Class #30 - Tuesday Nov 9

Today:

- Examples: "Nonlinear Systems"

- next topic: "rational expressions"

Ex: $\frac{1}{x}$, $\frac{1}{x^2}$,

$$\frac{x-2}{x^2+6x-8}$$

- Thurs/Fri - solved a nonlinear system graphically
- today: solve nonlinear systems algebraically.

"2×2"

Let's revisit "Nonlinear Systems" #1,
and solve it algebraically:

Solve:

$$y = (x-6)^2 + 2 \quad (1) \quad [\text{nonlinear – quadratic}]$$

$$y = -13x + 50 \quad (2) \quad [\text{linear!}]$$

Substitute "$y = -13x + 50$" from (2) for "y" in (1):

$$\underbrace{-13x + 50}_{\text{"}y = -13x+50\text{" from (2)}} = (x-6)^2 + 2$$

now just solve this quadratic equation for x!

$$0 = (x-6)^2 + 2 - 50 + 13x$$

Let's solve by factoring (if possible) and/or quadratic formula:

So first we need to FOIL & simplify
(in order to get the quadratic eqn in "standard form" $ax^2+bx+c=0$)

$$(x^2 - 12x + 36) - 48 + 13x = 0$$

$$x^2 + x - 12 = 0$$

easiest/most efficient to solve by factoring!

$$(x+4)(x-3) = 0$$

$\Rightarrow$ solutions are $x = -4$ & $x = 3$

in the chat!!

Last step? Find the corresponding y-values (by plugging in $x=-4$ and $x=3$ into either of the original equations)

Nonlinear Systems #2

(1) $y = \sqrt{x}$

(2) $x^2 + y^2 = 56$

system of 2 equations & (both are nonlinear!)

Graphically? circle (center at (0,0) w/ radius $r = \sqrt{56}$

Algebraically: substitute $y = \sqrt{x}$ into (2):

(2): $x^2 + (\sqrt{x})^2 = 56$ ★

$x^2 + x = 56$

$x^2 + x - 56 = 0$

$(x+8)(x-7) = 0$

$x = -8$, $x = 7$

Find y-values using (1):

$y = \sqrt{-8}$

$y = \sqrt{7}$

$(7, \sqrt{7})$

Rational Expressions : ratio of 2 polynomials.

(in function notation: $f(x) = \frac{p(x)}{g(x)}$ where $p(x)$, $g(x)$ are polynomials, and $g(x) \neq 0$)

Ex: "Reducing Rational Expressions")

$$\frac{15x^2+60x}{27x} = \frac{3x(5x+20)}{3x(9)} = \frac{5x+20}{9} //$$