

NAME _____

Module 14 Graphing Quadratic Relations
Lesson 1 Graphing Simple Quadratic Relations

**independent
practice**

Find the equation of the axis of symmetry.

1. $y = x^2 + 4x + 1$ $x = -2$ _____

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

3. $y = -4x^2 + 8x - 2$ $x = 1$ _____

4. $y = 2x^2 - 12x + 7$ $x = 3$ _____

5. $y = 3x^2 - 9x + 2$ $x = 1\frac{1}{2}$ _____

6. $y = 5x^2 - 2$ $x = 0$ _____

Identify the vertex.

7. $y = x^2 - 6x - 9$ $(3, -18)$ _____

8. $y = -3x^2 + 6x + 2$ $(1, 5)$ _____

9. $y = 2x^2 - 8x + 7$ $(2, -1)$ _____

10. $y = 2x^2 + 4$ $(0, 4)$ _____

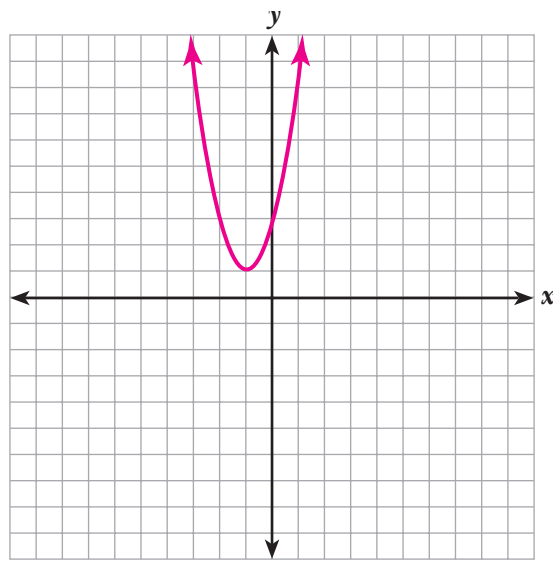
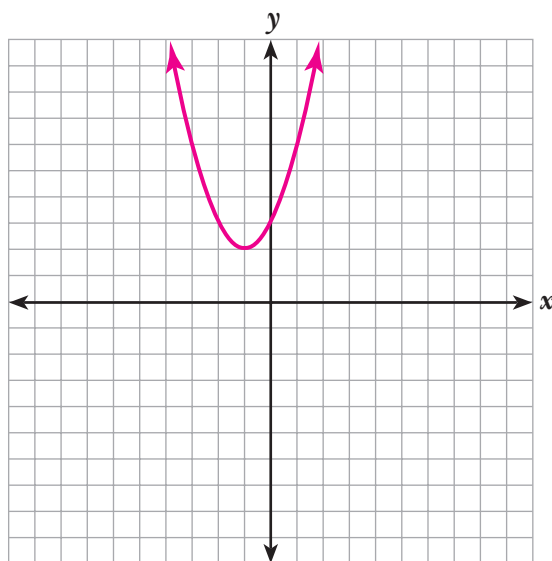
11. $y = -x^2 - 2x$ $(-1, 1)$ _____

12. $y = x^2 + x + 1$ $(-\frac{1}{2}, \frac{3}{4})$ _____

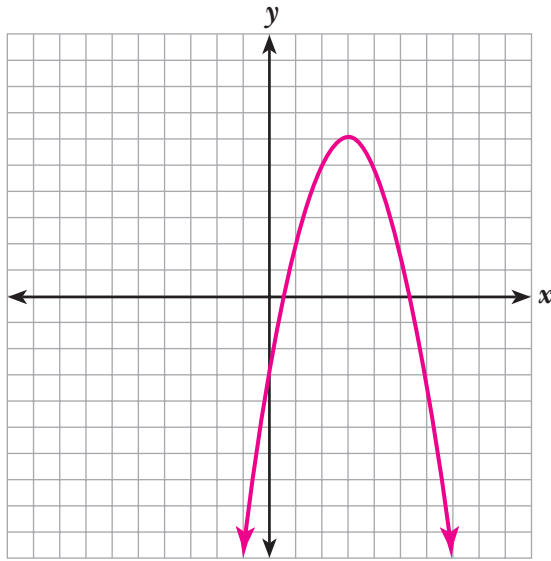
Graph.

13. $y = x^2 + 2x + 3$

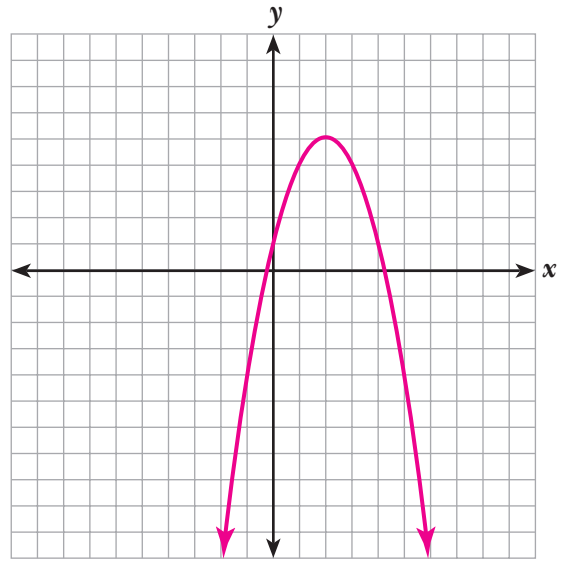
14. $y = 2x^2 + 4x + 3$



15. $y = -x^2 + 6x - 3$



16. $y = -x^2 + 4x + 1$



Journal

1. What is the axis of symmetry of a graph?
2. Joe says that the axis of symmetry of $y = 3x^2 - 6x + 2$ is $x = -1$, but Jenny says that it is $x = 1$. Who is correct and why?
3. Explain how to find the vertex of $y = 3x^2 - 6x + 2$.
4. Explain how to graph the equation $y = 3x^2 - 6x + 2$.
5. Explain in words as many properties of the graph of $y = 3x^2 - 6x + 2$ as you can.

