Name _____ Period _____ Date _____

Graphing Quadratic Functions

Quadratic Function	A **quadratic function** is a function that can be written in the form $f(x) = ax^2 + bx + c$ 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**. Axis of symmetry for graph of $y = ax^2 + bx + c$, where $a \neq 0$, is $x = -\frac{b}{2a}$.

Example

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

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

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

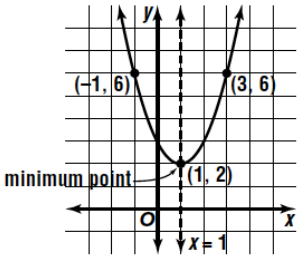
Since you know the line of symmetry, you know the x-coordinate for the vertex is 1.

$y = x^2 - 2x + 3$
$y = 1 - 2 + 3$ or 2 *Replace x with 1.*

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

Graph the vertex and the line of symmetry, $x = 1$.

Using the equation, you can find another point on the graph. The point (3, 6) is 2 units right of the axis of symmetry. Since the graph is symmetrical, if you go 2 units left of the axis and 6 units up, you will find a third point on the graph, (−1, 6). Repeat this for several other points. Then sketch the parabola.



Practice

Write the equation of the axis of symmetry and find the coordinates of the vertex of the graph of each equation. State if the vertex is a *maximum* or *minimum*. Then graph the equation.

1. $y = x^2 + 10x + 24$
2. $y = -x^2 - 6x + 7$
3. $y = x^2 - 2x + 1$
4. $y = -3x^2 - 18x - 24$
5. $y = x^2 + x - 6$
6. $y = 2x^2 - 18$
7. $y = -x^2 + 1$
8. $y = 3x^2$
9. $y = x^2 + 2x + 1$

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.** For graphs, see Answer Key. **1.** $x = -5$; $(-5, -1)$; minimum **2.** $x = -3$; $(-3, 16)$; maximum **3.** $x = 1$; $(1, 0)$; minimum **4.** $x = -3$; $(-3, 3)$; maximum **5.** $x = -0.5$; $(-0.5, -6.25)$; minimum **6.** $x = 0$; $(0, -18)$; minimum **7.** $x = 0$; $(0, 1)$; maximum **8.** $x = 0$; $(0, 0)$; minimum **9.** $x = -1$; $(-1, 0)$; minimum **10.** C