5.2 - Solving Nonlinear Systems

January 22, 2020 10:39 AM

FOUNDATIONS OF MATH 11 Ch. 5 – Day 2: Solving Nonlinear Systems of Equations

If we recall the quadratic equations from our last unit, we'll remember they are very much not linear.

Technically, we would call them a "curve," but more generally we can refer to them as nonlinear equations.

Just like how we can have a system of linear equations if all the equations in the system are linear, we can have a system of nonlinear equations if at least one of the equations are nonlinear.

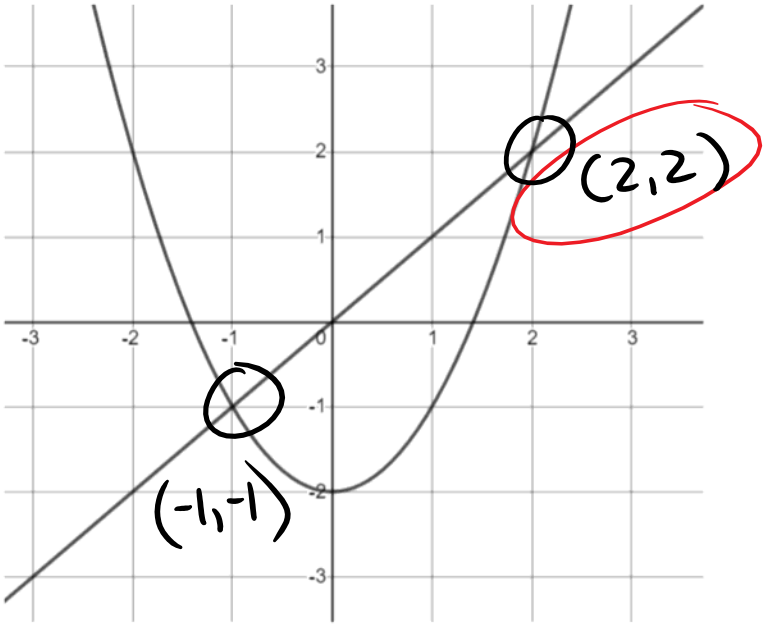
The good news is we can find the solution of a system of nonlinear equations the exact same way we find the solution to a system of linear equations.

Particularly, we find the points where the two equations intersect (overlap). That's the point that "satisfies" both equations.

Example

Determine the solution of the system of equations graphed below.

$y = x^2 - 2$
$y = x$



$y = x^2 - 2$ $\quad$ $y = x$

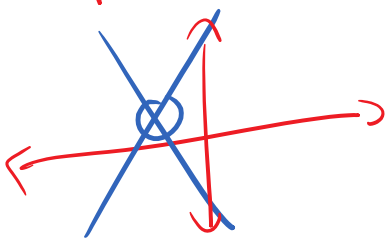
$2 = (2)^2 - 2$ $\quad$ $2 = 2$ ✓ ☺

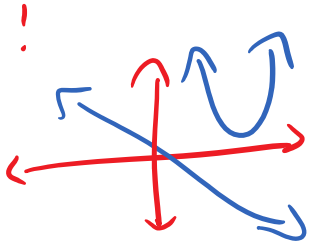
$2 = 2$ ✓ ☺

Solution: (2,2), (-1,-1)

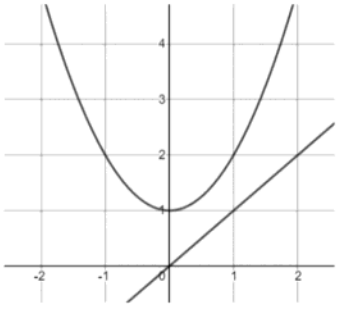
What do you notice that's different between the answer for this system versus the answers from a strictly linear system?

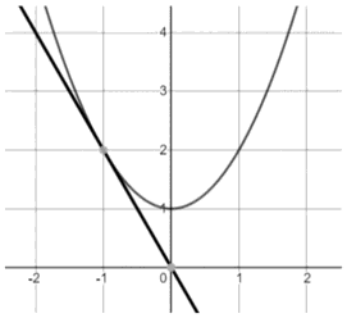
There can be more than 1 answer!
or 0!

