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DEPARTMENT OF EDUCATION

Mathematics

Quarter 2 - Module 7:
Solving Equations Involving Radical Expressions

AIRs - LM

Mathematics 9
Quarter 2 - Module 7: Solving Equations Involving Radical Expressions
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Jumpstart

Activity 1: Simply Me!

Directions: Match the following radicals in column A with their exponential form in column B and the simplified form in column C.

Column A	Column B	Column C
1. $\sqrt{36x^2}$	A. $(9)^{\frac{1}{2}}\,(y^2)^{\frac{1}{2}} - (16)^{\frac{1}{4}}$	L. 3y−2
2. $\sqrt[3]{27y^3}$	B. $\frac{(4x^2)^{\frac{1}{2}}}{(16y^2)^{\frac{1}{2}}}$	M. y − 3
3. $\sqrt[4]{256}$	C. $\{(y-3)^4\}^{\frac{1}{4}}$	N. y − 9
4. $\sqrt{(x-1)^2}$	D. $\{(y-9)^3\}^{\frac{1}{3}}$	O. $\frac{x}{2y}$
5. $\sqrt[3]{m^3}$	E. $\{(x-2)^2\}^{\frac{1}{2}}$	P. x−1
6. $\sqrt{(x-2)^2}$	F. $(m^3)^{\frac{1}{3}}$	Q. 6x
7. $\sqrt[3]{(y-9)^3}$	G. $\{(x-1)^2\}^{\frac{1}{2}}$	R. 3y
8. $\sqrt[4]{(y-3)^4}$	H. $(256)^{\frac{1}{4}}$	S. m
9. $\sqrt{\frac{4x^2}{16y^2}}$	I. $(27)^{\frac{1}{3}}\,(y^3)^{\frac{1}{3}}$	T. x − 2
10. $\sqrt{9y^2}$ - $\sqrt[4]{16}$	J. $(36)^{\frac{1}{2}}\,(x^2)^{\frac{1}{2}}$	U. 4

Discover

A **radical equation** is an equation containing a variable in the radicand.

Examples of radical equations:

$$\sqrt{x} = 4$$

$$\sqrt{x+8} = 5$$

$$\sqrt{x-1} = x-7$$

In solving radical equations, note that if two numbers are equal then their squares are also equal. In symbols; if $\boldsymbol{a = b}$ then $\boldsymbol{a^2 = b^2}$.

Power Rule:

If both sides of an equation are raised to the same power, all solutions of the original equation are also solutions of the new equation.

For example, if $\sqrt{16} = 4$ are equal, then $(\sqrt{16})^2 = (4)^2$ are equal.

To simplify further: $(\sqrt{16})^2$ is expressed as $\left\{(16)^{\frac{1}{2}}\right\}^2$ by applying the law of radical. So that, if $\left\{(16)^{\frac{1}{2}}\right\}^2 = 16$ then $16 = 16$. The key to solving radical equations is to raise both sides of the equation to the same power.

Solving radical equations means finding the value/s of the variable that would make the radical equation true.

Steps in solving a radical equation:

1. Arrange the terms of the equation such that the term with radical is isolated on the left side of the equation.
2. Square/raise the nth power of both sides of the radical equation.
3. If a radical still remains,repeat steps 1 to 2
4. Combine like terms
5. Solve for the variable
6. Check apparent solution in the original equation.

Note that if the solution would **not** make the equation true, then the solution is an **extraneous solution.**

Example 1: Solve $\sqrt{x} = 4$

$\sqrt{x} = 4$	Arrange the terms of the equation such that the term with radical is isolated on the left side of the equation.
$\left(x^{\frac{1}{2}}\right)^2 = (4)^2$	Square both sides of the radical equation
	Combine like terms
$x = 16$ **The solution is 16.**	Solve for the variable
If $x = 16$ $\sqrt{x} = 4$ $\sqrt{16} \stackrel{?}{=} 4$ $16 \cong 16$	Check apparent solution in the original equation.

Example 2: Solve $\sqrt{x+8} = 5$

$\left\{(x+8)^{\frac{1}{2}}\right\}^2 = (5)^2$ square both sides

$(x+8) = 25$

$x = 25 - 8$ combine like terms

$x = 17$ solve for the variable

The solution is 17.

Check: $\sqrt{x+8} = 5$ substitute the value of x in the original

$\sqrt{17+8} = 5$ equation

$\sqrt{25} \stackrel{?}{=} 5$

$5 = 5$

Example 3: Solve $\sqrt{x-1} = x-7$

$$\left\{(x-1)^{\frac{1}{2}}\right\}^2 = (x-7)^2 \qquad \text{square both sides}$$

$$x-1 = x^2-14x+49$$

$$x^2-14x-x+49+1=0 \qquad \text{combine like terms}$$

$$x^2-15x+50=0 \qquad \text{solve for the variable by factoring}$$

$$(x-10)(x-5)=0$$

$$x=10 \;\; and \;\; x=5$$ **The solutions are 10 and 5.**

Check:

If x = 10 $\quad \sqrt{x-1} = x-7$ $\quad$ substitute the value of x in the

$\sqrt{10-1} = 10-7$ $\quad$ original equation

$\sqrt{9} \stackrel{?}{=} 3$

$3 = 3$ $\quad$ $x = 10$ ***is the only solution***

If x = 5 $\quad \sqrt{x-1} = x-7$ $\quad$ substitute the value of x in the

$\sqrt{5-1} = 5-7$ $\quad$ original equation

$\sqrt{4} \stackrel{?}{=} -2$

$2 \neq -2$ $\quad$ x = 5 ***is an extraneous solution***.

Explore

Activity 2: Find my Solutions!

Directions: Solve the following radical equations on a separate sheet of paper.

1. $\sqrt{y} = 10$
2. $\sqrt{2x} = 10$
3. $\sqrt{y-4} = 1$
4. $\sqrt{2x-1} = 5$
5. $\sqrt[4]{2m} = 4$
6. $\sqrt{6y} - 4 = 2$
7. $\sqrt{y+3} + 5 = 12$
8. $\sqrt{6y+5} = \sqrt{2y+10}$
9. $(3\sqrt{3})^2 = \sqrt{x}$
10. $2\sqrt[3]{y+5} = 4\sqrt[3]{2y+10}$

Deepen

Activity 3: Justify your Actions!

Directions: Solve the radical equations. Write your complete solution and indicate the property, definition, or theorem used in your solution.

Radical Equations	Solution	Reason
1. $5\sqrt{5x+2} = 10$		
2. $\sqrt[4]{n+2} = 3$		
3. $\sqrt[3]{3a+9} = \sqrt[3]{6a+15}$		
4. $\sqrt[4]{2m+10} = 4$		

Additional Activity

Directions: Solve the following radical equations and check. Determine whether the obtained value is really a solution or extraneous solution.

1. $x - 4 = \sqrt{2x}$
2. $\sqrt{y-2} = -3 + \sqrt{4y+1}$