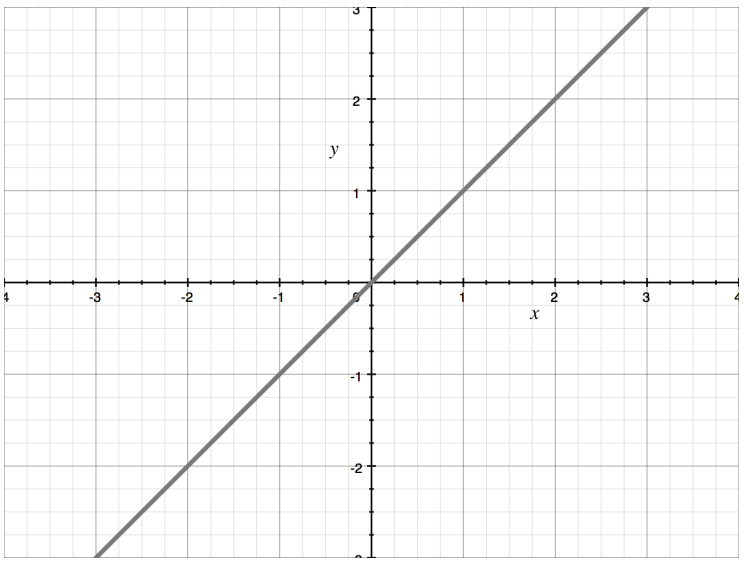
Topic: Graphing parabolas

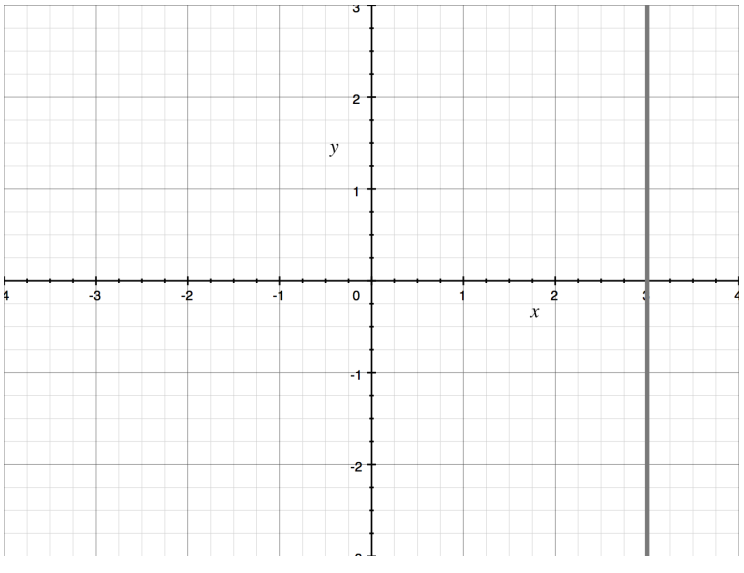
Question: Which graph represents a non-linear function?

Answer choices:

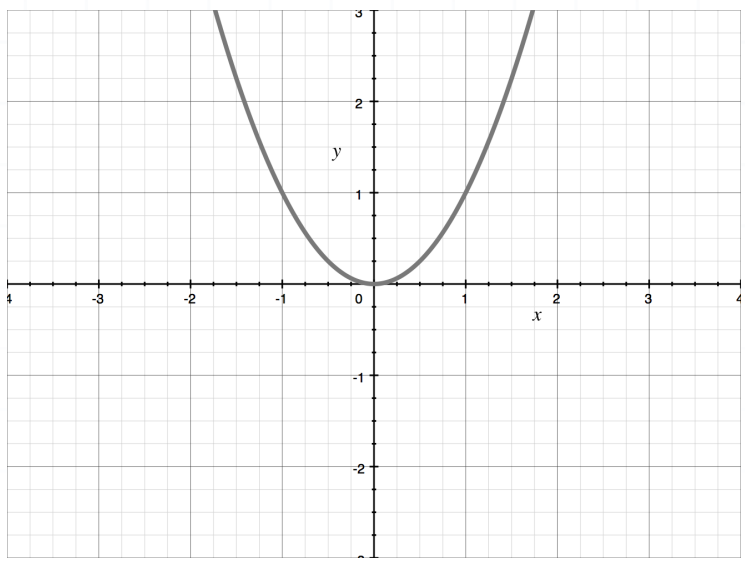
A $y = x$



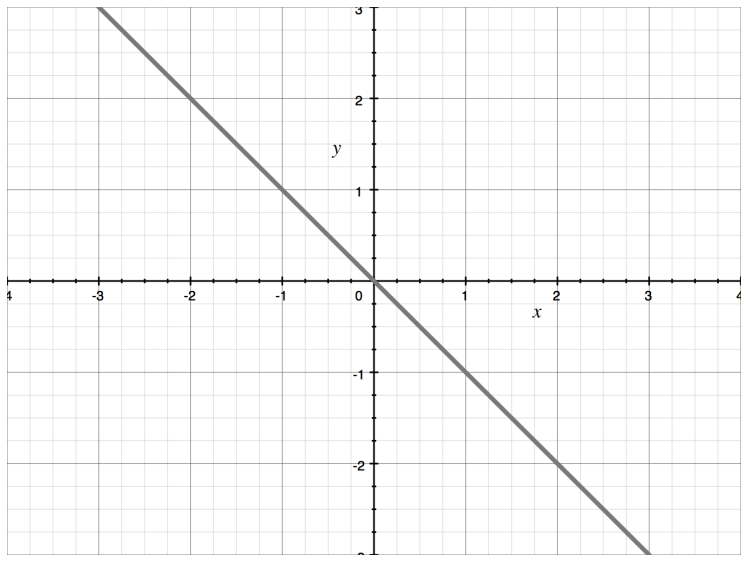
B $x = 3$



C $y = x^2$



D $y = -x$



Solution: C

The graph in answer choice C is the only graph that its't a line, which means it represents the only non-linear function.

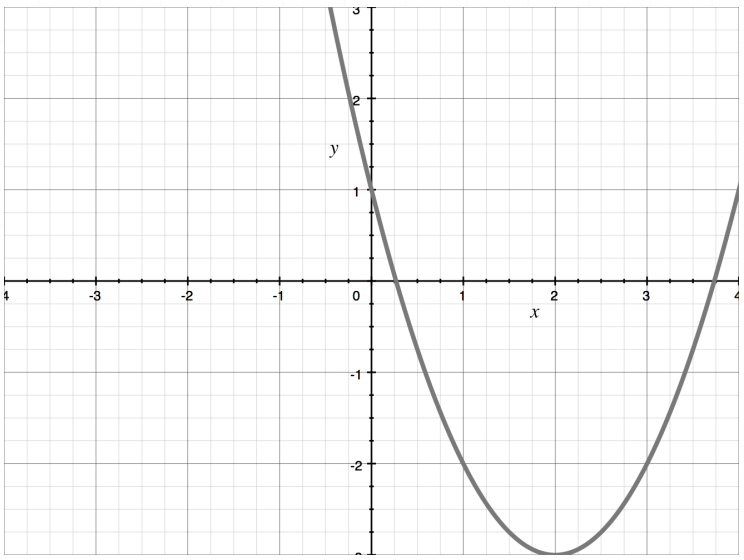
Topic: Graphing parabolas

Question: Which graph represents the function?

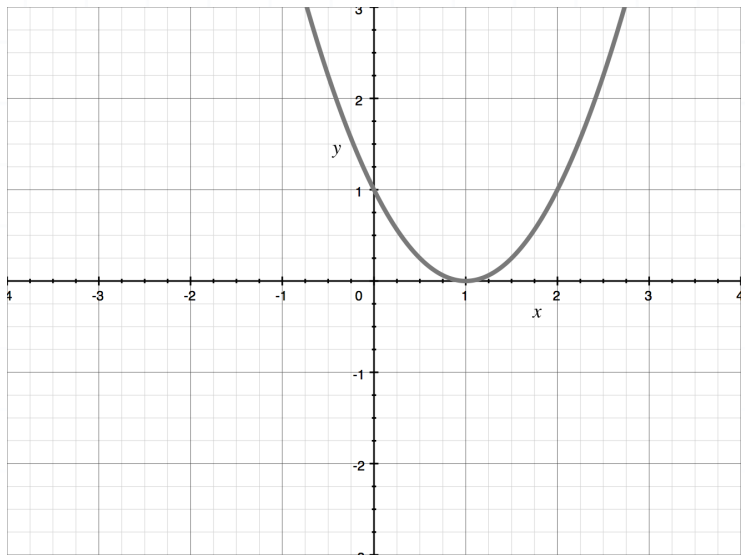
$$y = -x^2 - 4x - 1$$

Answer choices:

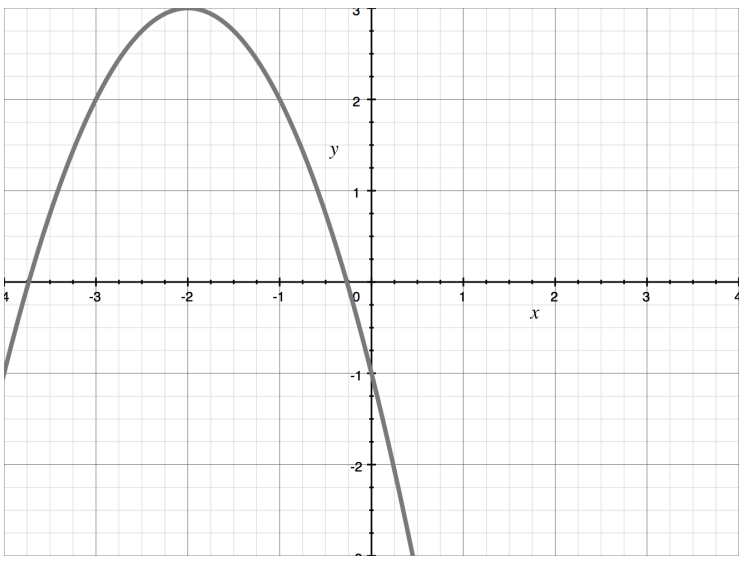
A



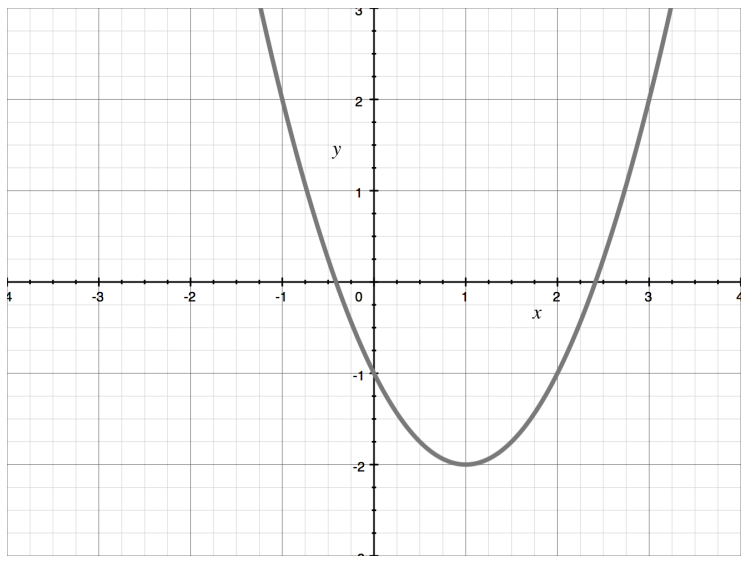
C



B



D



Solution: B

We want to put the parabola in standard form,

$$f(x) = a(x - h)^2 + k$$

where (h, k) is the vertex of the parabola.

We'll do this by completing the square.

Before we can do that though, we need to make the coefficient on the x^2 term a positive 1 instead of a negative 1, which we'll do by factoring out a -1.

$$y = -x^2 - 4x - 1$$

$$y = -\left(x^2 + 4x + 1\right)$$

Now taking the coefficient on the first-degree x term, 4, and dividing it by 2, we get

$$\frac{4}{2} = 2$$

Squaring the result gives

$$(2)^2 = 4$$

This is the value we have to add in order to complete the square. But we have to be careful. If we add 4 inside the parentheses on the right, the negative sign outside of the parentheses applies to it, which means we're actually subtracting 4 from the right. So we'll have to subtract 4 from the left as well in order to keep the equation balanced.

$$y = -\left(x^2 + 4x + 1\right)$$

$$y - 4 = -\left(x^2 + 4x + 4 + 1\right)$$

$$y - 4 = -\left[\left(x^2 + 4x + 4\right) + 1\right]$$

$$y - 4 = -\left(x^2 + 4x + 4\right) - 1$$

$$y = -\left(x^2 + 4x + 4\right) + 3$$

$$y = -(x + 2)(x + 2) + 3$$

$$y = -(x + 2)^2 + 3$$

Now that we've got the parabola in standard form, we can identify its characteristics.

1. The negative sign in front of the parentheses indicates the parabola opens down

2. It's vertex and maximum point is at $(-2,3)$

3. The y-intercept is at $y = -1$