**Algebra I**

**Lesson 9.1 – Identifying Quadratic Functions**

**Mrs. Snow, Instructor**

A soccer ball kicked across a field can be described by a quadratic function. As the seconds tick away the ball goes higher into the air until it reaches a maximum height and then it will start to fall back to the ground. In Chapter 8 we studied polynomials and in particular focused on 2nd degree polynomials A.K.A. **quadratic polynomials.** In Chapter 9 we will take our quadratic expressions, add and equal sign and a **y** variable to form a quadratic function.

**Vocabulary:**

**Quadratic function –** any function that can be written in the standard form of $\boldsymbol{y = ax^2 + bx + c}$, $where\ \ a, b, and\ c\ are\ real\ numbers\ and\ a \neq 0$

**Parent quadratic function –** stripping down the quadratic function to its simplest form of $\boldsymbol{y = x^2}$

**Parabola –** the graph of a quadratic function is a curve and is called a parabola.

**Vertex –** the highest or lowest point on a quadratic

**Minimum –** if a>0, the parabola opens upward, and the y-value of the vertex is the minimum value of the function.

**Maximum –** if a<0, the parabola opens downward, and the y-value of the vertex is the maximum value of the function.

**Leading coefficient –** the coefficient associated with the $x^2$ term.

When you look at the equation you can tell the equation is a quadratic because it is a 2nd degree equation. What if you are given a table of values, how do you tell if the table of values represents a quadratic function? What did we do with a table of values for a linear function? Is this table linear?

|  | x | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|
| | y | 1 | 3 | 5 | 7 |

For quadratics we will find that the first differences between our **y** values are not constant. BUT!!! The look at the second differences, you will find they are constant: for $y = x^2$

| x | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| y | 0 | 1 | 4 | 9 | 16 |

+1 +3 +5 +7 *first differences*

*+2 +2 +2 second differences*

***All quadratic functions will have constant second differences.***

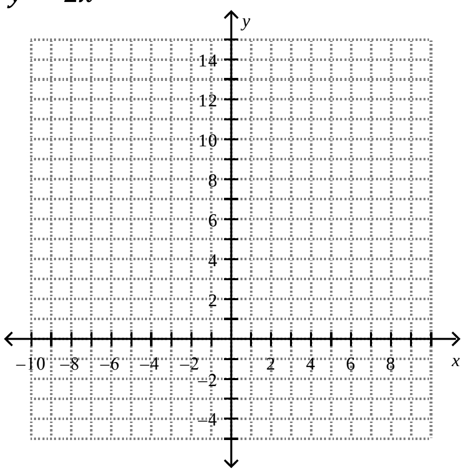
Tell whether each function is a quadratic, explain:

$\{(-2,4), (-1,1), (0,0), (1,1), (2,4)\}$ $\qquad$ $x + y = 2x^2$

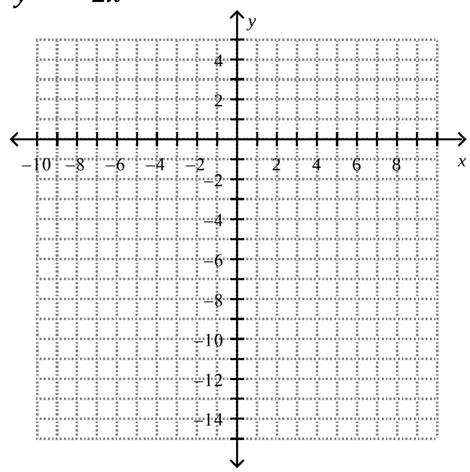
Graphing a quadratic may be accomplished as we first did with linear functions. **Use a table of values with at least 5 values!** This number of values is necessary for us to accurately graph the curve of the parabola.

Graph the quadratics using a table of values:

$y = 2x^2$




$y = -2x^2$




What is the sign of the leading coefficient for each of the above graphs? Is the vertex a minimum or a maximum value?

The parabola opens upward for a positive leading coefficient – when $a > 0$. The y-value of the vertex is the minimum value of the function.

The parabola opens downward for a negative leading coefficient – when $a < 0$. The y-value of the vertex is the maximum value of the function.

Tell whether the graph of each quadratic function will open upward or downward. Explain.

| $f(x) = -4x^2 - x + 1$ | $y - 5x^2 = 2x - 6$ | $y + x^2 = -x - 2$ |
|---|---|---|
| | | |

The domain of a quadratic is the set of all real numbers (unless the domain is given). Find the range by looking at the graph.

Identify the vertex, the minimum or maximum, the domain and the range of the following parabolas: