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# Solving Systems of Linear and Quadratic Equations

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# Remember these?

$$2x + y = 8$$

$$x - y = 10$$

## Systems of Linear Equations

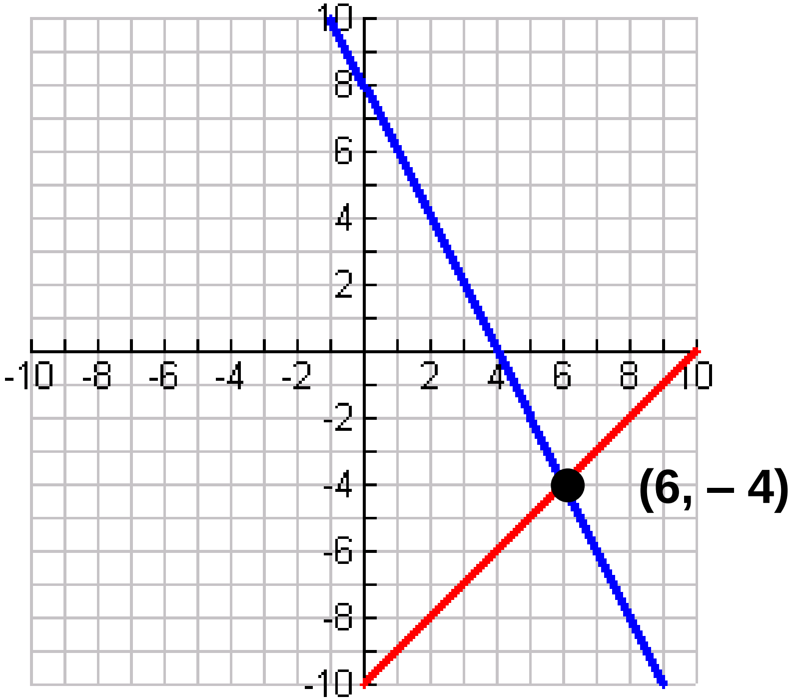
**We had 3 methods to solve them.**

**<u>Method 1</u> - Graphing**

**Solve for y.**

$$y = -2x + 8$$

$$y = x - 10$$



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# Remember these?

Systems of Linear Equations

$$2x + y = 8$$
$$x - y = 10$$

**<u>Method 2</u> - Substitution**

$$y = -2x + 8$$

$$x - y = 10$$
$$x - (\ ) = 10$$
$$x + 2x - 8 = 10$$
$$3x = 18$$
$$x = 6$$

$$y = -2x + 8$$
$$y = -2(\ ) + 8$$
$$y = -12 + 8$$
$$y = -4$$

(6, – 4)

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# Remember these?

$$2x + y = 8$$
$$x - y = 10$$

Systems of Linear Equations

**<u>Method 3</u> - Elimination**

$$2x + y = 8$$
$$+ \quad x - y = 10$$
$$3x = 18$$
$$x = 6$$

$$( \quad )x - y = 10$$
$$-y = 4$$
$$y = -4$$

$(6, -4)$

**All 3 methods giving us the same answer (6,–4).**

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# Try the following.

1. $\begin{cases} x + 3y = -9 \\ 4y = x + 16 \end{cases}$ **(12,1)**

2. $\begin{cases} 2x + 3y = 3 \\ -6x - 12y = -11 \end{cases}$ $\left(\frac{1}{2}, \frac{2}{3}\right)$

3. $\begin{cases} 3m + 6n = 12 \\ 4m + 5n = 28 \end{cases}$ (12, – 4)

4. $\begin{cases} -3x + 6y = 18 \\ y = \frac{1}{2}x + 3 \end{cases}$ Many solutions Same Line!

5. $\begin{cases} 5x - \frac{28}{3}y = 2 \\ -3x = 4y \end{cases}$ $\left(\frac{1}{6}, -\frac{1}{8}\right)$

6. $\begin{cases} \frac{1}{2}x - \frac{1}{3}y = \frac{1}{6} \\ 6x - 4y = 1 \end{cases}$ NO solution Parallel Lines!

