Presentation MSEIP workshop **Spring 2017** **Graphing Parabolas** **The three types of equation of parabola**

Lucie Mingla

Some Information before the activity

Standard Form Equation for Parabola

The **standard form** equation for parabolas looks like your standard quadratic:

$$y = ax^2 + bx + c$$

This form provides you a couple of key bits of information.

1. The first number you see, *a*, tells you whether your parabola opens up or down. If *a* is negative, it will open downwards and look like a frown. If 'it is positive, it will open up and will look like a smile. A good way to remember this is to think of the phrase, 'Be positive; don't frown.'

$$a < 0 \quad \text{opens down}$$
$$a > 0 \quad \text{opens up}$$

2. Using both *a* and *b* will give you the axis of symmetry of the parabola. The **axis of symmetry** of the parabola is the line that acts as a mirror for the parabola. The parabola on either side of the axis of symmetry is the mirror image of the other side. The formula for finding the axis of symmetry from the standard form equation is:

$$x = -\frac{b}{2a}$$

To Convert from $f(x) = ax^2 + bx + c$ Form to Vertex Form:

Method 1: Completing the Square

To convert a quadratic from $y = ax^2 + bx + c$ form to vertex form, $y = a(x - h)^2 + k$, you use the process of completing the square. Let's see an example.

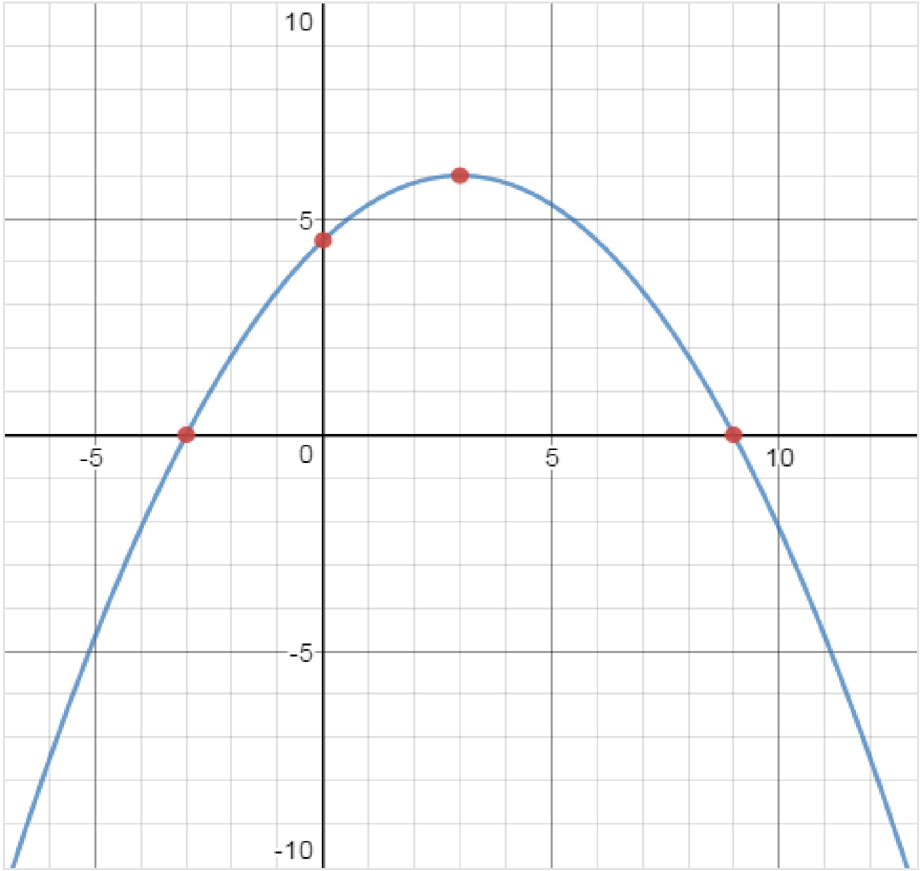
Example: Convert $y = 2x^2 - 4x + 5$ into vertex form, and state the vertex.

Equation in $y = ax^2 + bx + c$ form.	$y = 2x^2 - 4x + 5$
Since we will be "completing the square" we will isolate the x^2 and x terms ... so move the + 5 to the other side of the equal sign.	$y - 5 = 2x^2 - 4x$
We need a leading coefficient of 1 for completing the square ... so factor out the current leading coefficient of 2.	$y - 5 = 2(x^2 - 2x)$
Get ready to create a perfect square trinomial. *BUT be careful!!* In previous completing the square problems with a leading coefficient not 1, our equations were set equal to 0. Now, we have to deal with an additional variable, "y" ... so we cannot "get rid of " the factored 2. When we add a box to both sides, the box will be multiplied by 2 on both sides of the equal sign.	$y - 5 + 2\square = 2(x^2 - 2x + \square)$
Find the perfect square trinomial. Take half of the coefficient of the x-term inside the parentheses, square it, and place it in the box.	$y - 5 + 2\boxed{1} = 2(x^2 - 2x + \boxed{1})$
Simplify and convert the right side to a squared expression.	$y - 3 = 2(x - 1)^2$
Isolate the y-term ... so move the -3 to the other side of the equal sign.	$y = 2(x - 1)^2 + 3$
In some cases, you may need to transform the equation into the "exact" vertex form of $y = a(x - h)^2 + k$, showing a "subtraction" sign in the parentheses before the h term, and the "addition" of the k term. (This was not needed in this problem.)	$y = 2(x - 1)^2 + 3$ Vertex form of the equation. Vertex = $(h, k) = (1, 3)$ (The vertex of this graph will be moved one unit to the right and three units up from (0,0), the vertex of its parent $y = x^2$.)

Activity Outline associated with solutions(my preparation)

1 of 16

Welcome!

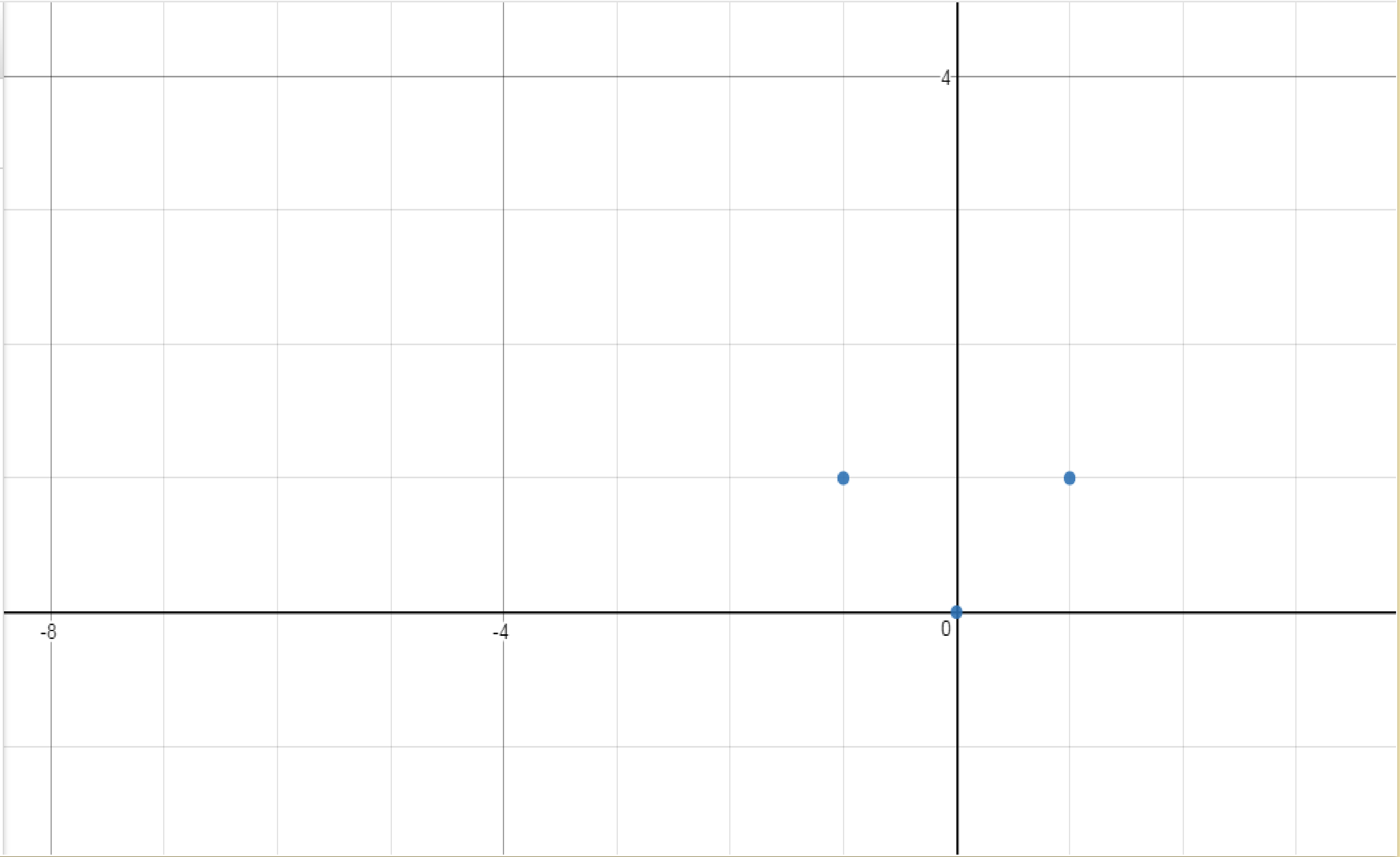


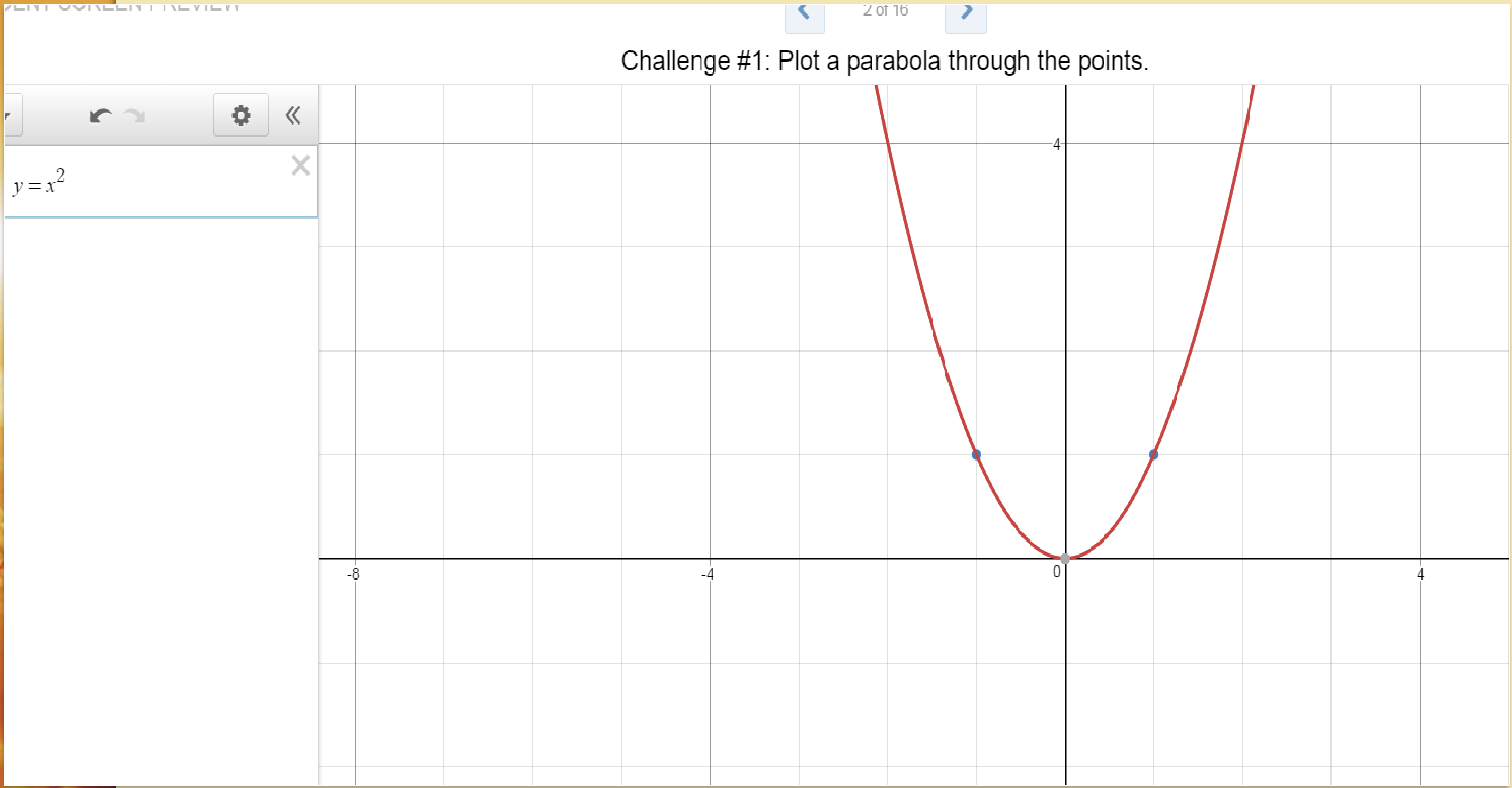
For each Match My Parabola challenge, plot a parabola that passes through the given points.

Click the right arrow above to get started!

