Chapter 10: Quadratic Equations and Functions
10.2 Graphing Quadratic Functions continued

In lesson 10.1, we learned that the graph of every quadratic function is a U-shaped, symmetric curve called a ________________.

The ____________ is the minimum (or maximum) point of the parabola. The ________________________ is an imaginary vertical line that divides the parabola in half.

We learned how to graph the __________ function \( y = x^2 \).

We also learned how to "transform" the parent function by doing ________________, ________________, and ________________.

Transformations of Quadratic Graphs - concepts to remember
If "a" is positive, the parabola opens __________.
If "a" is negative, the parabola opens __________.
If \( a > 1 \), the parabola is vertically ________________.
If \( 0 < a < 1 \), the parabola is vertically ________________.
If \( c > 0 \), the parabola is ________________ up.
If \( c < 0 \), the parabola is ________________ down.
One thing we have not yet learned is how to shift a parabola *horizontally*.

\[ y = ax^2 + bx + c \]

- *a* affects the width and opening direction of the parabola.
- *b* affects the vertical shift of the parabola (y-intercept).
- *c* affects the horizontal shift of the parabola.

**The location of the vertex shifts horizontally when the "b" value changes**

\[
\text{VERTEX (x-coordinate)} = \frac{-b}{2a}
\]

**Unfortunately, this formula only gives us the X-COORDINATE of the vertex. To find the y-coordinate, plug the resulting x-value back into the original equation.**

**Equation of the AXIS OF SYMMETRY**

\[ x = \_\_\_\_\_\_\_ \]
Example 1 \[ y = -2x^2 + 12x - 7 \]

a) Find the vertex of the function.

b) Write the equation of the Axis of Symmetry (A.O.S.)

c) Is the vertex a minimum or a maximum?

Example 2 \[ y = 3x^2 - 6x + 2 \]

a) Find the vertex of the function.

b) Write the equation of the Axis of Symmetry (A.O.S.)

c) Is the vertex a minimum or a maximum?
Example 3:
Find the vertex, opening direction, axis of symmetry, and then graph the quadratic (without a graphing calc).

\[ y = -2x^2 - 8x + 6 \]

Vertex ( , )

Parabola opens ____

A.O.S. \( x = \)

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
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**MULTIPLE CHOICE** What is the vertex of the graph of the function \(y = -3x^2 + 18x - 13\)?

- **A** \((-3, -94)\)
- **B** \((-3, -14)\)
- **C** \((3, -13)\)
- **D** \((3, 14)\)

**MULTIPLE CHOICE** Which function has the graph shown?

- **A** \(y = -2x^2 + 8x + 3\)
- **B** \(y = -\frac{1}{2}x^2 + 2x + 3\)
- **C** \(y = \frac{1}{2}x^2 + 2x + 3\)
- **D** \(y = 2x^2 + 8x + 3\)
10.2 HOMEWORK

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1. **VOCABULARY** Explain how you can tell whether a quadratic function has a maximum value or minimum value without graphing the function.

**FINDING AXIS OF SYMMETRY AND VERTEX** Find the axis of symmetry and the vertex of the graph of the function.

3. \( y = 2x^2 - 8x + 6 \)
4. \( y = x^2 - 6x + 11 \)
5. \( y = -3x^2 + 24x - 22 \)
6. \( y = -x^2 - 10x \)
7. \( y = 6x^2 + 6x \)
8. \( y = 4x^2 + 7 \)
9. \( y = -\frac{2}{3}x^2 - 1 \)
10. \( y = \frac{1}{2}x^2 + 8x - 9 \)
11. \( y = -\frac{1}{4}x^2 + 3x - 2 \)

**MAXIMUM AND MINIMUM VALUES** Tell whether the function has a minimum value or a maximum value. Then find the minimum or maximum value.

28. \( f(x) = x^2 - 6 \)
29. \( f(x) = -5x^2 + 7 \)
30. \( f(x) = 4x^2 + 32x \)
31. \( f(x) = -3x^2 + 12x - 20 \)
32. \( f(x) = x^2 + 7x + 8 \)
33. \( f(x) = -2x^2 - x + 10 \)
GRAPHING QUADRATIC FUNCTIONS Graph the function. Label the vertex and axis of symmetry.

15. \( y = x^2 + 6x + 2 \)
16. \( y = x^2 + 4x + 8 \)
17. \( y = 2x^2 + 7x + 21 \)
18. \( y = 5x^2 + 10x - 3 \)
19. \( y = 4x^2 + x - 32 \)
20. \( y = -4x^2 + 4x + 8 \)
10.1 - 10.2 Quiz Thursday 4/10

Quadratic Equations

\[ y = ax^2 + bx + c \]

Stuff to know:
- Find the vertex of a parabola
- Find the Axis of Symmetry of a parabola
- Graph the parabola (by making a table of values)

Transformations of Parabolas
- Reflections = graph opens up or down (flip)
- Dilations = vertical "stretch" or "compression"
- Translations = vertical "shift" up or down (slide)

Is the vertex a minimum or a maximum? How can you tell?
Properties of Parabolas

Identify the vertex of each.

1) \( y = x^2 + 16x + 64 \)  
2) \( y = 2x^2 - 4x - 2 \)

3) \( y = -x^2 + 18x - 75 \)  
4) \( y = -3x^2 + 12x - 10 \)

Graph each equation.

5) \( y = x^2 - 2x - 3 \)  
6) \( y = -x^2 - 6x - 10 \)

Identify the min/max value of each. Then sketch the graph.

7) \( f(x) = -x^2 + 8x - 20 \)  
8) \( f(x) = \frac{1}{3}x^3 + \frac{4}{3}x - \frac{16}{3} \)
9) \( f(x) = x^2 + 2x - 1 \)

10) \( f(x) = -x^2 - 10x - 30 \)

Identify the vertex, axis of symmetry, and min/max value of each.

11) \( f(x) = 3x^2 - 54x + 241 \)

12) \( f(x) = x^2 - 18x + 86 \)

13) \( f(x) = -\frac{4}{5}x^2 + \frac{48}{5}x - \frac{114}{5} \)

14) \( f(x) = -2x^2 - 20x - 46 \)

15) \( f(x) = -\frac{1}{4}x^2 + 7 \)

16) \( f(x) = x^2 - 12x + 44 \)

17) \( f(x) = \frac{1}{4}x^2 - x + 9 \)

18) \( f(x) = x^2 + 4x + 5 \)