

Graphing Quadratic Functions

(Pages 458–463)

Quadratic Function	A quadratic function is a function that can be written in the form $y = ax^2 + bx + c$ where $a \neq 0$. The graph of a quadratic function is a parabola . a is positive: parabola opens upward and vertex is a minimum point of the function a is negative: parabola opens downward and vertex is a maximum point of the function
Axis of Symmetry	Parabolas have symmetry , which means that when they are folded in half on a line that passes through the vertex, each half matches the other exactly. This line is called the axis of symmetry . The axis of symmetry for the graph of $y = ax^2 + bx + c$, where $a \neq 0$, is $x = -\frac{b}{2a}$.

EXAMPLE

Given the function $y = x^2 - 2x + 3$, find the equation for the axis of symmetry, the coordinates of the vertex, and graph the function.

In the equation $y = x^2 - 2x + 3$, $a = 1$ and $b = -2$. Substitute these values into the equation for the axis of symmetry.

axis of symmetry: $x = -\frac{b}{2a}$

$$x = -\frac{-2}{2(1)} \text{ or } 1$$

Since you know the axis of symmetry, you know the x -coordinate for the vertex is 1.

$$y = x^2 - 2x + 3$$

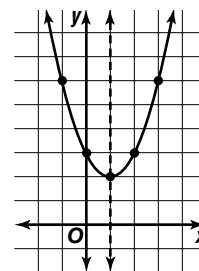
$$y = 1 - 2 + 3 \text{ or } 2 \quad \text{Replace } x \text{ with } 1.$$

Coordinates of vertex: $(x, y) = (1, 2)$

This point is a minimum.

Make a table of values to find points on the graph. Choose some values for x that are less than 1 and greater than 1 to ensure that points on each side of the axis of symmetry are graphed. Graph the coordinate pairs and connect the points with a smooth curve.

x	$x^2 - 2x + 3$	y	(x, y)
-1	$(-1)^2 - 2(-1) + 3$	6	$(-1, 6)$
0	$0^2 - 2(0) + 3$	3	$(0, 3)$
1	$1^2 - 2(1) + 3$	2	$(1, 2)$
2	$2^2 - 2(2) + 3$	3	$(2, 3)$
3	$3^2 - 2(3) + 3$	6	$(3, 6)$



PRACTICE

Graph each quadratic equation by making a table of values.

1. $y = x^2 + 10x + 24$

2. $y = -x^2 - 6x + 7$

3. $y = x^2 - 2x + 1$

Write the equation of the axis of symmetry and the coordinates of the vertex of the graph of each quadratic function. Then graph the function.

4. $y = 3x^2$

5. $y = -x^2 + 2$

6. $y = 2x^2 - 18$

7. $y = x^2 + x - 6$

8. $y = x^2 + 2x + 1$

9. $y = -3x^2 - 18x - 24$



10. **Standardized Test Practice** What is the vertex of the graph of

$$y = 1 - 4x + 2x^2?$$

A (2, 1)

B (-2, 17)

C (1, -1)

D (-1, 7)

Answers: 1–9. See Answer Key for graphs. 4. $x = 0; (0, 0)$ 5. $x = 0; (0, 2)$ 6. $x = 0; (0, -18)$ 7. $x = -0.5; (-0.5, -6.25)$ 8. $x = -1; (-1, 0)$ 9. $x = -3; (-3, 0)$ 10. C