UDENT SCREEN PREVIEW

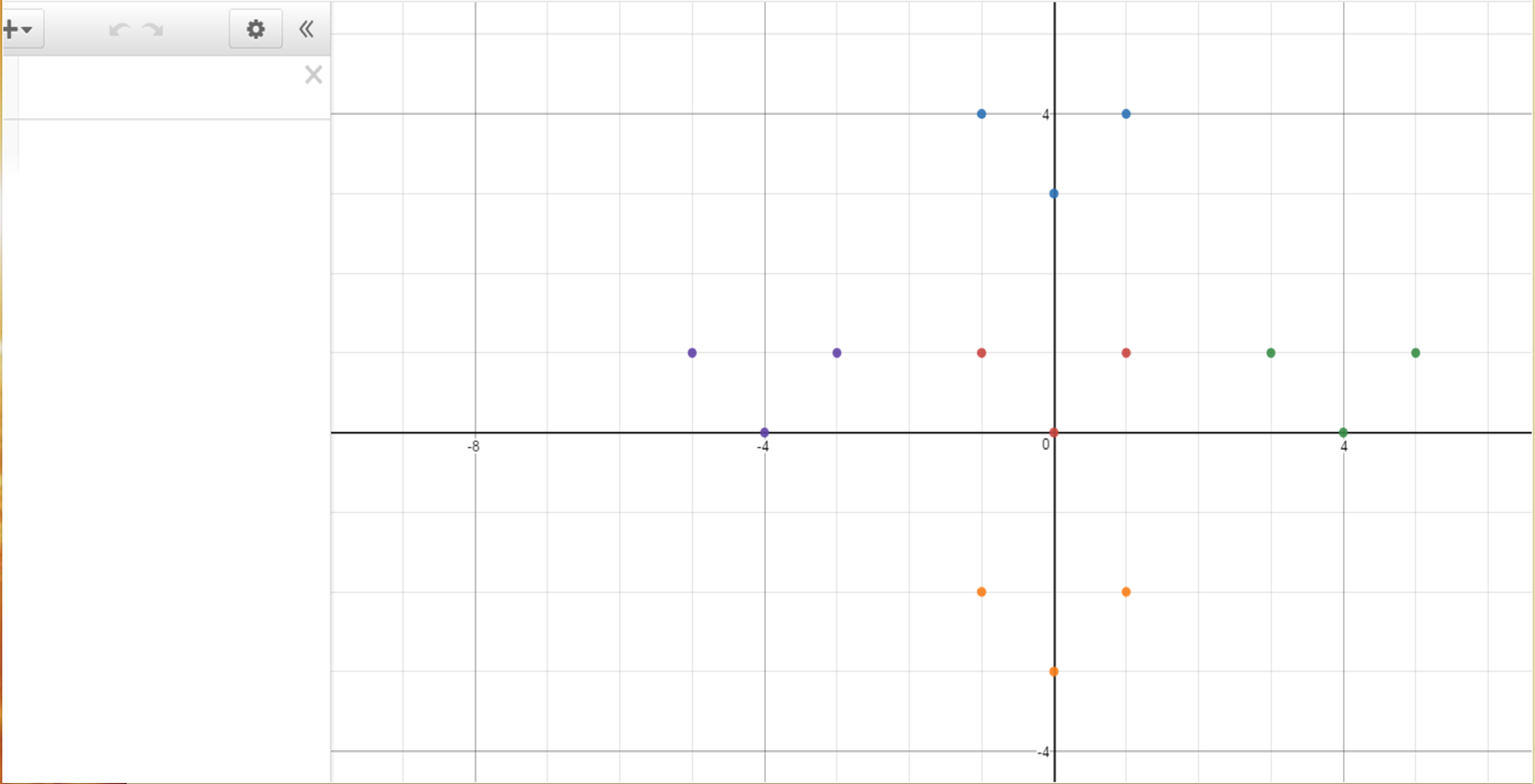
Challenge #1: Plot a parabola through the points.



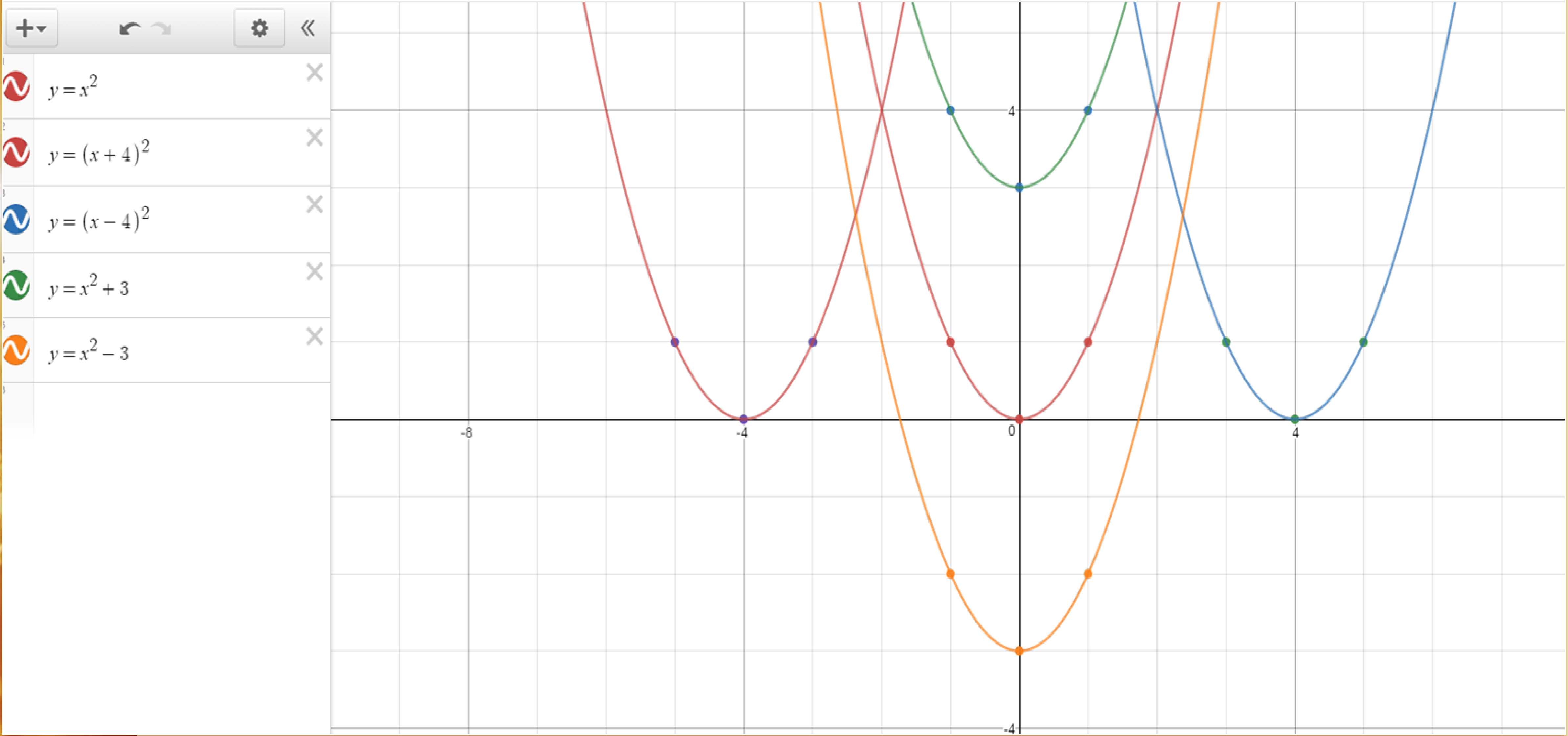


2 of 16
Challenge #1: Plot a parabola through the points.
$y = x^2$
4
-8
-4
0
4

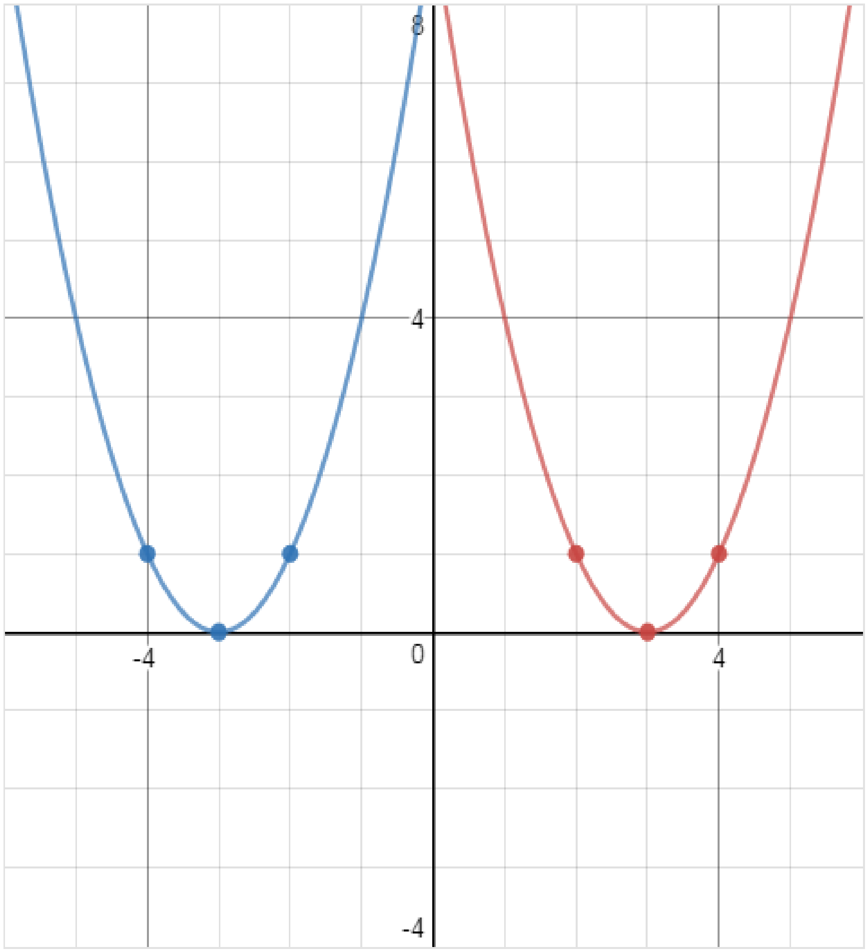
Challenge #2: Plot five parabolas, one through each set of color-coordinated points.



Challenge #2: Plot five parabolas, one through each set of color-coordinated points.



Consider these graphs:



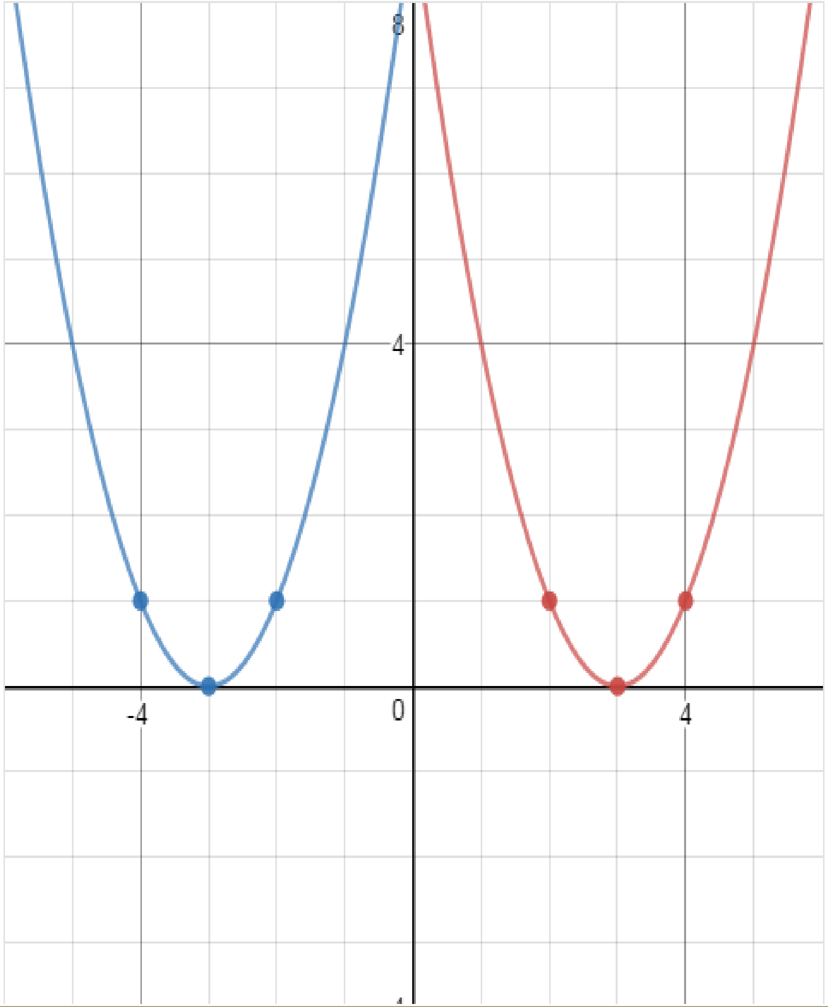
Eric thinks the equation $y = (x - 3)^2$ will match the blue graph. Jenny thinks it will match the red graph.

Whom do you agree with and why?

Eric

Jenny

Consider these graphs:



Eric thinks the equation $y = (x-3)^2$ will match the blue graph. Jenny thinks it will match the red graph.

Whom do you agree with and why?

Eric | Jenny

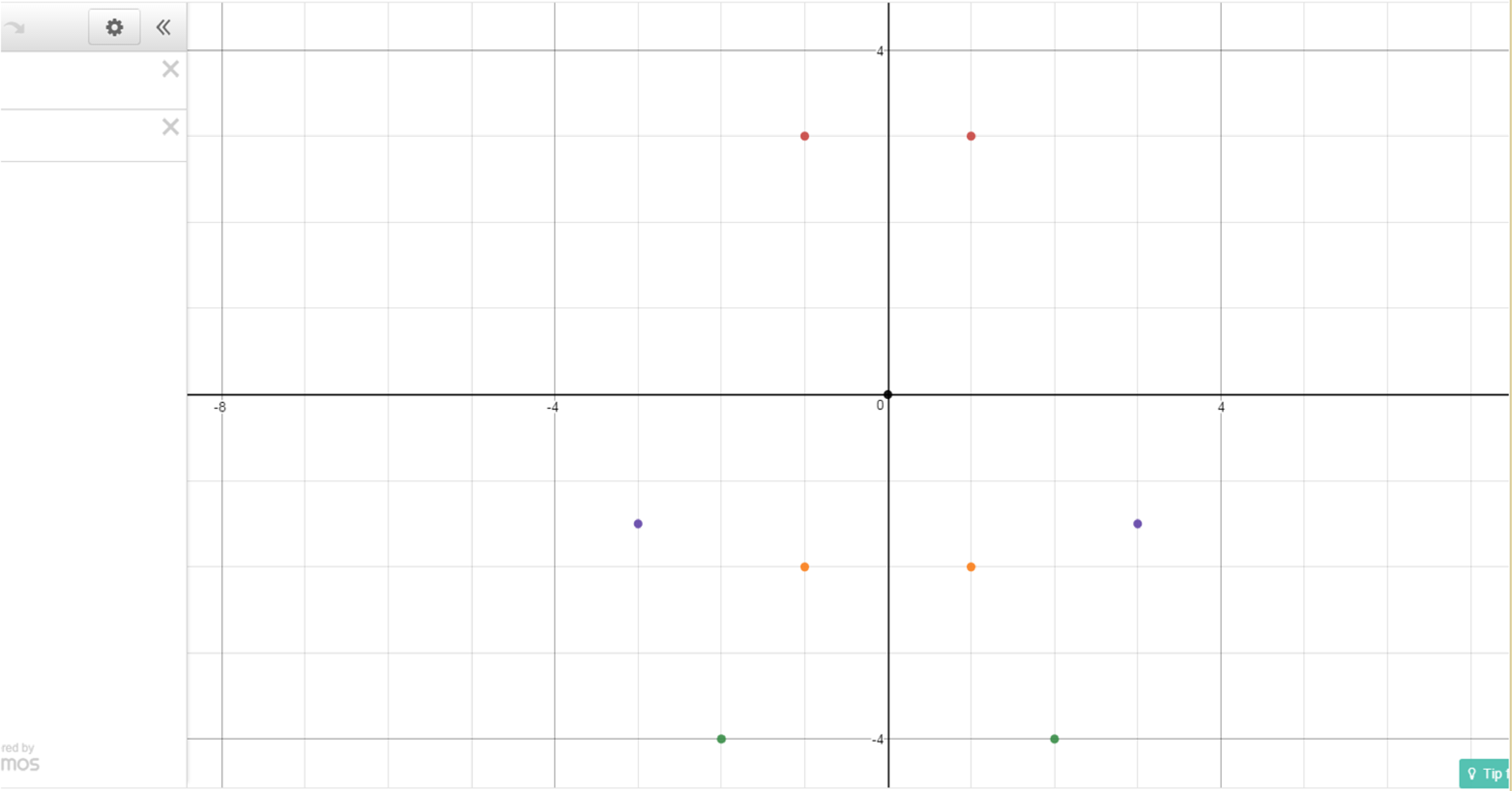
Explain your answer.

The vertex is at (3,0). Only red parabola satisfies that condition.
I also saw from previous example that when we add a number to x under the square the parabola shifts to the left by that number of units. While if we subtract from x under the square parabola shifts to the right by that number of units.

Edit your response

Three other students' responses would show up here.

Challenge #3: Plot five parabolas. Each parabola should pass through the origin and a pair of color-coordinated points.



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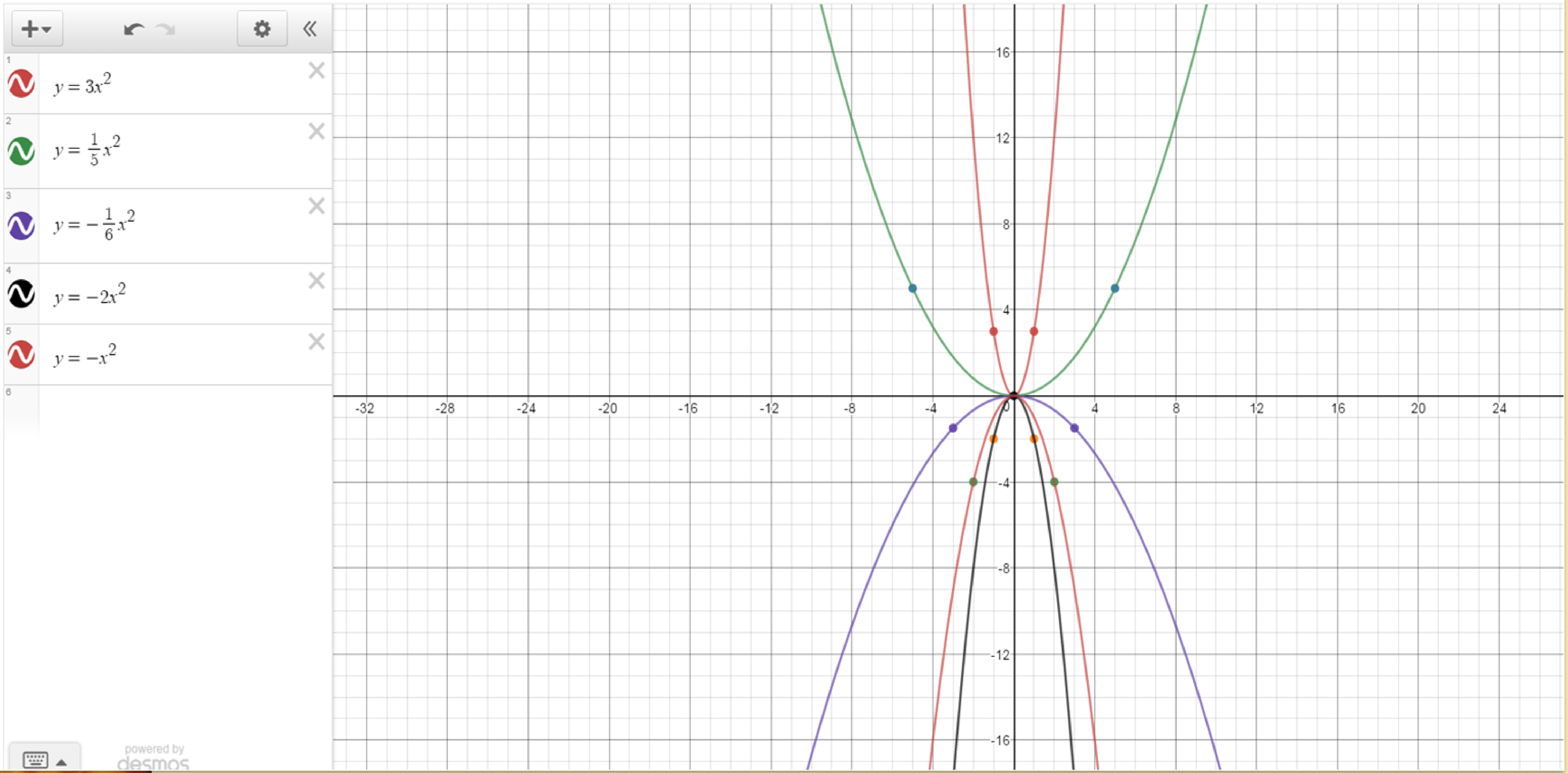
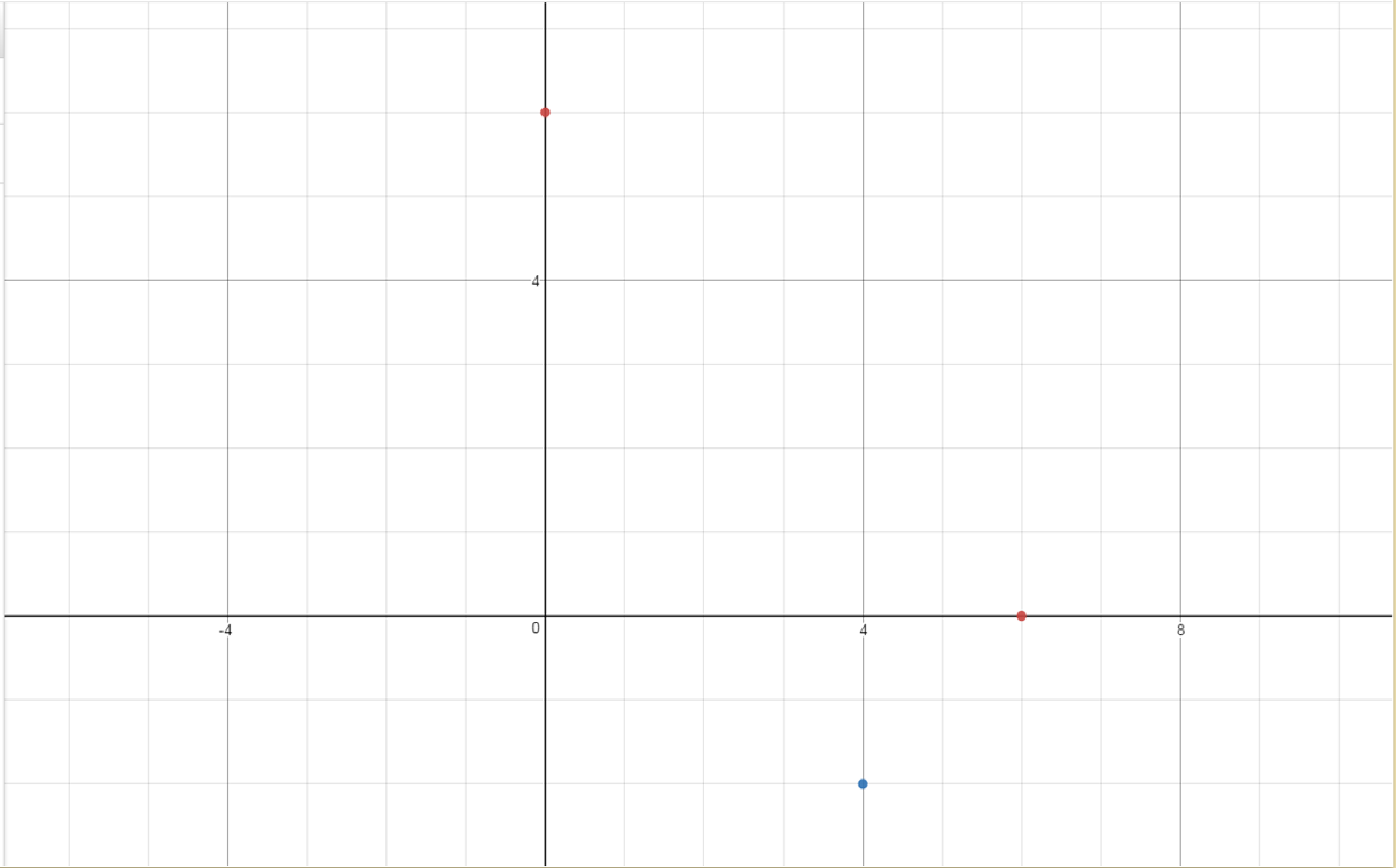


Challenge #4: Plot a parabola through the points.

Hint



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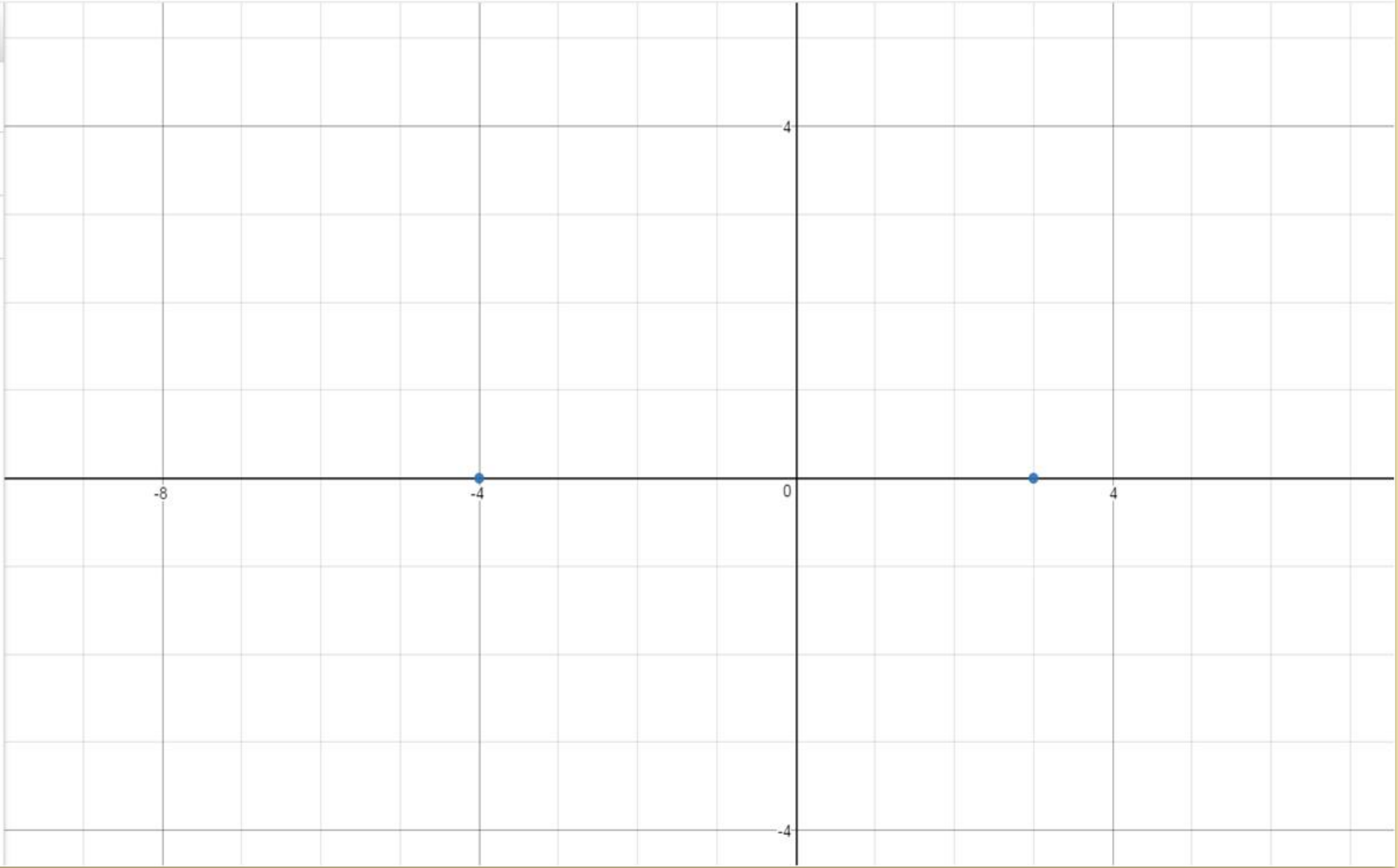
Challenge #4: Plot a parabola through the points.

STUDENT SCREEN PREVIEW

Challenge #5: Plot a parabola through the points.

Hint

Note



Challenge #5: Plot a parabola through the points.

