-1 - 7}{4}$$

$$x = \frac{6}{4} \quad x = \frac{-8}{4}$$

$$x = \frac{3}{2}$$

$$x = -2$$

*** Now check in original equation!

*** Note: If you get a decimal for your answer, follow the directions, or round to 4 decimal places!!!

Solve each equation using the quadratic formula:

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

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

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

4) $2x^2 + x - 1 = 0$

5) $3x^2 + 5x + 2 = 0$

6) $3x^2 + 5x + 2 = 0$

7) $x^2 + 6x + 9 = 0$

8) $4x^2 - 4x + 1 = 0$

9) $x^2 + 10x = -25$

10) $x^2 + x = 12$

11) $x^2 + 2x = 24$

12) $x^2 = x + 2$

13) $x^2 + 8 = 6x$

14) $2x^2 - 10 = x$

15) $x^2 - 9 = 0$

16) $5x^2 = 20$

17) $x^2 - 3x + 1 = 1$

18) $x^2 = 5x$

19) $x^2 - 2x - 2 = 0$

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

21) $x^2 + 2x - 4 = 0$

22) $x^2 - 2 = 4x$

23) $2x^2 - 8x + 7 = 0$

24) $4x^2 = 2x + 1$

For each of the following, figure out which type of equation you have been given, then choose the best method to solve. Do not forget to check!

1) $20 - (5/8)x = 40$

2) $6(7x - 2) = 8(4x + 1)$

3) $2(5x - 4) - 3(4x + 3) = -43$

4) $x^2 + 44 = 15x$

5) $3x^2 + 18x = 81$

6) $3x^2 = 5x + 5$

7) $11x - 5 = 7x - 53$

8) $6(3x + 1) + 5(10 - 4x) = 39$

9) $\frac{1}{4}x - 33 = -49$

10) $7x^2 - 1 = 3x$

11) $9(3x + 1) = 8(5x + 6)$

12) $15x = x^2 - 16$

13) $x^2 + 8x = 12$

14) $9(4x + 7) - 6(7x + 10) = -54$

15) $44 = 20 - 2x$

16) $4x^2 - 128 = 16x$

17) $3x^2 - 8x + 6 = x + 6$

18) $7(6x + 2) = 10(3x + 5)$

19) $3x^2 + 13x - 12 = 9x^2 - 11x - 12$

20) $2x^2 - 14 = 10x$