Quadratic Functions / Equations.

Graphs of Quadratic Functions

Lesson #1.

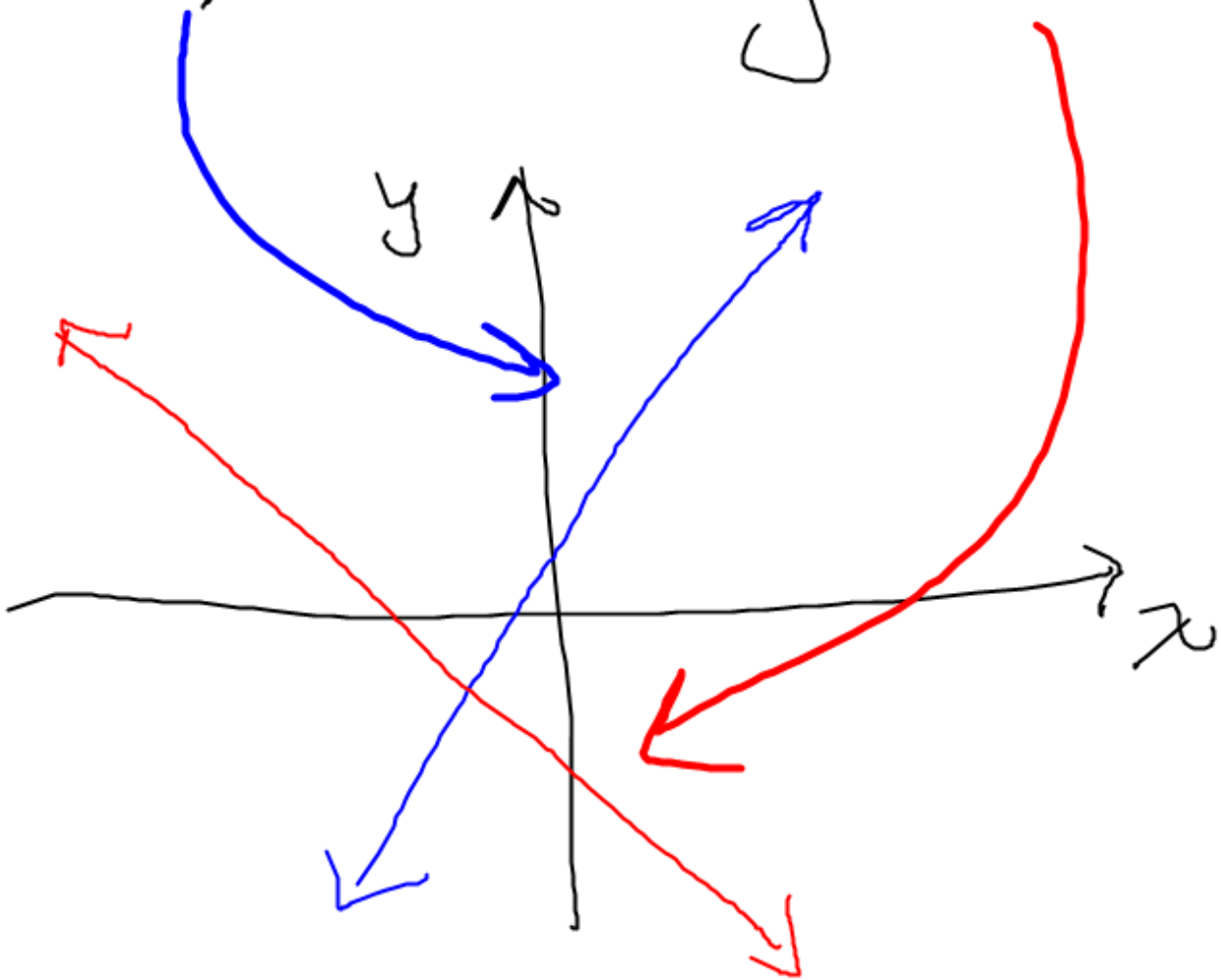
Learning targets:

- Demonstrate understanding of new terminology pertaining to quadratic functions.
- Properly label the features of a quadratic function's graph.
- Identify characteristics of a quadratic function by examining its graph.