Cumulative Review

Solve the equations by evaluating square roots, factoring, completing the square, or using the quadratic formula.

1. $x^2 + 3x - 4 = 0$ $x = -4$ or 1

2. $x^2 = 12$ $x = 2\sqrt{3}$ or $-2\sqrt{3}$

3. $x^2 + 4x = 12$ $x = -6$ or 2

4. $2x^2 - x - 3 = 0$ $x = 1.5$ or -1

5. $3x^2 - 5x - 2 = 0$ $x = 2$ or $-\frac{1}{3}$

6. $2x^2 + x - 4 = 0$ $x = \frac{-1 + \sqrt{33}}{4}$ or $\frac{-1 - \sqrt{33}}{4}$

Calculator Problem

Consider the equation $y = 2x^2 - 5x + 1$.

1. Press $\boxed{\text{Y=}}$ and enter $2x^2 - 5x + 1$ into $Y_1=$. See Figure 1.
2. Press $\boxed{\text{GRAPH}}$. See Figure 2. (You may want to set your window measurements as in Figure 3.)
3. From the **CALC** menu, select **3:minimum**. **Left Bound?** will appear in the lower left hand corner of the screen. Use the arrow keys to move the cursor to the left of what appears to be the vertex, press $\boxed{\text{ENTER}}$. **Right Bound?** will appear in the lower left hand corner of the screen. Use the arrow keys to move the cursor to the right of what appears to be the vertex; press $\boxed{\text{ENTER}}$. **Guess?** will appear in the lower left hand corner of the screen; press $\boxed{\text{ENTER}}$. See Figure 4. The x and y values of the minimum point of the graph are in the lower left hand corner of the screen. These values are the x - and y -coordinates of the vertex.
4. The axis of symmetry is determined by the equation $x = -\frac{b}{2a}$. The axis of symmetry also may be determined by the x -coordinate of the vertex.
 $x = -\frac{b}{2a} = -\frac{-5}{2 \cdot 2} = \frac{5}{4} = 1.25$. The value given by the equation and x -coordinate of the vertex correspond.

```

Plot1 Plot2 Plot3
\Y1=2X^2-5X+1
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
    
```

Figure 1

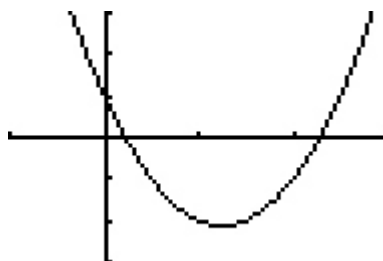


Figure 2

```

WINDOW
Xmin=-1
Xmax=3
Xscl=1
Ymin=-3
Ymax=3
Yscl=1
Xres=1
    
```

Figure 3

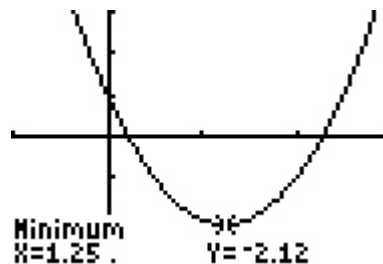
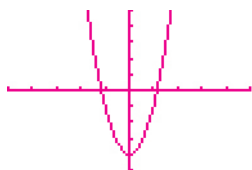


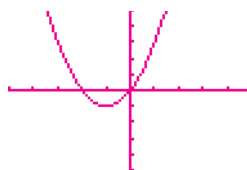
Figure 4

Graph the equations and determine the x - and y -coordinates of the vertex.

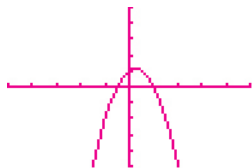
1. $y = 3x^2 - 4$ **Vertex: (0, -4)** _____



2. $y = x^2 + 2x$ **Vertex: (-1, -1)** _____



3. $y = -2x^2 + x + 1$ **Vertex: (0.25, 1.125)** _____



4. $y = -x^2 - 3x + 4$ **Vertex: (-1.5, 6.25)** _____



Possible Journal Answers

1. The axis of symmetry is the line that separates a graph into two matching halves. If you were to fold the paper on that line, both sides would match.
2. Jenny is correct. She used the formula $x = -\frac{b}{2a}$. Joe forgot to take the opposite of b before dividing by $2a$.
3. After finding the equation for the axis of symmetry $x = 1$, substitute $x = 1$ into the equation $y = 3x^2 - 6x + 2$. So, $y = 3(1)^2 - 6(1) + 2$; therefore, $y = 3 - 6 + 2$, or $y = -1$. The vertex is $(1, -1)$.
4. Find the vertex $(1, -1)$. Graph this point in the coordinate plane (start at the origin, move one unit right and one unit down, and put a dot). Then, choose other x -coordinates and substitute them into the equation to find the corresponding y -coordinates. For example, if $x = 0$, then $y = 2$. If $x = -1$, then $y = 11$. Using the axis of symmetry and these points, draw the parabola on the coordinate plane.
5. The shape of the graph is a parabola. The axis of symmetry is $x = 1$. The vertex is $(1, -1)$. It is skinnier than the graph of $y = x^2$. It opens up.