



Graphing Quadratic Equations

The graph of a quadratic equation, meaning one in the form $y = ax^2 + bx + c$, or $y = a(x - h)^2 + k$, is a **parabola**. Using this second form of the equation, called **standard form**, describes the appearance of the parabola:

$x = h$ is the **line of symmetry**

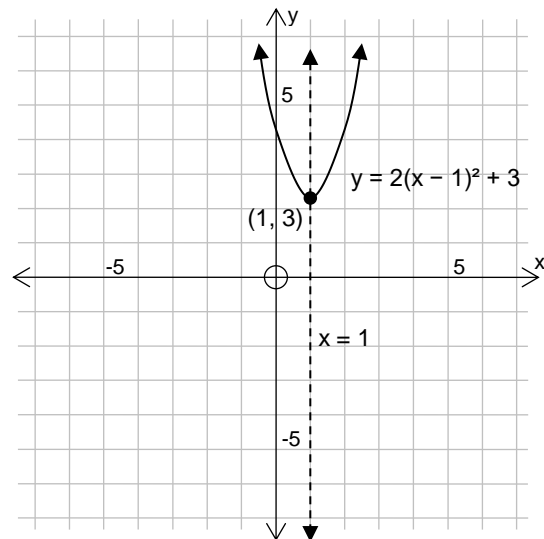
(h, k) is the **vertex** of the parabola

if $a > 0$ then the parabola opens upward; if $a < 0$ then the parabola opens downward

Example 1: Graph $y = 2(x - 1)^2 + 3$

Solution: First, we look for the vertex. We use h and k from the standard form to get the coordinates. In this case, it's $(1, 3)$. This means the line of symmetry is at $x = 1$.

We look at a , which equals 2. Since $2 > 0$, the parabola opens upwards. We plot a few points by plugging in values for x near 1, and we get the graph on the right.



Example 2: Graph $y = 2x^2 + 8x + 10$.

Solution: Since this equation is not in standard form, we must rewrite it in standard form so that we can extract the information we need. We do this by completing the square.

$$y = 2x^2 + 8x + 10$$

$$= 2(x^2 + 4x) + 10$$

$$= 2(x^2 + 4x + 4 - 4) + 10$$

$$= 2(x^2 + 4x + 4) - 8 + 10$$

$$2(x + 2)^2 + 2$$

First factor the coefficient on x^2 from the x^2 and x terms, even if this creates fractions

Take the new coefficient on x , and divide it by 2. Square the result. Add and subtract this number inside the parentheses.

Move the subtracted value outside the parentheses. Note the -4 was multiplied by 2 because everything in the brackets was.

The parentheses should be a perfect square. Simplify.

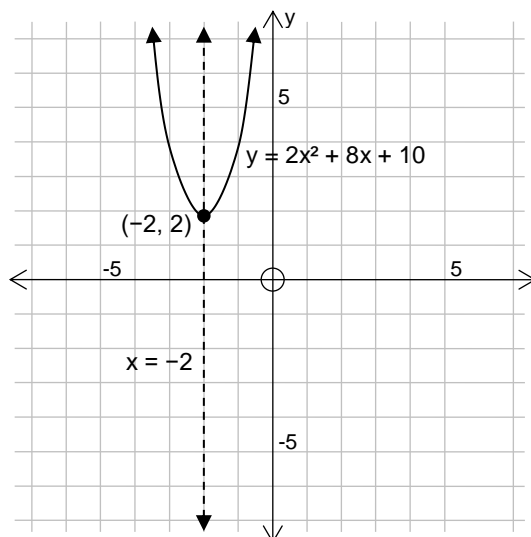


So $y = 2(x + 2)^2 + 2$.

The vertex is at $(-2, 2)$. Remember standard form says $a(x - h)$..., so if we have $(x + 2)^2$, then $h = -2$. Line of symmetry is at $x = -2$.

$a = 2$, and since $2 > 0$, this parabola opens up.

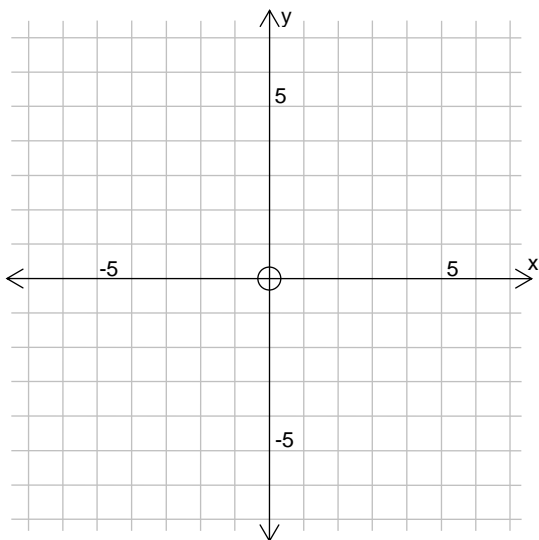
Once again, we select values for x near the vertex and plot the points we get from the equation to see what the graph looks like.



