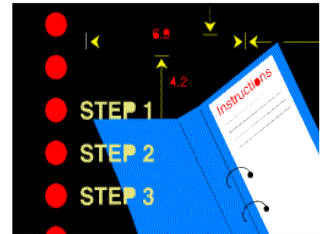


# Solving a Linear Quadratic System Graphically

Solving a linear-quadratic system of equations graphically involves following a series of steps.



## Example

Solve the following system of equations graphically:

$$y = x^2 - 4x - 2 \quad (\text{quadratic equation of form } y = ax^2 + bx + c)$$

$$y = x - 2 \quad (\text{linear equation of form } y = mx + b)$$

**Step 1: Graph one of the equations.** Let's graph the quadratic equation first. By its form,  $y = x^2 - 4x - 2$ , we know it is a parabola.

Rather than picking numbers at random to form our table of values, let's find the axis of symmetry where the turning point of the parabola will occur.

To find the axis of symmetry, we use the formula  $x = -b/2a$

In this example,  $a = 1$ ,  $b = -4$ , and  $c = -2$ . Substituting we get:

$$x = -(-4)/2(1)$$

$$x = 4/2$$

$$x = 2 \quad \text{axis of symmetry}$$

Since the  $x$ -coordinate of the turning point is 2, let's use this value as the **middle** value for  $x$  in our table. We will also include 3 values above and below 2 in our table.

Substitute each value of  $x$  into the quadratic equation to find the corresponding values for  $y$  and complete the table.

For example, substituting -1 for  $x$  we get  $y = (-1)^2 - 4(-1) - 2 = 1 + 4 - 2 = 3$

$x$	$y$
-1	
0	
1	
2	
3	
4	
5	

$x$	$y$
-1	3
0	-2
1	-5
2	-6
3	-5
4	-2
5	3

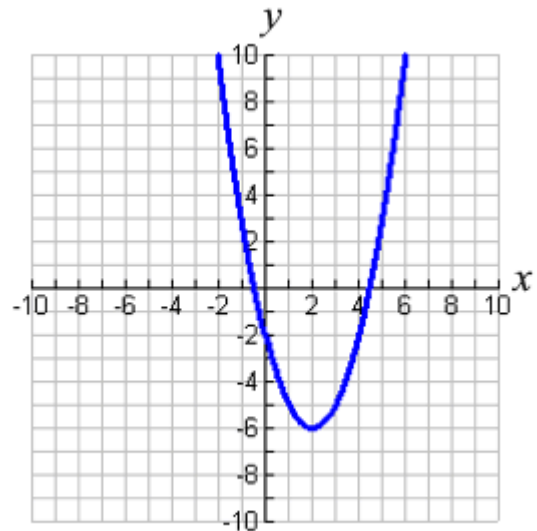
Set up the table.

Complete the table.

Next, graph the points from the table to get the graph of the parabola at the right.



**Step one done!**

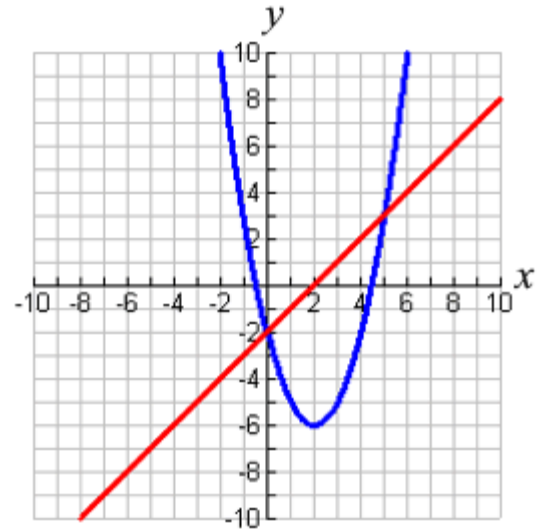


**Step 2: Graph the second equation:** Now graph the linear equation, a straight line,  $y = x - 2$  on the same set of axes.

To graph the straight line we need to know the slope and the  $y$ -intercept. Remember, from the form,  $y = mx + b$ ,  $m$  is the slope and  $b$  is the  $y$ -intercept. For our equation,  $m = 1$ ,  $b = -2$ .

Draw the graph of the line starting at  $-2$  on the  $y$ -axis.

Use slope (which is rise over run) to find other points by going **up 1** and to the **right 1**, or **down 1** and to the **left 1**.



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

**Step 3: Find the intersection points (where they cross).**

The last step is to find the point(s) where the two graphs intersect. This is the solution set, the answer, of the system of equations.

Our graphs intersect at 2 points whose coordinates are  $(0, -2)$  and  $(5, 3)$ .

**The solution set for this problem is:**  
 **$\{(0, -2), (5, 3)\}$**