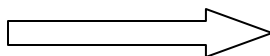


# DOING BATTLE WITH RADICAL EQUATIONS EXAMPLES



- Inverse Operations** – Operations that undo each other, such as multiplication and division.
- Warm-up Activity** → Ask students to rewrite each of the following using “inverse” operations.

a) $x + 4 = 10$
b) $x - 5 = 6$
c) $2x = 12$
d) $\frac{x}{3} = 6$
e) $2x + 4 = 10$
f) $\frac{x}{3} - 5 = 1$



a) $x + 4 - 4 = 10 - 4 \rightarrow x = 10 - 4$
b) $x - 5 + 5 = 6 + 5 \rightarrow x = 6 + 5$
c) $2x \div 2 = 12 \div 2 \rightarrow x = 12 \div 2$
d) $\frac{x}{3}(3) = 6(3) \rightarrow x = 6(3)$
e) $2x + 4 - 4 = 10 - 4$ $(2x + 4 - 4) \div 2 = (10 - 4) \div 2$ $x = (10 - 4) \div 2$
f) $\frac{x}{3} - 5 + 5 = 1 + 5$ $(\frac{x}{3} - 5 + 5)(3) = (1 + 5)(3)$ $x = (1 + 5)(3)$



- Ask students what operation represents the inverse (**opposite**) of taking “**square root**.” (Make sure that students understand that “**squaring**” and “**square roots**” are “**inverse**” operations.)
- Equations containing “**radicals**” with variables in the “**radicand**” are called “**radical**” equations. To solve such equations, first isolate the “**radical**” on one side of the equation. Then “**square**” each side of the equation to eliminate the “**radical**.”
- Have students solve each equation below by “**squaring**” each side of the equation. (Make sure that students understand that we are using an “**inverse**” operation.)

a) $\sqrt{x} = 4$ $(\sqrt{x})^2 = (4)^2$ $x = 16$
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b) $\sqrt{m} = 3$ $(\sqrt{m})^2 = (3)^2$ $m = 9$
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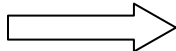
c) $\sqrt{x} = 16$ $(\sqrt{x})^2 = (16)^2$ $x = 256$
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c) $\sqrt{x} = \frac{1}{4}$ $(\sqrt{x})^2 = (\frac{1}{4})^2$ $x = \frac{1}{16}$
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6. **Emphasize** the importance of checking solution!

$$\begin{aligned}\sqrt{x} &= -4 \\ (\sqrt{x})^2 &= (-4)^2 \\ x &= 16\end{aligned}$$

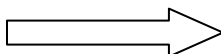


$$\begin{aligned}\sqrt{x} &= -4 \\ \sqrt{16} &= -4 \\ 4 &\neq -4\end{aligned}$$

**Does not  
check.**

7. **Example:** Solve  $\rightarrow \sqrt{x} = 11$  and **check** to see if answer is reasonable!

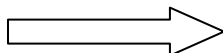
$$\begin{aligned}\sqrt{x} &= 11 \\ (\sqrt{x})^2 &= (11)^2 \\ x &= 121\end{aligned}$$



$$\begin{aligned}\text{Check: } \sqrt{x} &= 11 \\ \sqrt{121} &= 11 \\ 11 &= 11\end{aligned}$$

8. **Example:** Solve  $\rightarrow \sqrt{2x} = -8$  and **check** to see if answer is reasonable!

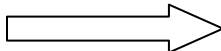
$$\begin{aligned}\sqrt{2x} &= -8 \\ (\sqrt{2x})^2 &= (-8)^2 \\ 2x &= 64 \\ x &= 32\end{aligned}$$



$$\begin{aligned}\text{Check: } \sqrt{2x} &= -8 \\ \sqrt{2(32)} &= -8 \\ \sqrt{64} &= -8 \\ 8 &\neq -8\end{aligned}$$

9. **Example:** Solve  $\rightarrow \sqrt{a+4} = 2$  and **check** to see if answer is reasonable!

$$\begin{aligned}\sqrt{a+4} &= 2 \\ (\sqrt{a+4})^2 &= (2)^2 \\ a+4 &= 4 \\ x &= 0\end{aligned}$$



$$\begin{aligned}\text{Check: } \sqrt{a+4} &= 2 \\ \sqrt{0+4} &= 2 \\ \sqrt{4} &= 2 \\ 2 &= 2\end{aligned}$$



10. **Example:** Solve  $\rightarrow \sqrt{\frac{2x}{3}} = -5$  and **check** to see if answer is reasonable!

