

Name: _____

Date: _____

Notes: Solving and Graphing Radical Equations

Do Now: **ALGEBRAICALLY** solve each equation.

$$\sqrt{x} = 3$$

$$x = 9$$

Why did you choose to do the first step you did to solve this equation?

Because I have to get the x alone and the inverse operation of square rooting is squaring.

$$\begin{aligned} \sqrt{x+7} &= 3 \\ x+7 &= 9 \\ -7 &-7 \end{aligned}$$

$$x = 2$$

Why did you choose to do the first step you did to solve this equation?

Because I have to get the x alone and the inverse operation of square rooting is squaring.

What Should I Be Able to Do?

- I can solve equations with a radical on one side of the equation.
- I can solve equations with a radical on both sides of the equation.
- I can solve equations with two radicals on one side of the equation.
- I can graph radical equations.
- I can explain why the graph of a radical equation ends where it does.

Solve the following equations.

$$1) \sqrt{2x+7} - 5 = 6$$

$$\sqrt{2x+7} = 11$$

$$2x+7 = 121$$

$$\frac{2x}{2} = \frac{114}{2}$$

$$x = 57$$

Check:

$$\sqrt{2(57)+7} - 5 = 6$$

$$\sqrt{121} - 5 = 6$$

$$11 - 5 = 6$$

$$6 = 6 \checkmark$$

$$2) \sqrt{4x-6} + 12 = 8$$

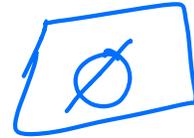
$$\sqrt{4x-6} = -4$$

$$4x-6 = 16$$

$$\frac{4x}{4} = \frac{22}{4}$$

$$x = 5.5$$

Extraneous Solution



Check:

$$\sqrt{4(5.5)-6} + 12 \neq 8$$

$$\sqrt{22-6} + 12 \neq 8$$

$$16 \neq 8 \quad \times$$

Vocab Corner

Extraneous Solution: A solution that is found when solving an equation but is not a valid solution to the equation.

Do Now Part II: Solve the following equation.

$$\sqrt{8x-1} = \sqrt{3x+4}$$

$$8x-1 = 3x+4$$

$$\frac{5x}{5} = \frac{5}{5}$$

$$x = 1$$

Check:

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

$$\sqrt{7} = \sqrt{7} \checkmark$$

Why did you choose to do the first step you did to solve this equation?

I chose to square both sides of the equation because the entirety of both sides of the equation are under a square root.

Do Now Part III: Solve the following equation.

WHAT NOT TO DO!

$$\sqrt{3x+5} - \sqrt{7x-3} = 0$$

$$(\sqrt{3x+5} - \sqrt{7x-3})^2 = 0^2$$

$$(\sqrt{3x+5} - \sqrt{7x-3})(\sqrt{3x+5} - \sqrt{7x-3}) = 0$$

$$3x+5 - \sqrt{(7x-3)(3x+5)} - \sqrt{(7x-3)(3x+5)} + 7x-3 = 0$$

$$3x+5 - \sqrt{21x^2 - 44x + 15} - \sqrt{21x^2 - 44x + 15} + 7x - 3 = 0$$

$$10x - 8 - 2\sqrt{21x^2 - 44x + 15} = 0$$

... and it keeps going...
and going... and going...

$$+\sqrt{7x-3} \quad +\sqrt{7x-3}$$

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

$$3x+5 = 7x-3$$

$$-3x+3 \quad -3x+3$$

$$\frac{8}{4} = \frac{4x}{4}$$

$$\boxed{2=x}$$

Check:

$$\sqrt{3(2)+5} - \sqrt{7(2)-3} = 0$$

$$\sqrt{11} - \sqrt{11} = 0 \quad 0=0 \checkmark$$

Why did you choose to do the first step you did to solve this equation?

I added $\sqrt{7x-3}$ to both sides of the equation in order to get the square roots alone on either side of the equation.

Checkpoint:

Solve each of the following equations.

