OBJECTIVE 1

1 EXAMPLE Solve each equation. Check your answers.

a. $\sqrt{x} - 5 = 4$

$\sqrt{x} - 5 = 4$

$\sqrt{x} = 9$ Isolate the radical on the left side of the equation.

$(\sqrt{x})^2 = 9^2$ Square each side.

$x = 81$

Check: $\sqrt{x} - 5 = 4$

$\sqrt{81} - 5 \stackrel{?}{=} 4$ Substitute 81 for x.

$9 - 5 \stackrel{?}{=} 4$

$4 = 4$ ✓

OBJECTIVE 1

1 EXAMPLE (continued)

b. $\sqrt{x-5} = 4$

$(\sqrt{x-5})^2 = 4^2$ Square each side.

$x - 5 = 9$ Solve for x.

$x = 21$

Check: $\sqrt{x-5} = 4$

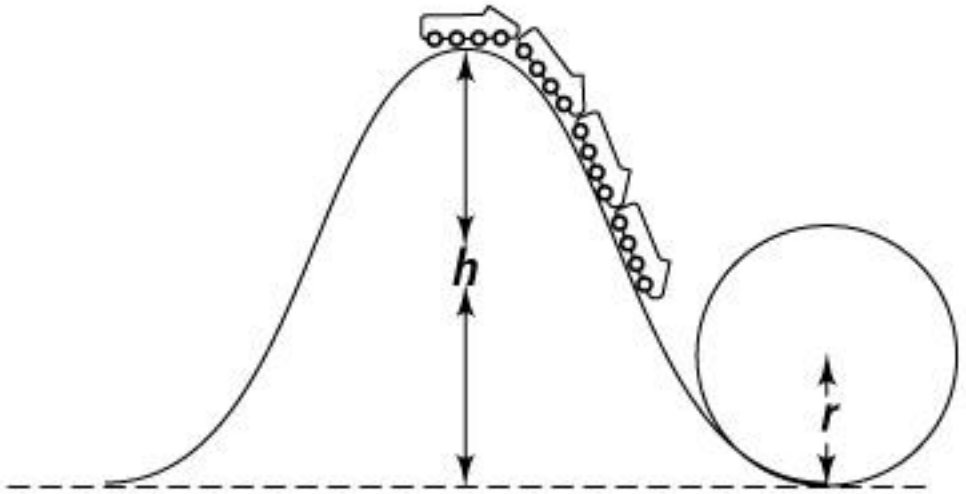
$\sqrt{21-5} = 4$ Substitute 21 for x.

$\sqrt{16} = 4$

$4 = 4$ ✓

OBJECTIVE 1

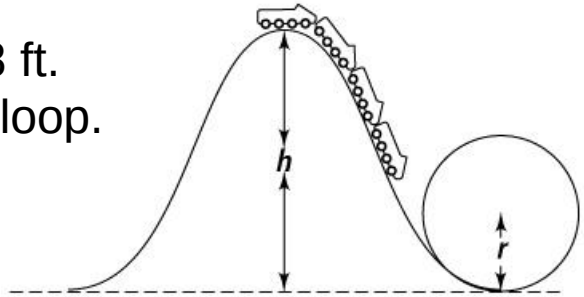
2 EXAMPLE On a roller coaster ride, your speed in a loop depends on the height of the hill you have just come down and the radius of the loop in feet. The equation $v = 8\sqrt{h - 2r}$ gives the velocity v in feet per second of a car at the top of the loop.



OBJECTIVE 1

2 EXAMPLE (continued)

The loop on a roller coaster ride has a radius of 18 ft. Your car has a velocity of 120 ft/s at the top of the loop. How high is the hill of the loop you have just come down before going into the loop?



Solve $v = 8\sqrt{h - 2r}$ for h when $v = 120$ and $r = 18$.

$120 = 8\sqrt{h - 2(18)}$ Substitute 120 for v and 18 for r.

$\frac{120}{8} = \frac{8\sqrt{h - 2(18)}}{8}$ Divide each side by 8 to isolate the radical.

$15 = \sqrt{h - 36}$ Simplify.

$(15)^2 = (\sqrt{h - 36})^2$ Square both sides.

$225 = h - 36$

$261 = h$

The hill is 261 ft high.

OBJECTIVE 1

3 EXAMPLE Solve $\sqrt{3x - 4} = \sqrt{2x + 3}$.

$(\sqrt{3x - 4})^2 = (\sqrt{2x + 3})^2$ Square both sides.

$3x - 4 = 2x + 3$ Simplify.

$3x = 2x + 7$ Add 4 to each side.

$x = 7$ Subtract $2x$ from each side.

Check: $\sqrt{3x - 4} = \sqrt{2x + 3}$

$\sqrt{3(7) - 4} \quad \sqrt{2(7) + 3}$ Substitute 7 for x.

$\sqrt{17} = \sqrt{17}$ ✔

The solution is 7.

OBJECTIVE 2

4 EXAMPLE Solve $x = \sqrt{x + 12}$.

$(x)^2 = (\sqrt{x + 12})^2$ Square both sides.

$x^2 = x + 12$

$x^2 - x - 12 = 0$ Simplify.

$(x - 4)(x + 3) = 0$ Solve the quadratic equation by factoring.

$(x - 4) = 0$ or $(x + 3) = 0$ Use the Zero–Product Property.

$x = 4$ or $x = -3$ Solve for x.

Check: $x = \sqrt{x + 12}$

$4 \stackrel{?}{=} \sqrt{4 + 12}$ $\quad -3 \stackrel{?}{=} \sqrt{-3 + 12}$

$4 = 4$ ✓ $\quad -3 \neq 3$

The solution to the original equation is 4.
The value –3 is an extraneous solution.

OBJECTIVE 2

5 EXAMPLE Solve $\sqrt{3x} + 8 = 2$.

$\sqrt{3x} = -6$

$(\sqrt{3x})^2 = (-6)^2$ Square both sides.

$3x = 36$

$x = 12$

Check: $\sqrt{3x} + 8 = 2$

$\sqrt{3(12)} + 8 \stackrel{?}{=} 2$ Substitute 12 for x.

$\sqrt{36} + 8 \stackrel{?}{=} 2$

$6 + 8 \neq 2$ $x = 12$ does not solve the original equation.

$\sqrt{3x} + 8 = 2$ has no solution.