

Solving Quadratic Equations

An equation of degree 2 is called a quadratic equation. Some examples include:

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

$$3x^2 + 10x = 8$$

$$4x^2 = 25$$

$$7x^3 = 0$$

Non-quad.

1. Solve the following quadratic equations:

a) $\frac{4x^2}{4} = \frac{9}{4}$

This quadratic equation is missing the x term, so it can be solved in two ways.

Method 1: Isolate the x .

$$\sqrt{x^2} = \sqrt{\frac{9}{4}} \quad x = \pm \frac{3}{2}$$

$$3 \cdot 3 = 9 \quad -3 \cdot -3 = 9$$

b) $25m^2 + 7 = 23$

$$\begin{aligned} & -7 \quad -7 \\ 25m^2 &= 16 \\ \frac{25m^2}{25} &= \frac{16}{25} \end{aligned}$$

$$\sqrt{m^2} = \sqrt{\frac{16}{25}} \quad m = \pm \frac{4}{5}$$

d) $5d^2 + 2 = 11d$

$$5d^2 - 11d + 2 = 0$$

$$d^2 - 11d + 10 = 0$$

$$(d - \frac{10}{5})(d - \frac{2}{5}) = 0$$

$$\begin{aligned} d - 2 &= 0 \\ \boxed{d = 2} \end{aligned}$$

$$(d - 2)(5d - 1) = 0$$

$$5d - 1 = 0$$

$$\frac{5d}{5} = \frac{1}{5} \quad \boxed{\frac{1}{5}}$$

f) $3n^2 - 27n + 60n = 0$

$$3n(n^2 - 9n + 20) = 0$$

$$3n(n - 4)(n - 5) = 0$$

$$\frac{3n}{3} = 0 \quad n - 4 = 0 \quad n - 5 = 0$$

$$\underline{n = 0} \quad \underline{n = 4} \quad \underline{n = 5}$$

Method 2: Move the 9 and then factor.

$$4x^2 - 9 = 0 \quad (2x + 3)(2x - 3) = 0$$

$$2x + 3 = 0 \quad \text{or} \quad 2x - 3 = 0$$

$$\therefore x = \frac{-3}{2} \quad \text{or} \quad x = \frac{3}{2}$$

$$2a + 5 = 0$$

$$-5 \quad -5$$

c) $p^2 + 2p - 48 = 0$

$$(p - 6)(p + 8) = 0$$

$$\frac{2a}{2} = \frac{5}{2} \quad \boxed{\frac{5}{2}}$$

$$\begin{aligned} p - 6 &= 0 & p + 8 &= 0 \\ +6 & +6 & -8 & -8 \end{aligned}$$

$$\underline{p = 6} \quad \underline{p = -8}$$

e) $8a^2 + 18a = 5$

$$8a^2 + 18a - 5 = 0$$

$$2a + 5 = 0$$

$$\underline{a = -\frac{5}{2}}$$

$$a^2 + 18a - 40 = 0$$

$$(a + \frac{20}{8})(a - \frac{2}{8}) = 0$$

$$\underline{4a - 1 = 0}$$

$$(a + \frac{5}{2})(a - \frac{1}{4}) = 0$$

$$\underline{a = \frac{1}{4}}$$

$$\begin{aligned} (2a + 5)(4a - 1) &= 0 \\ \cancel{9} (5m - 2)^2 &= (3m - 4)^2 \end{aligned}$$

2. When a football is kicked with a vertical speed of 20m/s, its height is given by:

$$h = 20t - 5t^2, \text{ where } h = \text{height in meters, and } t = \text{time in seconds.}$$

How long after the kick is the ball at a height of 15 m?