

EXAMPLE 5 Solve a polynomial equationSolve the equation $x^2 + \frac{2}{3}x + \frac{1}{9} = 0$.

$$x^2 + \frac{2}{3}x + \frac{1}{9} = 0$$

Write original equation.

$$9x^2 + 6x + 1 = 0$$

Multiply each side by 9.

$$(3x)^2 + 2(3x \cdot 1) + (1)^2 = 0$$

Write left side as $a^2 + 2ab + b^2$.

$$(3x + 1)^2 = 0$$

Perfect square trinomial pattern

$$3x + 1 = 0$$

Zero-product property

$$x = -\frac{1}{3}$$

Solve for x .▶ The solution of the equation is $-\frac{1}{3}$.**FIND SOLUTIONS**

This equation has two identical solutions, because it has two identical factors.

EXAMPLE 6 Solve a vertical motion problem**FALLING OBJECT** A window washer drops a wet sponge from a height of 64 feet. After how many seconds does the sponge land on the ground?**Solution**Use the vertical motion model to write an equation for the height h (in feet) of the sponge as a function of the time t (in seconds) after it is dropped.The sponge was dropped, so it has no initial vertical velocity. Find the value of t for which the height is 0.

$$h = -16t^2 + vt + s$$

Vertical motion model

$$0 = -16t^2 + (0)t + 64$$

Substitute 0 for h , 0 for v , and 64 for s .

$$0 = -16(t^2 - 4)$$

Factor out -16 .

$$0 = -16(t - 2)(t + 2)$$

Difference of two squares pattern

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

Zero-product property

$$t = 2 \quad \text{or} \quad t = -2$$

Solve for t .

Disregard the negative solution of the equation.

▶ The sponge lands on the ground 2 seconds after it is dropped.

**GUIDED PRACTICE** for Examples 5 and 6

Solve the equation.

5. $a^2 + 6a + 9 = 0$

6. $w^2 - 14w + 49 = 0$

7. $n^2 - 81 = 0$

8. **WHAT IF?** In Example 6, suppose the sponge is dropped from a height of 16 feet. After how many seconds does it land on the ground?