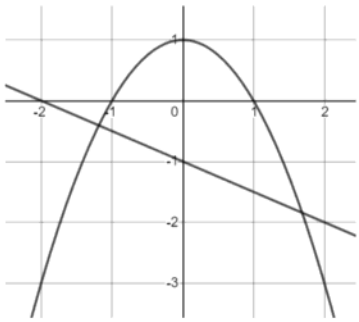




In a system of equations which contains one linear equation and one quadratic equation, it's possible to have 0, 1, or 2 solutions:







0 1 2

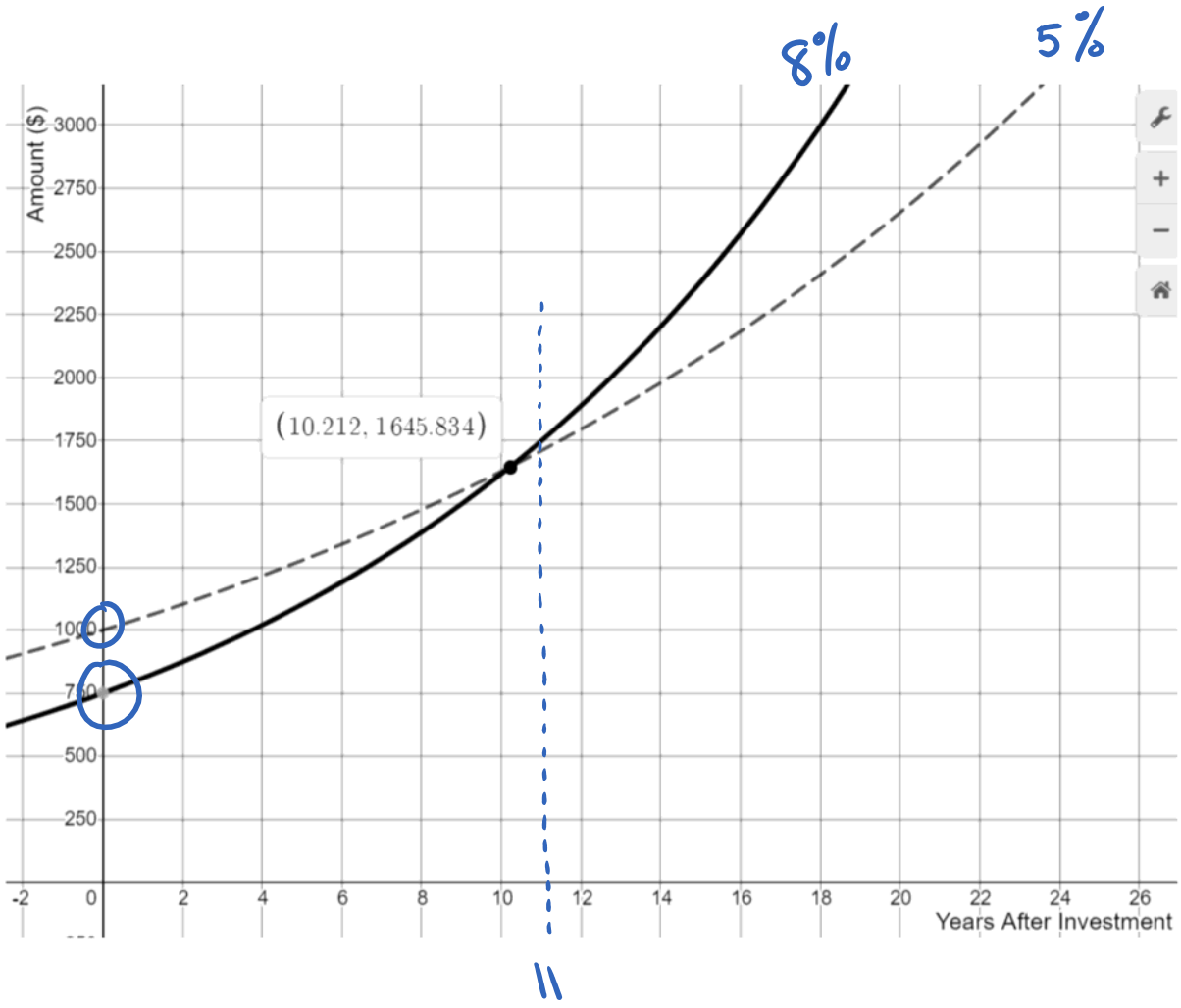
In this course, we won't be dealing with situations where there is no solution, I've listed it here simply for completeness.

Example

John invested \$750 in an account which pays 8% interest per year. The amount of money he will have after *n* years is given by $A = 750(1.08)^n$.

Sara invested \$1000 in an account which pays 5% interest per year. The amount of money she will have after *n* years is given by $A = 1000(1.05)^n$.

I've graphed both equations below, where John is the solid line, and Sara is the dashed line:



What is the solution to the above system of equations?

(10.212, 1645.83)

What does this point mean?

How long it takes for the money in both accounts to be the same.

Assuming interest is paid at the end of each year, after how many complete years will John's investment be worth more than Sara's?

11 years.