5 Radical Equations with 12 Radical Terms

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PRE-CALCULUS 11 Unit 4 – Day 5: RADICAL EQUATIONS (Part 2)

RADICAL EQUATIONS WITH TWO RADICAL TERMS

$x-1 \geq 0$ $5-x \geq 0$ $x \leq 5$

$\sqrt{x-1} - \sqrt{5-x} = 0$ is an example of a radical equation with *two* radical terms.

With two radical terms, there are *two restrictions* to consider: $x-1 \geq 0$ and $5-x \geq 0$ which work out to $x \geq 1$ and $x \leq 5$, $\therefore 1 \leq x \leq 5$.

Radical equations will be easier to solve without the radicals: 1) isolate a radical and 2) square both sides of the equation.

example: Solve $\sqrt{x-1} - \sqrt{5-x} = 0$ $\quad \sqrt{x-1} - \sqrt{5-x} = 0$

- State **restrictions** on x $\quad \therefore 1 \leq x \leq 5$
- Isolate the first square root.
- Square both sides of the equation. $\quad \left(\sqrt{x-1}\right)^2 = \left(\sqrt{5-x}\right)^2$
- Simplify. $\quad x-1 = 5-x$ $\quad +x \quad +1 \quad +x \quad +1$
- Solve for x. $\quad 2x = 6 \quad x = 3$
- **Remember to check the roots**!

(Check against restrictions & by plugging in.) $\quad 1 \leq x \leq 5$ $\quad x = 3$ ✓

$\sqrt{3-1} - \sqrt{5-3} = 0$

$\sqrt{2} - \sqrt{2} = 0$

$0 = 0$ ✓

$\therefore \boxed{x = 3}$

exercise: Solve $\sqrt{x+6} - \sqrt{3-2x} = 0$

Restrictions: $x+6 \geq 0$ $\quad x \geq -6$ $\quad 3-2x \geq 0$ $\quad -2x \geq -3$ $\quad -2 \quad -2$ $\quad x \leq \frac{3}{2}$

Isolate 1st "$\sqrt{\ }$"

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

$x+6 = 3-2x$ $\quad +2x \quad -6 \quad -6 \quad +2x$

$3x = -3$

$x = -1$

Check against restrictions: $x \geq -6$ & $x \leq \frac{3}{2}$ TRUE for $x = -1$ ✓

Check by plugging in: $\sqrt{-1+6} - \sqrt{3-2(-1)} = 0$

$\sqrt{5} - \sqrt{5} = 0$

$0 = 0$ ✓ $\quad \therefore$ accept $\boxed{x = -1}$

Isolating one of the radicals and squaring both sides of the equation may *not* eliminate *both* radical symbols. If that happens *work on one radical at a time*.

example: Solve $\sqrt{4x+5} - \sqrt{2x-1} = 2$

$\sqrt{4x+5} - \sqrt{2x-1} = 2$

$(\sqrt{4x+5})^2 = (2+\sqrt{2x-1})^2$

$4x+5 = (2+\sqrt{2x-1})(2+\sqrt{2x-1})$

$4x+5 = 4 + 2\sqrt{2x-1} + 2\sqrt{2x-1} + (2x-1)$

$4x+5 = 3 + 4\sqrt{2x-1} + 2x$

$-2x \quad -3 \quad -3 \quad -2x$

$\frac{2x+2}{2} = \frac{4\sqrt{2x-1}}{4}$

$= \sqrt{2x-1}$

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

$4(2x-1) = \frac{(x^2+2x+1)}{4}4$

$8x-4 = x^2+2x+1$

$-8x+4 \quad -8x+4$

$0 = x^2 - 6x + 5$

$(x^2 - x - 5x + 5) = 0$

$x(x-1) - 5(x-1) = 0$

$(x-5)(x-1) = 0$

$\therefore x-5=0$ OR $x-1=0$

$x = 5$ OR $x = 1$

$(a+b)^2 = a^2 + 2ab + b^2$

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

Divide both sides by 4.

$(a+b)^2 = a^2+2ab+b^2$

- State **restrictions** on x

$4x+5 \geq 0$ $\quad 2x-1 \geq 0$

$4x \geq -5$ $\quad 2x \geq 1$

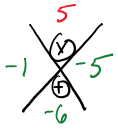
$x \geq \frac{-5}{4}$ $\quad x \geq \frac{1}{2}$

- Isolate the *first* square root.
- Square both sides.
- Simplify.

- Isolate the second square root.

- Simplify
- Square both sides.

- Simplify



- Solve for x.

- **Remember to check the roots**!

(Check against restrictions & by plugging in.)

Both rnts satisfy $x \geq -\frac{5}{4}$ & $x \geq \frac{1}{2}$ ✓

Plug in $x=1$:

$\sqrt{4\cdot1+5} - \sqrt{2\cdot1-1} = 2$

$\sqrt{9} - \sqrt{1} = 2$

$3 - 1 = 2$

$2 = 2$ ✓ $x=1$

Plug in $x=5$:

$\sqrt{4\cdot5+5} - \sqrt{2\cdot5-1} = 2$

$\sqrt{25} - \sqrt{9} = 2$

$5 - 3 = 2$

$2 = 2$ ✓

$\therefore x = 5$

HW: p. 301 #9, 10, 13-18

Solve:

a) $\sqrt{x+1} - \sqrt{x+7} = 0$

b) $\sqrt{x-5} + \sqrt{x+4} = 9$

c) $\sqrt{x-5} + 3 = \sqrt{2x+7}$