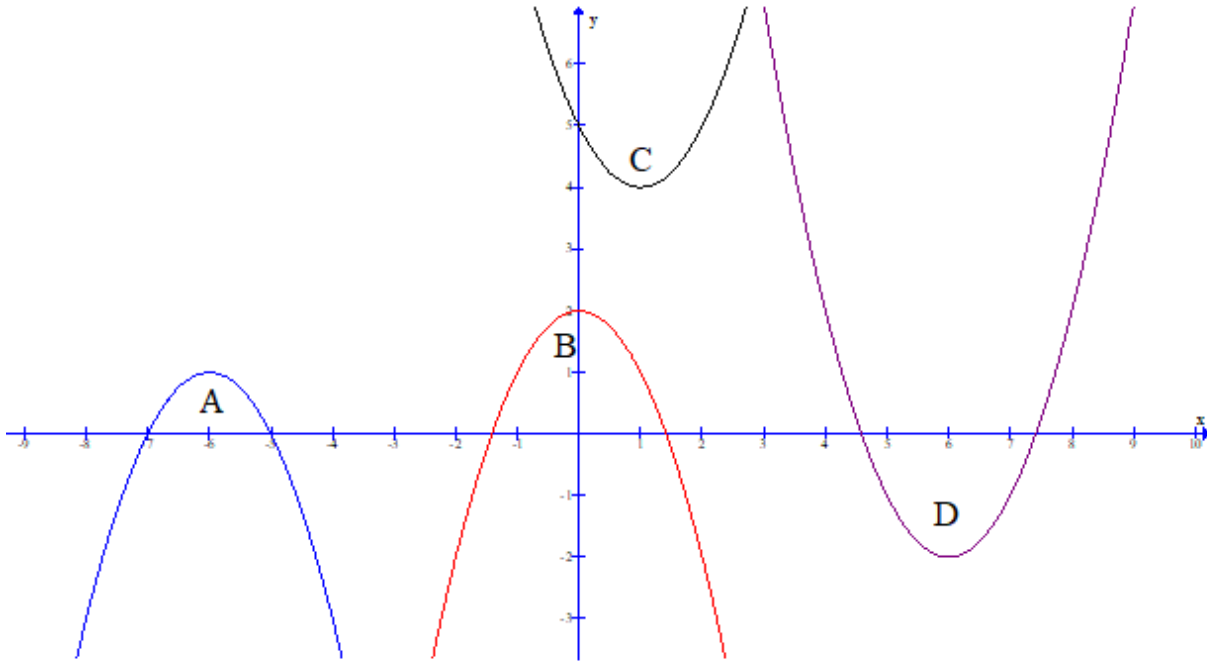


Analyzing 'a', 'p', and 'q'

Practice Questions

1. Match the following equations with the graph below.



- i)  $y = (x - 1)^2 + 4$  \_\_\_\_\_
- ii)  $y = -x^2 + 2$  \_\_\_\_\_
- iii)  $y = (x - 6)^2 - 2$  \_\_\_\_\_
- iv)  $y = -(x + 6)^2 + 1$  \_\_\_\_\_

2. Sketch the graph of  $y = (x + 2)^2 + 3$ . Clearly show the vertex, the equation of the axis of symmetry and the range.

3. A graph has a maximum value of  $-3$ , an equation of the axis of symmetry of  $x = 1$ , and has a vertical stretch twice the amount as compared to  $y = x^2$ . Write the equation of this quadratic function in the form,  $y = a(x - p)^2 + q$ .

4. The graph of  $y = x^2$  is reflected in the  $x$ -axis. It is then translated horizontally 5 units left, and then translated vertically 4 units up. Write the equation of this quadratic function in the form,  $y = a(x - p)^2 + q$ .

5. Given the quadratic function,  $y = 4(x - 2)^2 - 6$ , state:

- i) The quadrant the vertex is positioned in.
- ii) The minimum or maximum value.
- iii) The range.