Recall: linear functions

$$y = mx + b$$

$y = 3x + 2$ $\qquad$ $y = -2x - 4$

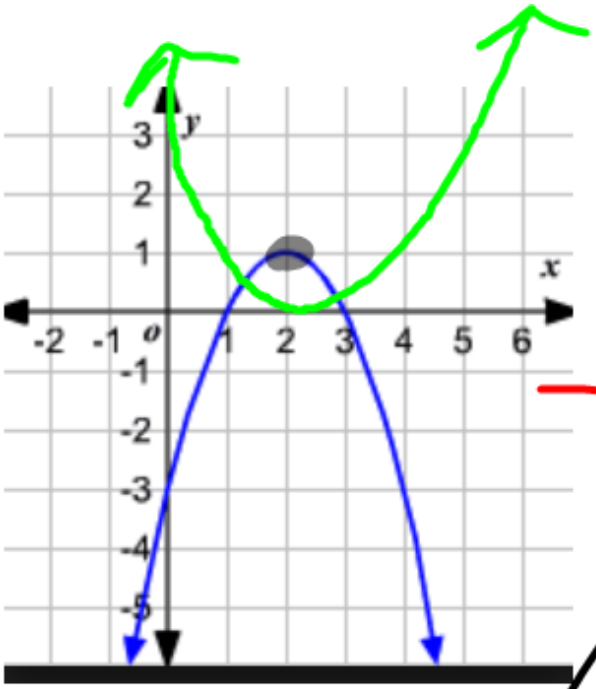


What is a *quadratic function*?

A quadratic function is a relation that can be written in the standard form $\boldsymbol{y = ax^2 + bx + c}$, where $a \neq 0$.

- x is the independent variable (horizontal axis)
- y is the dependent variable (vertical axis)

