Grade Level/Course: Algebra 2
Lesson/Unit Plan Name: Solving Radical Equations
Rationale/Lesson Abstract: **The primary objective of this lesson is for students to continue practicing their equation-solving skills, but incorporating radicals.** **Students will also recognize the importance of checking their solutions to find extraneous solutions, reinforcing what they have learned when solving rational equations.**
Timeframe: 55 minutes
Common Core Standard(s): A-REI.2--Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Instructional Resources/Materials: **Copies of handout (pgs. 6-7)** **Copies of exit tickets (p. 8)**

Activity/Lesson:

Do Now: (5 minutes)

I. Solve

$$(x-4)^2+2=6$$
$$(x-4)^2=4$$
$$\sqrt{(x-4)^2}=\sqrt{4}$$
$$x-4=\pm 2$$
$$x-4=2 \text{ or } x-4=-2$$
$$x=6 \text{ or } x=2$$

II. Is $x=25$ a solution to $\sqrt{x}=-5$? Explain.

$$\sqrt{x}=-5$$
$$\sqrt{25}=-5$$
$$5\neq -5$$

$x=25$ is not a solution because it does not make the sentence true.

III. $\left(\sqrt{8}\right)^2=$

Solution: 8

IV. $\left(\sqrt{x}\right)^2=$

Solution: x

We Do and You Try: (15 minutes)

Ask students to read (silently, chorally, volunteer) the title and the objective of the lesson.

Read We Do #1. Ask students to repeat chorally ("the square root of *x*"). Ask students to turn and tell their team/partner "What value makes this sentence true?" Students should recognize the solution is 25.

Demonstrate that squaring a number is the inverse operation of square rooting a number, undoing that operation. Show what is expected for the Check part of the problem. Use parentheses when substituting values, as it will be useful in later problems.

Do We Do #2. Turn and Talk: "Tell your partner/team what value makes the sentence true." Students may recognize that there is no solution. Show that the solution that was found does not make the original sentence true. This is called an "extraneous" solution or root.

Do We Do #3, following syntax provided. Students do You Try and check the solution.

Do We Do #4: Note that it becomes a quadratic. Set equation equal to zero and factor if possible. Check both solutions. Only one checks. The other solution is extraneous. Note that sometimes both solutions will check.

Students do You Try #2. Post solution ($x=3$) and the extraneous root ($x=0$) . Check for understanding: "Raise your hand if you got that right."

Teamwork: (20 minutes)

Students work in teams together to find solutions to the remaining problems.

Here are some good team norms that the teacher can reinforce through positive narration. Consider giving team or class "points" to reinforce team expectations.

--Same problem, same time.
--Help each other.
--Math discussions only.
--Team questions only.

Solutions found on pgs. 3-5

Independent Practice: (10 minutes)

Assign these problems with about 15 minutes left in the period. Students work quietly.

Assessment--Exit Ticket: (4 minutes)

Distribute exit tickets, remind students this is quiet time, and collect at the door as student are excused.

Assess your success by quickly checking exit tickets and modifying your next class' lesson accordingly. An error analysis problem for the next day's Do Now based on exit ticket results is another way to use the data you will collect.

Solutions to Handout and Exit Ticket

Solving Radical Equations Name:_____ Per: ____

Objective: SW solve radical equations and check for extraneous roots.

Note: You will need some scratch paper for some of your calculations.

We Do #1: Solve

$$\sqrt{x} = 5$$

$$\left(\sqrt{x}\right)^2 = (5)^2$$

$$x = 25$$

What value makes this sentence true?

Check it:

$$\sqrt{x} = 5$$

$$\sqrt{25} = 5$$

$$5 = 5$$

$\therefore x = 25$ is a solution.

We Do #2:

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

$$\left(\sqrt{x}\right)^2 = (-7)^2$$

$$x = 49$$

Check it:

$$\sqrt{49} = -7$$

$$7 = -7$$

False, so $x = 49$ is not a solution.

We Do #3: Solve

$$\sqrt{x+2} = 3$$

$$\left(\sqrt{x+2}\right)^2 = (3)^2$$

$$x + 2 = 9$$

$$x = 7$$

Check it:

$$\sqrt{(7)+2} = 3$$

$$\sqrt{9} = 3$$

$$3 = 3 \text{ True}$$

$\therefore x = 7$

You Try #1:

$$\sqrt{x-9} = 4$$

$$\left(\sqrt{x-9}\right)^2 = (4)^2$$

$$x - 9 = 16$$

$$x = 25$$

Check it:

$$\sqrt{(25)-9} = 4$$

$$\sqrt{16} = 4$$

$$4 = 4 \text{ True}$$

$\therefore x = 25$

We Do #4:

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

$$\left(\sqrt{x-1}\right)^2 = (x-7)^2$$

$$x - 1 = (x-7)(x-7)$$

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

$$0 = x^2 - 15x + 50$$

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

$$x = 10 \text{ and } x = 5$$

Check:

$$\sqrt{(10)-1} = (10) - 7 \qquad \sqrt{(5)-1} = (5) - 7$$

$$\sqrt{9} = 3 \qquad \sqrt{4} = -2$$

$$3 = 3 \text{ True} \qquad 2 = -2 \text{ False}$$

$\therefore x = 10$ is a solution.
There is an extraneous root at $x = 5$

You Try #2:

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

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

$$x + 1 = (x-1)(x-1)$$

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

$$0 = x^2 - 3x$$

$$0 = x(x-3)$$

$$x = 0 \text{ and } x = 3$$

Check:

$$\sqrt{(0)+1} = (0) - 1 \qquad \sqrt{(3)+1} = (3) - 1$$

$$\sqrt{1} = -1 \qquad \sqrt{4} = 2$$

$$1 = -1 \text{ False} \qquad 2 = 2 \text{ True}$$

$\therefore x = 3$ is a solution.
There is an extraneous root at $x = 0$

Teamwork:

1.

$$\sqrt{n+9}=2$$
$$\left(\sqrt{n+9}\right)^2=(2)^2$$
$$n+9=4$$
$$n=-5$$

Check:

$$\sqrt{(-5)+9}=2$$
$$\sqrt{4}=2$$
$$2=2 \text{ True}$$

$\therefore n=-5$ is a solution.

2.

$$3=\sqrt{4m}$$
$$(3)^2=\left(\sqrt{4m}\right)^2$$
$$9=4m$$
$$\frac{9}{4}=\frac{4m}{4}$$
$$\frac{9}{4}=m$$

Check:

$$3=\sqrt{4\left(\frac{9}{4}\right)}$$
$$3=\sqrt{\frac{36}{4}}$$
$$3=\sqrt{9}$$
$$3=3 \text{ True}$$

$\therefore m=\frac{9}{4}$ is a solution.

3.

$$\sqrt{12-r}=r$$
$$\left(\sqrt{12-r}\right)^2=(r)^2$$
$$12-r=r^2$$
$$0=r^2+r-12$$
$$0=(x+4)(x-3)$$
$$x=-4 \text{ and } x=3$$

Check:

$$\sqrt{12-(-4)}=(-4)$$
$$\sqrt{16}=-4$$
$$4=-4 \text{ False}$$

$$\sqrt{12-(3)}=(3)$$
$$\sqrt{9}=3$$
$$3=3 \text{ True}$$

$\therefore x=3$ is a solution.
There is an extraneous root at $x=-4$

4.

$$w=\sqrt{-4+4w}$$
$$(w)^2=\left(\sqrt{-4+4w}\right)^2$$
$$w^2=-4+4w$$
$$w^2-4w+4=0$$
$$(w-2)(w-2)=0$$
$$x=2$$

Check:

$$(2)=\sqrt{-4+4(2)}$$
$$2=\sqrt{-4+8}$$
$$2=\sqrt{4}$$
$$2=2 \text{ True}$$

$\therefore x=2$ is a solution.

5. Hint: Subtract 5 from both sides to isolate the radical.

$$\sqrt{x-4}+5=12$$
$$\sqrt{x-4}=7$$
$$\left(\sqrt{x-4}\right)^2=(7)^2$$
$$x-4=49$$
$$x=53$$

Check:

$$\sqrt{(53)-4}+5=12$$
$$\sqrt{49}+5=12$$
$$7+5=12$$
$$12=12 \text{ True}$$

$\therefore x=53$ is a solution.