The following 3 questions are based on an important mathematical fact. If a point is on a graph, it means that the point can be substituted into the equation to make a true statement. This fact allows us to find the value of unknown letters in an equation.

6. The point (2,31) is on the graph defined by the quadratic equation,  $y = 3(x + 2)^2 - q$ . State the vertex of this graph.
  
  
  
  
  
  
  
  
  
  
7. The point (5,-6) is on the graph defined by the quadratic equation,  $y = a(x - 1)^2 - 10$ . Find the value of 'a'.
  
  
  
  
  
  
  
  
  
  
8. Given the fact that (-2,50) is a point on the graph of  $y = -10(x - 1)^2 - q$ , determine the range and the maximum or minimum value.
  
  
  
  
  
  
  
  
  
  
9. The graph of  $y = -a(x + p)^2 - q$ , has a vertex in quadrant 3. The maximum value is -4, the equation of the axis of symmetry is  $x = -8$ . If this graph

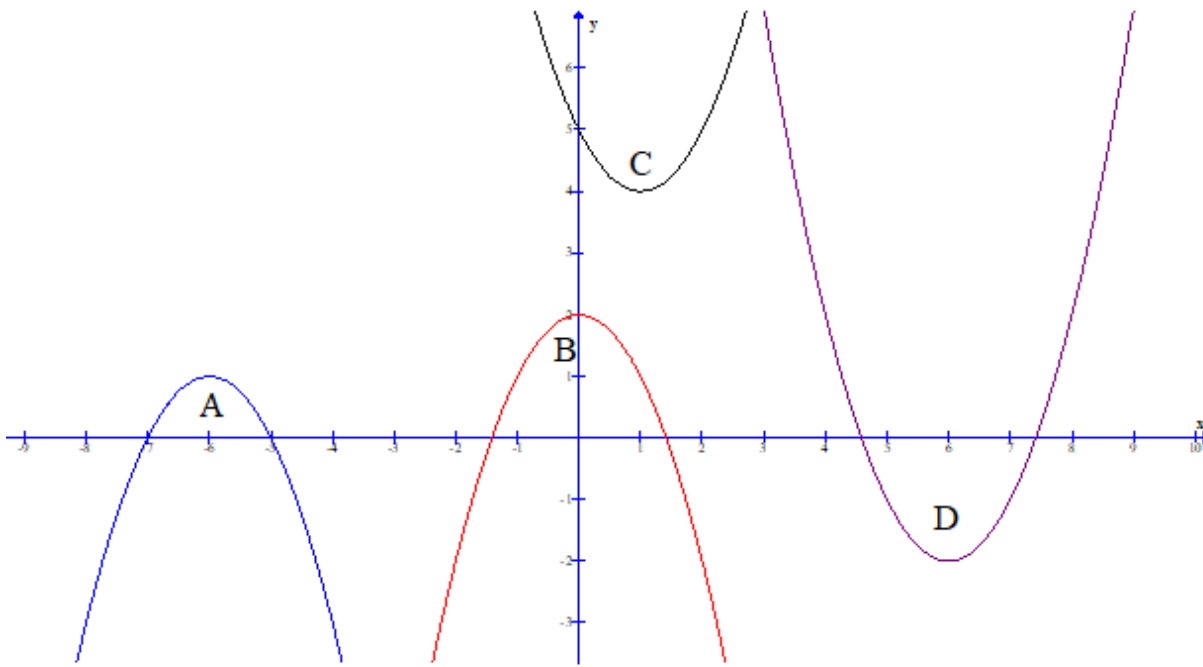
undergoes a vertical translation of 5 units up and a horizontal translation of 10 units right, what is the vertex of this new graph?