$\sqrt{\frac{2x}{3}} = -5$ $\left(\sqrt{\frac{2x}{3}}\right)^2 = (-5)^2$ $\frac{2x}{3} = 25$ $2x = 75$ $x = 37.5$	$\rightarrow$	<p><b>Check:</b> <math>\sqrt{\frac{2x}{3}} = -5</math></p> $\sqrt{\frac{2(37.5)}{3}} = -5$ $\sqrt{25} = -5$ $5 \neq -5$
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11. **Example:** Solve  $\rightarrow \sqrt{3x-5} - 4 = 0$  and **check** to see if answer is reasonable!

$\sqrt{3x-5} - 4 = 0$ $\sqrt{3x-5} = 4$ $(\sqrt{3x-5})^2 = (4)^2$ $3x - 5 = 16$ $3x = 21$ $x = 7$	$\rightarrow$	<p><b>Check:</b> <math>\sqrt{3x-5} - 4 = 0</math></p> $\sqrt{3(7)-5} - 4 = 0$ $\sqrt{16} - 4 = 0$ $4 - 4 = 0$ $0 = 0$
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12. Why must you check solutions?



Consider this equation.  
 $x = 2$   
 Now square each side.  
 $x^2 = 4$

The solutions for this equation are 2 and -2.  
 We know that  $x = 2$ , therefore, one of the solutions is not correct. We must check the answer to see if both are reasonable!



13. Stress that “**squaring**” each side of an equation often produces results that do not check. Thus, it is important to check “**all**” possible solutions. A result that does not check is called an “**extraneous**” value.

14. Emphasize the importance of “**isolating**” the “**radical**” by showing an example of what happens if you do not.

$$\begin{aligned}\sqrt{x} + 3 &= 0 \\ (\sqrt{x} + 3)^2 &= (0)^2 \\ x + 6\sqrt{x} + 9 &= 0\end{aligned}$$

**The radical still remains!**

15. **Extension**→ The time “*t*” in seconds that it takes an object, initially at rest, to fall a vertical distance of “*s<sub>v</sub>*” meters is given by the formula (“*g*” is the acceleration due to gravity.) Find “*s<sub>v</sub>*,” when *t* = 4 and the acceleration due to gravity is 9.8

$\frac{m}{s^2}$ . (answer = 78.4 meters).



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

## DOING BATTLE WITH RADICAL EQUATIONS WORKSHEET

Solve by using “inverse” operations. Check!

1.  $\sqrt{x} = 3$

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

3.  $\sqrt{x} = 25$

4.  $\sqrt{3x} = 3$

5.  $\sqrt{3x} = -9$

6.  $\sqrt{x} - 5 = 0$

7.  $\sqrt{2x} + 1 = 0$

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

9.  $\sqrt{4x+1} = 3$

10.  $\sqrt{8x+1} - 5 = 0$

11.  $\sqrt{\frac{x}{4}} = 6$

12.  $\sqrt{\frac{4x}{3}} - 2 = 0$

13.  $5\sqrt{2x^2 - 28} = 20$



## DOING BATTLE WITH RADICAL EQUATIONS WORKSHEET KEY

Solve by using “inverse” operations. Check!

1.  $\sqrt{x} = 3$

$$\begin{aligned}(\sqrt{x})^2 &= (3)^2 \\ x &= 9\end{aligned}$$

$$\begin{aligned}\text{Check} \rightarrow \sqrt{x} &= 3 \\ \sqrt{9} &= 3 \\ 3 &= 3\end{aligned}$$

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

$$\begin{aligned}(\sqrt{x})^2 &= (-2)^2 \\ x &= 4\end{aligned}$$

$$\begin{aligned}\text{Check} \rightarrow \sqrt{x} &= -2 \\ \sqrt{4} &= -2 \\ 2 &\neq -2\end{aligned}$$

3.  $\sqrt{x} = 25$

$$\begin{aligned}(\sqrt{x})^2 &= (25)^2 \\ x &= 625\end{aligned}$$

$$\begin{aligned}\text{Check} \rightarrow \sqrt{x} &= 25 \\ \sqrt{625} &= 25 \\ 25 &= 25\end{aligned}$$

4.  $\sqrt{3x} = 3$

$$\begin{aligned}(\sqrt{3x})^2 &= (3)^2 \\ 3x &= 9 \\ x &= 3\end{aligned}$$

$$\begin{aligned}\text{Check} \rightarrow \sqrt{3x} &= 3 \\ \sqrt{3(3)} &= 3 \\ 3 &= 3\end{aligned}$$

5.  $\sqrt{3x} = -9$

$$\begin{aligned}(\sqrt{3x})^2 &= (-9)^2 \\ 3x &= 81 \\ x &= 27\end{aligned}$$

$$\begin{aligned}\text{Check} \rightarrow \sqrt{3x} &= -9 \\ \sqrt{3(27)} &= -9 \\ 9 &\neq -9\end{aligned}$$

6.  $\sqrt{x} - 5 = 0$

$$\begin{aligned}(\sqrt{x})^2 &= (5)^2 \\ x &= 25\end{aligned}$$

$$\begin{aligned}\text{Check} \rightarrow \sqrt{x} - 5 &= 0 \\ \sqrt{25} - 5 &= 0 \\ 0 &= 0\end{aligned}$$

7.  $\sqrt{2x} + 1 = 0$

$$\begin{aligned}\sqrt{2x} &= -1 \\ (\sqrt{2x})^2 &= (-1)^2 \\ 2x &= 1 \\ x &= .5\end{aligned}$$

**Check** →  $\sqrt{2(.5)} = -1$   
 $1 \neq -1$

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

$$\begin{aligned}5 + \sqrt{2x} &= 8 \\ \sqrt{2x} &= 3 \\ (\sqrt{2x})^2 &= (3)^2 \\ 2x &= 9 \\ x &= 4.5\end{aligned}$$

**Check** →  $5 + \sqrt{2(4.5)} = 8$   
 $5 + 3 = 8$   
 $8 = 8$

9.  $\sqrt{4x+1} = 3$

$$\begin{aligned}(\sqrt{4x+1})^2 &= (3)^2 \\ 4x + 1 &= 9 \\ 4x &= 8 \\ x &= 2\end{aligned}$$

**Check** →  $\sqrt{4(2)+1} = 3$   
 $\sqrt{9} = 3$   
 $3 = 3$

10.  $\sqrt{8x+1} - 5 = 0$

$$\begin{aligned}\sqrt{8x+1} &= 5 \\ (\sqrt{8x+1})^2 &= (5)^2 \\ 8x + 1 &= 25 \\ 8x &= 24 \\ x &= 3\end{aligned}$$

**Check** →  $\sqrt{8(3)+1} = 5$   
 $\sqrt{25} = 5$   
 $5 = 5$

$$11. \sqrt{\frac{x}{4}} = 6$$

$$\begin{aligned} \left(\sqrt{\frac{x}{4}}\right)^2 &= (6)^2 \\ \frac{x}{4} &= 36 \\ x &= 144 \end{aligned}$$

$$\begin{aligned} \text{Check} \rightarrow \sqrt{\frac{144}{4}} &= 6 \\ \sqrt{36} &= 6 \\ \mathbf{6} &= \mathbf{6} \end{aligned}$$

$$12. \sqrt{\frac{4x}{3}} - 2 = 0$$

$$\begin{aligned} \sqrt{\frac{4x}{3}} &= 2 \\ \left(\sqrt{\frac{4x}{3}}\right)^2 &= (2)^2 \\ \frac{4x}{3} &= 4 \\ 4x &= 12 \\ x &= 3 \end{aligned}$$

$$\begin{aligned} \text{Check} \rightarrow \sqrt{\frac{4(3)}{3}} - 2 &= 0 \\ \sqrt{4} - 2 &= 0 \\ 2 - 2 &= 0 \\ \mathbf{0} &= \mathbf{0} \end{aligned}$$

$$13. 5\sqrt{2x^2 - 28} = 20$$

$$\begin{aligned} \sqrt{2x^2 - 28} &= 4 \\ (\sqrt{2x^2 - 28})^2 &= 4^2 \\ 2x^2 - 28 &= 16 \\ 2x^2 &= 44 \\ x^2 &= 22 \\ x &= \sqrt{22} \text{ or } -\sqrt{22} \end{aligned}$$

$$\begin{aligned} \text{Check} \rightarrow 5\sqrt{2(\sqrt{22})^2 - 28} &= 20 \\ 5\sqrt{44 - 28} &= 20 \\ \sqrt{16} &= 4 \\ \mathbf{4} &= \mathbf{4} \end{aligned}$$

$$\begin{aligned} \text{Check} \rightarrow 5\sqrt{2(\sqrt{-22})^2 - 28} &= 20 \\ 5\sqrt{44 - 28} &= 20 \\ \sqrt{16} &= 4 \\ \mathbf{4} &= \mathbf{4} \end{aligned}$$

Student Name: \_\_\_\_\_

Date: \_\_\_\_\_

## **DOING BATTLE WITH RADICAL EQUATIONS CHECKLIST**

1. On question 1, did the student solve and check the equation correctly by using “inverse” operations?
  - a. Yes (25 points)
  - b. Solved equation by using “inverse” operations but did not check solution (20 points)
  - c. Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - d. Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - e. Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).
  
2. On question 2, did the student solve and check the equation correctly by using “inverse” operations?
  - a. Yes (25 points)
  - b. Solved equation by using “inverse” operations but did not check solution (20 points)
  - c. Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - d. Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - e. Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).
  
3. On question 3, did the student solve and check the equation correctly by using “inverse” operations?
  - a. Yes (25 points)
  - b. Solved equation by using “inverse” operations but did not check solution (20 points)
  - c. Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - d. Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - e. Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).

4. On question 4, did the student solve and check the equation correctly by using “inverse” operations?
  - a. Yes (25 points)
  - b. Solved equation by using “inverse” operations but did not check solution (20 points)
  - c. Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - d. Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - e. Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).
  
5. On question 5, did the student solve and check the equation correctly by using “inverse” operations?
  - a. Yes (25 points)
  - b. Solved equation by using “inverse” operations but did not check solution (20 points)
  - c. Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - d. Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - e. Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).
  
6. On question 6, did the student solve and check the equation correctly by using “inverse” operations?
  - a. Yes (25 points)
  - b. Solved equation by using “inverse” operations but did not check solution (20 points)
  - c. Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - d. Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - e. Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).

7. On question 7, did the student solve and check the equation correctly by using “inverse” operations?
- Yes (25 points)
  - Solved equation by using “inverse” operations but did not check solution (20 points)
  - Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).
8. On question 8, did the student solve and check the equation correctly by using “inverse” operations?
- Yes (25 points)
  - Solved equation by using “inverse” operations but did not check solution (20 points)
  - Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).
9. On question 9, did the student solve and check the equation correctly by using “inverse” operations?
- Yes (25 points)
  - Solved equation by using “inverse” operations but did not check solution (20 points)
  - Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).

10. On question 10, did the student solve and check the equation correctly by using “inverse” operations?
- Yes (25 points)
  - Solved equation by using “inverse” operations but did not check solution (20 points)
  - Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).
11. On question 11, did the student solve and check the equation correctly by using “inverse” operations?
- Yes (25 points)
  - Solved equation by using “inverse” operations but did not check solution (20 points)
  - Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).
12. On question 12, did the student solve and check the equation correctly by using “inverse” operations?
- Yes (25 points)
  - Solved equation by using “inverse” operations but did not check solution (20 points)
  - Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
  - Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
  - Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).

13. On question 13, did the student solve and check the equation correctly by using “inverse” operations?

- a. Yes (25 points)
- b. Solved equation by using “inverse” operations but did not check solution (20 points)
- c. Solved equation correctly but not by “inverse” operations. Student did check solution (15 points)
- d. Student did not solve equation correctly but did use “inverse” operations and did check solution (10 points)
- e. Student did not solve equation correctly, did not use “inverse” operations, and did not check solution (5 points).