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# Now let's look at Systems of Linear and Quadratic Equations!

# Solve the System Algebraically

Use Substitution

$$y = x^2 + 1$$

$$y - x = 1$$

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

$$x^2 - x = 0$$

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

$$x = 0 \quad or \quad x - 1 = 0$$

$$x = 0 \quad or \quad x = 1$$

$x = 0$

$$y = 0^2 + 1$$

$$y = 1$$

**(0, 1)**

$x = 1$

$$y = 1^2 + 1$$

$$y = 2$$

**(1, 2)**

Answer: (0,1) (1,2)

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# Solve the System Algebraically

## Use Substitution

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

$$y - 2x = -2$$

$$y = 2x - 2$$

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

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

$$0 = x^2 - 4x + 4$$

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

$$0 = x - 2$$

$$x = 2$$

$$\boxed{x = 2}$$

$$y - 2(2) = -2$$

$$y - 4 = -2$$

$$y = 2$$

**(2, 2)**

Answer: (2,2)

# Solve the System Algebraically

Use Substitution

$$x^2 + y^2 = 26$$

$$x - y = 6$$

$$y = x - 6$$

$$x^2 + (x-6)^2 = 26$$

$$x^2 + x^2 - 12x + 36 = 26$$

$$2x^2 - 12x + 10 = 0$$

$$x^2 - 6x + 5 = 0$$

$$(x-5)(x-1) = 0$$

$$x = 5 \quad or \quad x = 1$$

$\boxed{x = 5}$

$$5 - y = 6$$

$$-y = 1$$

$$y = -1$$

**(5, –1)**

$\boxed{x = 1}$

$$1 - y = 6$$

$$-y = 5$$

$$y = -5$$

**(1, – 5)**

Answer: **(5, –1) (1, – 5)**

# Solve the System Algebraically

## Use Substitution

$$x^2 + y^2 = 25$$

$$4y = 3x$$

$$y = \frac{3}{4}x$$

$$x^2 + \left(\frac{3}{4}x\right)^2 = 25$$

$$x^2 + \frac{9}{16}x^2 = 25$$

$$16x^2 + 9x^2 = 400$$

$$25x^2 = 400$$

$$x^2 = 16$$

$$x = \pm 4$$

$$\boxed{x = 4}$$

$$4y = 3(4)$$

$$4y = 12$$

$$y = 3$$

**(4, 3)**

$$\boxed{x = -4}$$

$$4y = 3(-4)$$

$$4y = -12$$

$$y = -3$$

**(– 4, – 3)**

Answer: **(4, 3) (–4, – 3)**

# Solve the System Algebraically

## Use ????

$$3x^2 - 4y^2 = 11$$

$$x^2 + y^2 = 13$$

# Now let's look at the Graphs of these Systems!

$$y = x^2 - 4$$

$$y = -x - 2$$

What does the graph of each look like?

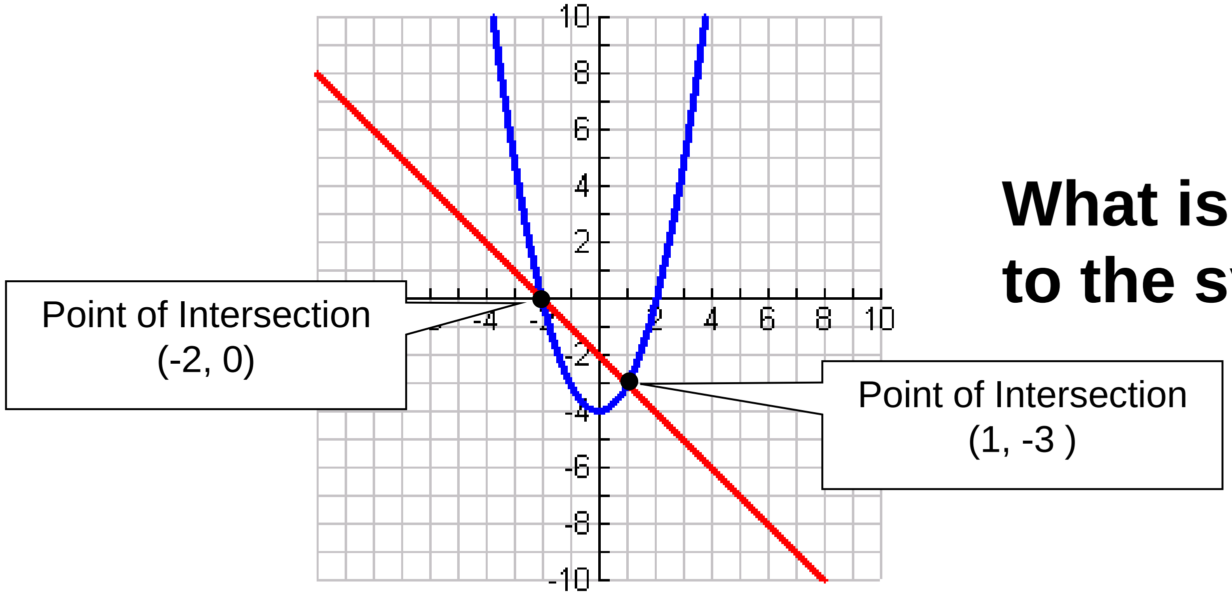
Classify each equation as linear/quadratic.

Quadratic

Parabola

Linear

Line




**What is the solution to the system?**

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# We have solved the following algebraically

**Now use your calculator to check it graphically.**

$$y = x^2 + 1$$

$$y - x = 1$$

Answer:

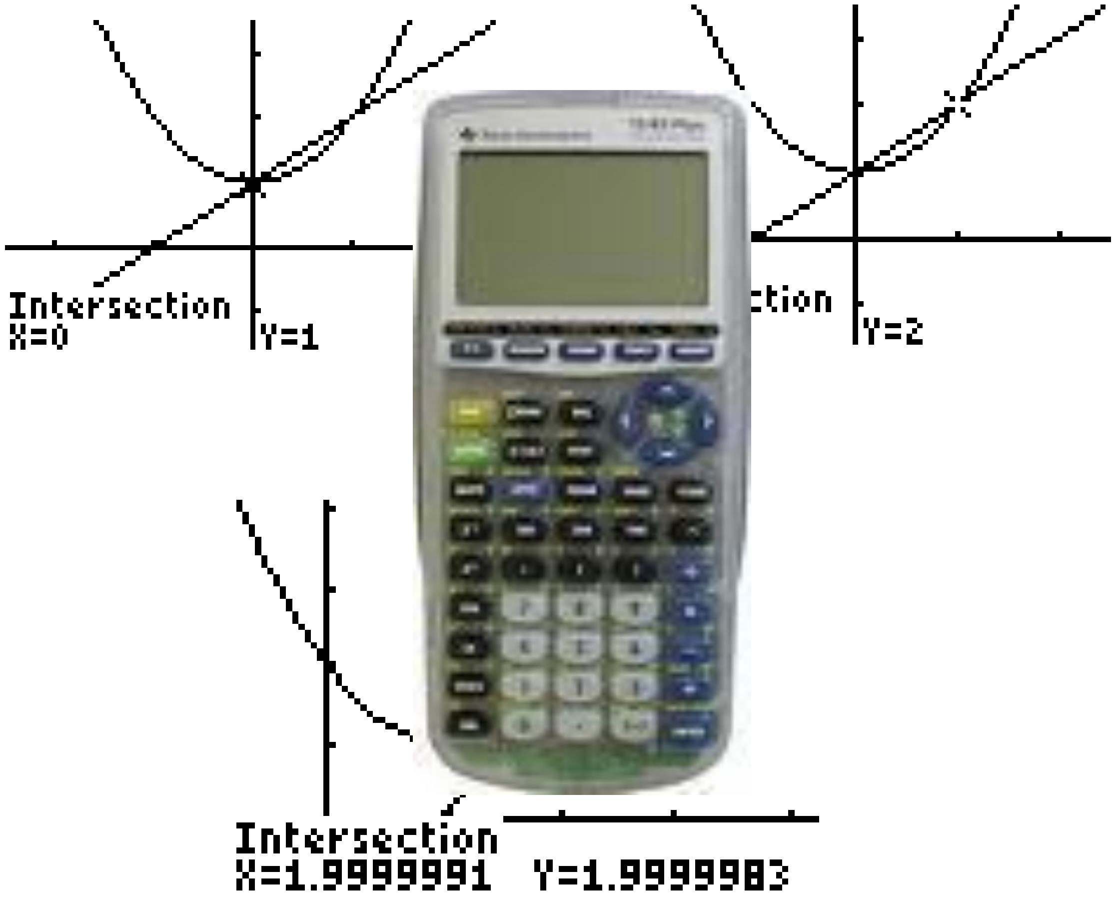
(0,1) (1,2)

