Warm Up

Determine the value of x, if possible.

1.
$$\sqrt{x} = 2$$

2.
$$\sqrt[3]{x} = -2$$

3.
$$\sqrt{x} = -2$$

Learning Goals

- Use Properties of Equality to solve radical equations.
- Identify extraneous roots when solving radical equations.

Key Term

· extraneous solutions

Worked Example

Solution Steps for a Quadratic Equation

$$2x^{2} - 5 = 13$$

$$2x^{2} = 18$$

$$x^{2} = 9$$

$$\sqrt{x^{2}} = \sqrt{9}$$

$$x = \pm 3$$

Solution Steps for a Radical Equation

$$2\sqrt{x} - 5 = 13$$
$$2\sqrt{x} = 18$$
$$\sqrt{x} = 9$$
$$(\sqrt{x})^2 = (9)^2$$
$$x = 81$$

each solution.

b. Describe the differences in the remaining steps of

- 1. Analyze the examples.
 - Describe the similarities in the first two steps of each solution.
 - 2. How would the strategy shown in the worked example change for cube and cube root equations? Provide an example to explain your reasoning.

Worked Example

Solve
$$3\sqrt{x} + 7 = 25$$
.

$$3\sqrt{x} + 7 = 25$$
$$3\sqrt{x} = 18$$
$$\sqrt{x} = 6$$
$$(\sqrt{x})^2 = (6)^2$$
$$x = 36$$

Check:

$$3\sqrt{36} + 7 \stackrel{?}{=} 25$$

3(6) + 7 $\stackrel{?}{=} 25$
25 = 25

Solve
$$\sqrt{x+1} = 8$$
.

$$\sqrt{x + 1} = 8$$
$$(\sqrt{x + 1})^2 = (8)^2$$
$$x + 1 = 64$$
$$x = 63$$

Check:

$$\sqrt{63 + 1} \stackrel{?}{=} 8$$

$$\sqrt{64} \stackrel{?}{=} 8$$

$$8 = 8 \checkmark$$

You should always check your answers when solving equations. But with radical equations, it's extra important to check your answers. You'll soon learn why.

- 1. Analyze the worked examples.
 - a. How does the form of the equation $3\sqrt{x} + 7 = 25$ compare to the form of the equation $\sqrt{x+1} = 8$?

b. How does the form of each equation relate to the solution strategy shown? **Extraneous solutions** are solutions that result from the process of solving an equation but are not valid solutions to the equation.

2. Solve and check each equation.

a.
$$\sqrt{2x} = 3$$

b.
$$\sqrt[3]{2x-3} = 2$$

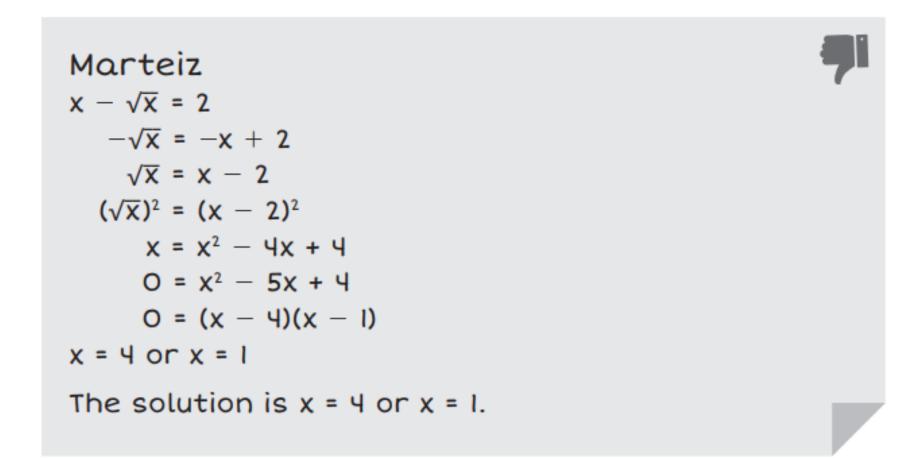
c.
$$4\sqrt{x-6} = 8$$

d.
$$\sqrt{2x+1} = 5$$

e.
$$2\sqrt[3]{x} + 16 = 0$$

f.
$$\sqrt{3x-1}+9=8$$

3. Marteiz solved the equation $x - \sqrt{x} = 2$. Explain Marteiz's error. Give the correct solution in your explanation.



4. Solve the equation $x - 1 = \sqrt{x + 1}$.

The Beaufort scale is a system that measures wind speed and describes conditions at sea and on land. The scale's range is from 0 to 12. A zero on the Beaufort scale means that the wind speed is less than 1 mile per hour and the conditions at sea and on land are calm. A twelve on the Beaufort scale represents hurricane conditions with wind speeds greater than 74 miles per hour, resulting in greater than 50-foot waves at sea and severe damage to structures and landscape.

- 1. Consider the equation $V = 1.837B^{\frac{1}{2}}$ that models the relationship between wind speed in miles per hour V and the Beaufort numbers B.
 - a. Solve the equation for *B*.
 - Determine the Beaufort number for a wind speed of 20 miles per hour.

In medicine, Body Surface Area *BSA* is used to help determine proper dosage for medications.

- 2. The equation $BSA = \frac{\sqrt{W \cdot H}}{60}$ models the relationship between BSA in square meters, the patient's weight W in kilograms, and the patient's height H in centimeters.
 - a. Solve the equation for H.

b. Determine the height of a patient who weighs 90 kilograms and has a *BSA* of 2.1.