6. Hint: Cube each side (raise to the third power) to undo the cube root.

$$\sqrt[3]{x-3}=2$$
$$\left(\sqrt[3]{x-3}\right)^3=(2)^3$$
$$x-3=8$$
$$x=11$$

Check:

$$\sqrt[3]{(11)-3}=2$$
$$\sqrt[3]{8}=2$$
$$2=2 \text{ True}$$

$\therefore x=11$ is a solution.

Independent Practice #1

$$\sqrt{4n+8} = n+3$$
$$\left(\sqrt{4n+8}\right)^2 = (n+3)^2$$
$$4n+8 = (n+3)(n+3)$$
$$4n+8 = n^2+6n+9$$
$$0 = n^2+2n+1$$
$$0 = (n+1)(n+1)$$
$$n = -1$$

Check:

$$\sqrt{4(-1)+8} = (-1)+3$$
$$\sqrt{-4+8} = 2$$
$$\sqrt{4} = 2$$
$$2 = 2 \text{ True}$$

$\therefore n = -1$ is a solution.

#2

$$\sqrt{x+2} - 3 = 6$$
$$\sqrt{x+2} = 9$$
$$\left(\sqrt{x+2}\right)^2 = (9)^2$$
$$x+2 = 81$$
$$x = 79$$

Check:

$$\sqrt{(79)+2} - 3 = 6$$
$$\sqrt{81} - 3 = 6$$
$$9 - 3 = 6$$
$$6 = 6 \text{ True}$$

$\therefore x = 79$ is a solution.

Exit Ticket Name:_____

Solve:

$$\sqrt{30-x} = x$$
$$\left(\sqrt{30-x}\right)^2 = (x)^2$$
$$30-x = x^2$$
$$0 = x^2+x-30$$
$$0 = (x+6)(x-5)$$
$$x = -6 \text{ and } x = 5$$

Check:

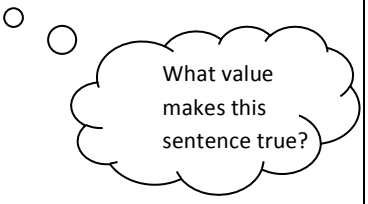
$$\sqrt{30-(-6)} = (-6) \qquad \sqrt{30-(5)} = (5)$$
$$\sqrt{36} = -6 \qquad \sqrt{25} = 5$$
$$6 = -6 \text{ False} \qquad 5 = 5 \text{ True}$$

$\therefore x = 3$ is a solution.
There is an extraneous root at $x = -4$

MA#_____: Solving Radical Equations Name:_____ Per: ____

Objective: SW solve radical equations and check for extraneous roots.
Note: You will need some scratch paper for some of your calculations.

We Do #1: Solve $\sqrt{x}=5$



Check it:

We Do #2: Solve $\sqrt{x}=-7$

Check it:

We Do #3: Solve $\sqrt{x+2}=3$

Check it:

You Try #1: Solve $\sqrt{x-9}=4$

Check it:

We Do #4: Solve $\sqrt{x-1}=x-7$

Check:

You Try #2: Solve $\sqrt{x+1}=x-1$

Check:

Teamwork:

1. $\sqrt{n+9}=2$

Check:

{-5}

2. $3=\sqrt{4m}$

Check:

$\left\{\frac{9}{4}\right\}$

3. $\sqrt{12-r}=r$

Check:

{3}

4. $w=\sqrt{-4+4w}$

Check:

{2}

5. $\sqrt{x-4}+5=12$ Hint: Subtract 5 from both sides to isolate the radical.

Check:

{53}

6. $\sqrt[3]{x-3}=2$ Hint: Cube each side (raise to the third power) to undo the cube root.

Check:

{11}

Independent Practice #1

$\sqrt{4n+8}=n+3$

Check:

{-1}

#2

$\sqrt{x+2}-3=6$

Check:

{7}

Exit Ticket Name:_____

Solve: $\sqrt{30-x}=x$ Check:

Exit Ticket Name:_____

Solve: $\sqrt{30-x}=x$ Check:

Exit Ticket Name:_____

Solve: $\sqrt{30-x}=x$ Check:

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Solve: $\sqrt{30-x}=x$ Check: