L4 - Radicals

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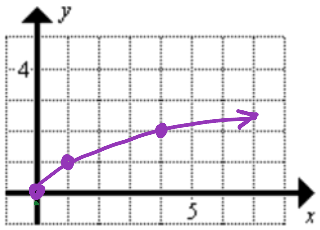
Equations & Inequalities
Lesson 4: Radical Functions, Equations & Inequalities

Radical Functions

Let's examine the function $y = \sqrt{x}$



x	y
0	0
1	1
4	2
9	3

Some general characteristics of the base radical function:

Domain: $x \geq 0$ (or $x \in [0, \infty[$) Range: $y \geq 0$

Start point: $(0,0)$ Endpoint: none (∞)

Shape: half sideways parabola

Radical Equations

"radicand" ≥ 0

Ex.1: **a)** State the ***restrictions*** on x in $5 + \sqrt{2x+1} = 12$ if the radical is a real number.

$2x+1 \geq 0$

$x \geq -\frac{1}{2}$

b) Solve $5 + \sqrt{2x+1} = 12$

$(\sqrt{2x+1})^2 = (7)^2$

$2x+1 = 49$

$2x = 48$

$x = 24$

*check: $5 + \sqrt{2(24)+1} = 12$

$5 + \sqrt{49} = 12$ ✓

Ex. 2: Identify the restrictions on n in $n - \sqrt{5-n} = -7$. Then, solve the equation.

$5 - n \geq 0$

$5 \geq n$

$n - \sqrt{5-n} = -7$

$-\sqrt{5-n} = -7 - n$

$(\sqrt{5-n})^2 = (7+n)^2$ → if $\pm\sqrt{5-n}$

FOIL!

$5 - n = (7+n)(7+n)$

$5 - n = 49 + 14n + n^2$

$0 = n^2 + 15n + 44$

$0 = (n+11)(n+4)$

$n = -11, -4$

extraneous root!

Check:

$-11 - \sqrt{5-(-11)} = -7$

$-11 - 4 = -7$ X

$-4 - \sqrt{5-(-4)} = -7$

$-4 - 3 = -7$ ✓

To solve radical equations:

1. State any **restrictions** on the variables. (Not necessary as long as you CHECK your solution(s)).
2. Isolate the radical. Square both sides.
3. Solve the remaining equation. Repeat step 2 if needed.
* 4. Check your solution(s). Reject any **extraneous roots**.

Extraneous roots are solutions that do not satisfy any initial conditions.

Ex. 3: Solve $7+\sqrt{3x}=\sqrt{5x+4}+5$

Restrictions: $3x\geq 0 \rightarrow x\geq 0$
$5x+4\geq 0 \rightarrow x\geq -4/5$
$\}\ x\geq 0$

Solve: $(2+\sqrt{3x})^2=(\sqrt{5x+4})^2$ (FOIL!)

$(2+\sqrt{3x})(2+\sqrt{3x})=5x+4$

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

$4+4\sqrt{3x}+3x=5x+4$

$(4\sqrt{3x})^2=(2x)^2$

$16(3x)=4x^2$

$48x=4x^2$

$0=4x^2-48x$

$0=4x(x-12)$

$x=0, 12$ ✓ ✓

Radical Inequalities

To solve radical inequalities:

1. State any restrictions on the domain (only for even degree).
2. Solve the inequality algebraically.
3. Test regions in between domain value(s) and algebraic solution(s).

Ex. 4: Solve $3+\sqrt{5x-10}\leq 8$

Restrictions: $5x-10\geq 0$
$x\geq 2$

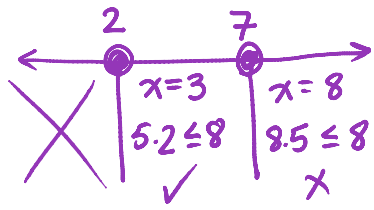
Solve: $3+\sqrt{5x-10}=8$

$(\sqrt{5x-10})^2=(5)^2$

$5x-10=25$

$5x=35 \rightarrow x=7$

Test:



$2\leq x\leq 7$

PRACTICE: Radical Functions, Equations and Inequalities Worksheet