Algebra 2 | Tues. 4-23-13 | Class Notes

Ch. 12-7 Solving Nonlinear Systems (of equations)

Nonlinear system of equations — A system of equations in which at least one of the equations is non-linear.

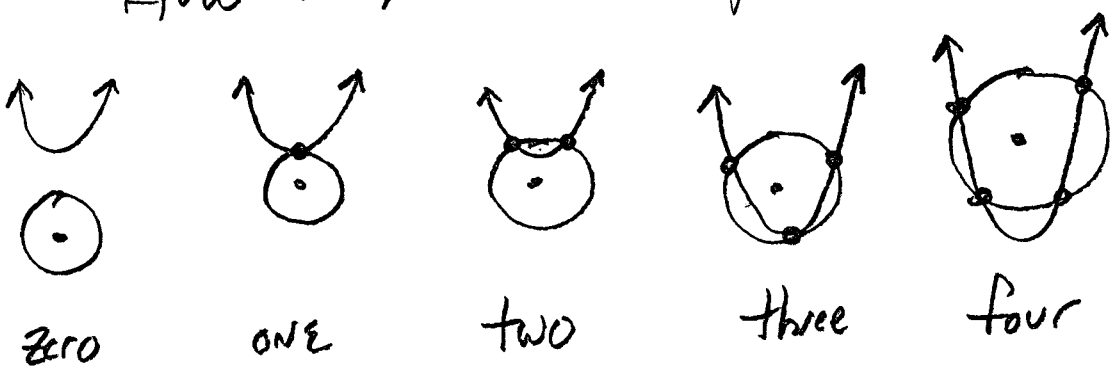
(Ex) $x^2 + y^2 = 25$ (Eq 1)

$y + 5 = \frac{1}{2}x^2$ (Eq 2)

(Eq 1) = ? circle

(Eq 2) = ? parabola

How many solutions possible?



Zero One Two Three Four

(Eq 1) $x^2+y^2=25$

(Eq 2) $5+y=\frac{x^2}{2} \Rightarrow 10+2y=x^2$

EBA $\Rightarrow$ Line up "like" terms (as many as possible)

$x^2-2y=10 \longrightarrow x^2-2y=10$

$x^2+y^2=25 \xrightarrow{(-1)} -x^2-y^2=-25$

$-y^2-2y=-15$

$y^2+2y=15$

$\therefore y^2+2y-15=0$

sum $\Rightarrow b=2$

prod $\Rightarrow ac=-15$

$-3, +5$

$(y-3)(y+5)=0 \quad \therefore y=\{-5, 3\}$

(Eq 1) $y=-5 \Rightarrow x^2+(-5)^2=25$

$x^2+25=25 \quad \therefore x=0 \Rightarrow \boxed{(0,-5)}$

(Eq 1) $y=3 \Rightarrow x^2+(3)^2=25$

$x^2+9=25$

$x^2=16$

$x=\pm 4$ when $y=3 \therefore \boxed{(4,3)}$ $\boxed{(-4,3)}$

(Eq1) $x^2 + y^2 = 25$

(Eq2) $5 + y = \frac{x^2}{2} \Rightarrow 10 + 2y = x^2$

EBS ⇒ get ONE "VARIABLE" by itself

(Eq1) $\Rightarrow (10 + 2y) + y^2 = 25$

$y^2 + 2y - 15 = 0$

sum $\Rightarrow b = 2$

prod $\Rightarrow ac = -15$

$+3 \quad +5$

$(y - 3)(y + 5) = 0 \quad \therefore y = \{-5, 3\}$

⇒ SAME ANSWERS AS EBA (see prior page)

Check with WolframAlpha

WolframAlpha computational knowledge engine

solving systems of equations

Examples Random

Assuming "solving systems of equations" refers to a computation | Use as a general topic instead

Assuming a system of two equations | Use more instead

- equation 1: x^2+y^2=25
- equation 2: y+5=(1/2)x^2

Input interpretation:

