Lesson 26: Radical Equations (5.8)

By the end of the lesson, we will be able to:

~ Solve equations with radicals in them.

$$\sqrt{\quad}$$

What is a radical?

$$\sqrt{}$$

What is an example of a Radical Equation?

$$4+\sqrt{x}=10$$

What is the area of the square?

$A = ?$ 5

5

$A = 25$

What is the length of a side of the square?

7

$A = 49$ 7

8

$A = 64$ 8

$\sqrt{50} = 5\sqrt{2}$

$A = 50$ $5\sqrt{2}$

Steps for solving radical equations:

1. Isolate the radical. (If there is more than one radical, isolate the biggest radical expression.)
2. Square both sides of the equation. (Or cube if radical is cube root, etc.)
3. If there are additional radicals left, repeat steps 1 and 2.
4. Isolate the variable.
5. Check your solution. (Some solutions may be *extraneous*.)

doesn't work in original problem

Examples:

a.) $(\sqrt{x})^2 = (4)^2$

$\boxed{x = 16}$

b.) $(\sqrt[3]{x - 20})^3 = (5)^3$

$x - 20 = 125$
$+20 \quad +20$

$\boxed{x = 145}$

c.) $5 + \sqrt{h + 1} = 8$
$-5 \qquad -5$

$(\sqrt{h+1})^2 = (3)^2$

$h + 1 = 9$
$-1 \quad -1$

$\boxed{h = 8}$

d.) $5 + \sqrt{w + 3} = -8$

next slide

d.) $5+\sqrt{w+3}=-8$

$$\begin{aligned} 5+\sqrt{w+3} &= -8 \\ -5 \quad\quad &\quad -5 \\ \hline \left(\sqrt{w+3}\right)^2 &= (-13)^2 \end{aligned}$$

$$\begin{aligned} w+3 &= 169 \\ -3 \quad &\quad -3 \\ \hline \cancel{\boxed{w = 166}} \end{aligned}$$

extraneous solution

check:

$$5+\sqrt{166+3}=-8$$

$$18 \neq -8$$

$$\boxed{\text{No Sol.}}$$

$$\begin{aligned} 5+\sqrt{w+3} &= -8 \\ -5 \quad\quad &\quad -5 \\ \hline \sqrt{w+3} &= -13 \end{aligned}$$

$$\boxed{\text{No Sol.}}$$

Examples:

e.) $\frac{2\sqrt{m-3}}{2} = \frac{7}{2}$

$\left(\sqrt{m-3}\right)^2 = \left(\frac{7}{2}\right)^2$

$m-3 = \frac{49}{4} + \frac{3}{1}$

$+3$

$m = \frac{49}{4} + \frac{12}{4}$

$\boxed{m = 61/4}$

Check:

$2\sqrt{\frac{61}{4} - \frac{12}{4}} = 7$

$2\sqrt{\frac{49}{4}} = 7$

$\cancel{2}\left(\frac{7}{\cancel{2}}\right) = 7$

$7 = 7$

Examples:

f.) $(3y-1)^{\frac{1}{3}}-2=0$

$$\sqrt[3]{3y-1}-2=0$$
$$\quad +2 \quad +2$$

$$\left(\sqrt[3]{3y-1}\right)^3=(2)^3$$

$$3y-1=8$$
$$\quad +1 \quad +1$$

$$\frac{3y}{3}=\frac{9}{3} \rightarrow \boxed{y=3}$$

Examples:

g.) $(2n+1)^{\frac{1}{4}}+5=2$

$$\sqrt[4]{2n+1}+5=2$$
$$-5 \quad -5$$

$$\sqrt[4]{2n+1}=-3$$

$$\boxed{\text{No Solution}}$$

* even roots = neg
→ no sol.

* odd roots = neg
could have an answer

Examples:

h.) Solve for L: $T = 2\pi\sqrt{\frac{L}{g}}$

$$\frac{T}{2\pi} = \frac{2\pi\sqrt{\frac{L}{g}}}{2\pi}$$

$$\left(\frac{T}{2\pi}\right)^2 = \left(\sqrt{\frac{l}{g}}\right)^2$$

$$\left(\frac{T^2}{4\pi^2}\right)\frac{g}{1} = \left(\frac{l}{\cancel{g}}\right)\frac{\cancel{g}}{1} \rightarrow \boxed{\frac{T^2 g}{4\pi^2} = l}$$

Examples:

biggest

i.) $\sqrt{x+21} - 1 = \sqrt{x+12}$ $+1$

$+1$

$$(\sqrt{x+21})^2 = (\sqrt{x+12} + 1)^2$$

$$x+21 = (\sqrt{x+12} + 1)(\sqrt{x+12} + 1)$$

$$x+21 = x+12 + \sqrt{x+12} + \sqrt{x+12} + 1$$

$$x+21 = \cancel{x} + 13 + 2\sqrt{x+12}$$

$$-x \; -13 \quad \cancel{-x} \; -13$$

$$\frac{8}{2} = \frac{2\sqrt{x+12}}{2}$$

$$4 = \sqrt{x+12}$$

$$(4)^2 = (\sqrt{x+12})^2$$

$$16 = x+12$$

$$-12 \quad -12$$

$$\boxed{4 = x}$$

Examples:

biggest

j.) $\sqrt{x-1} = \sqrt{x} - \sqrt{5}$

$+\sqrt{5} \qquad\qquad +\sqrt{5}$

$(\sqrt{x-1} + \sqrt{5})^2 = (\sqrt{x})^2$

$(\sqrt{x-1} + \sqrt{5})(\sqrt{x-1} + \sqrt{5}) = x$

$x - 1 + \sqrt{5(x-1)} + \sqrt{5(x-1)} + 5 = x$

$x + 4 + 2\sqrt{5x-5} = x$

$-x - 4 \qquad\qquad -x - 4$

$$\frac{2\sqrt{5x-5}}{2} = \frac{-4}{2}$$

$$\sqrt{5x-5} = -2$$

$$\boxed{\text{No Solution}}$$

By the end of the lesson, we will be able to:

~ Solve equations with radicals in them.

Can you?

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Homework:

Assignment 26

Happy Holidays!