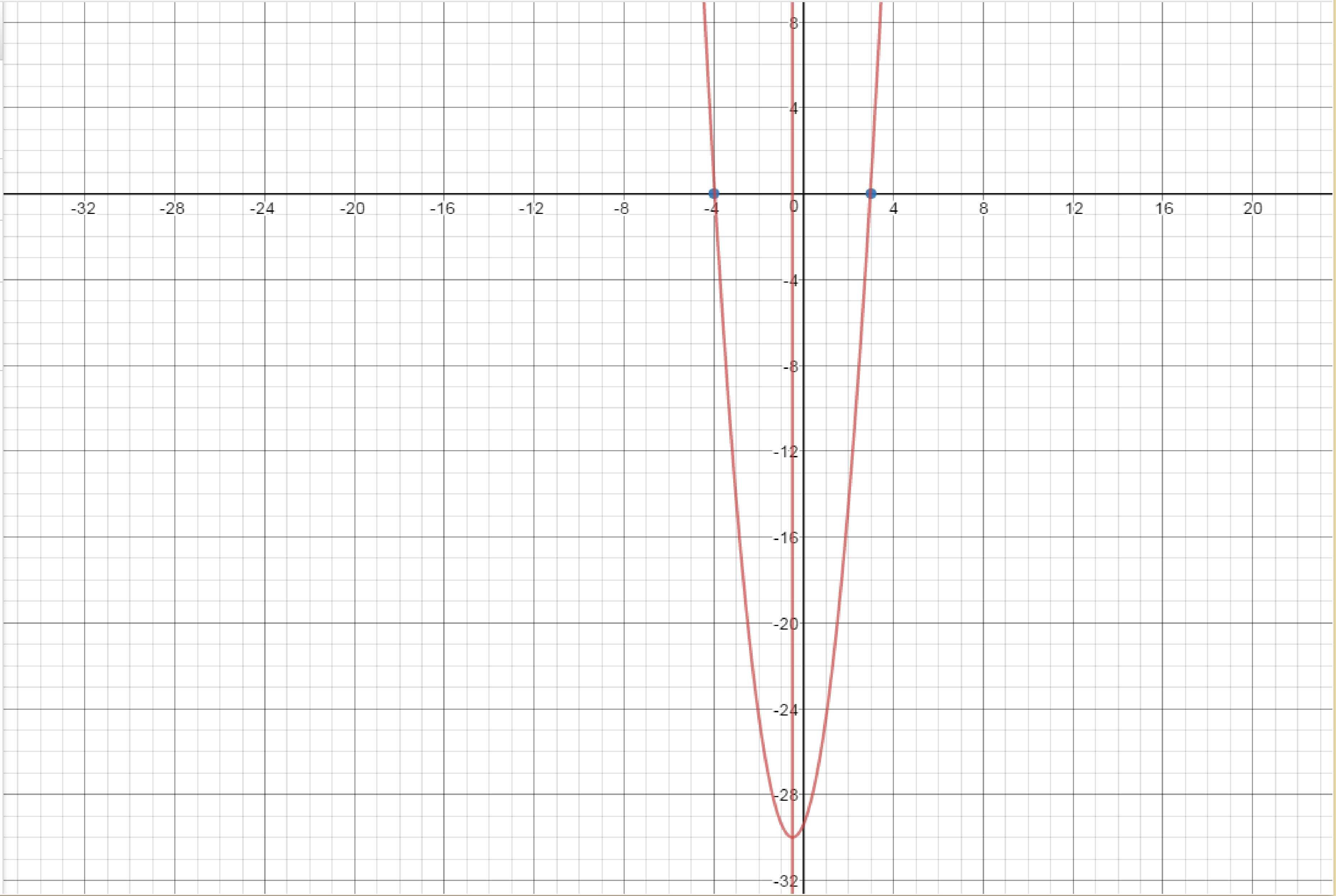
$x = -0.5$

−10 10

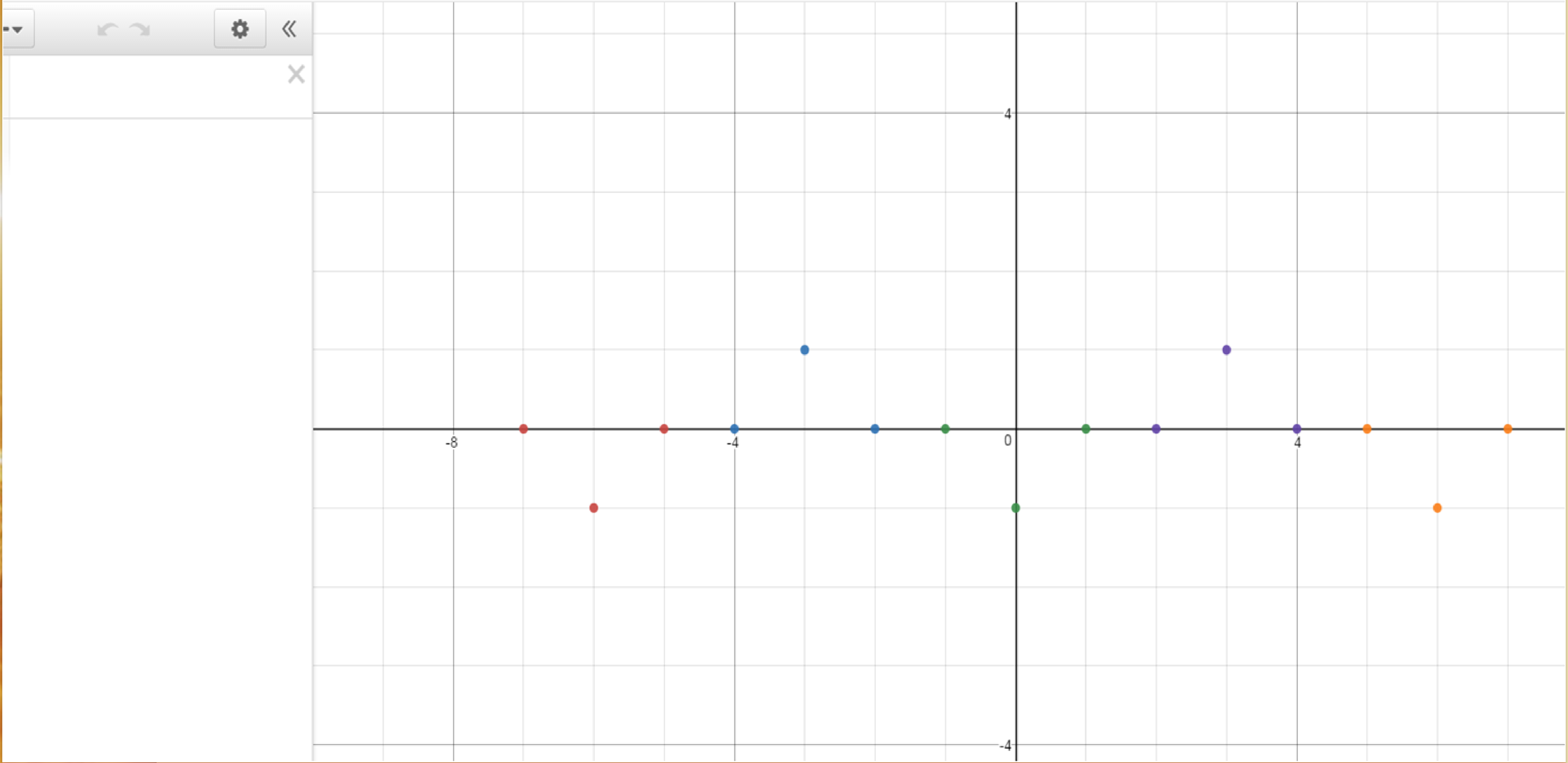
Hint

Note

$y = \frac{5}{2}(x + 0.5)^2 - 30$

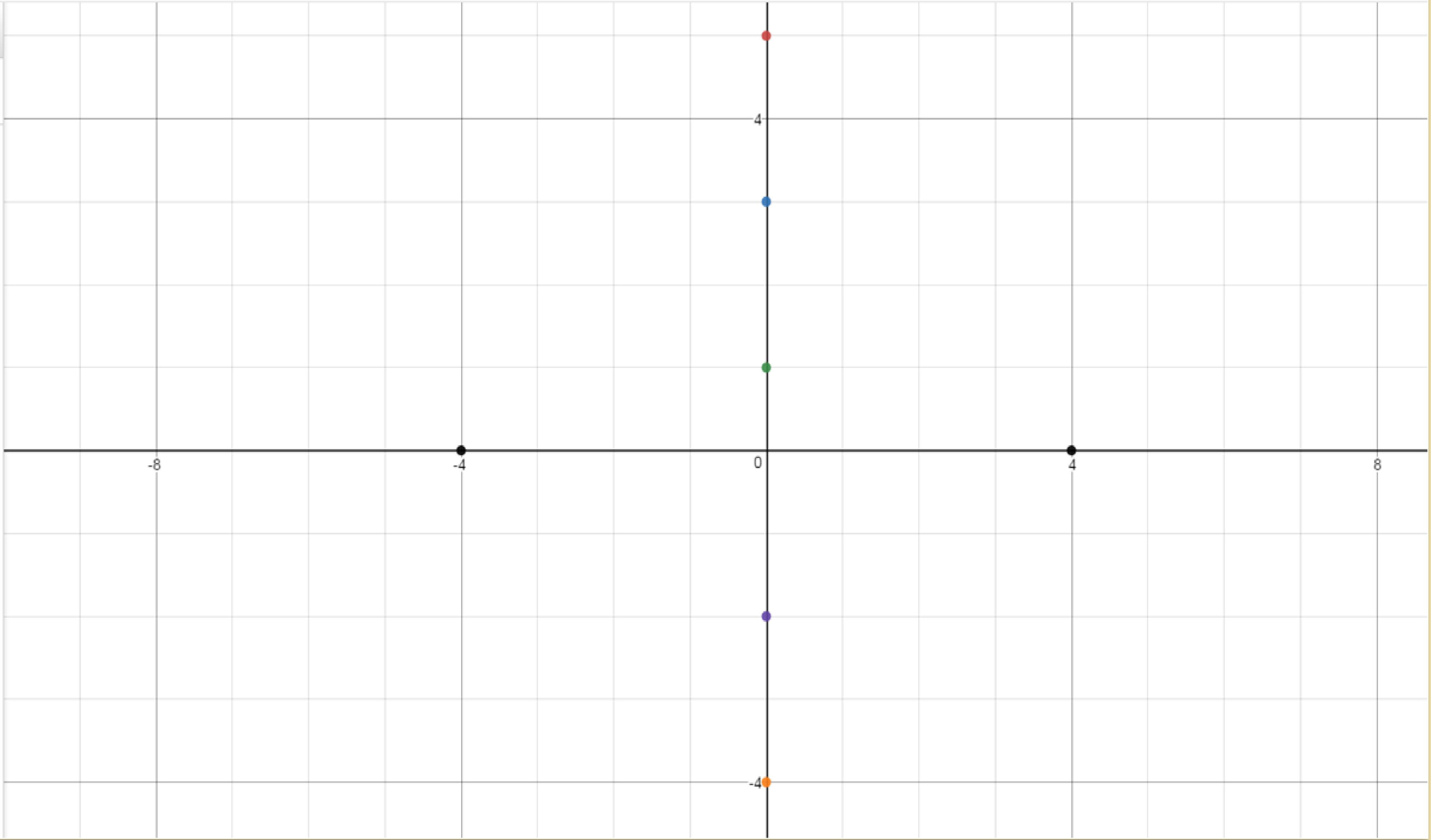


Challenge #6: Plot five parabolas, one through each set of color-coordinated points.

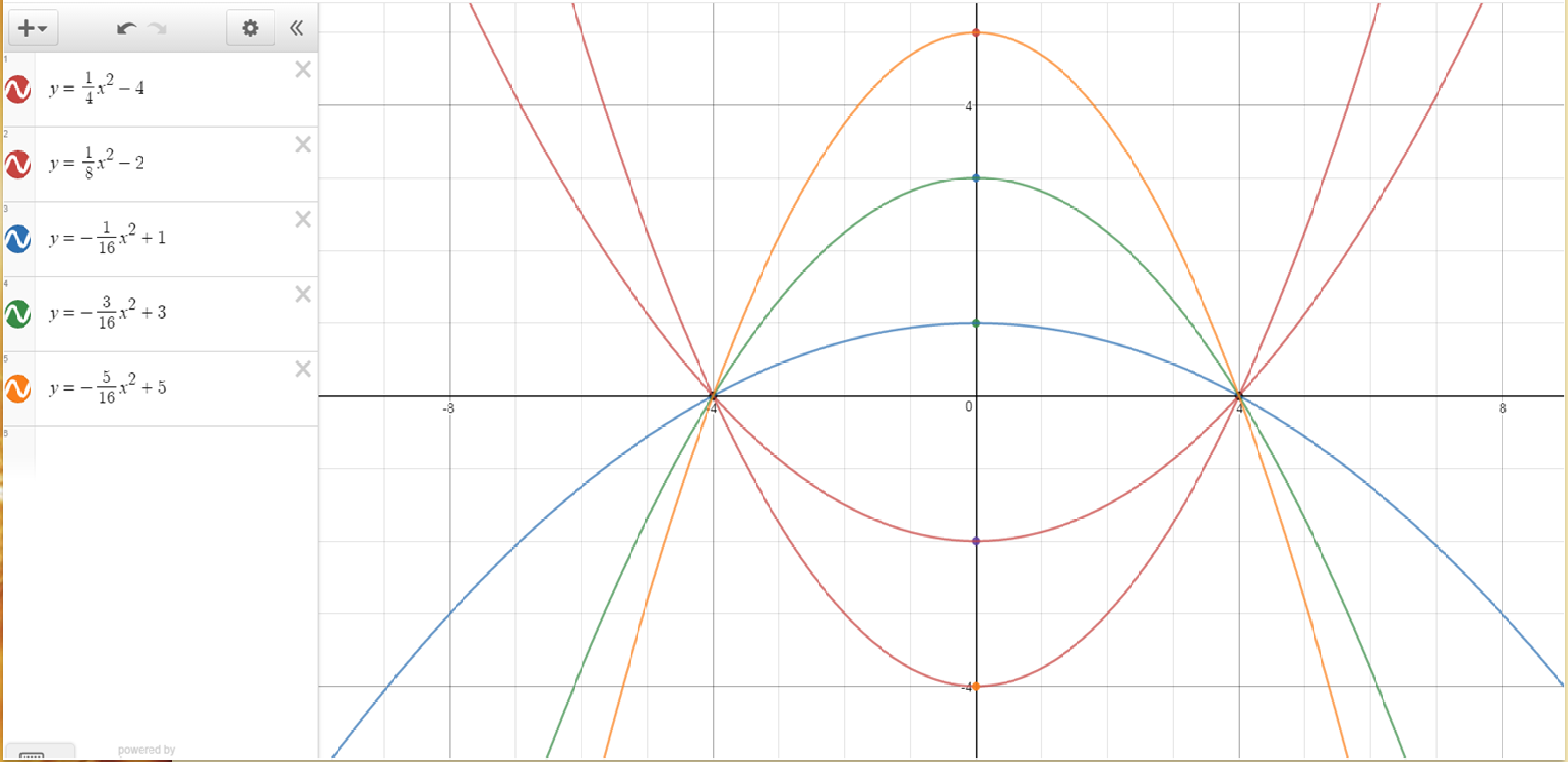


Challenge #6: Plot five parabolas, one through each set of color-coordinated points.

