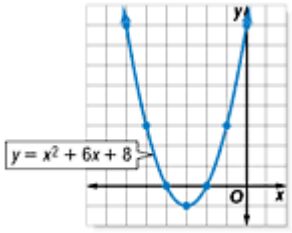
Lesson 10-1

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

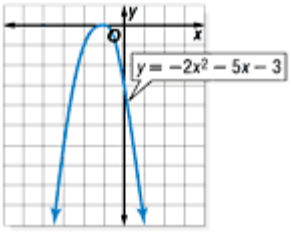


Graph these ordered pairs and connect them with a smooth curve.

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.

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

$x = -\frac{-4}{2(5)}$ or $\frac{2}{5}$ $a = 5$ 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 $\frac{2}{5}$.

$y = 5x^2 - 4x + 1$ Original equation

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

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

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

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

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.

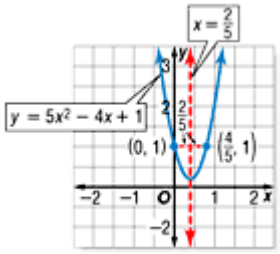
You can use the symmetry of the parabola to help you draw its graph. On a coordinate plane, graph the vertex and the axis of symmetry. Choose a value of x other than $\frac{2}{5}$. For example, choose 0 and find the y-coordinate that satisfies the equation.

$y = 5x^2 - 4x + 1$ Original equation

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

$y = 1$ 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?

$y = 5x^2 - 4x + 1$ Original equation

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

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

$1 = 1$

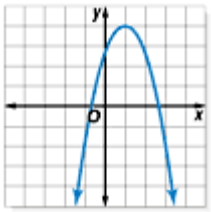
The ordered pair $(\frac{4}{5}, 1)$ satisfies the equation $y = 5x^2 - 4x + 1$ and the point is on the graph.

Example 4 Match Equations and Graphs

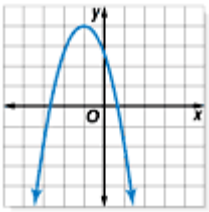
Multiple-Choice Test Item

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

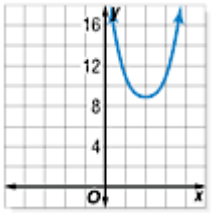
A.



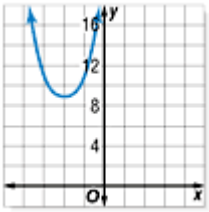
B.



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

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