Lesson 12-5

Example 1

Use the quadratic formula to solve $3x^2 - 5x + 2 = 0$.

Solution

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

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(2)}}{2(3)}$$ Substitute for a, b, and c.

$$x = \frac{-(-5) \pm \sqrt{25 - 24}}{6}$$ Simplify.

$$x = \frac{5 \pm \sqrt{1}}{6} = \frac{5 \pm 1}{6}$$

$$x = \frac{5 + 1}{6}, x = \frac{5 - 1}{6}$$

$$x = 1, x = \frac{4}{6} = \frac{2}{3}$$

$3x^2 - 5x + 2 = 0$ has two solutions, 1 and $\frac{2}{3}$.

Example 2

Use the quadratic formula to solve $4x + 2 = x^2$.

Solution

$0 = x^2 - 4x - 2$ Write the equation in standard form.

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ Use the quadratic equation.

$x = \dfrac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-2)}}{2(1)}$ Substitute for a, b, and c.

$x = \dfrac{4 \pm \sqrt{16 + 8}}{2}$ Simplify.

$x = \dfrac{4 \pm \sqrt{24}}{2} = \dfrac{4 \pm \sqrt{4(6)}}{2}$

$x = \dfrac{4 \pm 2\sqrt{6}}{2} = 2 \pm \sqrt{6}$

The solutions for the quadratic equation $4x + 2 = x^2$ are $x = 2 + \sqrt{6}$ and $x = 2 - \sqrt{6}$.

Example 3

AERONAUTICS A model rocket is launched at a velocity of 96 ft/sec.

a. How long does it take the rocket to reach its maximum height?

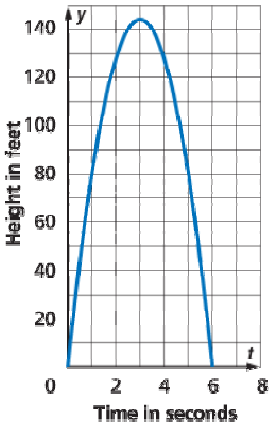
b. What is the maximum height reached by the rocket?

c. How many seconds does it take the rocket to return to the ground?

Solution

The velocity is 96 feet per second, so $d = 96t - 16t^2$.

a. At its maximum height, the rocket is at the vertex of the parabola formed by the flight path. the time required to reach the maximum height is the x-coordinate of the vertex. Use $-\frac{b}{2a}$ to find the time.



$$-\frac{96}{2(-16)} = \frac{96}{32} = 3$$

It takes the rocket 3 seconds to reach its maximum height.

b. The maximum height is the y-coordinate of the vertex. Substitute t = 3 into the equation.

$d = 96(3) - 16(3)^2$
$d = 288 - 16(9)$
$d = 288 - 144 = 144$

The maximum height reached by the rocket is144 feet.

c. At ground level, d is 0. To find when the rocket returns to the ground, solve the equation.

$96t - 16t^2 = 0$
$6t - t^2 = 0$
$t(6 - t) = 0 \qquad t = 0, t = 6$

The rocket returns to the ground level in 6 seconds.