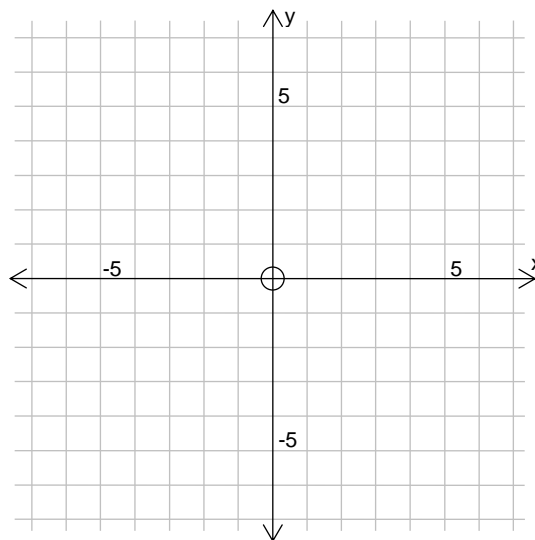
EXERCISES

A. Graph:

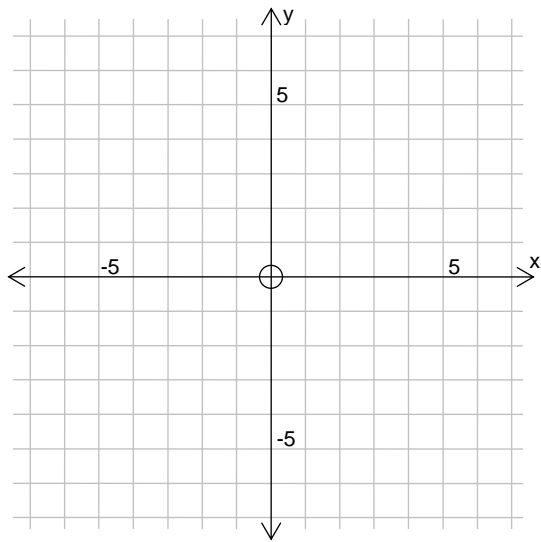
1) $y = x^2 + 5$



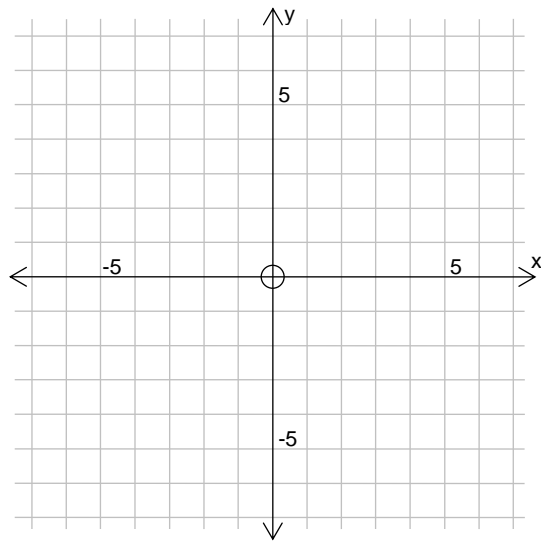
3) $y = (x + 4)^2 - 2$



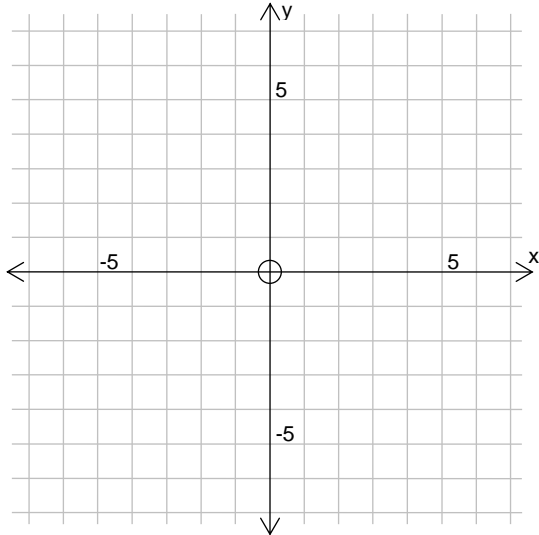
2) $y = (x - 1)^2 + 3$



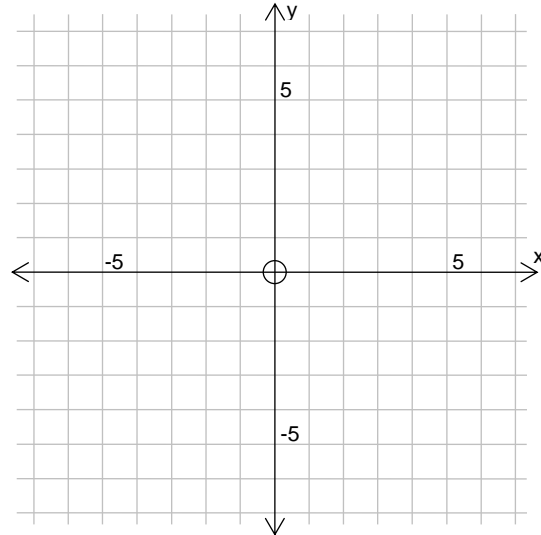
4) $y = 2(x - 3)^2 - 4$



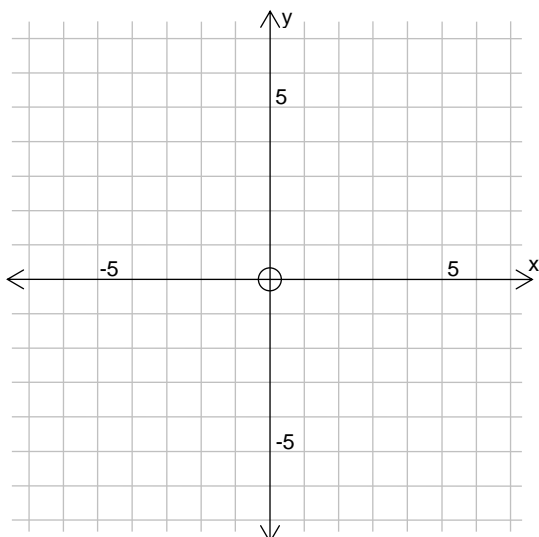