Because the x has been raised to the power of 2, these functions are said to have a **"degree of 2"**.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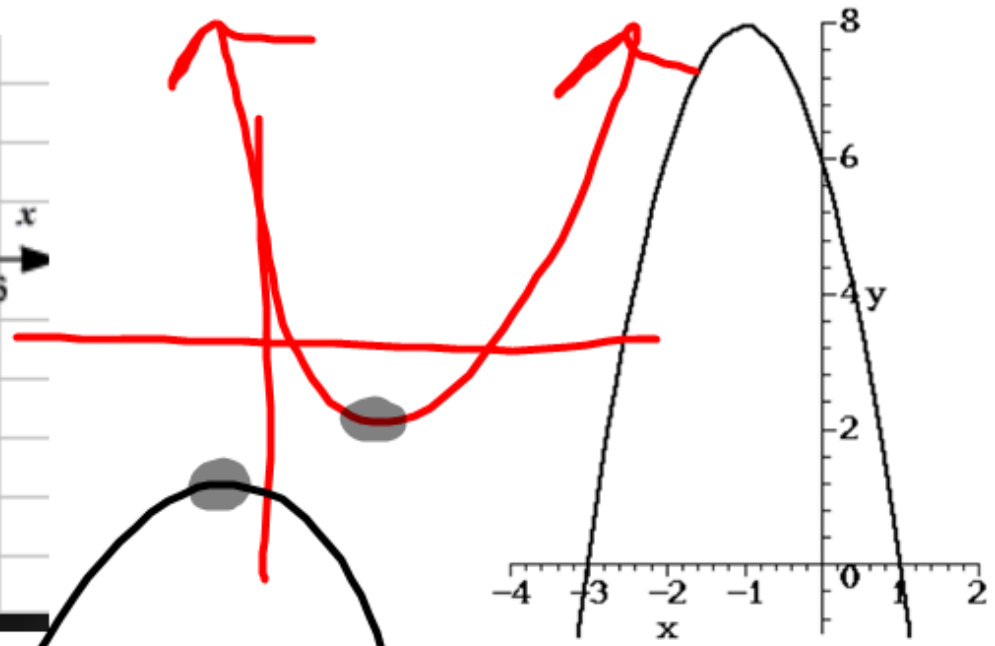
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