

## Lesson 2 Solving Systems of Equations Algebraically

### Recall: Solving Linear Systems

Solve, using substitution

$$y = 4x - 4$$

$$2x + 3y = -5$$

$$2x + 3(4x - 4) = -5$$

$$2x + 12x - 12 = -5$$

$$14x = 7$$

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

$$y = 4\left(\frac{1}{2}\right) - 4 = -2 \quad \left(\frac{1}{2}, -2\right)$$

Solve, using elimination

$$3x + 2y = 9 \quad \textcircled{1} \times 2$$

$$2x + 3y = 11 \quad \textcircled{2} \times 2$$

$$\begin{array}{r} 6x + 4y = 18 \\ \underline{-(6x + 9y = 22)} \\ -5y = -15 \end{array}$$

$$-5y = -15$$

$$y = 3$$

$$3x + 2(3) = 9$$

$$3x = 3$$

$$x = 1$$

$$(1, 3)$$

### Linear-Quadratic

#### Example 1

Solve, algebraically.

$$y = \frac{1}{3}x^2 - 3$$

$$y + x = -3$$

$$\frac{1}{3}x^2 - 3 + x = -3$$

$$\frac{1}{3}x^2 + x = 0$$

$\times 3$

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

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

$$x = 0 \quad x = -3$$

2 points of intersection

$$x = 0$$

$$y + 0 = -3$$

$$y = -3$$

$$(0, -3)$$

$$x = -3$$

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

$$y = 0$$

$$(-3, 0)$$

**Example 2**

Solve, algebraically.

$$\begin{aligned} x^2 - y + 2 &= 0 \\ 4x &= 14 - y \end{aligned}$$

$x^2 + 2 = y$

$$\begin{aligned} 4x &= 14 - (x^2 + 2) \\ 4x &= 14 - x^2 - 2 \\ x^2 + 4x - 12 &= 0 \\ (x + 6)(x - 2) &= 0 \\ x &= -6 \quad x = 2 \end{aligned}$$

$$\begin{aligned} x &= -6 & x &= 2 \\ y &= (-6)^2 + 2 & y &= 2^2 + 2 \\ &= 38 & y &= 6 \end{aligned}$$

Quadratic - Quadratic

**Example 3**

Solve, algebraically.

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

$$\begin{aligned} (x + 2)^2 - 1 &= x^2 - 4x - 5 \\ \cancel{x^2} + 4x + 4 - 1 &= \cancel{x^2} - 4x - 5 \\ 8x &= -8 \\ x &= -1 \end{aligned}$$

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

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## Pre-Calculus 11 Enriched Systems of Equations & Inequalities

### Example 4 $x, y$

Two unknown numbers are related in the following ways. The square of the first number subtract the second number is equal to 5. The first number is equal to the second number subtract 7. Determine the numbers.

$$\begin{aligned} x^2 - y &= 5 \\ x &= y - 7 \\ x + 7 &= y \end{aligned}$$

$$x^2 - (x + 7) = 5$$

$$x^2 - x - 7 = 5$$

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

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

$$x = 4 \quad x = -3$$

$$x = 4$$

$$y = 4 + 7 = 11$$

$$x = -3$$

$$y = -3 + 7 = 4$$

The numbers are either 4 and 11 or -3 and 4

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# 1b, c, e, g, h  
2 a-e, 3, 5