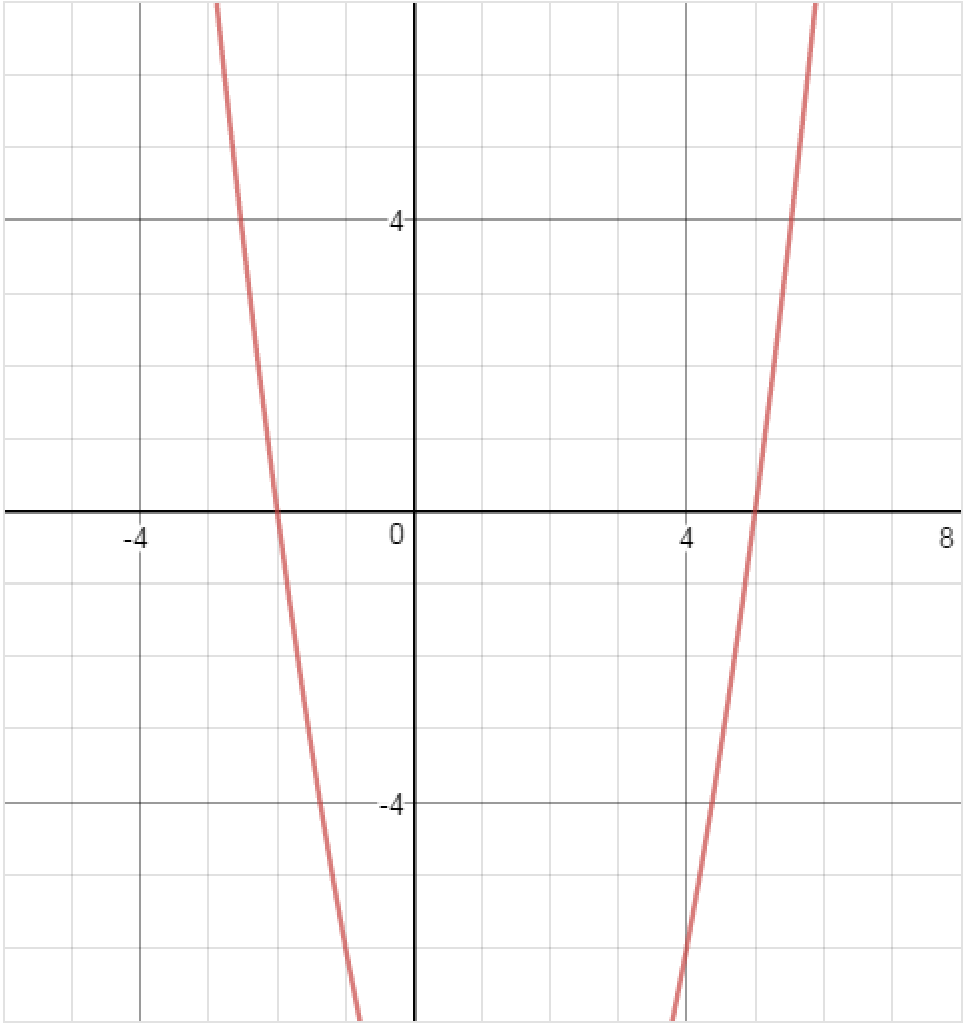
Challenge #7: Plot five parabolas with the same x-intercepts (black), but different vertices (other colors).



Challenge #7: Plot five parabolas with the same x-intercepts (black), but different vertices (other colors).



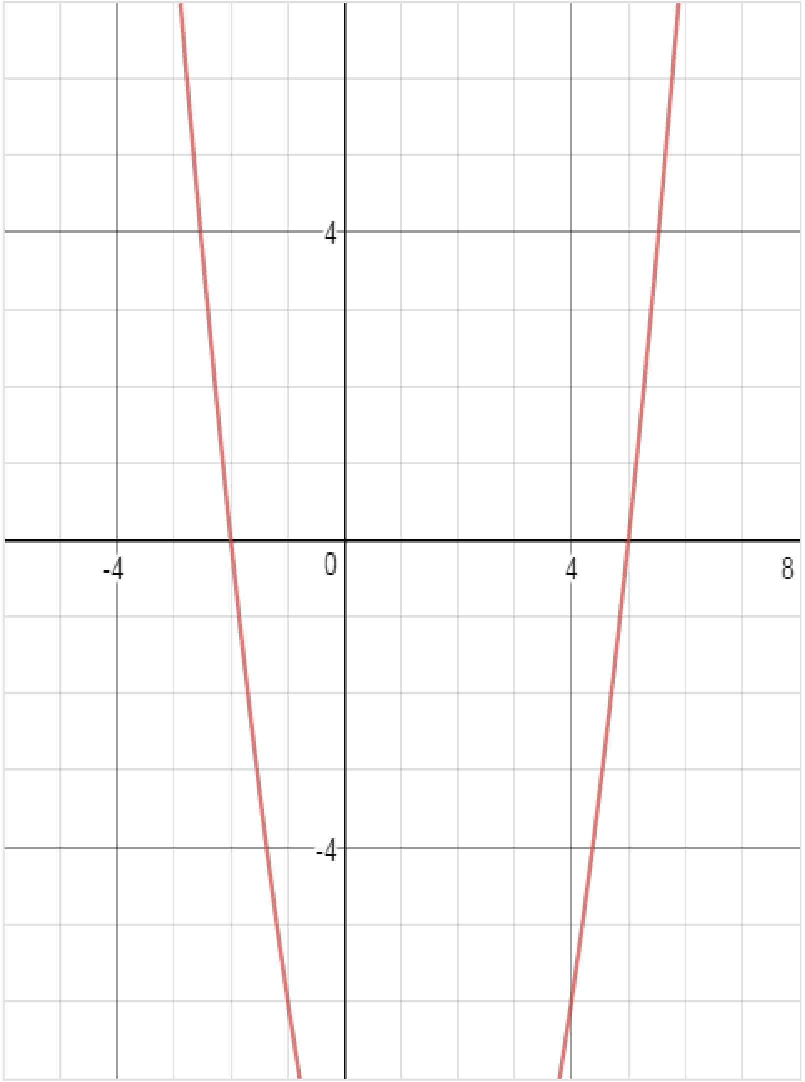
Consider these equations:



Which equation will match the graph shown?

- $y = (x+2)(x-5)$
- $y = (x-2)(x+5)$
- $y = -(x-2)(x+5)$
- $y = -(x+2)(x-5)$

Consider these equations:



Which equation will match the graph shown?

- (selected) $y = (x+2)(x-5)$
- $y = (x-2)(x+5)$
- $y = -(x-2)(x+5)$
- $y = -(x+2)(x-5)$

Explain your answer.

Zeros of this function are -2, 5. That happens where y=0
If we equal (x+2)(x-5)=0 the roots of this equation are
x=-2 and x=5

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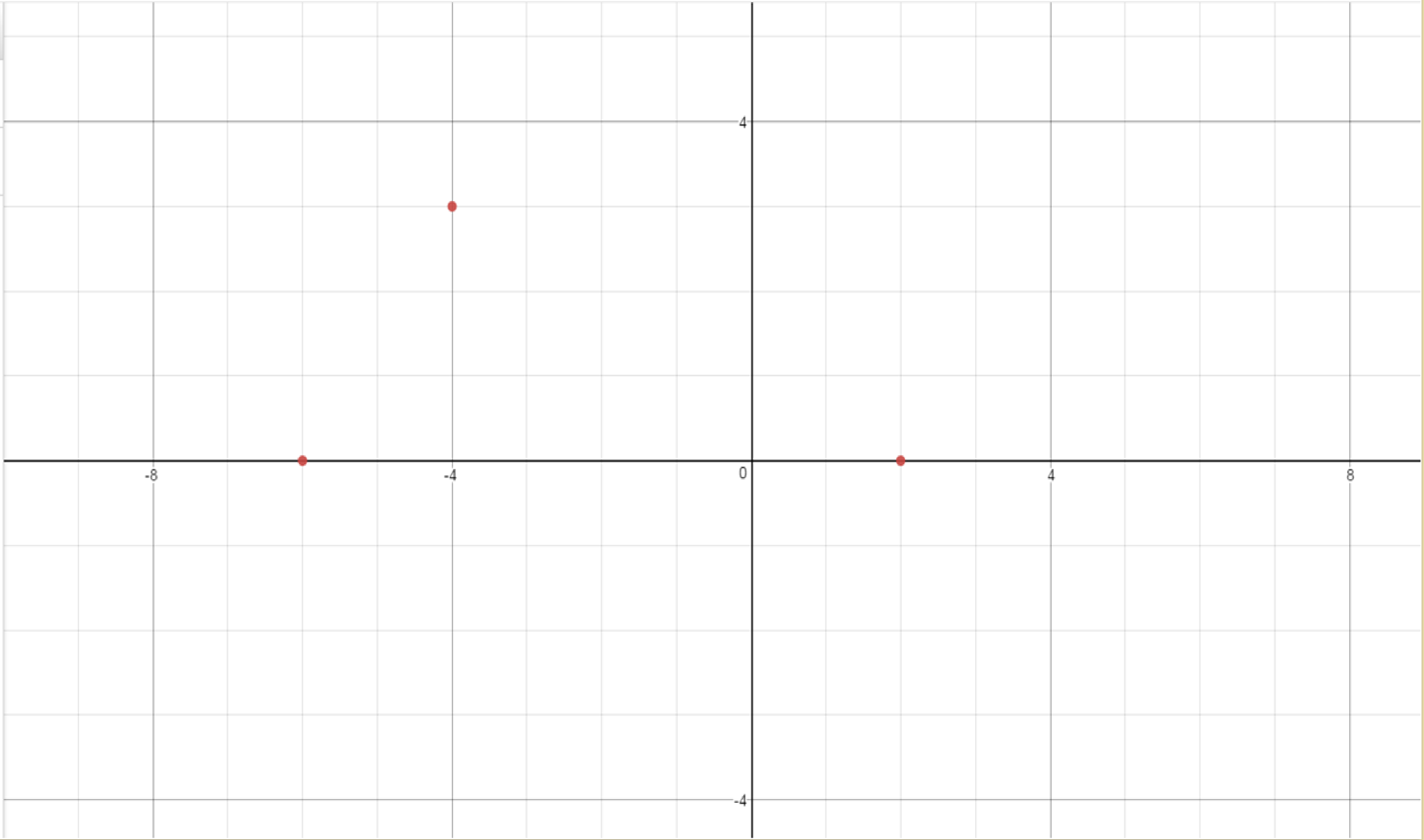
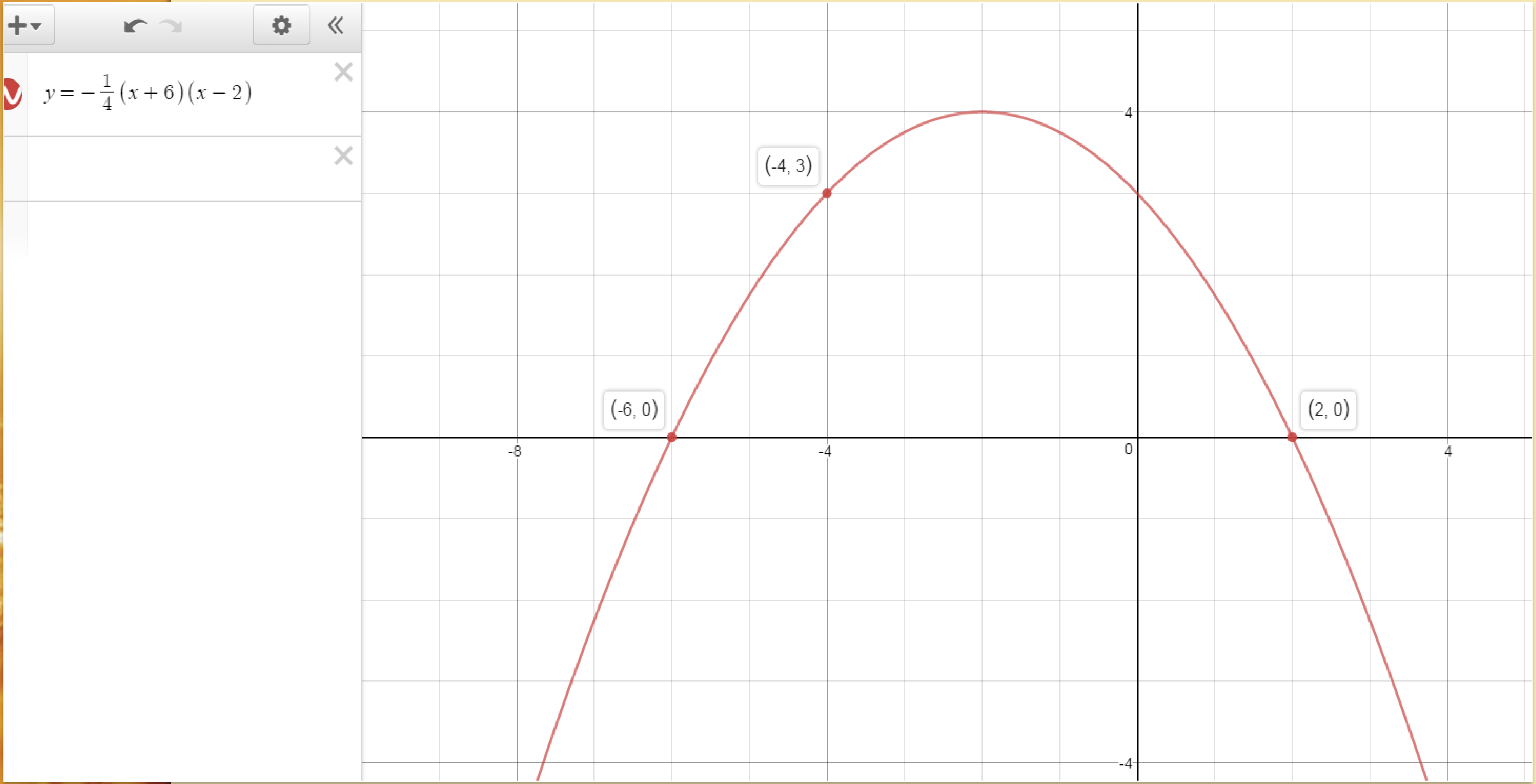
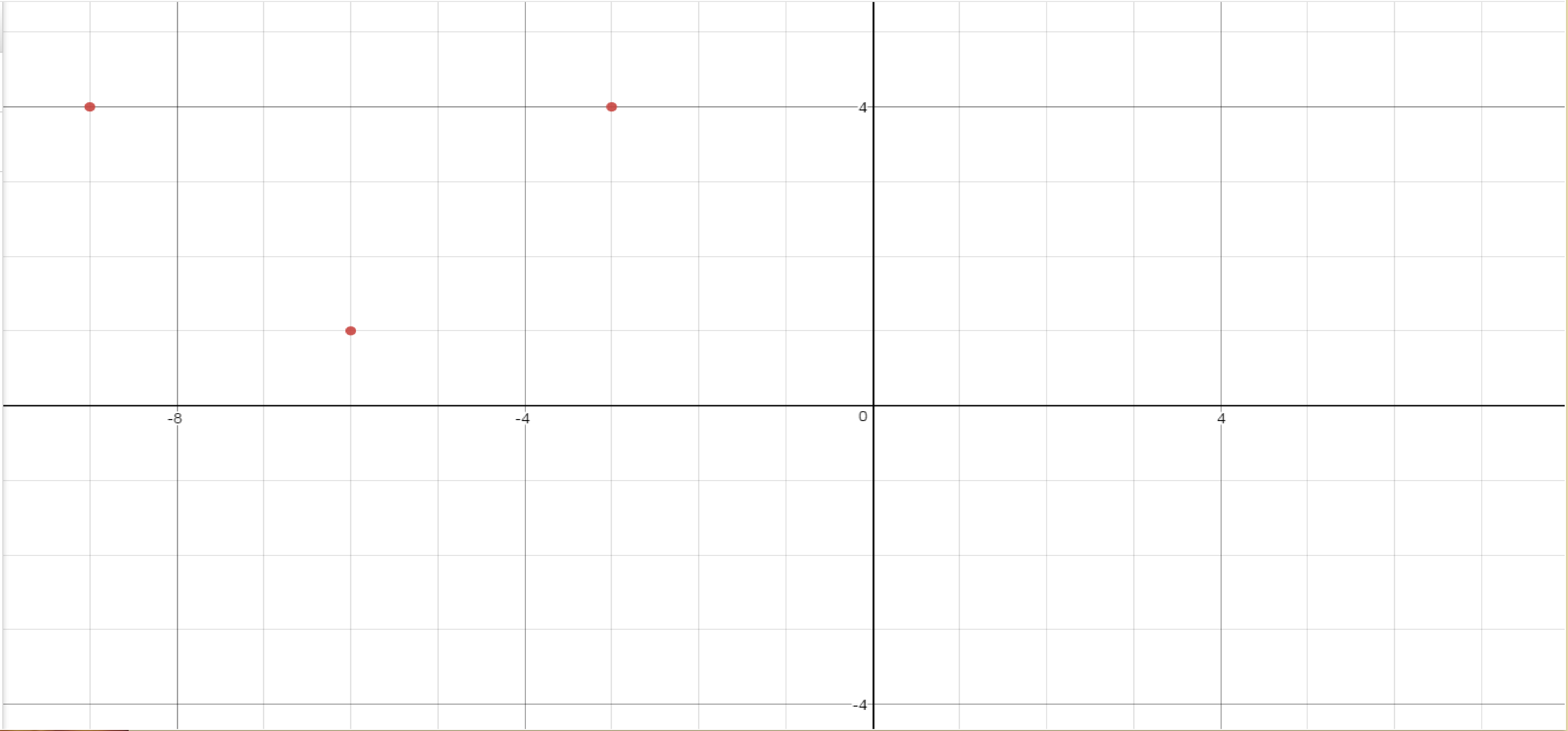
Challenge #8: Plot a parabola through the points. (Bonus: Try to do it two different ways.)



