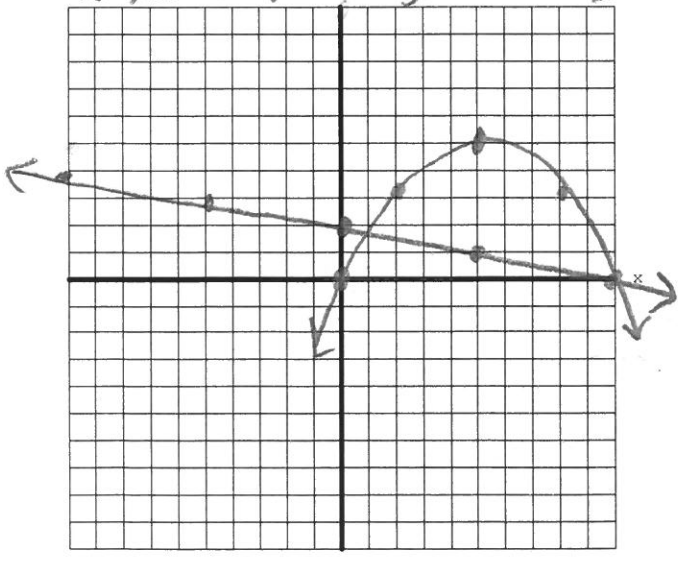
System of Linear and Quadratic Equations: WORD PROBLEMS

1. Use substitution to find your solution.
   The height of a ball "x" seconds after it was thrown is modeled by the equation $y = -16x^2 + 67x$, where y is its height in feet above the ground. At the same time, a bird flying through the air had a height of $y = 3x + 48$.
   a. Solve the system to find the time(s) when the ball and the bird were at the same elevation.
   b. What is the elevation at that time(s)?
   c. Do you need all of the answers you found? Why or why not?

$-16x^2+67x = 3x+48$
$0 = 16x^2-64x+48$
$0 = 16(x^2-4x+3)$
$0 = 16(x-3)(x-1)$
$x=3 \quad x=1$
$y=57 \quad y=51$

a) after 1 & 3 seconds
b) 51 & 57 feet
c) If the ball hits the bird after 1 second, there won't be a second answer at 3 seconds.

2. Graph to find your solution.
   A rocket is launched from the ground and follows a parabolic path (parabola) represented by the equation $y = -x^2 + 10x$. At the same time a flare is launched from a height of 10 feet and follows a linear path (line) represented by the equation $y = -x + 10$.
   a. Find the coordinates of the point or points where the paths intersect. (10,0) & (1,9)
   b. What is the height or heights of intersection? 9 ft. and 0 ft.
   c. Do you need all of the answers you found? Why or why not? not if the flare hit the rocket.




$x = \frac{-b}{2a} = \frac{-10}{2(-1)} = 5$ Vertex
$y = -(5)^2+10(5) = 25$

| x | y |
|---|---|
| 0 | 0 |
| 2 | 16 |
| 5 | 25 |
| 8 | 16 |
| 10 | 0 |

(1,9)
(10,0)

3. Use any method to find your solution.
A pelican flying in the air over water drops a crab from a height of 30 feet. The distance the crab is from the water as it falls can be represented by the equation $y = -16x^2 + 30$, where "x" is time, in seconds. To catch the crab as it falls, a seagull flies along a path represented by the equation $y = -8x + 15$.
   a. Can the gull catch the crab before the crab hits the water?
   b. Do you need all of the answers you found? Why or why not?

$-16x^2 + 30 = -8x + 15$

$0 = 16x^2 - 8x - 15$

$x = \frac{8 \pm \sqrt{(-8)^2 - 4(16)(-15)}}{2(16)} = \frac{8 \pm \sqrt{1024}}{32} = 1.25 \text{ or } -.7$

yes, after 1.25 seconds at a height of 5 feet, the negative answer doesn't make sense... crab hasn't been dropped yet.

4. Use any method to find your solution.
The "Jump Shot" company sells basketballs. The amount of money, "y" that the company takes in from selling "x" basketballs per day is modeled by the equation $y = -2x^2 + 40x$. The amount of money "y" that it costs the company to make "x" basketballs per day is modeled by the equation $y = 10x + 100$.
   a. Solve the system to find the number of basketballs sold each day to break even. 5 or 10 balls/day
   b. How much money was earned on these days? 150 or 200 dollars
   c. How many basketballs per day may "Jump Shot" sell in order to make a profit? 6, 7, 8, or 9

break even when revenue = cost

$-2x^2 + 40x = 10x + 100$

$0 = 2x^2 - 30x + 100$

$0 = 2(x^2 - 15x + 50)$

$0 = 2(x - 10)(x - 5)$

$x = 10 \quad x = 5$

$y = 200 \quad y = 150$