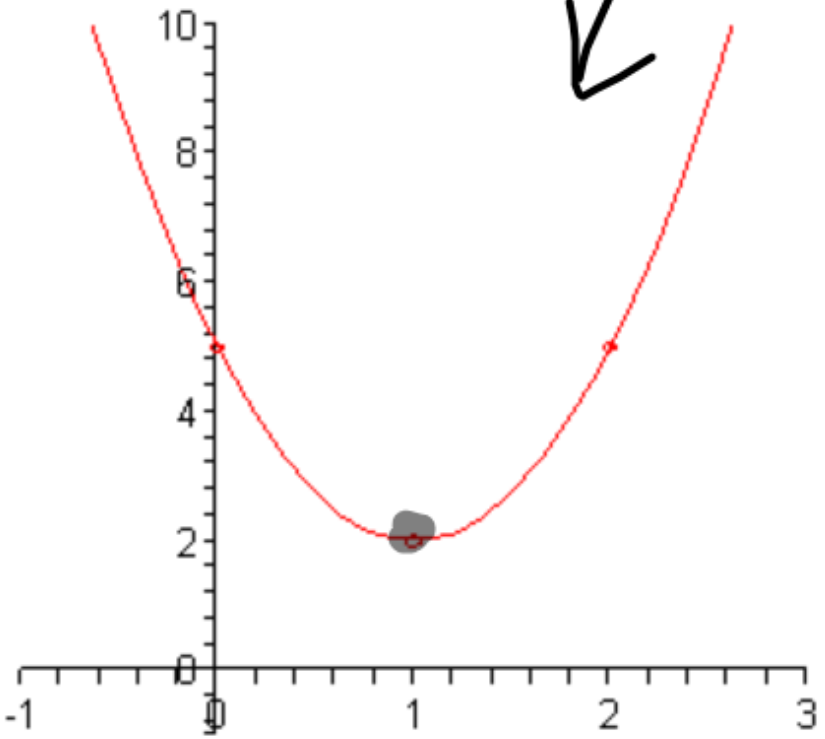
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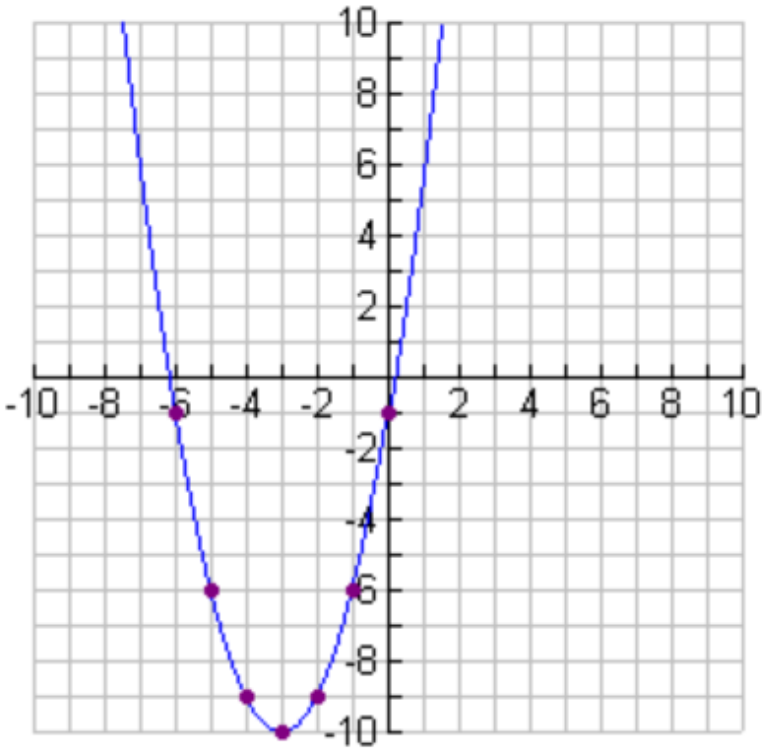
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What does the graph of a *quadratic function* look like?