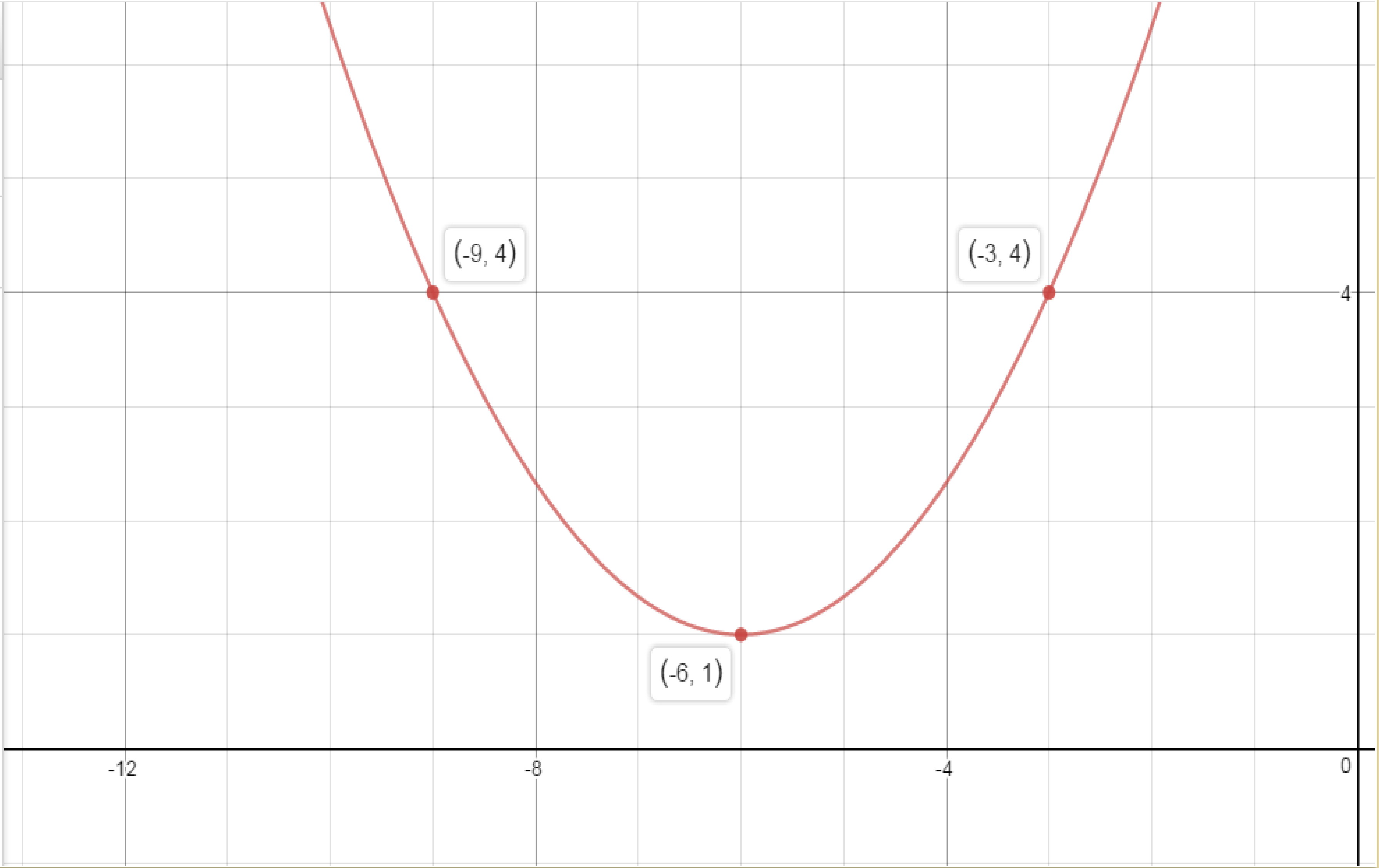

$y = -\frac{1}{4}(x+6)(x-2)$
(-4, 3)
(-6, 0)
(2, 0)
-8
-4
0
4
4
-4

Challenge #9: Plot a parabola through the points. (Bonus: Try to do it two different ways.)



Challenge #9: Plot a parabola through the points. (Bonus: Try to do it two different wa

$$y = \frac{1}{3}(x+6)^2 + 1$$

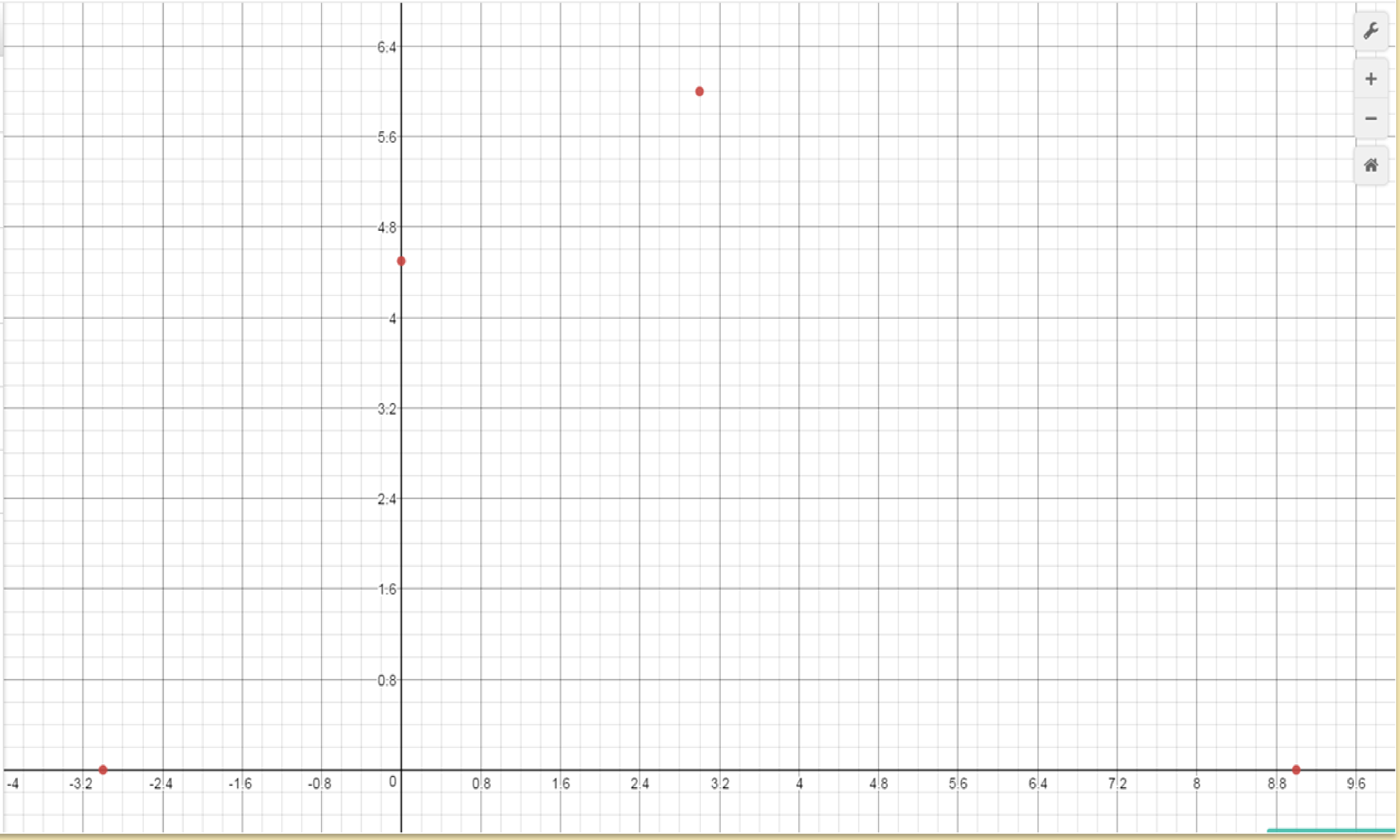


Challenge #10: Plot a parabola through the points. (Bonus: Try to do it three different ways.)

Use a vertex-form equation to plot a parabola through the four points.

Next, use a intercept-form equation to plot a parabola through the same four points.

Finally, use a standard-form equation to plot a parabola through the same four points.



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Finally, use a standard-form equation to plot a parabola through the same four points.

$$y = -\frac{1}{6}(x-3)^2 + 6$$

$$y = -\frac{1}{6}(x+3)(x-9)$$

$$y = -\frac{1}{6}x^2 + x + \frac{27}{6}$$

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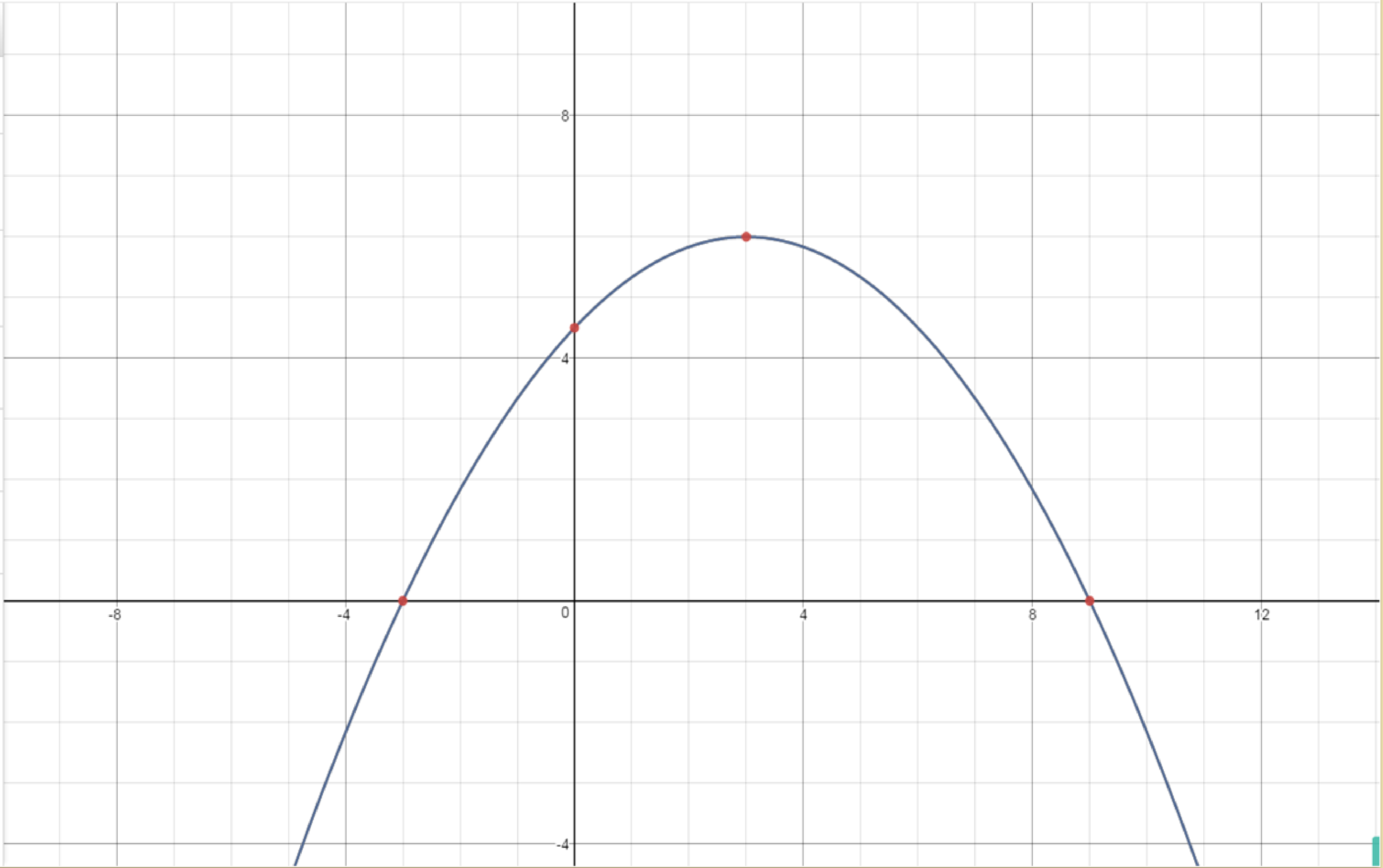