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

$$y - 2x = -2$$

Answer:

(2,2)



# Equations must be solved for y!!

$$x^2 + y^2 = 26$$

$$x - y = 6$$

$$x^2 + y^2 = 26$$

$$y^2 = 26 - x^2$$

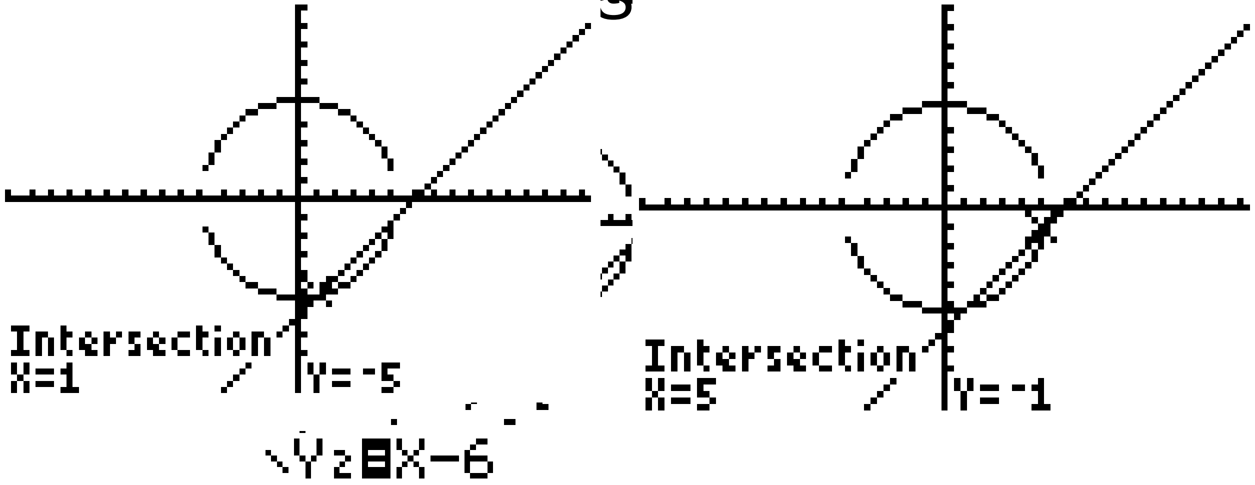
$$y = \pm\sqrt{26 - x^2}$$

*and*

$$y = x - 6$$

The first equation must be entered as two separate entries:

Zoom 6: ZStandard




Answer: **(5, –1) (1, – 5)**