

Exercise 3,3,37 Graph the function

$f(x) = 2x^2 - 4x + 1$ by starting with the graph of $y = x^2$ and using transformations.

HINT: If necessary, write in the form $f(x) = a(x-h)^2 + k$.

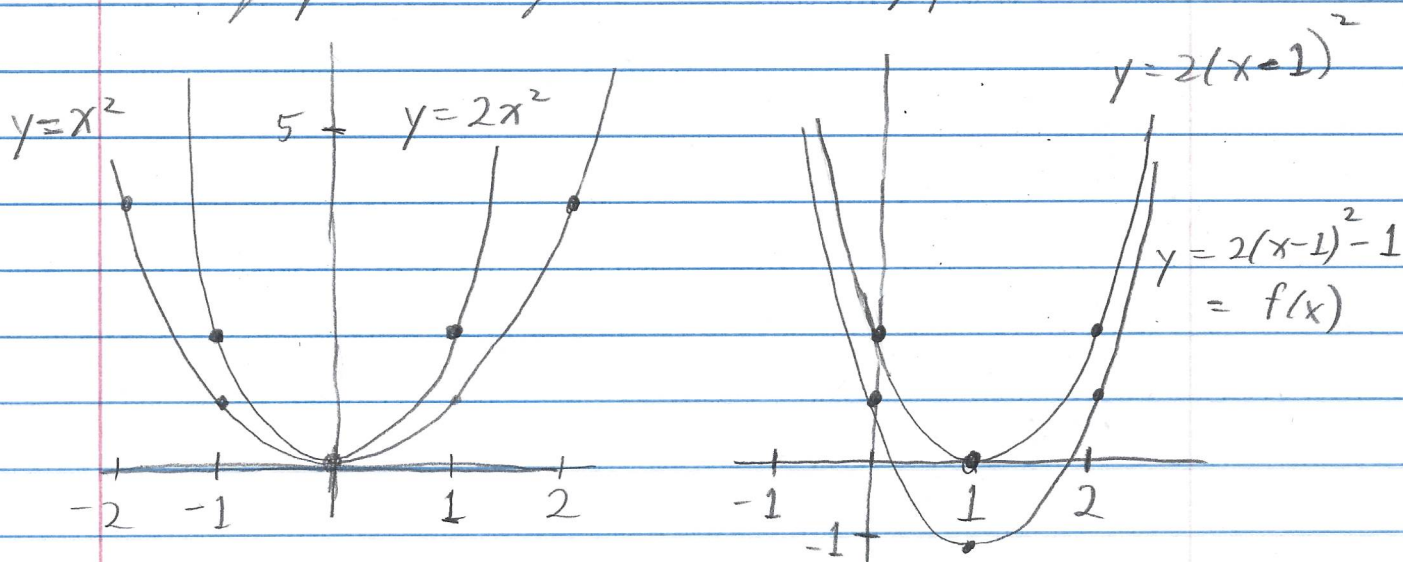
Solution

We complete the square to get

$$f(x) = 2x^2 - 4x + 1 = 2(x^2 - 2x) + 1$$

$$= 2(x^2 - 2x + 1) + 1 - 2(1) = 2(x-1)^2 - 1.$$

So we start with the graph of $y = x^2$ and vertically stretch it by a factor of $a = 2$ to get $y = 2x^2$. Next, we horizontally translate this graph 1 unit to the right by replacing x with $x-h = x-1$ to get $y = 2(x-1)^2$. Then we vertically translate this graph 1 unit down to get $y = f(x) = 2(x-1)^2 - 1$. This gives the graphs (along with three "key points"):



□