1) $-4\sqrt{2x+10} - 2 = -10$
+2 +2

$$\frac{-4\sqrt{2x+10}}{-4} = \frac{-8}{-4}$$

$$\sqrt{2x+10} = 2$$

$$\frac{2x+10}{-10} = \frac{4}{-10}$$

$$\frac{2x}{2} = \frac{-6}{2}$$

$$\boxed{x = -3}$$

Check:

$$\begin{aligned} -4\sqrt{2(-3)+10} - 2 &= -10 \\ -4(2) - 2 &= -10 \\ -10 &= -10 \checkmark \end{aligned}$$

2) $\sqrt{2x+8} + \sqrt{6x+16} = 0$

$$(\sqrt{2x+8})^2 = (-\sqrt{6x+16})^2$$

$$\frac{2x+8}{-2x-16} = \frac{6x+16}{-2x-16}$$

$$\frac{-8}{4} = \frac{4x}{4}$$

$$-2 = x$$

$$\boxed{\emptyset}$$

Check:

$$\begin{aligned} \sqrt{2(-2)+8} + \sqrt{6(-2)+16} &\neq 0 \\ \sqrt{4} + \sqrt{4} &\neq 0 \\ 2 + 2 &\neq 0 \\ 4 &\neq 0 \end{aligned}$$

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

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

$$\frac{3}{6}x+1 = \frac{4}{6}x-4$$

$$\frac{-3}{6}x+4 \quad \frac{-2}{6}x+4$$

$$(6)5 = \frac{1}{6}x(6)$$

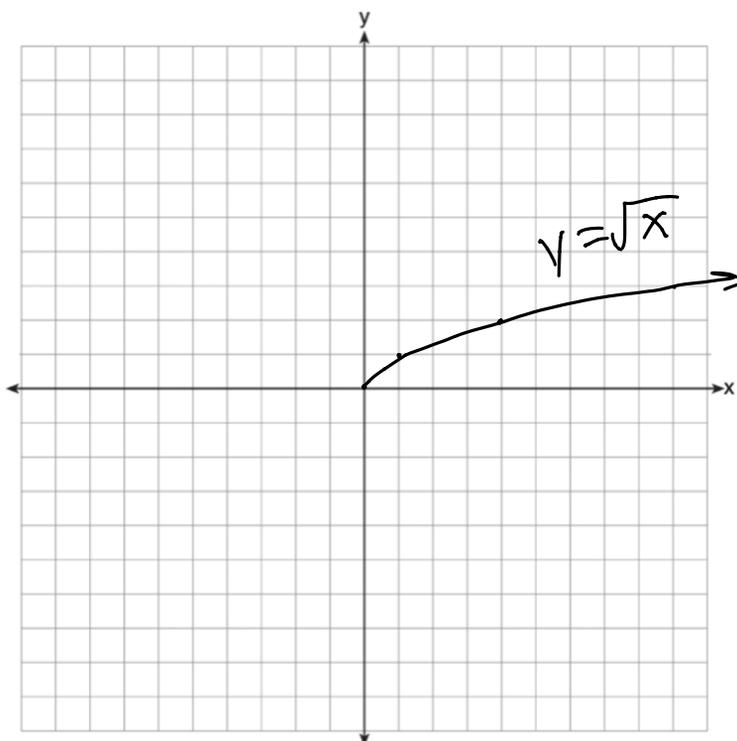
$$\boxed{30=x}$$

Check:

$$\begin{aligned} \sqrt{\frac{1}{2}(30)+1} &= \sqrt{\frac{2}{3}(30)-4} \\ \sqrt{16} &= \sqrt{16} \checkmark \end{aligned}$$

Graph the equation $y = \sqrt{x}$.

x	y
0	0
1	1
4	2
9	3
16	4



Why does the graph of $y = \sqrt{x}$ behave in the way you are seeing? Talk about both the left-end behavior and the right-end behavior.

Left-end Behavior: If x is being square rooted, then x cannot be negative and stay a real number. Therefore the lowest value x can be is 0, thus making the left-most point of the graph of $y = \sqrt{x}$ $(0,0)$.