10. If the graph of,  $y = 2x^2 + k$ , is shifted 3 units up, what is the range in terms of  $k$ ?

Analyzing 'a', 'p', and 'q'

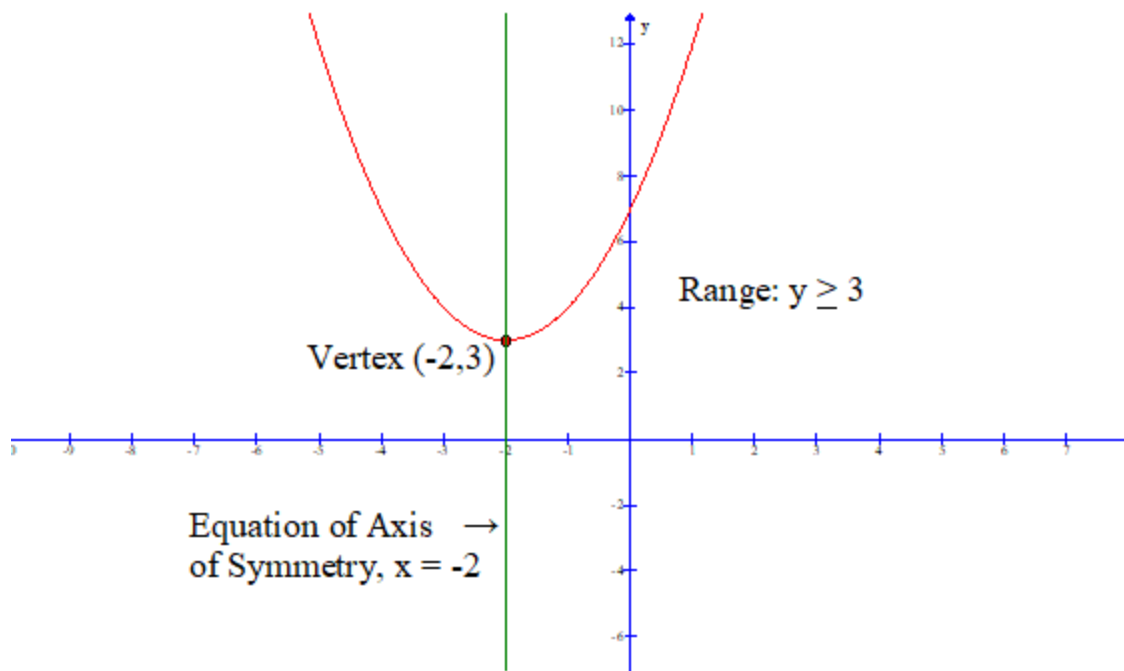
Practice Questions **Answers**

1. Match the following equations with the graph below.

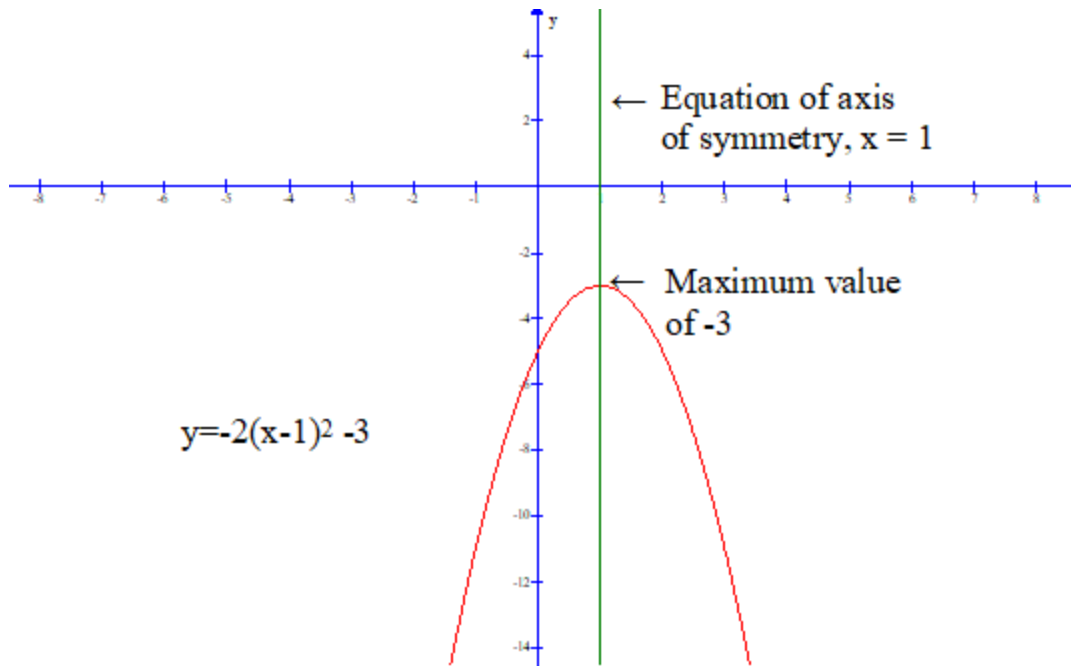


- 
- |      |                      |          |