- The graph of a quadratic function has a very distinct shape, called a **parabola**.
- Every parabola has a single vertical line of symmetry running down the middle. This is called the **axis of symmetry.**
- Some parabolas **open upward**. The lowest point on these graphs is the **vertex** of the parabola. These graphs have a **minimum** value at the vertex.
- Some parabolas **open downward**. The highest point on these graphs is the **vertex** of the parabola. These graphs have a **maximum** value at the vertex.
- **Note: the vertex always lies on the axis of symmetry**
- Every quadratic function has a y**-intercept**.
- A quadratic function may have 1, 2 or no x**-intercepts**.

Illustration #1: Parabola opening upwards

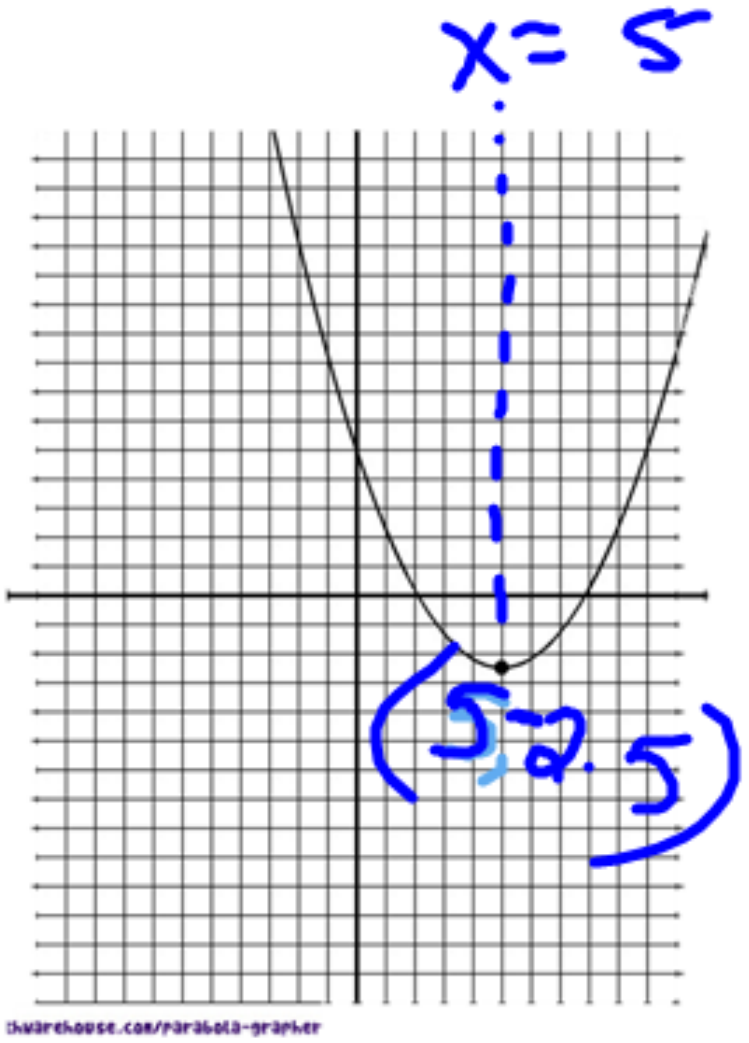
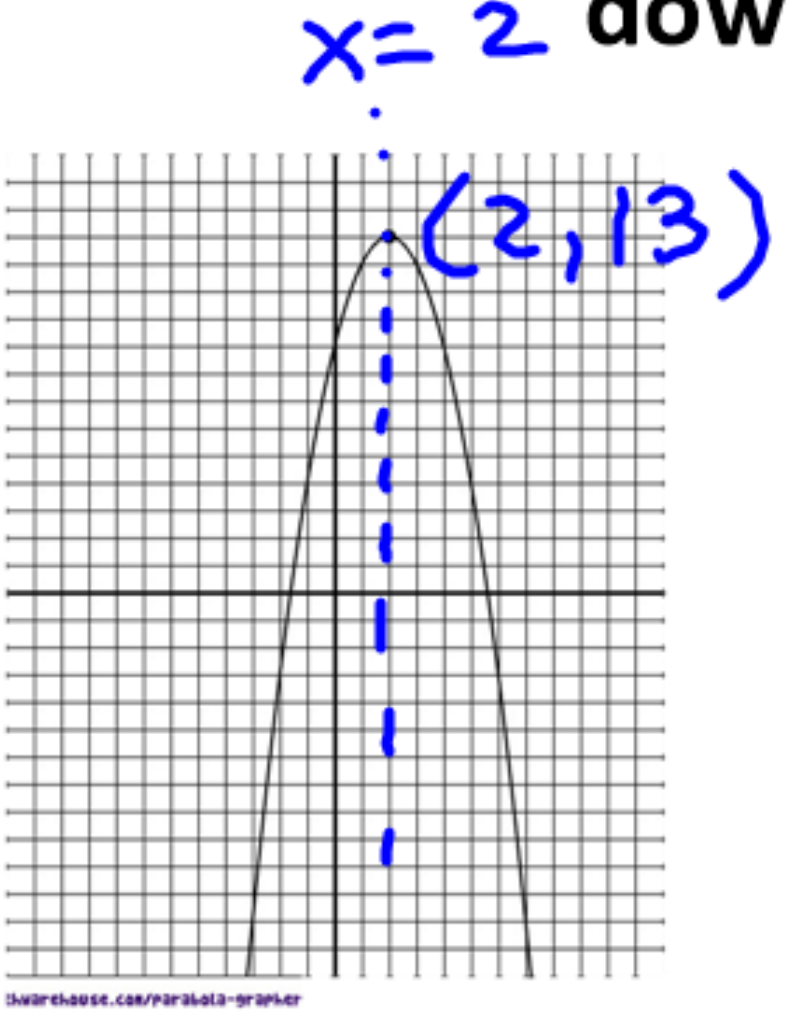