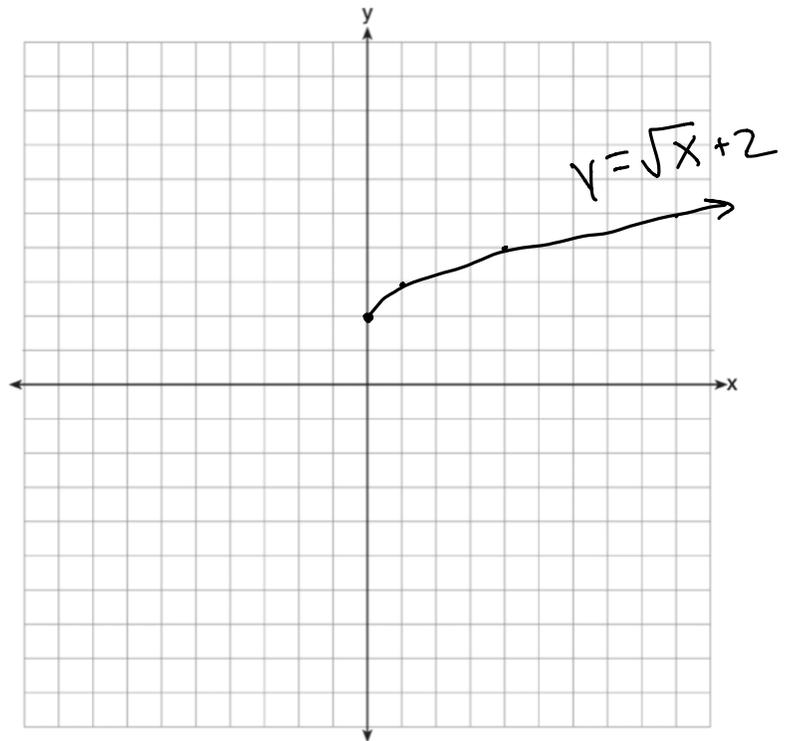
Right-end Behavior: The graph continues to rise, but at a slower rate as you go further right.

$$\sqrt{x} = y, \quad \sqrt{25} = 5, \quad \sqrt{36} = 6, \quad \sqrt{49} = 7, \quad \sqrt{64} = 8$$

+11 +1 +13 +1 +15 +1

Graph the equation $y = \sqrt{x} + 2$.

X	Y
0	2
1	3
4	4
9	5
16	6



Success Criteria

- I can solve equations with a radical on one side of the equation.

Solve the following equations.

$$1) -2\sqrt{12x-8} - 4 = -10$$

$$\begin{aligned} -2\sqrt{12x-8} &= -6 && \text{Check:} \\ \frac{-2\sqrt{12x-8}}{-2} &= \frac{-6}{-2} && -2\sqrt{12(\frac{17}{12})-8} - 4 = -10 \\ \sqrt{12x-8} &= 3 && -10 = -10 \checkmark \\ 12x-8 &= 9 && \\ +8 &+8 && \\ 12x &= 17 && \boxed{x = \frac{17}{12}} \end{aligned}$$

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

$$\begin{aligned} \sqrt{2x-1} &= -2 \\ (\sqrt{2x-1})^2 &= (-2)^2 \\ 2x-1 &= 4 \\ +1 &+1 \\ 2x &= 5 \\ x &= \frac{5}{2} \end{aligned}$$

$\boxed{\emptyset}$

Check:

$$\begin{aligned} \sqrt{2(\frac{5}{2})-1} + 4 &\neq 2 \\ \sqrt{4} + 4 &\neq 2 \\ 6 &\neq 2 \quad \times \end{aligned}$$

- I can solve equations with a radical on both sides of the equation.

Solve the following equations.

$$1) \sqrt{-3x+15} = \sqrt{4x+24}$$

$$\begin{aligned} -3x+15 &= 4x+24 \\ +3x &-24 &+3x &-24 \\ -9 &= 7x \\ \frac{-9}{7} &= \frac{7x}{7} \\ \boxed{x = \frac{-9}{7}} && \text{Check} & \\ \sqrt{-3(\frac{-9}{7})+15} &= \sqrt{4(\frac{-9}{7})+24} \\ \sqrt{\frac{132}{7}} &= \sqrt{\frac{132}{7}} \checkmark \end{aligned}$$

$$2) \sqrt{\frac{1}{5}x+9} = \sqrt{5x-2}$$

$$\begin{aligned} \frac{1}{5}x+9 &= 5x-2 \\ -\frac{1}{5}x+2 &= -\frac{1}{5}x+2 \\ (\frac{5}{24})11 &= \frac{24}{5}x(\frac{5}{24}) \\ \boxed{x = \frac{55}{24}} \end{aligned}$$

Check:

$$\begin{aligned} \sqrt{\frac{1}{5}(\frac{55}{24})+9} &= \sqrt{5(\frac{55}{24})-2} \\ \sqrt{\frac{227}{24}} &= \sqrt{\frac{227}{24}} \checkmark \end{aligned}$$

- I can solve equations with two radicals on one side of the equation.

