

Example 4

Apply Quadratic Equations

Dock jumping is an exciting dog event in which dogs compete for the longest jumping distance from a dock into a body of water. The path of a Jack Russell terrier on a particular jump can be approximated by the quadratic function $h(d) = -\frac{3}{10}d^2 + \frac{11}{10}d + 2$, where h is the height above the surface of the water and d is the horizontal distance the dog travels from the base of the dock, both in feet. All measurements are taken from the base of the dog's tail. Determine the horizontal distance of the jump.



Solution

When the dog lands in the water, the dog's height above the surface is 0 m. To solve this problem, determine the roots of the quadratic equation $-\frac{3}{10}d^2 + \frac{11}{10}d + 2 = 0$.

$$-\frac{3}{10}d^2 + \frac{11}{10}d + 2 = 0$$

$$-\frac{1}{10}(3d^2 - 11d - 20) = 0$$

Factor out the common factor of $-\frac{1}{10}$.

$$-\frac{1}{10}(3d + 4)(d - 5) = 0$$

$$3d + 4 = 0 \quad \text{or} \quad d - 5 = 0$$

$$3d = -4 \qquad d = 5$$

$$d = -\frac{4}{3}$$

Solve for d to determine the roots of the equation.

Why does the factor $-\frac{1}{10}$ neither result in a root nor affect the other roots of the equation?

Example 5**Write and Solve a Quadratic Equation**

The length of an outdoor lacrosse field is 10 m less than twice the width. The area of the field is 6600 m^2 . Determine the dimensions of an outdoor lacrosse field.

**Solution**

Let w represent the width of the field.
Then, the length of the field is $2w - 10$.

Use the area formula.

$$A = lw$$

$$6600 = (2w - 10)(w)$$

$$6600 = 2w^2 - 10w$$

$$0 = 2w^2 - 10w - 6600$$

$$0 = 2(w^2 - 5w - 3300)$$

$$0 = w^2 - 5w - 3300$$

$$0 = (w - 60)(w + 55)$$

$$w - 60 = 0 \quad \text{or} \quad w + 55 = 0$$

$$w = 60$$

$$w = -55$$

Since the width of the field cannot be negative, $w = -55$ is rejected. The width of the field is 60 m. The length of the field is $2(60) - 10$ or 110 m.

Check:

The area of the field is $(60)(110)$ or 6600 m^2 .

Chapter
4**Quadratic Equations**

Two consecutive positive multiples of 5 have a product of 300.

- a) Write a quadratic equation that could be used to solve this problem.
- b) Determine the two numbers.

Answer

a) One possible equation is

$$x^2 + 5x - 300 = 0$$

b) 15, 20

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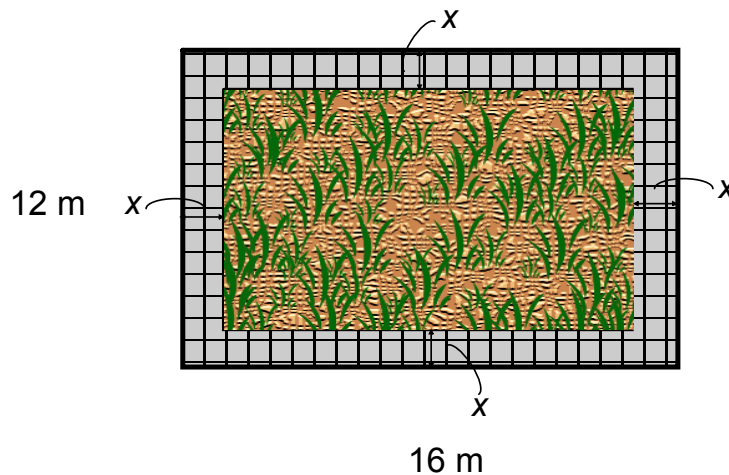
Chapter

4

Quadratic Equations

Toji is building a rectangular garden surrounded by a brick border as shown. It is known that the area of his garden is 96 m^2 and the brick border has a uniform width $x \text{ m}$.

Write a quadratic equation that could be used to solve this problem. Then, determine the width of the border.



Answer

The quadratic equation is
 $(12 - 2x)(16 - 2x) = 96$.

The width of the border is 2 m.

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