5) $y = -3(x + 1)^2 - 4$



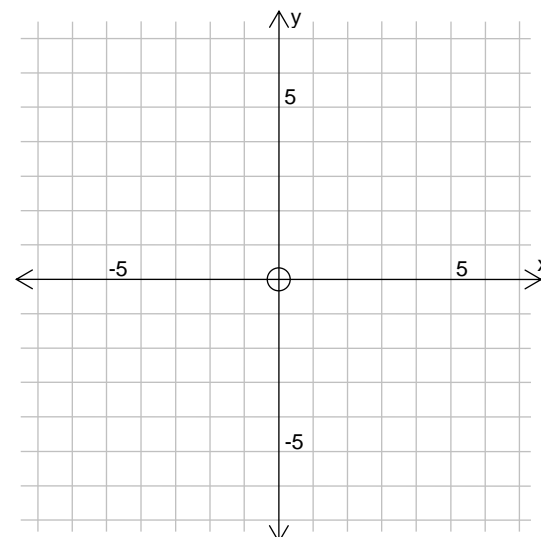
8) $y = -x^2 + 4x$



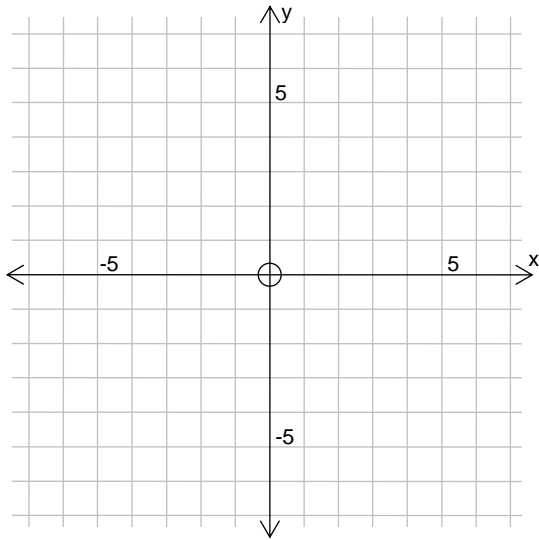
6) $y = x^2 + 2x + 3$



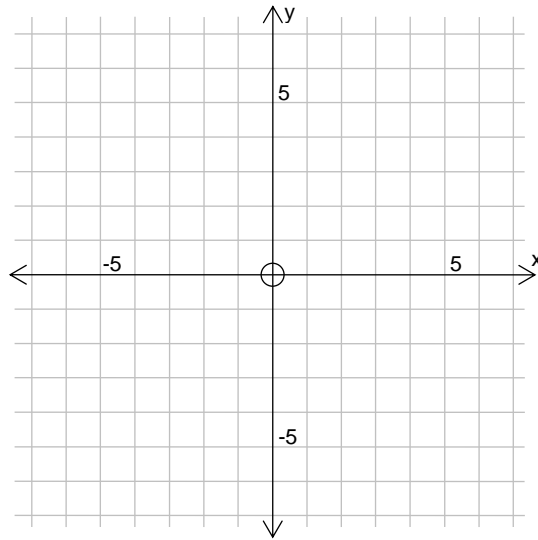
9) $y = -2x^2 - 2x + 2$



7) $y = x^2 - 4x + 5$

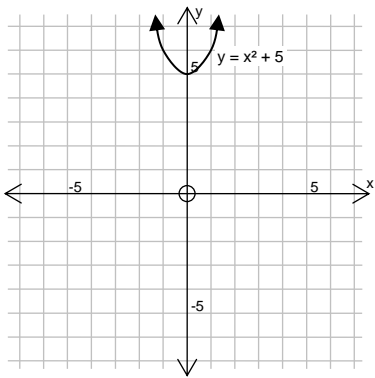


10) $y = -3x^2 + 6x + 3$

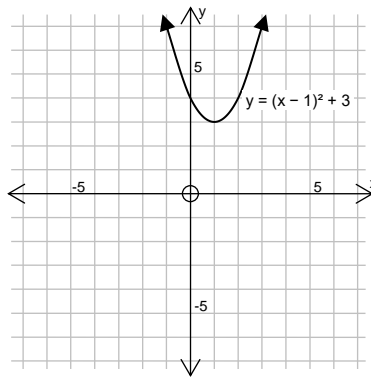


