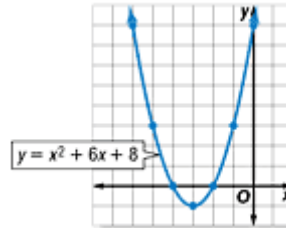


Lesson 10-1

Example 1 Graph Opens Upward

Use a table of values to graph $y = x^2 + 6x + 8$.

x	y
-6	8
-5	3
-4	0
-3	-1
-2	0
-1	3
0	8

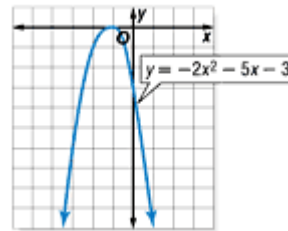


Graph these ordered pairs and connect them with a smooth curve.

Example 2 Graph Opens Downward

Use a table of values to graph $y = -2x^2 - 5x - 3$.

x	y
-4	-15
-3	-6
-2	-1
-1	0
0	-3
1	-10
2	-21



Graph these ordered pairs and connect them with a smooth curve.

Example 3 Vertex and Axis of Symmetry

Consider the graph of $y = 5x^2 - 4x + 1$.

a. Write the equation of the axis of symmetry.

In $y = 5x^2 - 4x + 1$, $a = 5$ and $b = -4$. Substitute these values into the equation of the axis of symmetry.

$$x = -\frac{b}{2a} \quad \text{Equation for the axis of symmetry of a parabola}$$

$$x = -\frac{-4}{2(5)} \text{ or } \frac{2}{5} \quad a = 5 \text{ and } b = -4$$

The axis of symmetry is $x = \frac{2}{5}$.

b. Find the coordinates of the vertex.

Since the equation of the axis of symmetry is $x = \frac{2}{5}$ and the vertex lies on the axis, the x -coordinate

for the vertex is $\frac{2}{5}$.

$$y = 5x^2 - 4x + 1 \quad \text{Original equation}$$

$$y = 5\left(\frac{2}{5}\right)^2 - 4\left(\frac{2}{5}\right) + 1 \quad x = \frac{2}{5}$$

$$y = \frac{4}{5} - \frac{8}{5} + 1 \quad \text{Simplify.}$$

$$y = \frac{1}{5}$$

The coordinates of the vertex are $\left(\frac{2}{5}, \frac{1}{5}\right)$.

c. Identify the vertex as a maximum or minimum.

Since the coefficient of the x^2 term is positive, the parabola opens upward and the vertex is a minimum point.

d. Graph the function.

You can use the symmetry of the parabola to help you draw its graph. On a coordinate plane, graph the vertex and the axis of symmetry. Choose a value of x other than $\frac{2}{5}$. For example, choose 0 and

find the y -coordinate that satisfies the equation.

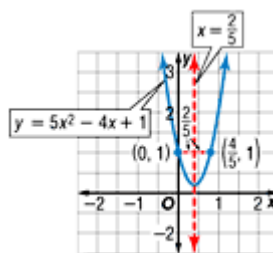
$$y = 5x^2 - 4x + 1 \quad \text{Original equation}$$

$$y = 5(0)^2 - 4(0) + 1 \quad x = 0$$

$$y = 1 \quad \text{Simplify.}$$

Graph $(0, 1)$. Since the graph is symmetrical, you can find another point on the other side of the axis of

symmetry. The point at $(0, 1)$ is $\frac{2}{5}$ unit to the left of



the axis. Go $\frac{2}{5}$ to the right of the axis and plot the

point $(\frac{4}{5}, 1)$. Repeat this for several other points.

Then sketch the parabola.

CHECK: Does $(\frac{4}{5}, 1)$ satisfy the equation?

$$y = 5x^2 - 4x + 1 \quad \text{Original equation}$$

$$1 \stackrel{?}{=} 5\left(\frac{4}{5}\right)^2 - 4\left(\frac{4}{5}\right) + 1 \quad y = 1 \text{ and } x = \frac{4}{5}$$

$$1 \stackrel{?}{=} \frac{16}{5} - \frac{16}{5} + 1 \quad \text{Simplify}$$

$$1 = 1$$

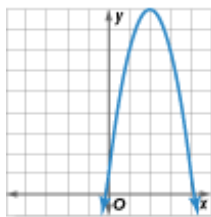
The ordered pair $(\frac{4}{5}, 1)$ satisfies the equation $y = 5x^2 - 4x + 1$ and the point is on the graph.

Example 4 Match Equations and Graphs

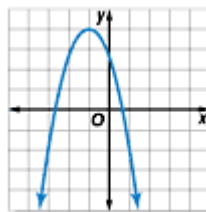
Multiple-Choice Test Item

Which graph corresponds with the equation $y = -2x^2 + 8x + 1$?

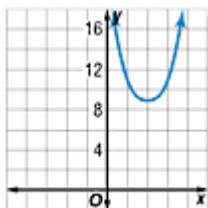
A.



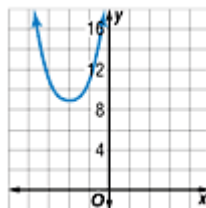
B.



C.



D.



Read the Test Item

You are given a quadratic equation, and you are asked to choose the graph that corresponds to the equation.

Solve the Test Item

Since the equation $y = -2x^2 + 8x + 1$ is in standard form, find the axis of symmetry.

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

Equation for the axis of symmetry of a parabola

$$x = -\frac{8}{2(-2)} \text{ or } 2$$

$a = -2$ and $b = 8$

The axis of symmetry is $x = 2$. Look at the graphs. Since A and C have this as their axis of symmetry, you can eliminate choices B and D. Since the coefficient of the x^2 term is negative, the graph opens downward. Eliminate choice C. The answer is A.