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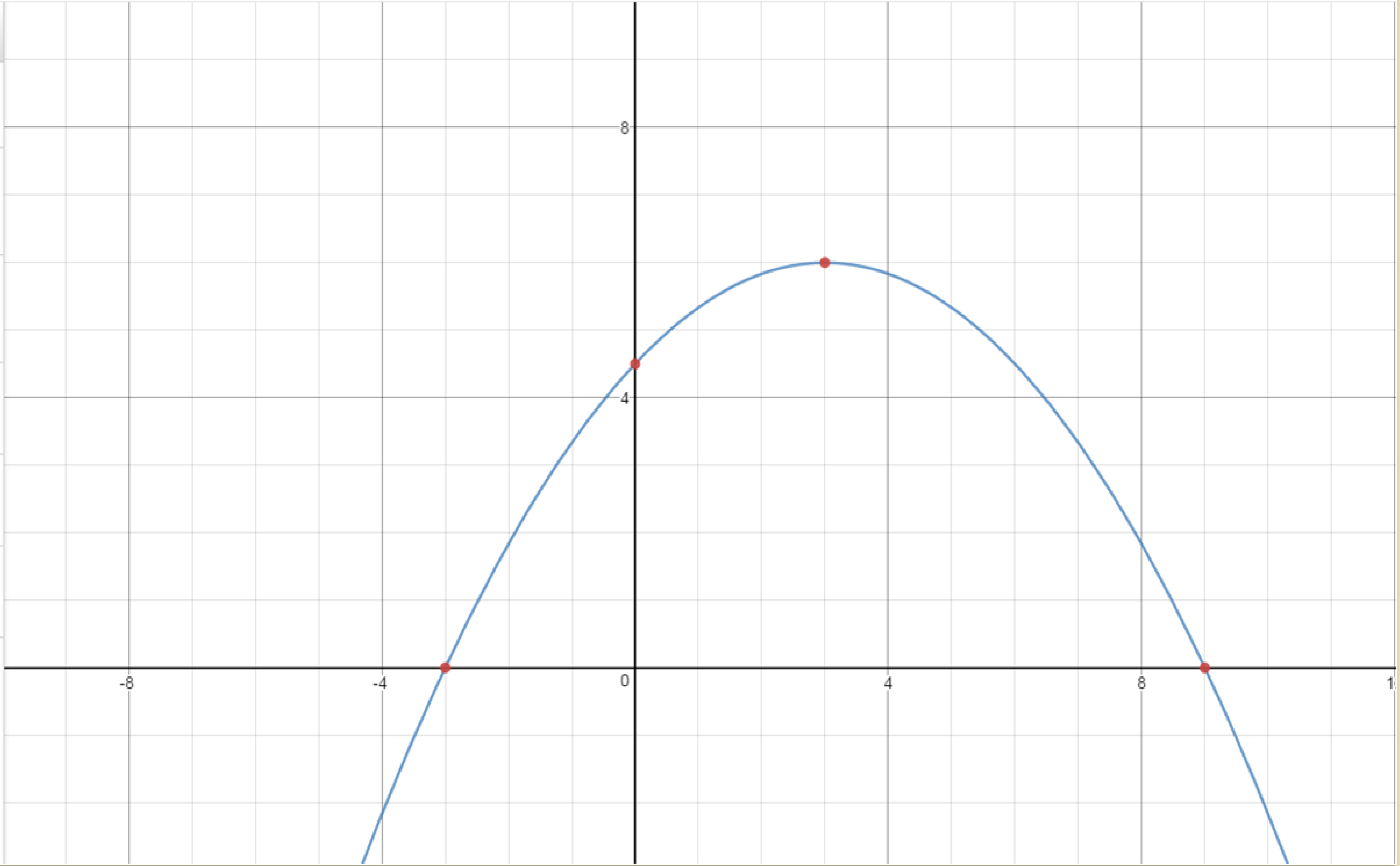
$y = -\frac{1}{6}(x-3)^2 + 6$

$y = -\frac{1}{6}(x+3)(x-9)$

$y = -\frac{1}{6}x^2 + x + \frac{27}{6}$



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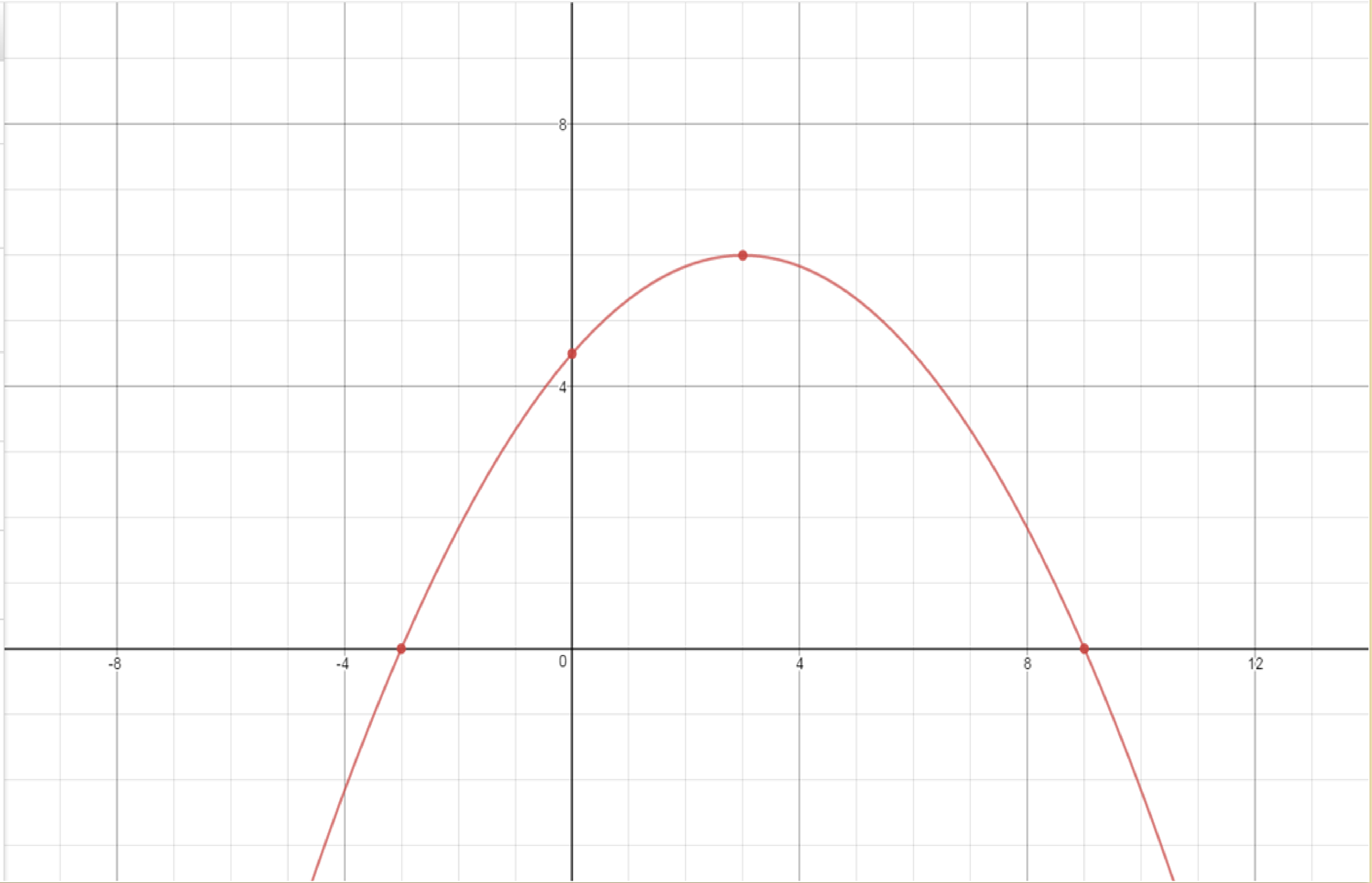
2. Next, use a intercept-form equation to plot a parabola through the same four points.

3. Finally, use a standard-form equation to plot a parabola through the same four points.

4. $y = -\frac{1}{6}(x-3)^2 + 6$

5. $y = -\frac{1}{6}(x+3)(x-9)$

6. $y = -\frac{1}{6}x^2 + x + \frac{27}{6}$



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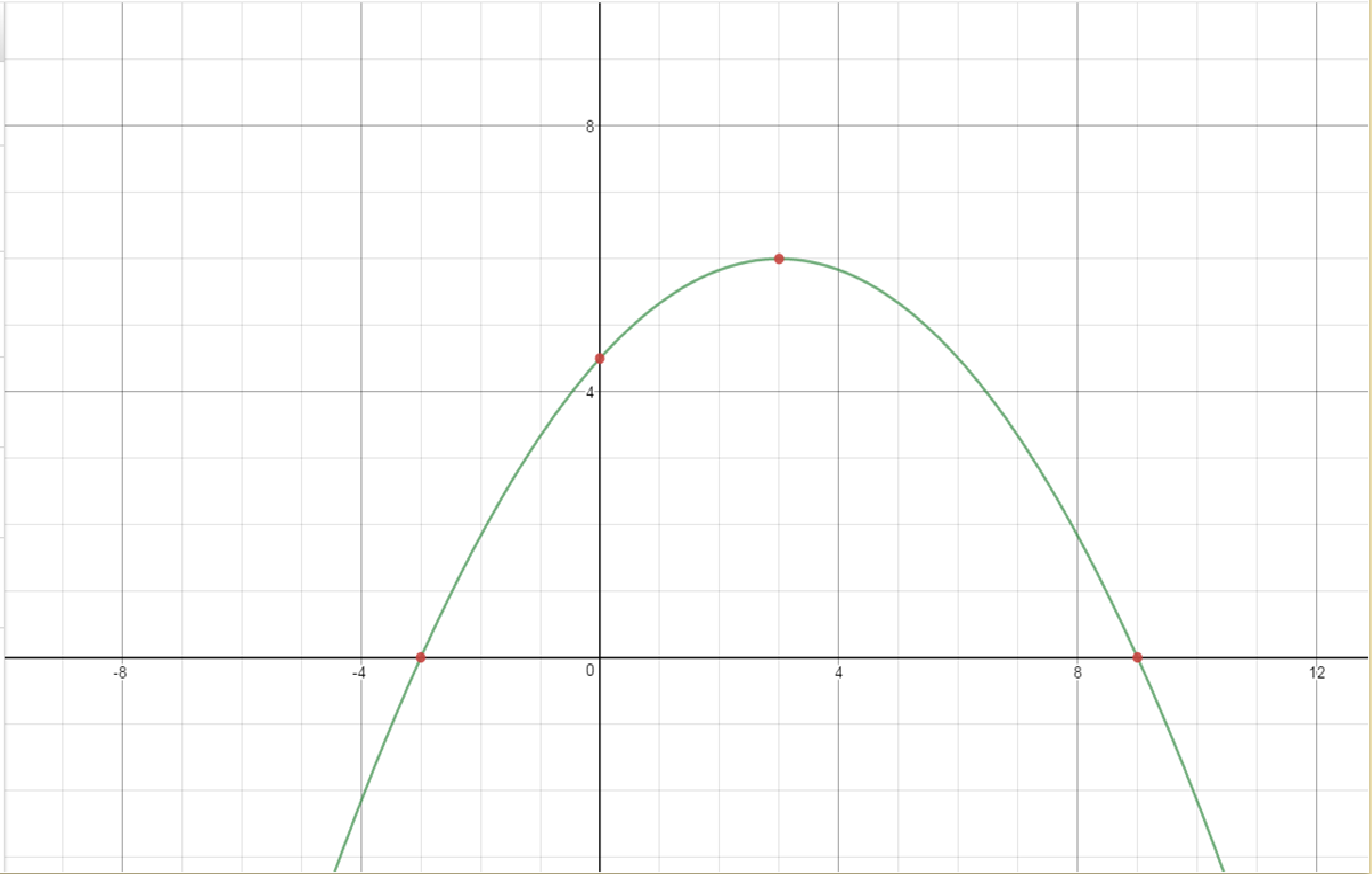
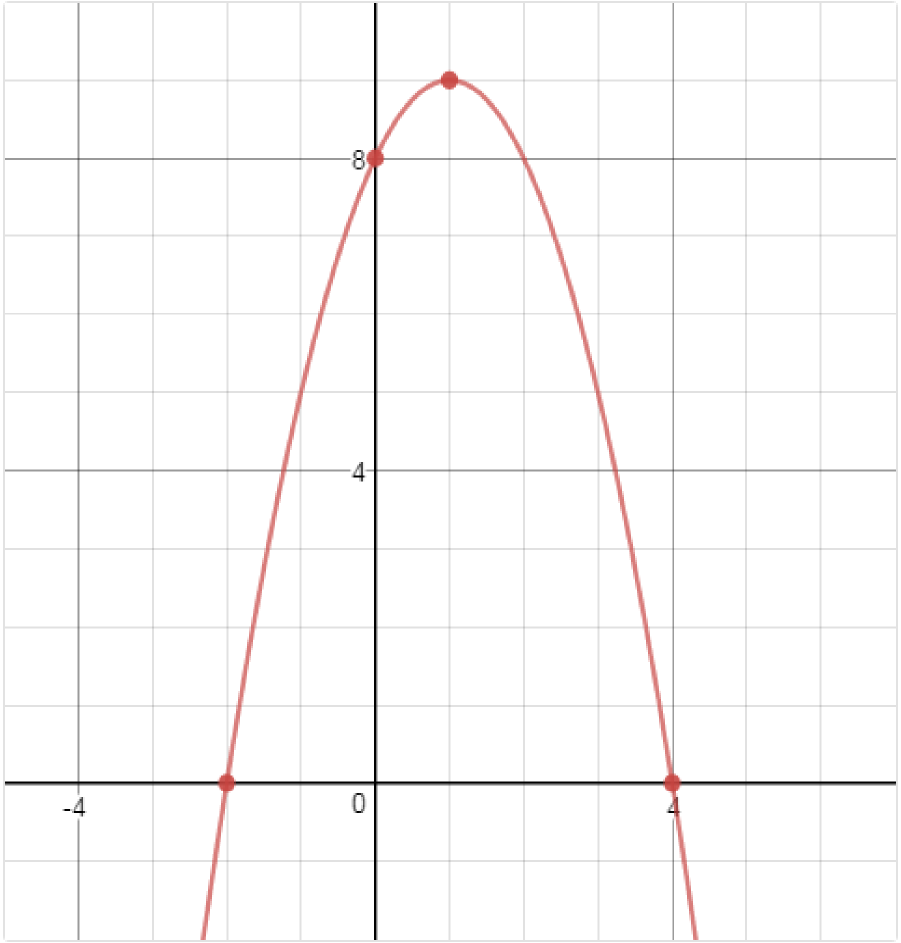
1. Use a vertex-form equation to plot a parabola through the four points.
2. Next, use a intercept-form equation to plot a parabola through the same four points.
3. Finally, use a standard-form equation to plot a parabola through the same four points.
4. $y = -\frac{1}{6}(x-3)^2 + 6$
5. $y = -\frac{1}{6}(x+3)(x-9)$
6. $y = -\frac{1}{6}x^2 + x + \frac{27}{6}$



Consider this graph:



What equation would produce this graph? Explain your thinking.