SOLUTIONS

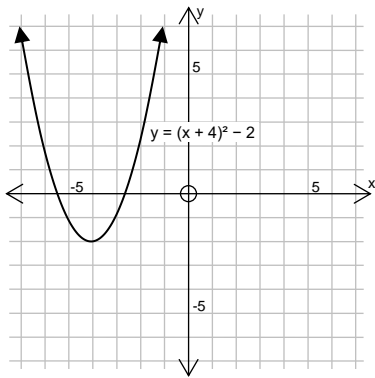
A. (1)



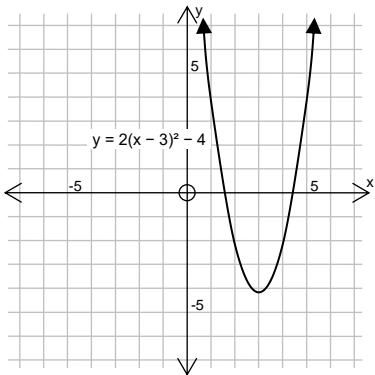
(2)



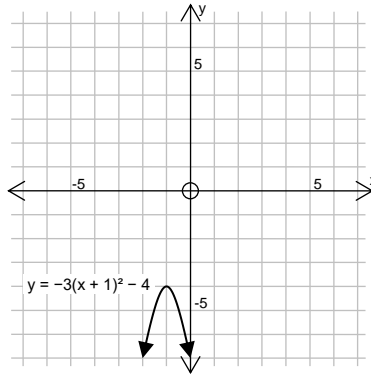
(3)



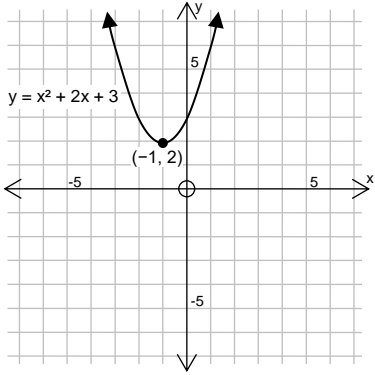
(4)



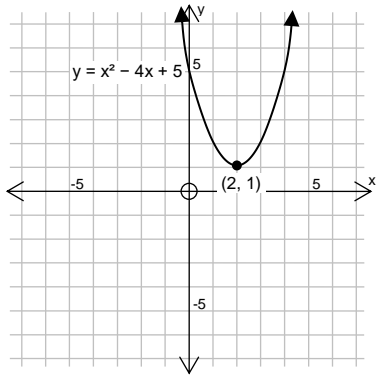
(5)



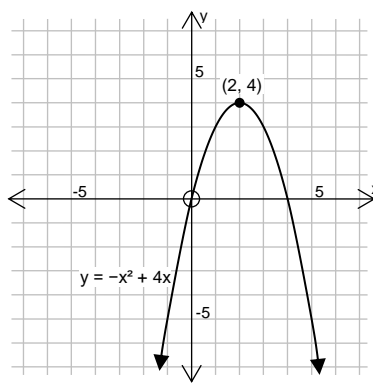
(6)



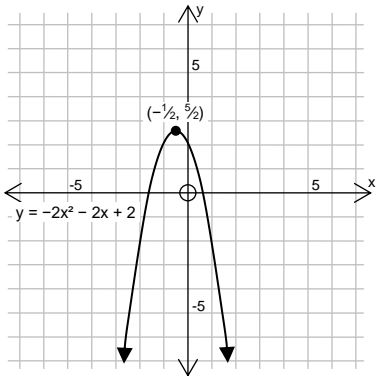
(7)



(8)



(9)



(10)

