

2 Find the zeros using quadratic formula

1. $x^2 - 2x - 2 = 0$
2. $x^2 - 4x - 1 = 0$
3. $x^2 - 2x - 1 = 0$
4. $x^2 - 4x + 2 = 0$
5. $2x^2 - 6x + 2 = 0$
6. $3x^2 + 2x - 1 = 0$
7. $5x^2 - 6x + 1 = 0$
8. $x^2 - 2x - 6 = 0$
9. $x^2 + x - 1 = 0$
10. $x^2 - 4 = 0$

2.1 Solutions

Quadratic Formula

If $ax^2 + bx + c = 0$, $a \neq 0$, and a, b, c are real numbers, then the roots are given by

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

1. $x^2 - 2x - 2 = 0$

$$\begin{aligned}x &= \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-2)}}{2(1)} \\&= \frac{2 \pm \sqrt{4 + 8}}{2} \\&= \frac{2 \pm \sqrt{12}}{2} \\&= \frac{2 \pm 4\sqrt{3}}{2} \\&= 1 \pm 2\sqrt{3}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= 1 + 2\sqrt{3} \\x &= 1 - 2\sqrt{3}\end{aligned}$$

The solution set is $\{1 - 2\sqrt{3}, 1 + 2\sqrt{3}\}$

2. $x^2 - 4x - 1 = 0$

$$\begin{aligned}x &= \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-1)}}{2(1)} \\&= \frac{4 \pm \sqrt{16 + 4}}{2} \\&= \frac{4 \pm \sqrt{20}}{2} \\&= \frac{4 \pm 2\sqrt{5}}{2} \\&= 2 \pm \sqrt{5}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= 2 + \sqrt{5} \\x &= 2 - \sqrt{5}\end{aligned}$$

The solution set is $\{2 - 2\sqrt{5}, 2 + 2\sqrt{5}\}$

3. $x^2 - 2x - 1 = 0$

$$\begin{aligned}x &= \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-1)}}{2(1)} \\&= \frac{2 \pm \sqrt{4 + 4}}{2} \\&= \frac{2 \pm \sqrt{8}}{2} \\&= \frac{2 \pm 2\sqrt{2}}{2} \\&= 1 \pm \sqrt{2}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= 1 + \sqrt{2} \\x &= 1 - \sqrt{2}\end{aligned}$$

The solution set is $\{1 - \sqrt{2}, 1 + \sqrt{2}\}$

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

$$\begin{aligned}x &= \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(2)}}{2(1)} \\&= \frac{4 \pm \sqrt{16 - 8}}{2} \\&= \frac{4 \pm \sqrt{8}}{2} \\&= \frac{4 \pm 2\sqrt{2}}{2} \\&= 2 \pm \sqrt{2}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= 2 + \sqrt{2} \\x &= 2 - \sqrt{2}\end{aligned}$$

The solution set is $\{2 - \sqrt{2}, 2 + \sqrt{2}\}$

5. $2x^2 - 6x + 2 = 0$

$$\begin{aligned}x &= \frac{-(-6) \pm \sqrt{(-6)^2 - 4(2)(2)}}{2(2)} \\&= \frac{6 \pm \sqrt{36 - 16}}{4} \\&= \frac{6 \pm \sqrt{20}}{4} \\&= \frac{6 \pm 2\sqrt{5}}{4} \\&= \frac{3 \pm \sqrt{5}}{2}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= \frac{3 + \sqrt{5}}{2} \\x &= \frac{3 - \sqrt{5}}{2}\end{aligned}$$

The solution set is $\left\{\frac{3 - \sqrt{5}}{2}, \frac{3 + \sqrt{5}}{2}\right\}$

6. $3x^2 + 2x - 1 = 0$

$$\begin{aligned}x &= \frac{-(2) \pm \sqrt{(2)^2 - 4(3)(-1)}}{2(3)} \\&= \frac{-2 \pm \sqrt{4 + 12}}{6} \\&= \frac{-2 \pm \sqrt{16}}{6} \\&= \frac{-2 \pm 4}{6}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= \frac{-2 + 4}{6} = \frac{1}{3} \\x &= \frac{-2 - 4}{6} = -1\end{aligned}$$

The solution set is $\left\{-1, \frac{1}{3}\right\}$

7. $5x^2 - 6x + 1 = 0$

$$\begin{aligned}x &= \frac{-(-6) \pm \sqrt{(-6)^2 - 4(5)(1)}}{2(5)} \\&= \frac{6 \pm \sqrt{36 - 20}}{10} \\&= \frac{6 \pm \sqrt{16}}{10} \\&= \frac{6 \pm 4}{10}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= \frac{6 + 4}{10} = 1 \\x &= \frac{6 - 4}{10} = \frac{1}{5}\end{aligned}$$

The solution set is $\{\frac{1}{5}, 1\}$

8. $x^2 - 2x - 6 = 0$

$$\begin{aligned}x &= \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-6)}}{2(1)} \\&= \frac{2 \pm \sqrt{4 + 24}}{2} \\&= \frac{2 \pm \sqrt{28}}{2} \\&= \frac{2 \pm 2\sqrt{7}}{2}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= 1 + \sqrt{7} \\x &= 1 - \sqrt{7}\end{aligned}$$

The solution set is $\{1 - \sqrt{7}, 1 + \sqrt{7}\}$

9. $x^2 + x - 1 = 0$

$$\begin{aligned}x &= \frac{-(1) \pm \sqrt{(1)^2 - 4(1)(-1)}}{2(1)} \\&= \frac{-1 \pm \sqrt{1+4}}{2} \\&= \frac{-1 \pm \sqrt{5}}{2}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= \frac{-1 + \sqrt{5}}{2} \\x &= \frac{-1 - \sqrt{5}}{2}\end{aligned}$$

The solution set is $\left\{\frac{-1 - \sqrt{5}}{2}, \frac{-1 + \sqrt{5}}{2}\right\}$

10. $x^2 - 4 = 0$

$$\begin{aligned}x &= \frac{-(0) \pm \sqrt{(0)^2 - 4(1)(-4)}}{2(1)} \\&= \frac{0 \pm \sqrt{16}}{2} \\&= \frac{\pm 4}{2}\end{aligned}$$

The zeros are

$$\begin{aligned}x &= \frac{4}{2} = 2 \\x &= \frac{-4}{2} = -2\end{aligned}$$

The solution set is $\{2, -2\}$