|------|----------------------|----------|
| i)   | $y = (x - 1)^2 + 4$  | <b>C</b> |
| ii)  | $y = -x^2 + 2$       | <b>B</b> |
| iii) | $y = (x - 6)^2 - 2$  | <b>D</b> |
| iv)  | $y = -(x + 6)^2 + 1$ | <b>A</b> |

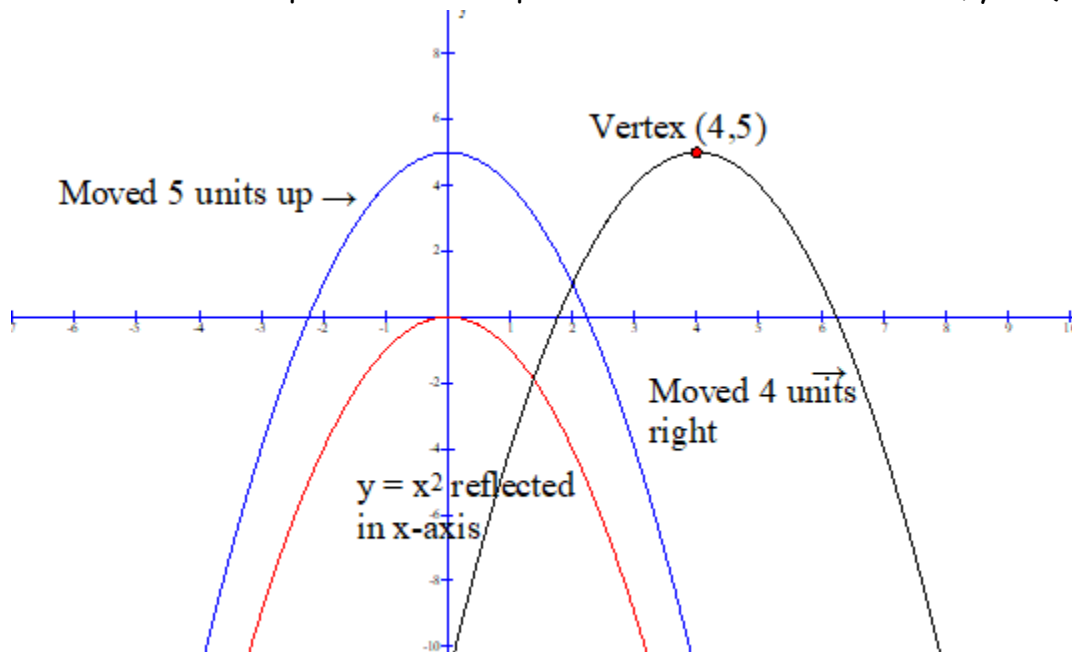
2. Sketch the graph of  $y = (x + 2)^2 + 3$ . Clearly show the vertex, the equation of the axis of symmetry and the range.