solve

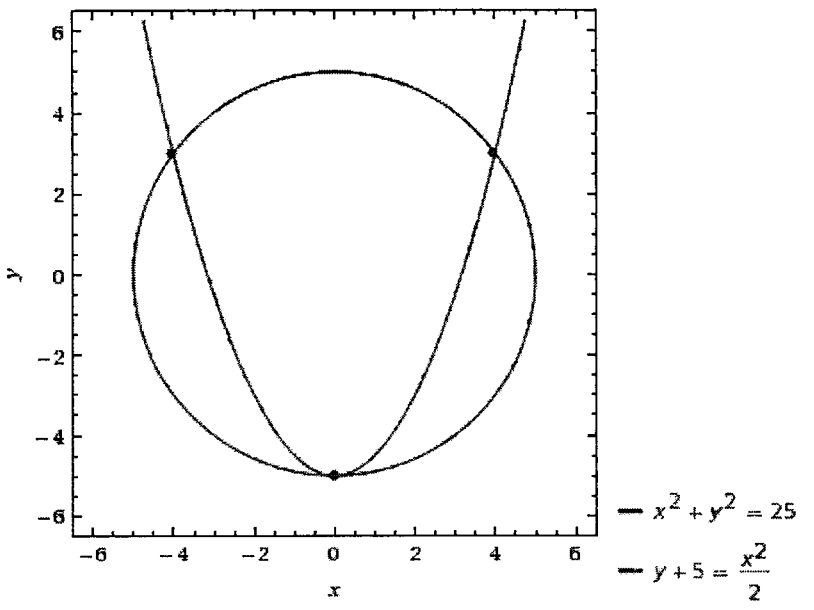
$$x^2 + y^2 = 25$$
$$5 + y = \frac{x^2}{2}$$

Results:

$x = \pm 4$ and $y = 3$

$x = 0$ and $y = -5$

Implicit plot:



(8x)
$$\begin{cases} 2x - y = 1 & \Rightarrow \text{line} \\ (y) + 7 = 2(x+1)^2 & \Rightarrow \text{parabola} \end{cases}$$

EBS $\Rightarrow y = (2x-1)$

0, 1, or two solutions

$$(2x-1) + 7 = 2[x^2 + 2x + 1]$$

$$2x + 6 = 2x^2 + 4x + 2$$
$$-2x \quad -6 \qquad -2x \quad -6$$

$$2x^2 + 2x - 4 = 0$$

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

sum $= b = 1$

prod $= ac = -2$

$-1, +2$

$$2(x-1)(x+2) = 0 \quad \therefore x = \{1, -2\}$$

(Eq 1) $x = 1 \Rightarrow 2(1) - y = 1$

$-y = -1 \quad \therefore y = 1 \Rightarrow \boxed{(1, 1)}$ (x, y)

(Eq 1) $x = -2 \Rightarrow 2(-2) - y = 1$

$-4 - 1 = y$

$-5 = y \quad \therefore y = -5 \Rightarrow \boxed{(-2, -5)}$

How to check solutions?

WolframAlpha computational... knowledge engine

systems of equations

Examples Random

Assuming "systems of equations" refers to a computation | Use as a general topic or referring to a mathematical definition instead

Assuming a system of two equations | Use more instead

- equation 1: 2x-y=1
- equation 2: y+7=2(x+1)^2

Input interpretation:

solve

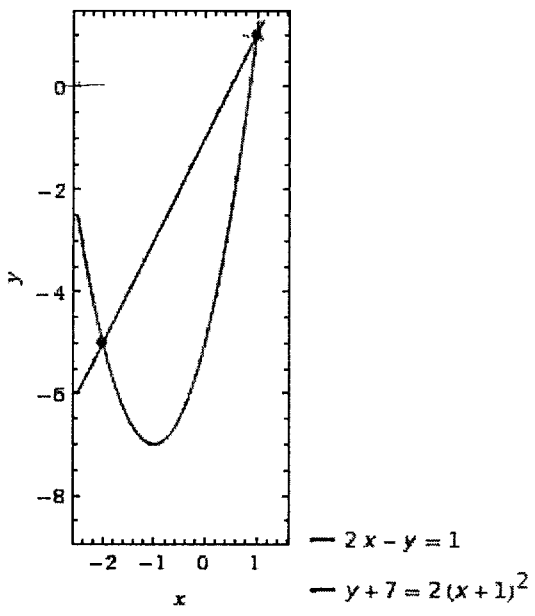
$$2x - y = 1$$
$$7 + y = 2(1 + x)^2$$

Results:

$x = -2$ and $y = -5$

$x = 1$ and $y = 1$

Implicit plot:



Worksheet Practice

① $x^2 + 2y^2 + 2x + 4y - 17 = 0$

$x^2 + 2x + \{1^2\} + 2y^2 + 4y + \{\quad\} = 17 + \{1+2\}$

$+ 2(y^2 + 2y + \{1^2\})$

$\frac{(x+1)^2}{2} + \frac{2(y+1)^2}{2} = \frac{20}{2}$

$\frac{(x+1)^2}{2} + \frac{(y+1)^2}{1} = 10$

↳ A left-right ellipse

Still need to get right side = to 1

$\frac{(x+1)^2}{20} + \frac{(y+1)^2}{10} = 1$ *

* Standard Form