Illustration #2:Parabola opening downwards



Domain and range:

The **domain** of every quadratic function is $\{x|x \in \mathbb{R}\}$

The **range** of a quadratic function with a **maximum** is
$\{y|y \leq \boldsymbol{maximum}, y \in \mathbb{R}\}$

The **range** of a quadratic function with a **minimum** is
$\{y|y \geq \boldsymbol{minimum}, y \in \mathbb{R}\}$

Example:

If the vertex of the function is at $(3, 6)$ the range would be:

$\{y|y \leq 6, y \in \mathbb{R}\}$ if the parabola opens downwards (it has a **maximum of 6**)

$\{y|y \geq 6, y \in \mathbb{R}\}$ if the parabola opens upwards (it has a **minimum of 6**)

Analyze and label:

Coordinates of vertex: (1, 0)

Direction of opening: up

Equation of the axis of symmetry: $x = 1$

Maximum or minimum? min

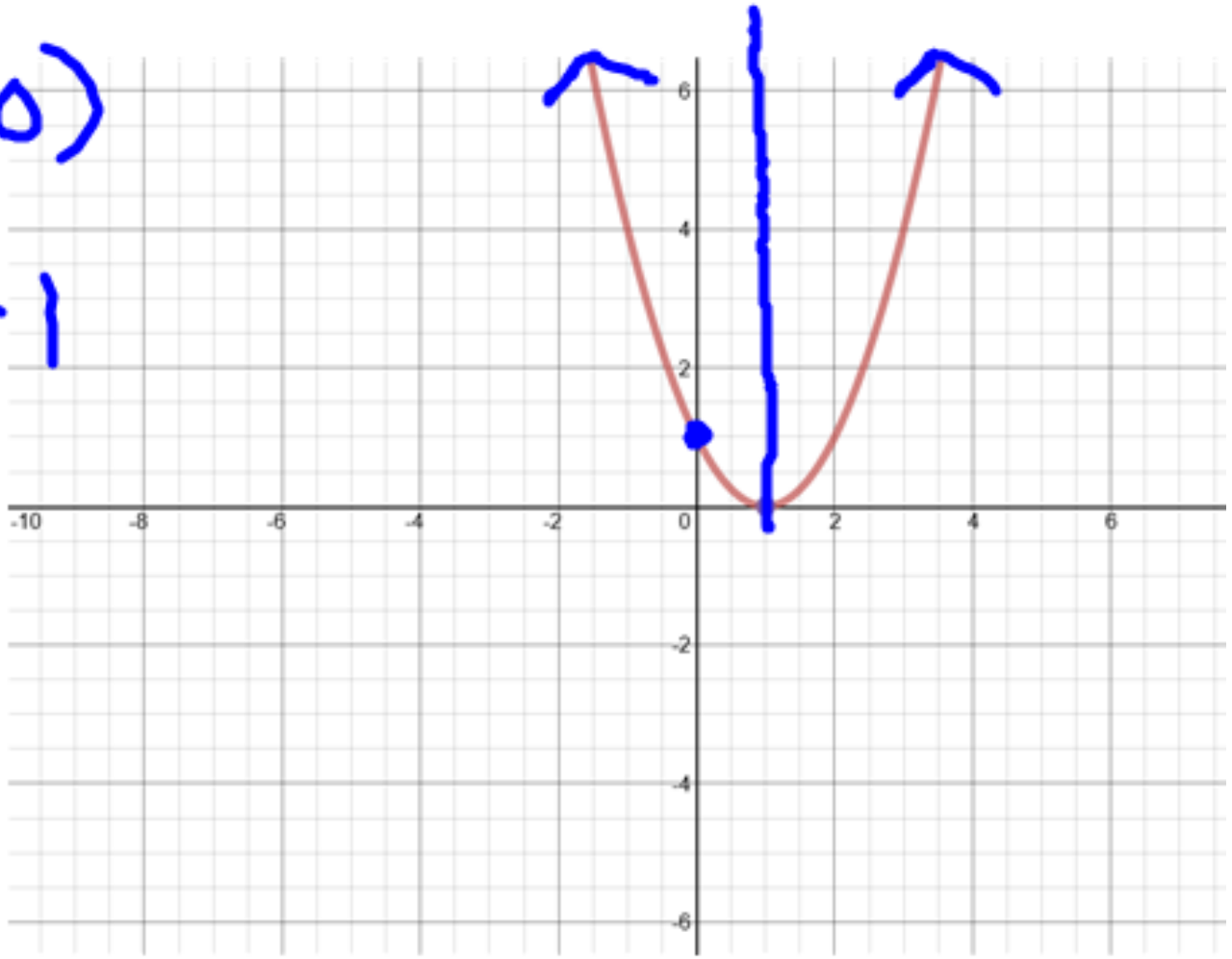
Max/min value: 0

y-intercept: (0, 1)