3. A graph has a maximum value of  $-3$ , an equation of the axis of symmetry of  $x = 1$ , and has a vertical stretch twice the amount as compared to  $y = x^2$ . Write the equation of this quadratic function in the form,  $y = a(x - p)^2 + q$ .



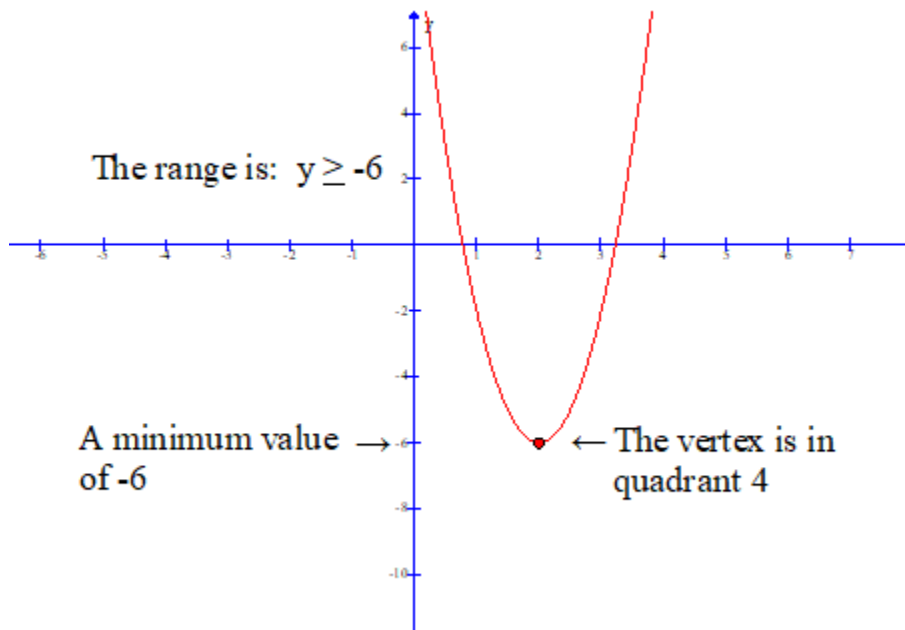
4. The graph of  $y = x^2$  is reflected in the  $x$ -axis. It is then translated vertically 5 units up, and then translated horizontally 4 units right. Write the equation of this quadratic function in the form,  $y = a(x - p)^2 + q$ .



The quadratic equation is:  $y = -(x - 4)^2 + 5$

5. Given the quadratic function,  $y = 4(x - 2)^2 - 6$ , state:

- i) The quadrant the vertex is positioned in.
- ii) The minimum or maximum value.
- iii) The range.



The following 3 questions are based on an important mathematical fact. If a point is on a graph, it means that the point can be substituted into the equation to make a true statement. This fact allows us to find the value of unknown letters in an equation.

6. The point (2,31) is on the graph defined by the quadratic equation,  $y = 3(x + 2)^2 - q$ . State the vertex of this graph.

$$(31) = 3((2) + 2)^2 - q$$

$$31 = 48 - q$$

$$q = 48 - 31$$

$$q = 17$$



Since the vertex is  $(p,q)$ , the vertex is  $(-2, 17)$ .

