

# Example 5: Graph $y = x^2 + 2x + 3$

Find the vertex and the axis of symmetry. Sketch these in.

- Find the x-intercept by plugging in 0 for y.
- Find the y-intercept by plugging in 0 for x.
- Reflect your points across the axis of symmetry and connect your dots with a smooth U-shaped (not V-shaped) curve.

fix the following

- $a = 1, b = 2, c = 3$
  - $x^2 + 2x + 3$
1. find the line of symmetry -
    1.  $x = (b/2a)$
    2.  $x = -(2) / 2(1) = -1$
  2. use this to find the vertex
  3. since we know that the along the x axis at -1 will be the vertex we replace x with 1 in the original formula
    1.  $x = -1$
    2.  $y = x^2 - 2x - 8$
    3.  $y = 1^2 + -2 * 1 - 8 = 1 - 2 - 8 = -9$
    4.  $y = -9$
  4. the vertex is  $(-1, -9)$
  5. since the vertex is  $-1, -9$  we know that  $x = -1$  is the axis of symmetry
  6. finding the y-intercept is the easiest to start with because we just replace x with 0
  7.  $x = 0 \mid y = x^2 - 2x - 8$
  8.  $y = 0 - 8 = -8$
  9. y-intercept =  $(0, -8)$
  10. so so To find the x-intercepts, you can set y equal to zero and solve for x:
  11.  $y = 0 \mid x = (-b \pm \sqrt{b^2 - 4ac}) / 2a$ 
    1.  $x = (-(-2) \pm \sqrt{(-2)^2 - 4(1)(-8)}) / 2(1)$   
 $x = (2 \pm \sqrt{4 + 32}) / 2$   
 $x = (2 \pm \sqrt{36}) / 2$   
 $x = (2 \pm 6) / 2$   
 $x = 8 / 2$  or  $x = -4 / 2$   
 $x = 4$  or  $x = -2$   
sooooo  $(-2, 0)$  &  $(4, 0)$

12. so since we know 3 y axis points on the graph and the axis of symmetry we can get another point without doing much work
1. symmetry line =  $x = 1$ ,
  2. calc'd x-intercept  $0, -8$ 
    1. the symmetry line is 1 and the known point is 0 since  $1 - 0 = 1$  we can add that to the x coordinate of y and keep the same y coordinate to get the mirrored point making another point on the graph  $(2, -8)$
  3. since we need one more point for the graph we can choose say  $x=3$ , |  $x^2 - 2x - 8$ 
    1.  $y = 3^2 - 3*2 - 8 = -5$ 
      1. soooo the new point is  $(3, -5)$  if we mirror that along  $1, -9$  we get  $(-1, -5)$  because 3 is 2 more than 1, and 2 less than 1 is -1. we also keep the same y coordinate
  4. so all points are:
    1.  $(1, -9)$
    2.  $(0, -8)$
    3.  $(2, -8)$
    4.  $(3, -5)$
    5.  $(-1, -5)$

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