LG #16

Solving Systems by Graphing & Algebra

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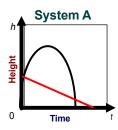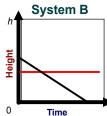_____

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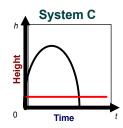
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Topic 1

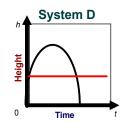**Example 1**

Relate a System of Equations to a Context

A springboard diver practices her dives from a 3-m springboard. Her coach uses video analysis to plot her height above the water.
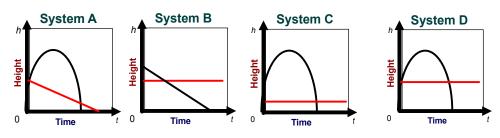
a) Which system below could represent the scenario? Explain.

b) Interpret the point(s) of intersection in the system you chose.

System A	System B	System C	System D
h Height / Time t / 0	h Height / Time t / 0	h Height / Time t / 0	h Height / Time t / 0

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System A
Height | Time
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System B
Height | Time
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System C
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System D
Height | Time
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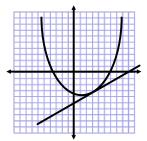
a)
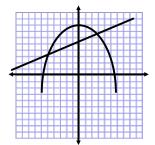
b)
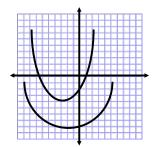
Number of Solutions

one solution   two solution   no solution

Example 2
Solve a System of Equations Graphically

Solve the following equations graphically.

$4x - y + 3 = 0$

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

1st put each system in $y =$

2nd type into Graph. Calc.

3rd find the intersection
points
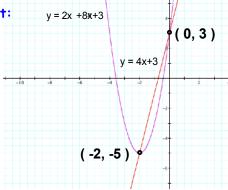
Steps to find Intersection Point:

2nd | TRACE | 5

• move cursor to a point of
intersection, then hit ENTER
• repeat for other points of
intersection

Solutions are

(-2,-5) and (0,3)

y = 2x +8x+3

y = 4x+3

(0, 3)

(-2, -5)

Try: Solve each system of equations graphically.

a) $x - y + 1 = 0$

  $x - 6x + y + 3 = 0$

b) $2x + 16x + y = -26$

  $x + 8x - y = -19$ $_2$

Topic 2

Example 1
Solve a System of Linear-Quadratic Equations Algebraically

Solve the following system of equations.

$$5x - y = 10$$
$$x + x - 2y = 0$$

Method 1: Substitution

1. Solve the linear equation for y.
   $$5x - y = 10$$
   $$y = 5x - 10$$
2. Substitute 5x - 10 for y in the quadratic equation and simplify.
   $$x + x - 2(5x - 10) = 0$$
   $$x - 9x + 20 = 0$$
3. Solve quadratic by factoring or Quad. Prgm.
   $$(x - 4)(x - 5) = 0$$
   $$x = 4 \text{ or } x = 5$$

Method 2: Elimination

1. Align the terms with the same degree.
   $$5x - y = 10 \ \text{①}$$
   $$x + x - 2y = 0 \ \text{②}$$
2. Multiply ① by -2 so you get opposite term to -2y in ①.
   $$-2(5x - y) = -2(10)$$
   $$-10x + 2y = -20 \ \text{③}$$
3. Add ③ and ② to eliminate y-terms.
   $$\text{0} \quad -10x + 2y = -20$$
   $$\underline{x + x - 2y = 0}$$
   $$x - 9x = -20$$
   $$x^2 - 9x + 20 = 0$$

Try: Solve the following system of equations
algebraically.

$3x + y = -9$

$4x - x + y = -9$

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Example 2
Model a Situation With a System
of Equations

Determine two integers such that the sum of the smaller number and twice the larger number is 46. Also, when the square of the smaller is decreased by three times the larger, the result is 93.

a) Write a system of equations.

Solution:
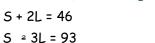
a) Let S represent the smaller number.

Let L represent the larger number.

First statement: "the smaller number and twice the larger number is" 46

$S + 2L = 46$

Second statement:" the square of the smaller is decreased by three times the larger, the result is 93

$S^2 - 3L = 93$

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b) Solve algebraically.

Hint: use Elimination Method

$S + 2L = 46$ ①

$S - 3L = 93$ ②

- Multiply ① by 3 and ② by 2

$3(S + 2L) = 3(46)$ $2(S - 3L) = 2(93)$

$3S + 6L = 138$ ③ $2S - 6L = 186$ ④

- Add ③ and ④ to eliminate L.

$0 + 3S + 6L = 138$

$2S - 0 - 6L = 186$

$2S + 3S = 324$

$2S + 3S - 324 = 0$ [use quad. prgm on Calc.]

$S = -13.5$ or 12

$S = 12$ numbers are supposed to be integers.

- Substitute $S = 12$ into linear equation to find L.

$S + 2L = 46$

$12 + 2L = 46$ **Solution**

$2L = 34$ **(12, 17)**

$L = 17$

Try: Determine two integers that have the following relationship: Fourteen more than twice the first integer gives the second integer. The second integer increased by one is the square of the first integer.

    a) Write a system of equations.
    b) Solve algebraically.

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Example 3
Solve a System of Quadratic-Quadratic Equations Algebraically

Solve the following systems of equations.

$$3x^2 - x + y - 2 = 0 \quad ①$$
$$6x^2 + 4x - y = 4 \quad ②$$

- Must eliminate y, so multiply ① by -1 then add ① and ② .

$$-3x^2 + x + y = -2$$
$$\underline{6x^2 + 4x - y = 4}$$
$$3x^2 + 5x = 2$$

- Solve the quadratic equation by factoring or Quad. Prgm.

$$x = -2 \quad \text{or} \quad x = \frac{1}{3}$$

- Now substitute these values into $3x^2 - x - y = 2$

$$3(-2)^2 - (-2) - y = 2 \qquad\qquad 3\left(\frac{1}{3}\right)^2 - \left(\frac{1}{3}\right) - y = 2$$
$$12 + 2 - y = 2 \qquad\qquad\qquad \frac{1}{3} - \frac{1}{3} - y = 2$$
$$y = 12 \qquad\qquad\qquad\qquad\qquad y = -2$$

$$Solutions: \ (-2, 12) \ and \ \left(\frac{1}{3}, -2\right)$$

Try: **a)** Solve the system algebraically.

$6x - 2x - y = -1$

$4x - 24x - y = -6$

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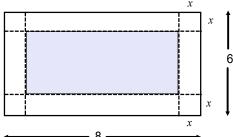**b)** Two paths for an "alley-oop" in basketball can be modelled by these two system of equations, where d is horizontal distance and h is height.

The pass: $d^2 - 2d + 3h = 9$

The jump for the dunk: $5d^2 - 10d + h = 0$

i) Solve the system of equations algebraically.

ii) Interpret your results.

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HMP:

1. Write 2 equations for the area of the bottom of the box.
The area of the bottom is 35cm

2. Find the dimensions.