Solve the following equations.

$$1) \sqrt{6x-2} - \sqrt{2x+14} = 0$$

$$\sqrt{6x-2} = \sqrt{2x+14}$$

$$6x-2 = 2x+14$$

$$4x = 16$$

$$x = 4$$

Check:

$$\sqrt{6(4)-2} - \sqrt{2(4)+14} = 0$$

$$\sqrt{22} - \sqrt{22} = 0$$

$$0 = 0 \checkmark$$

$$2) \sqrt{3x+6} + \sqrt{6x+12} = 0$$

$$(\sqrt{3x+6})^2 = (-\sqrt{6x+12})^2$$

$$3x+6 = 6x+12$$

$$-3x-12 = -3x-12$$

$$-6 = 3x$$

$$x = -2$$

Check

$$\sqrt{3(-2)+6} + \sqrt{6(-2)+12} = 0$$

$$\sqrt{0} + \sqrt{0} = 0$$

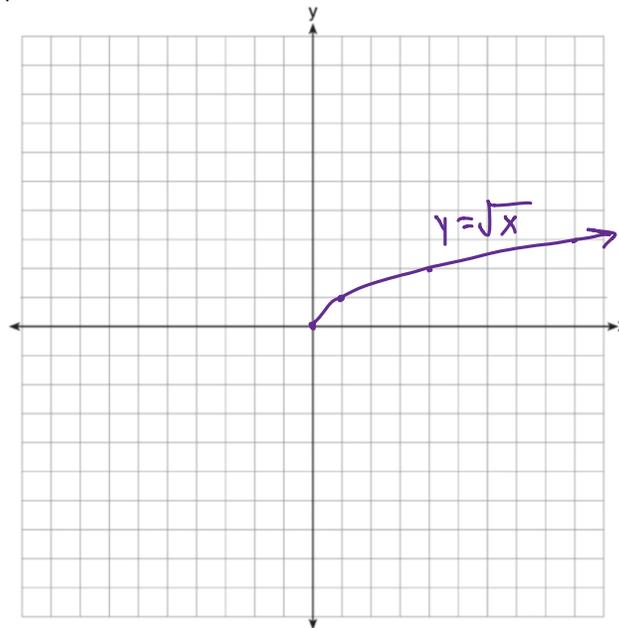
$$0 = 0 \checkmark$$

- I can graph radical equations.

- I can explain why the graph of a radical equation ends where it does.

Graph the equation $y = \sqrt{x}$.

x	y
0	0
1	1
4	2
9	3



Why does the graph of $y = \sqrt{x}$ behave in the way you are seeing? Talk about both the left-end behavior and the right-end behavior.

Left-end Behavior - As x is under a square root, the lowest x can be is 0 in order to stay inside the set of real numbers. Therefore the left-most point of $y = \sqrt{x}$ is (0,0)

Right-end Behavior - The graph approaches ∞ on the right as it continues to rise.

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Classwork: Solving and Graphing Radical Equations

Solve each of the following equations.

$$1) \sqrt{-x+17} - \sqrt{-9x-11} = 0$$

$$\sqrt{-x+17} = \sqrt{-9x-11}$$

$$-x+17 = -9x-11$$

$$+9x-17 + 9x-17$$

$$\frac{8x}{8} = \frac{-28}{8}$$

$$x = \frac{-7}{2}$$

Check:

$$\sqrt{-(-3.5)+17} - \sqrt{-9(-3.5)-11} = 0$$

$$\sqrt{20.5} - \sqrt{20.5} = 0$$

$$\checkmark 0 = 0$$

$$3) \frac{\sqrt{3-x}}{6} + 10 = 18$$

$$\frac{\sqrt{3-x}}{6} = 8$$

$$\sqrt{3-x} = 48$$

$$3-x = 2304$$

$$-3 -3$$

$$\frac{-x}{-1} = \frac{2301}{-1}$$

$$x = -2301$$

Check:

$$\frac{\sqrt{3-(-2301)}}{6} + 10 = 18$$

$$\checkmark 18 = 18$$

$$5) 20\sqrt{2x} - 2 = -12$$

$$+2 +2$$

$$\frac{20\sqrt{2x}}{20} = \frac{-10}{20}$$

$$\sqrt{2x} = -0.5$$

$$\emptyset$$

Square root cannot be negative

$$2) \sqrt{-0.45x-1} = \sqrt{41+0.3x}$$

$$-0.45x-1 = 41+0.3x$$

$$+0.45x-41-41+0.45x$$

$$\frac{-42}{0.75} = \frac{0.75x}{0.75}$$

$$x = -56$$

Check:

