

Systems of Non-Linear Equations HW

Name: \_\_\_\_\_

Solve each system of non-linear equations. Show your work on a separate sheet of paper.

1)  $x^2 + y^2 = 13$   $(2, -3)$   $(3, 2)$   
 $x^2 - y = 7$   $(-2, -3)$   $(-3, 2)$

2)  $3x - y = -2$   $(-\frac{1}{2}, \frac{1}{2})$   $(2, 8)$   
 $2x^2 - y = 0$

3)  $x^2 - y^2 = 4$  no solution  
 $y = x^2$

4)  $x^2 - 4y^2 + 7 = 0$   $(3, 2)$   $(3, -2)$   
 $3x^2 + y^2 = 31$   $(-3, 2)$   $(-3, -2)$

5)  $x + y + 1 = 0$   $(0, -1)$   $(0, -\frac{1}{2})$   
 $x^2 + y^2 + 6y - x = -5$

6)  $y = x - 4$   $(\frac{13}{4}, -\frac{3}{4})$   
 $x^2 - y^2 = 10$

7)  $xy = 0.4$   $(4, 0.1)$   $(-0.1, -4)$   
 $x = y + 3.9$

# Non Linear HW

$$1) \begin{cases} x^2 + y^2 = 13 \\ x^2 - y = 7 \rightarrow x^2 = y + 7 \end{cases}$$

$$\begin{aligned} (y+7) + y^2 &= 13 \\ y^2 + y + 7 &= 13 \\ y^2 + y - 6 &= 0 \end{aligned}$$

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

$$\begin{aligned} y+3 &= 0 & y-2 &= 0 \\ y &= -3 & y &= 2 \end{aligned}$$

$$\begin{aligned} x^2 &= (-3) + 7 \\ x^2 &= 4 \\ x &= \pm 2 \end{aligned}$$

$$\begin{pmatrix} 2, -3 \\ -2, -3 \end{pmatrix}$$

$$\begin{aligned} x^2 &= (2) + 7 \\ x^2 &= 9 \\ x &= \pm 3 \end{aligned}$$

$$\begin{pmatrix} 3, 2 \\ -3, 2 \end{pmatrix}$$

$$2) \begin{cases} 3x - y = -2 \\ 2x^2 - y = 0 \end{cases} \quad \begin{aligned} 3x - y &= -2 \\ -y &= -3x - 2 \\ y &= 3x + 2 \end{aligned}$$

$$\begin{aligned} 2x^2 - (3x+2) &= 0 \\ 2x^2 - 3x - 2 &= 0 \end{aligned}$$

$$(2x+1)(x-2) = 0$$

$$\begin{aligned} 2x+1 &= 0 & x-2 &= 0 \\ x &= -\frac{1}{2} & x &= 2 \end{aligned}$$

$$\begin{aligned} y &= 3\left(-\frac{1}{2}\right) + 2 \\ y &= -\frac{3}{2} + 2 \end{aligned}$$

$$y = \frac{1}{2}$$

$$\left(-\frac{1}{2}, \frac{1}{2}\right)$$

$$\begin{aligned} y &= 3(2) + 2 \\ y &= 8 \end{aligned}$$

$$(2, 8)$$

$$3) \begin{cases} x^2 - y^2 = 4 \\ y = x^2 \end{cases}$$

$$\begin{aligned} y - y^2 &= 4 \\ 0 &= y^2 - y + 4 \end{aligned}$$

$$-(-1) \pm \sqrt{(-1)^2 - 4(1)(4)}$$

$$\frac{1 \pm \sqrt{-15}}{2}$$

NO Solution



$$4) \begin{cases} x^2 - 4y^2 + 7 = 0 \\ 3x^2 + y^2 = 31 \end{cases} \rightarrow \begin{cases} x^2 - 4y^2 = -7 \\ 3x^2 + y^2 = 31 \end{cases}$$

$$\begin{array}{r} 3x^2 + y^2 = 31 \\ -3x^2 + 12y^2 = 21 \\ \hline 13y^2 = 52 \\ y^2 = 4 \\ y = \pm 2 \end{array}$$

$$\begin{pmatrix} 3, 2 \\ -3, 2 \end{pmatrix}$$

$$\begin{aligned} 3x^2 + (2)^2 &= 31 \\ 3x^2 + 4 &= 31 \\ 3x^2 &= 27 \\ x^2 &= 9 \\ x &= \pm 3 \end{aligned}$$

$$\begin{aligned} 3x^2 + (-2)^2 &= 31 \\ 3x^2 + 4 &= 31 \\ 3x^2 &= 27 \\ x^2 &= 9 \\ x &= \pm 3 \end{aligned}$$

$$5) \begin{cases} x + y + 1 = 0 \\ x^2 + y^2 + 6y - x = -5 \end{cases} \rightarrow y = -1 - x$$

$$\begin{aligned} x^2 + (1-x)^2 + 6(1-x) - x &= -5 \\ x^2 + 1 + 2x + x^2 - 6 - 6x - x &= -5 \\ 2x^2 - 5x - 5 &= -5 \\ 2x^2 - 5x &= 0 \\ x(2x - 5) &= 0 \end{aligned}$$

$$\begin{aligned} x = 0 & \quad 2x - 5 = 0 \\ & \quad 2x = 5 \\ & \quad x = \frac{5}{2} \end{aligned}$$

$$\begin{aligned} y &= -1 - 0 \\ y &= -1 \end{aligned}$$

$$(0, -1)$$

$$y = -1 - \frac{5}{2}$$

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

$$(0, -\frac{7}{2})$$



$$6) \begin{cases} y = x - 4 \\ x^2 - y^2 = 10 \end{cases}$$

$$\begin{aligned} x^2 - (x-4)^2 &= 10 \\ x^2 - (x^2 - 8x + 16) &= 10 \\ \cancel{x^2} - \cancel{x^2} + 8x - 16 &= 10 \\ 8x &= 26 \\ x &= \frac{26}{8} \\ x &= \frac{13}{4} \end{aligned}$$

$$y = \left(\frac{13}{4}\right) - 4$$

$$y = -\frac{3}{4}$$

$$\left(\frac{13}{4}, -\frac{3}{4}\right)$$

$$7) \begin{cases} xy = .4 \\ x = y + 3.9 \end{cases} \rightarrow y = \frac{.4}{x}$$

$$x \left( x \right) = \left( \frac{.4}{x} + 3.9 \right)^2$$

$$\begin{aligned} x^2 &= .4 + 3.9x \\ x^2 - 3.9x - .4 &= 0 \end{aligned}$$

$$\frac{3.9 \pm \sqrt{(-3.9)^2 - 4(1)(-.4)}}{2(1)}$$

$$\frac{3.9 \pm \sqrt{16.81}}{2}$$

$$\frac{3.9 \pm 4.1}{2}$$

$$\begin{array}{c} 2 \\ / \quad \backslash \\ 4 \quad -1 \end{array}$$

$$y = \frac{.4}{4}$$

$$y = -1$$

$$(4, -1)$$

$$y = \frac{.4}{-1}$$

$$y = -4$$

$$(-1, 4)$$