Use the sketch tool on the graph if that helps to illustrate your thinking.

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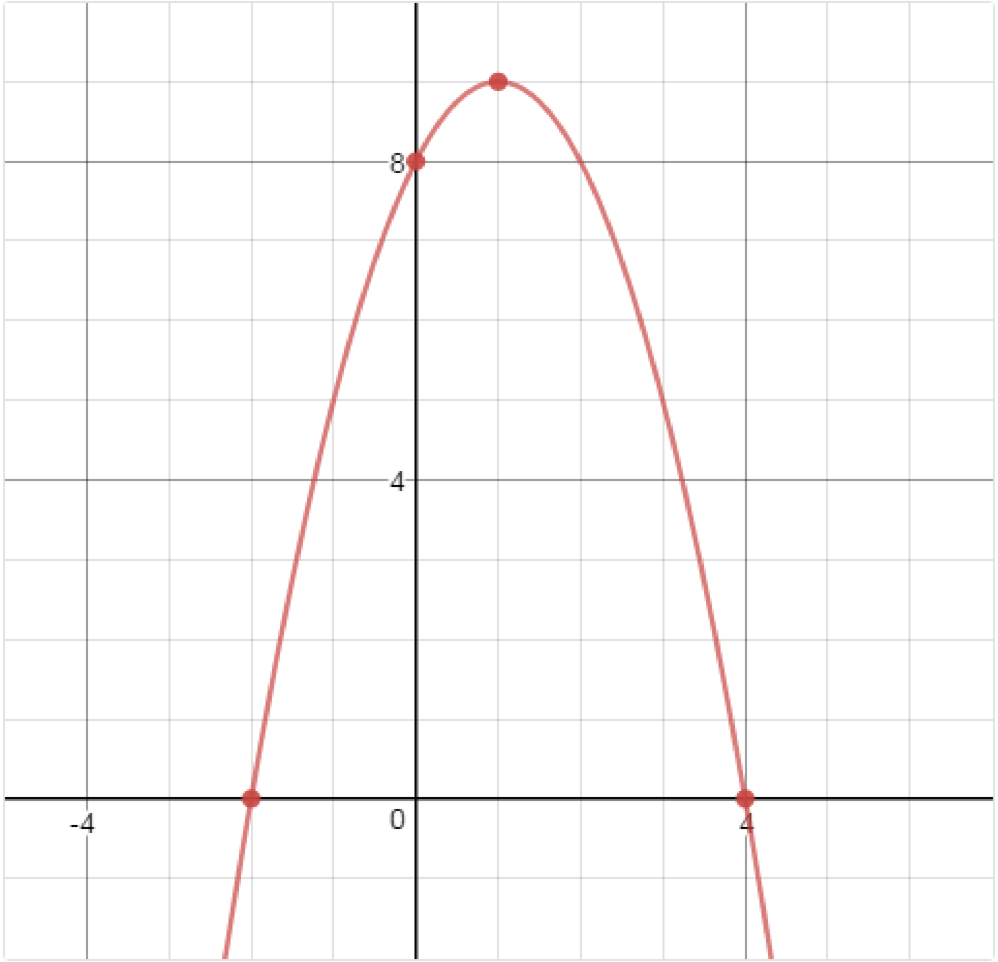
Consider this graph:



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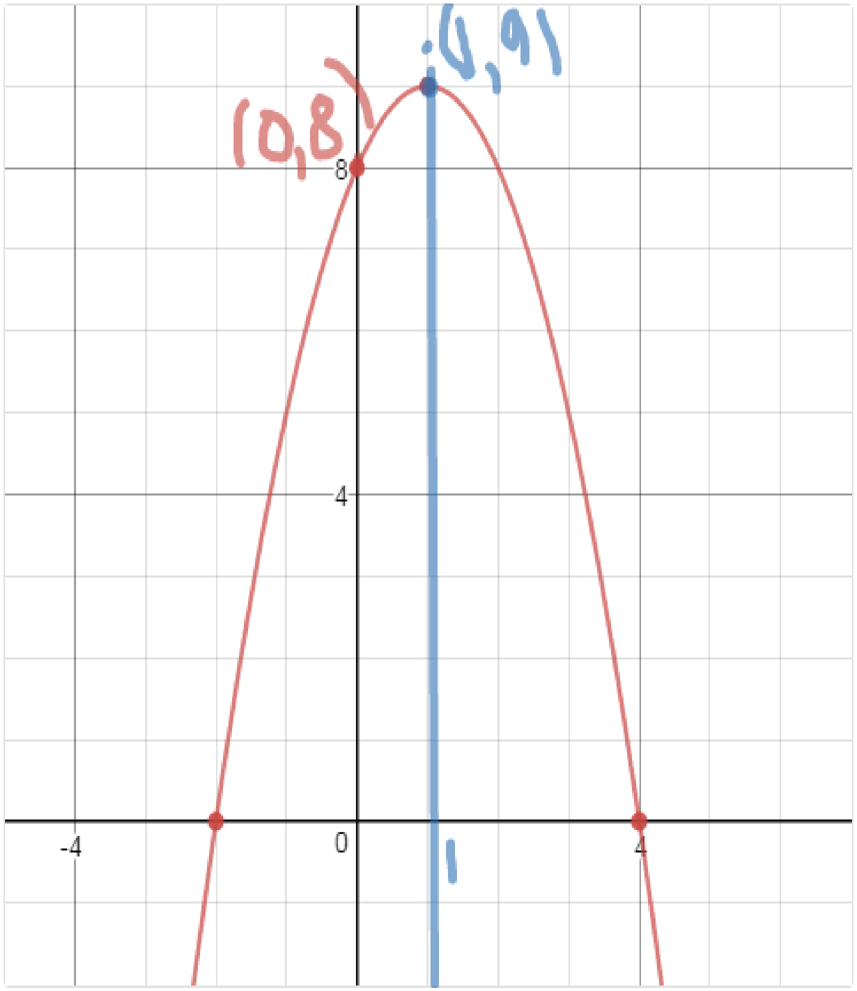

What equation would produce this graph? Explain your thinking.

Use the sketch tool on the graph if that helps to illustrate your thinking.

y=-(x-1)^2+9

I know that a is negative.I know also that h=1, k=9
so i know y=_(x-1)^2+9. I just need to know a. For that I substitute x=0 and see for which value of a i get 8 as value of y. I found -1.

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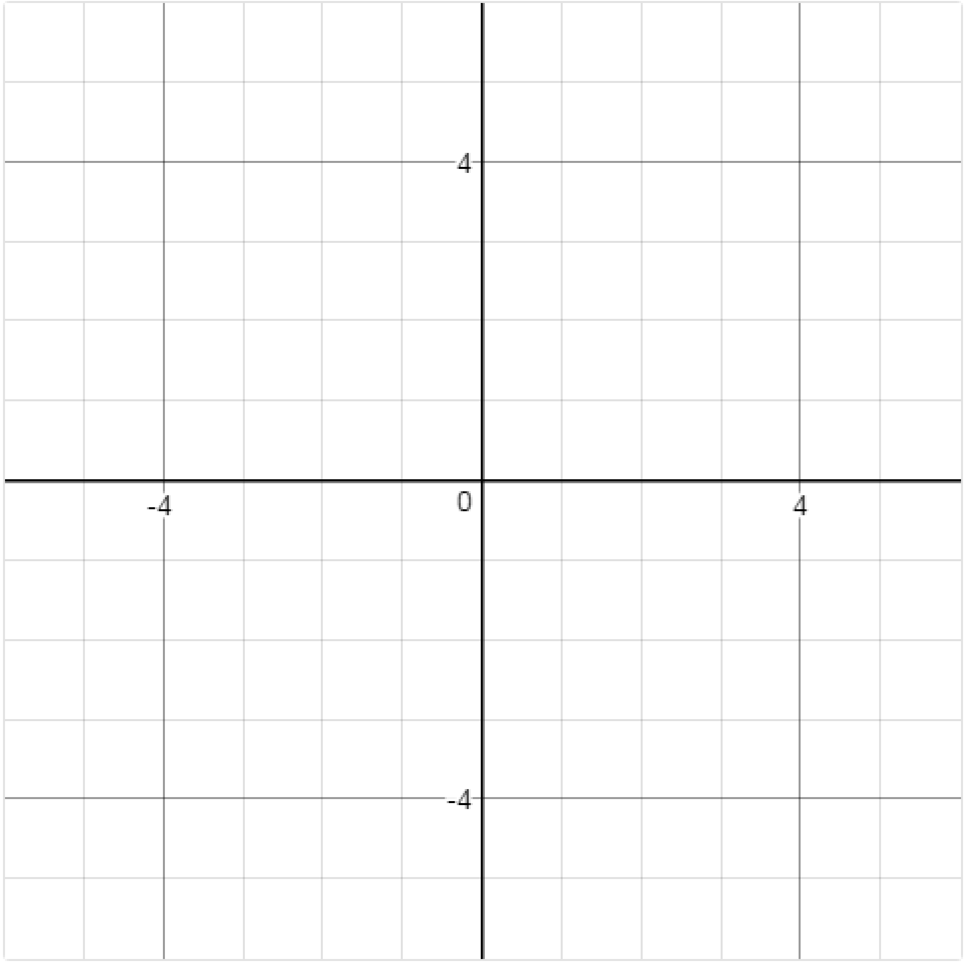
Consider this equation:



Sketch the graph of the following equation:

$$y = \frac{1}{4}(x-2)^2 - 4$$

Explain your thinking.

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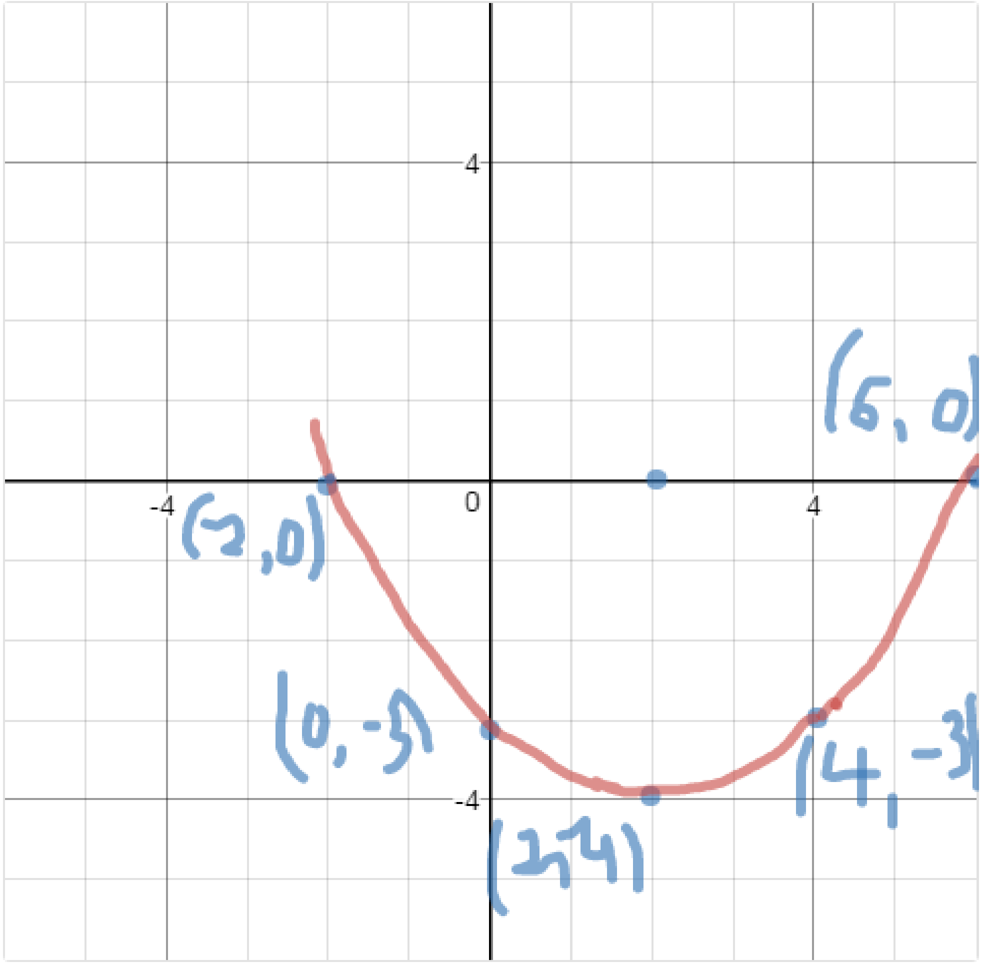
Consider this equation:



Sketch the graph of the following equation:

$$y = \frac{1}{4}(x-2)^2 - 4$$

Explain your thinking.

I know the vertex is (2,-4) from the vertex standard form formula.I know that parabola will be upward (a>0). I give 0 value to the x to see where y-intercept is. (0,-3), symmetrical value of x is 4, so I find y for x=4 (4,-3).
Find x intercepts by setting the y=o I find two other points (-2,0); (6,0). Trace the graph.

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