Linear and Quadratic Systems

Solve $\begin{cases} y = x^2 + 4x + 3 \\ y - 2x = 6 \end{cases}$

Step 1: Simplify and solve both equations for y.

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

$y - 2x = 6$

$y = 2x + 6$

Step 2: Substitute one equation into the y value of the other. (Essentially, just set them equal to each other.) Solve for x.

$x^2 + 4x + 3 = 2x + 6$

$x^2 + 2x – 3 = 0$ Get the equation equal to zero.

$(x + 3)(x – 1) = 0$ Factor.

$x = -3 \quad x = 1$ Find the zeros.

Solve $\begin{cases} y + 1 = \frac{1}{2}(x - 3)^2 \\ x - y = 6 \end{cases}$

Step 1: Solve both equations for y.

$y + 1 = \frac{1}{2}(x^2 - 6x + 9)$	$-y = 6 - x$
$y + 1 = \frac{1}{2}x^2 - 3x + 4.5$	$y = x - 6$
$y = \frac{1}{2}x^2 - 3x + 3.5$	

Step 2: Set the two equations equal to each other.

$\frac{1}{2}x^2 – 3x + 3.5 = x – 6$

$x^2 – 6x + 7 = 2x – 12$

$x^2 – 8x + 19 = 0$

Step 2 continued: This equation does not factor, so use the quadratic formula to find the x-values.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{8 \pm \sqrt{8^2 - 4(1)(19)}}{2(1)}$$

$$x = \frac{8 \pm \sqrt{-12}}{2}$$

No real solutions.

There is no solution to this system of equations.

A punter kicks a football. The height of the football is given by $h = -4.9t^2 + 18.24t + 0.8$, where t is the time after the ball is kicked. The height of an approaching defender's hands is $h = -1.43t + 4.26$. Does the blocker knock down the punt?

$-4.9t^2 + 18.24t + 0.8 = -1.43t + 4.26$

Set the equations equal to each other.

$-4.9t^2 + 19.67t - 3.46 = 0$

Get the equation equal to zero.

$$t = \frac{-19.67 \pm \sqrt{19.67^2 - 4(-4.9)(-3.46)}}{2(-4.9)}$$

Use the quadratic formula.

$$t = \frac{-19.67 + \sqrt{319.0929}}{-9.8} \; and \; t = \frac{-19.67 - \sqrt{319.0929}}{-9.8}$$

t = 0.184 and t = 3.830