7. The point  $(5,-6)$  is on the graph defined by the quadratic equation,  $y = a(x - 1)^2 - 10$ . Find the value of 'a'.

$$(-6) = a((5) - 1)^2 - 10$$

$$-6 = 16a - 10$$

$$4 = 16a$$

$$a = \frac{1}{4}$$

8. Given the fact that  $(-2,50)$  is a point on the graph of  $y = -10(x - 1)^2 - q$ , determine the range and the maximum or minimum value.

$$50 = -10((-2) - 1)^2 - q$$

$$50 = -90 - q$$

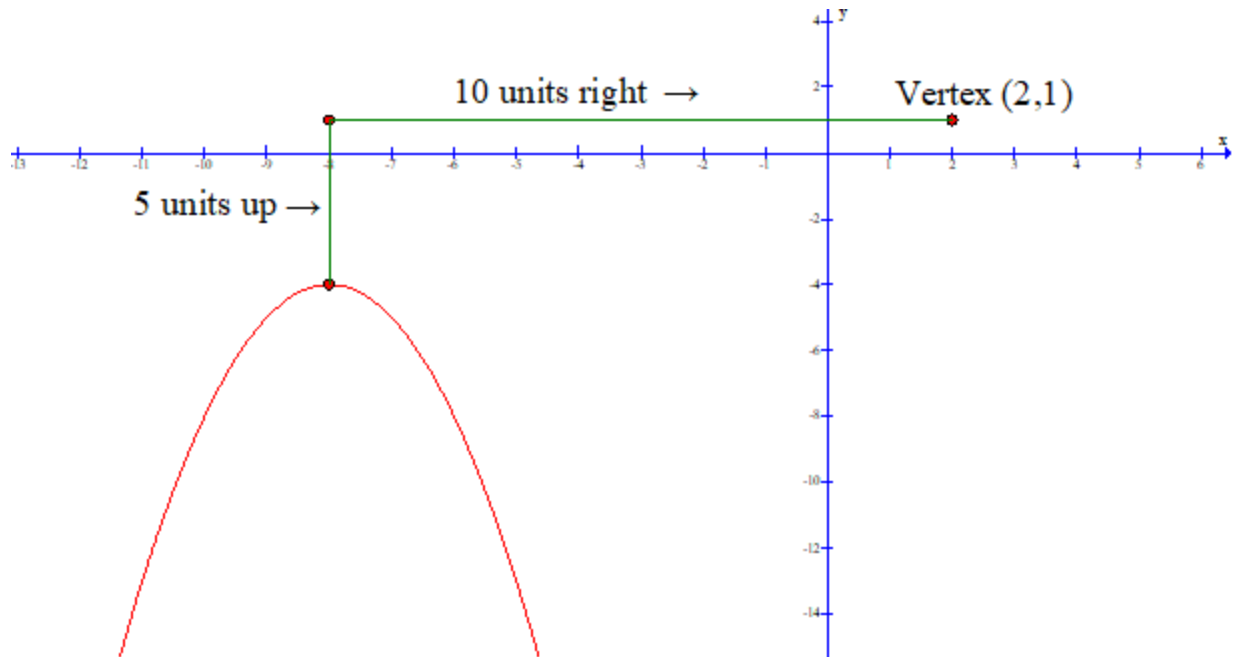
$$q = -90 - 50$$

$$q = -140$$

Since 'a' is negative, the graph opens down. Therefore there is a maximum value of  $-140$ .

The range is:  $y \leq -140$

9. The graph of  $y = -a(x + p)^2 - q$ , has a vertex in quadrant 3. The maximum value is  $-4$ , the equation of the axis of symmetry is  $x = -8$ . If this graph undergoes a vertical translation of 5 units up and a horizontal translation of 10 units right, what is the vertex of this new graph?



10. If the graph of,  $y = 2x^2 + k$ , is shifted 3 units up, what is the range in terms of  $k$ ?

The phrase, 'in terms of  $k$ ' means that the answer will have ' $k$ ' in it.

If ' $k$ ' was 2, and then shifted 3 units up, the range would be:  $y \geq 5$

If ' $k$ ' was 6, and then shifted 3 units up, the range would be:  $y \geq 9$

If ' $k$ ' was 20, and then shifted 3 units up, the range would be:  $y \geq 23$ .

Whatever ' $k$ ' is, 3 must be added to it.

The range, in terms of ' $k$ ', is:  $y \geq k + 3$ .