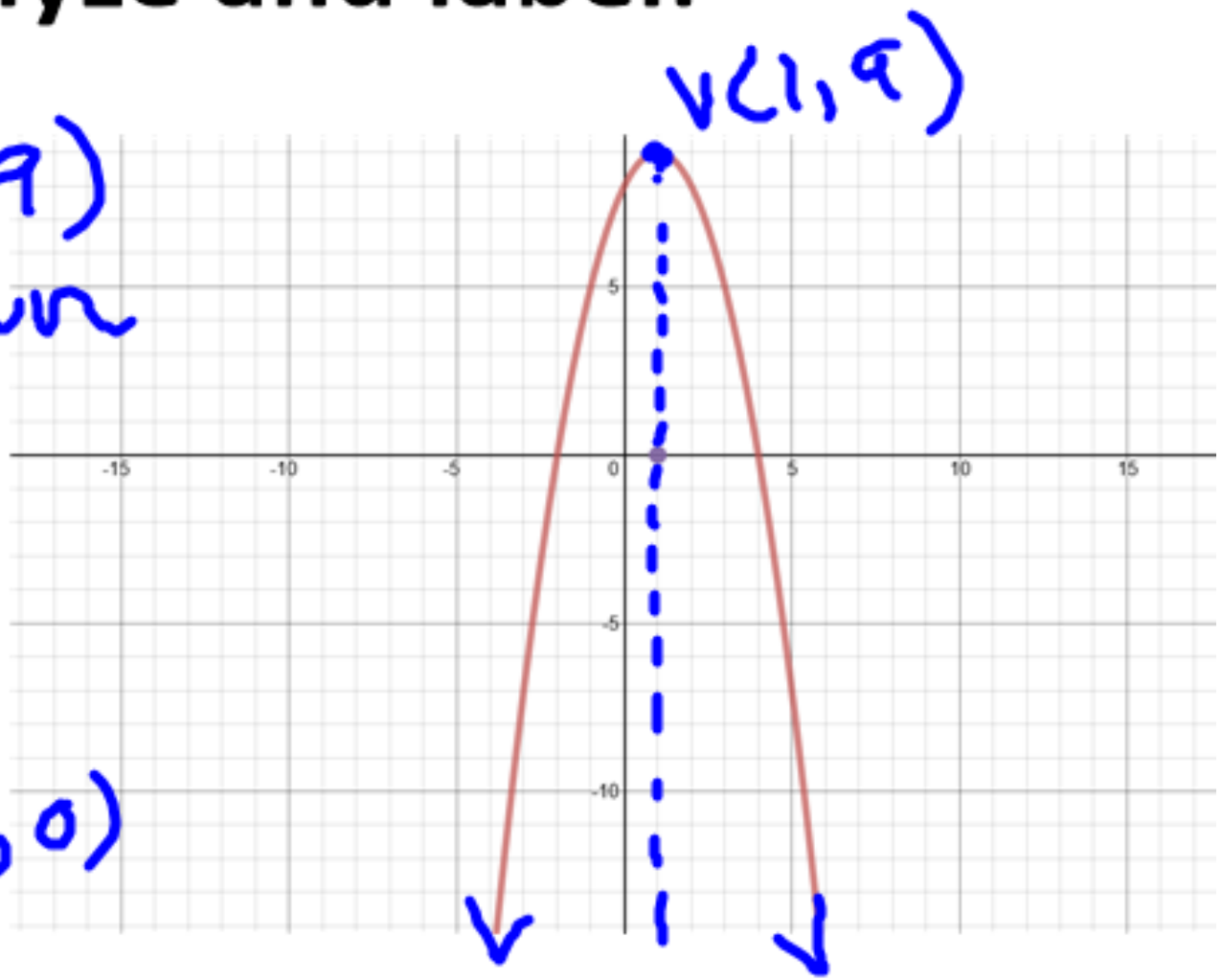
x-intercepts: (1, 0)

Domain: $x \in \mathbb{R}$

Range: $y \geq 0$



Analyze and label:



Coordinates of vertex: (1,9)

Direction of opening: Down

Equation of the axis of symmetry: $x=1$

Maximum or minimum? max

Max/min value: 9

y-intercept: (0,8)

x-intercepts: (-2,0) (4,0)

Domain: $x \in \mathbb{R}$

Range: $y \leq 9$

Assignment

Handout: #1 – 3