$$\sqrt{-0.45(-56)-1} = \sqrt{41+0.3(-56)}$$

$$\sqrt{24.2} = \sqrt{24.2} \checkmark$$

$$4) \sqrt{6x+4} + \sqrt{3x+12} = 0$$

$$-\sqrt{3x+12} - \sqrt{3x+12}$$

$$(\sqrt{6x+4})^2 = (-\sqrt{3x+12})^2$$

$$6x+4 = 3x+12$$

$$-3x -4 -3x -4$$

$$\frac{3x}{3} = \frac{8}{3}$$

$$x = \frac{8}{3} \quad \emptyset$$

Check

$$\sqrt{6(\frac{8}{3})+4} + \sqrt{3(\frac{8}{3})+12} \neq 0$$

$$\sqrt{20} + \sqrt{20} \neq 0$$

$$6) \sqrt{13x+32} = \sqrt{13x+21}$$

$$13x+32 = 13x+21$$

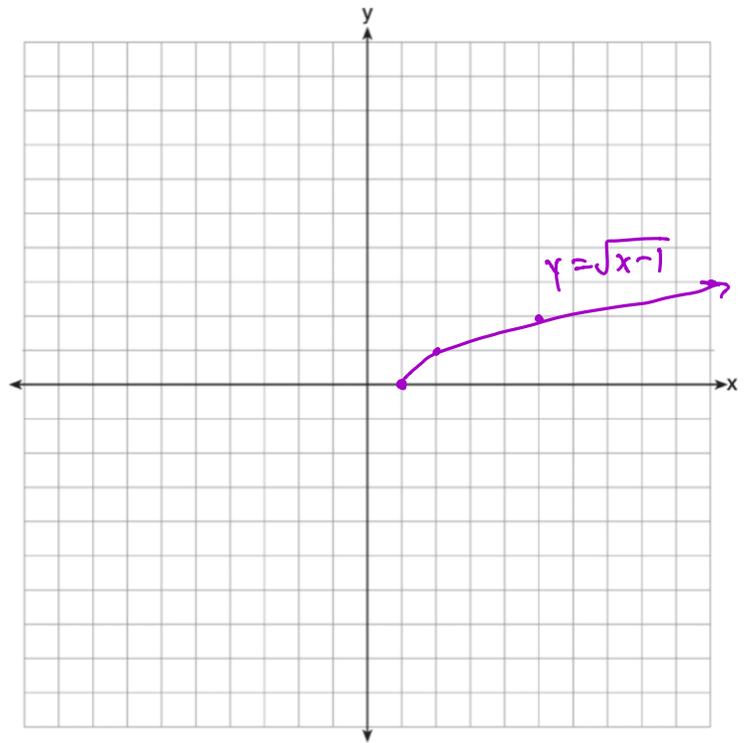
$$-13x -21 -13x -21$$

$$11 \neq 0$$

$$\emptyset$$

7) Graph the equation $y = \sqrt{x-1}$.

x	y
1	0
2	1
5	2
10	3



8) Solve the following equation:

$$\left(\frac{1}{4x+1}\right)^{-1/2} = \frac{\left(\frac{x}{3}+5\right)^{-7/2}}{\left(\frac{x}{3}+5\right)^{-4}}$$

Check:

$$\left(\frac{1}{4\left(\frac{12}{11}\right)+1}\right)^{-1/2} = \frac{\left(\frac{\frac{12}{11}}{3}+5\right)^{-7/2}}{\left(\frac{\frac{12}{11}}{3}+5\right)^{-4}}$$

$$2.315952582... = 2.315952582...$$



$$(4x+1)^{1/2} = \left(\frac{x}{3}+5\right)^{-7/2 + (+8/2)}$$

$$(4x+1)^{1/2} = \left(\frac{x}{3}+5\right)^{1/2}$$

$$\left(\sqrt{4x+1}\right)^2 = \left(\sqrt{\frac{x}{3}+5}\right)^2$$

$$4x+1 = \frac{x}{3}+5$$

$$\frac{12}{3}x+1 = \frac{1}{3}x+5$$

$$-\frac{1}{3}x \quad -1 \quad -\frac{1}{3}x \quad -1$$

$$\left(\frac{3}{11}\right)\frac{11}{3}x = 4\left(\frac{3}{11}\right)$$

$$x = \frac{12}{11}$$