

Example 4 Graph $f(x) = x^2 - 2x - 8$

Steps to Graph $ax^2 + bx + c$

- 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.

Graph $f(x) = x^2 - 2x - 8$

[image.png](#)

for now, I'm just gonna type my work and figure out what to do next

1. find the line of symmetry -
 1. $a = 1, b = -2, c = -8$
2. use this to find the vertex
 1. $x = (b/2a)$
 2. $x = -(-2) / 2(1) = 1$
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. $x = -(-2) \pm \sqrt{(-2)^2 - 4(1)(-8)}) / 2(1)$

$$x = (2 \pm \sqrt{4 + 32}) / 2$$

$$x = (2 \pm \sqrt{36}) / 2$$

$$x = (2 \pm 6) / 2$$

$$x = 8 / 2 \text{ or } x = -4 / 2$$

$$x = 4 \text{ or } x = -2$$

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. $y = 3^2 - 3 \cdot 2 - 8 = -5$

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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