Teacher Notes

3.1.2 How can I use a graph to solve an equation? Notes & Classwork

Solving Equations Graphically

3-24.

Consider the equation $\sqrt{2x+3} = x$ by completing parts (a) through (d)

a. Use algebraic strategies to solve $(\sqrt{2x+3})^2 = x^2$. How many solutions did you come up with? Which strategies did you use?

$2x+3 = x^2$

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

$0 = (x-3)(x+1)$

$x - 3 = 0$, $+3 \; +3$, $\boxed{x=3}$

$x + 1 = 0$, $-1 \; -1$, $\boxed{x=-1}$

* 2 solutions
* Factored

b. In thinking about $\sqrt{2x+3} = x$, Miranda writes down $y = \sqrt{2x+3}$ and $y = x$. How many solutions does $y = \sqrt{2x+3}$ have? How many solutions does $y = x$ have? (graph)

born cross the x-axis only 1 time. 1 solution each.

c. Miranda says, "*I'll graph both the functions $y = \sqrt{2x+3}$ and $y = x$ to check the solutions from part (a).*" How will graphing help her determine the solution? Be sure everyone on your team can answer this before moving on.

where both functions intersect will be the solution

d. Miranda looks at the graph on her graphing calculator and says, "*I think something is wrong.*" Graph the system on your graphing calculator and locate the intersection point(s) of the graphs. How many intersection points are there? Does this confirm your solution from part (a)? Explain your results.

on the graph it only intersects at $x=3$ not $x=-1$

3-25.

When a result from a correctly-solved equation does not make the original equation true, it is called an **extraneous solution**. It is not a solution of the equation, even though it is a result when solving algebraically.

If you have not already done so, check your solutions from part (a) of problem 3–24 algebraically.

$x = 3$

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

$\sqrt{9} = 3$

$3 = 3$ ✓

$x = -1$

$\sqrt{2(-1)+3} = -1$

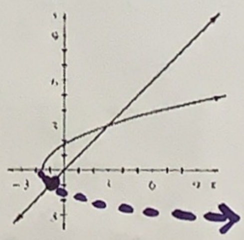
$\sqrt{1} = -1$

$1 = -1$ ✗

3-26.

The fact that extraneous solutions can arise after solving correctly makes checking your solutions especially important!

But why does the extraneous solution appear in this problem? Examine the graph of the system of equations $y = \sqrt{2x+3}$ and $y = x$, shown at right. Where would an extraneous solution $x = -1$ appear on the graph? Why do the graphs not intersect at that point? Explain.



Domain restricts the graph.

3-27.

After solving the equation $2x^2 + 5x - 3 = x^2 + 4x + 3$, Gustav gets called to the office and leaves his team. When his teammates examine his graphing calculator to figure out how he found his solution, they only see the graph of $y = x^2 + x - 6$. Consider this situation as you complete the parts below.

a. Solve $2x^2 + 5x - 3 = x^2 + 4x + 3$ algebraically.

$-x^2 - 4x - 3 \quad -x^2 - 4x - 3$

$x^2 + 1x - 6 = 0$

$(x+3)(x-2) = 0$

$\boxed{x=-3}$ $\boxed{x=2}$

b. Where does Gustav get the equation $y = x^2 + x - 6$?

when he moves all terms to one side.

c. How many solutions will $y = x^2 + x - 6$ have?

2 solutions

d. How can you see the solutions to $2x^2 + 5x - 3 = x^2 + 4x + 3$ in the graph of $y = x^2 + x - 6$? Explain why this makes sense.

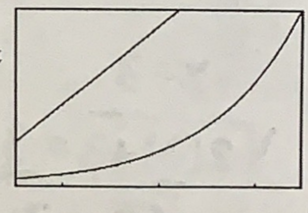
They are the x-int. because that is where $x^2 + x - 6 = 0$.

e. Maiya solves $2x^2 + 5x - 3 = x^2 + 4x + 3$ by graphing a system of equations and looking for the points of intersection. What equations do you think she uses? Graph these equations on your graphing calculator and explain where the solutions to the equation exist on the graph.

She would graph $y = 2x^2 + 5x - 3$ & $y = x^2 + 4x + 3$ & find intersection points $\rightarrow$ $(-3, 0)$ & $(2, 15)$

3-28.

Yajaira cannot figure out how to solve $20x + 1 = 3^x$ algebraically, so she decides to use her graphing calculator. However, when she graphs the equations $y = 20x + 1$ and $y = 3^x$, she gets the graph shown at right. After studying the graph, Yajaira thinks there are no solutions to $20x + 1 = 3^x$.



a. What do you think? If there are solutions, what are they? If there are no solutions, demonstrate that there cannot be a solution. 2 solutions, $x=0$ & $x=4$

b. What should solutions to the equation $20x + 1 = 3^x$ look like? In other words, will solutions be a single number, or will they be the coordinates of a point? Explain. intersections (just x-coordinate)

c. Yajaira's teammate, Emma, starts to solve by subtracting 1 from both sides of the equation. When she graphs her system later, she uses the equations $y = 20x$ and $y = 3^x - 1$. Will she get the same solutions? Test your conclusion using your graphing calculator. yes!

d. Discuss with your team why Yajaira cannot solve the system algebraically. What do you think?

x in the exponent.