

Objectives:

- I can solve a system of equations that involve lines and circles or line and parabolas algebraically.

Warm-Up #1:

1. Distribute:

$$(2x-5)^2$$

$$(2x-5)(2x-5)$$

$$4x^2 - 10x - 10x + 25$$

$$4x^2 - 20x + 25$$

2. Solve by factoring:

$$x^2 - 9x = 10$$

$$+10 \quad -10$$

$$x^2 - 9x - 10 = 0$$

$$(x+1)(x-10) = 0$$

$$x = -1 \quad x = 10$$

3. Solve by factoring:

$$3x^2 - 10x - 8 = 0$$

$$3x^2 + 2x - 2x - 8 = 0$$

$$x(3x+2) - 4(3x+2) = 0$$

$$(3x+2)(x-4) = 0$$

$$3x+2=0 \quad x=4$$

$$3x = -2$$

$$x = -2/3$$

Warm-Up #2: Solve the Linear System of Equations:

$$y = 5x - 2$$

$$y = 6x - 3$$

Solve the system algebraically: use substitution

$$5x - 2 = 6x - 3$$

$$-5x \quad -5x$$

$$-2 = x - 3$$

$$+3 \quad +3$$

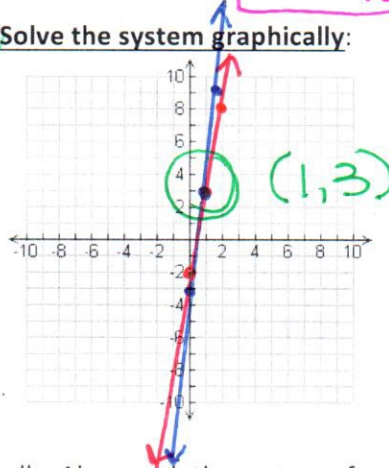
$$x = 1$$

$$y = 6(1) - 3$$

$$y = 3$$

$$(1, 3)$$

Solve the system graphically:



Example 1: Solve the system of non-linear equations algebraically. Also graph the system of equations and identify the solutions.

$$y = 3x$$

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

line parabola vertex $h = \frac{-b}{2a} = \frac{-4}{2(1)} = -2$

Solve the system algebraically: use substitution

$$3x = x^2 + 4x - 2$$

$$-3x \quad -3x$$

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

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

$$x = 1 \quad x = -2$$

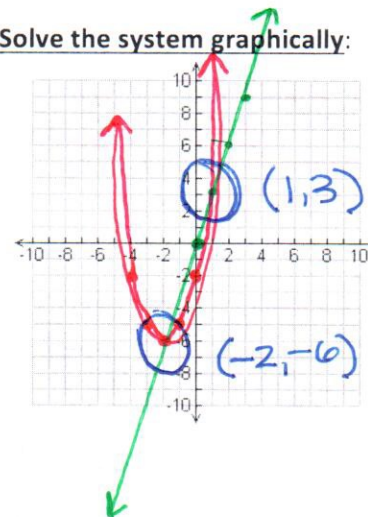
$$y = 3(1) \quad y = 3(-2)$$

$$y = 3 \quad y = -6$$

$$(1, 3) \quad (-2, -6)$$

vertex

Solve the system graphically:



| x | y |
|----|----|
| 0 | -2 |
| -1 | -5 |
| -2 | -6 |
| -3 | -5 |
| -4 | -2 |

Example 2: Solve the system of non-linear equations algebraically. Also graph the system of equations and identify the solutions.

$$\begin{cases} y = 2x^2 + 13x + 15 \\ y = x - 1 \end{cases}$$

parabola vertex: $-\frac{b}{2a} = \frac{-13}{2(2)} = -3.25$
line

| x | y |
|-------|------|
| -2 | -3 |
| -3 | -6 |
| -3.25 | -6.2 |
| -4 | -5 |
| -5 | 0 |

Solve the system algebraically: use substitution

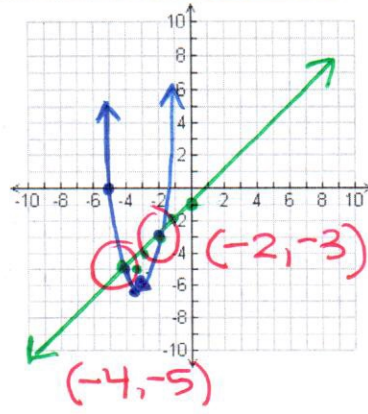
$$\begin{aligned} 2x^2 + 13x + 15 &= x - 1 \\ -x + 1 & \quad -x + 1 \\ \hline 2x^2 + 12x + 16 &= 0 \\ 2(x^2 + 6x + 8) &= 0 \\ \hline x^2 + 6x + 8 &= 0 \end{aligned}$$

ac
B
2,4
1,8

$$\begin{aligned} (x+2)(x+4) &= 0 \\ x = -2 \quad x = -4 \\ y = -2 - 1 \quad y = -4 - 1 \\ y = -3 \quad y = -5 \end{aligned}$$

$(-2, -3)$
 $(-4, -5)$

Solve the system graphically:



Example 3: Solve the system of non-linear equations algebraically. Also graph the system of equations and identify the solutions.

$$\begin{cases} x^2 + y^2 = 25 \\ y = x + 1 \end{cases}$$

circle (0,0) r=5
line

Solve the system algebraically:

$$\begin{aligned} x^2 + (x+1)^2 &= 25 \\ (x+1)(x+1) \\ x^2 + x + x + 1 \\ x^2 + 2x + 1 \end{aligned}$$

$$x^2 + x^2 + 2x + 1 = 25$$

$$-25 \quad -25$$

$$\begin{aligned} 2x^2 + 2x - 24 &= 0 \\ 2(x^2 + x - 12) &= 0 \\ \hline x^2 + x - 12 &= 0 \end{aligned}$$

ac
-12
-2,6
2,-6
-3,4
3,-4
-1,12
1,-12

$$\begin{aligned} (x-3)(x+4) &= 0 \\ x = 3 \quad x = -4 \\ y = 3 + 1 \quad y = -4 + 1 \\ y = 4 \quad y = -3 \end{aligned}$$

$(3, 4)$
 $(-4, -3)$

Solve the system graphically:

