Example

Find the solutions for the equation $x^2 + 5x + 4 = 0$.

Solution

The given equation can be expressed as $(1)x^2 + (5)x + (4) = 0$. In other words, $a = 1$, $b = 5$, and $c = 4$. The two roots of this equation can be found by substituting these values into the quadratic equation, as follows:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-5 \pm \sqrt{5^2 - (4)(1)(4)}}{(2)(1)} = \frac{-5 \pm \sqrt{9}}{2} = \frac{-5 \pm 3}{2}$$

The two roots are $x = \frac{-5 + 3}{2} = -1$ and $x = \frac{-5 - 3}{2} = -4$.

$$\boxed{x = -1 \text{ and } x = -4}$$

We can evaluate these answers by substituting them into the given equation and verifying that the result is zero.

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

For $x = -1$, $(-1)^2 + 5(-1) + 4 = 1 - 5 + 4 = 0$.

For $x = -4$, $(-4)^2 + 5(-4) + 4 = 16 - 20 + 4 = 0$.

Example

Factor the equation $2x^2 - 3x - 4 = 0$.

Solution

The given equation can be expressed as $(2)x^2 + (-3)x + (-4) = 0$. Thus, $a = 2$, $b = -3$, and $c = -4$. Substitute these values into the quadratic equation to factor the given equation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{3 \pm \sqrt{(-3)^2 - (4)(2)(-4)}}{(2)(2)} = \frac{3 \pm \sqrt{41}}{4} = \frac{3 \pm 6.403}{4}$$

The two roots are $x = \frac{3 + 6.403}{4} = 2.351$ and $x = \frac{3 - 6.403}{4} = -0.851$.

$$\boxed{x = 2.351 \text{ and } x = -0.851}$$

Again, evaluate these answers by substituting them into the given equation.

$$2x^2 - 3x - 4 = 0$$

For $x = 2.351$, $2(2.351)^2 - 3(2.351) - 4 = 11.054 - 7.053 - 4 \approx 0$.

For $x = -0.851$, $2(-0.851)^2 - 3(-0.851) - 4 = 1.448 + 2.553 - 4 \approx 0$.