8-1 Identifying Quadratic Functions

**Objectives**: Identify quadratic functions and determine whether they have a minimum or a maximum. Graph a quadratic function and give its domain and range.

A **quadratic function** is any function that can be written in the standard form y = ax2 + bx + c, where a, b, and c are real numbers and a ≠ 0.



\***Note**: The differences between y-values for a constant change in x-values are called

 **first differences**.

\***Note**: The differences between first differences of a function are **second differences**.

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| --- | --- | --- | --- | --- | --- |
| x | 0 | 1 | 2 | 3 | 4 |
| y = x2 | 0 | 1 | 4 | 9 | 16 |

 \***Note**: Quadratics do not have constant first differences but do have constant second

 differences.

**Example 1**: Tell whether each function is a quadratic. Explain.

1. {(-2, -9), (-1, -2), (0, -1), (2, 7)}
2. y = 7x + 3
3. y – 10x2 = 9

\***Note**: The graph of a quadratic function is a curve called a **parabola**.

**Example 2**: Use a table of values to graph each quadratic function.

1. y = $\frac{1}{3}$x2
2. y = -4x2

 \***Note**: A parabola opens **upward** when a > 0.

 A parabola opens **downward** when a < 0

**Example 3**: Tell whether the graph of each quadratic function opens upward or downward. Explain.

1. y - $\frac{1}{4}$x2 = x – 3
2. y = 5x – 3x2

\***Note**: The highest or lowest point on a parabola is the **vertex**.

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| **Minimum and Maximum Values** |
| If a > 0, the parabola opens upward, and the y-value of the vertex is the minimum value of the function. | If a < 0, the parabola opens downward, and the y-value of the vertex is the maximum value of the function. |
| y = x2 + 6x + 9 | y = -x2 + 6x - 4 |

**Example 4**: Identify the vertex of each parabola. Then give the minimum or maximum value of the function.

 \***Note**: Unless domain is specified, assume the domain of a quadratic function is all real

 numbers.

 Range is where all of the y-values of the function exist.

**Example 5**: Find the domain and range.