First Name _____ Last Name _____ Date ___ – ___ – ___ Period ____ Score ____

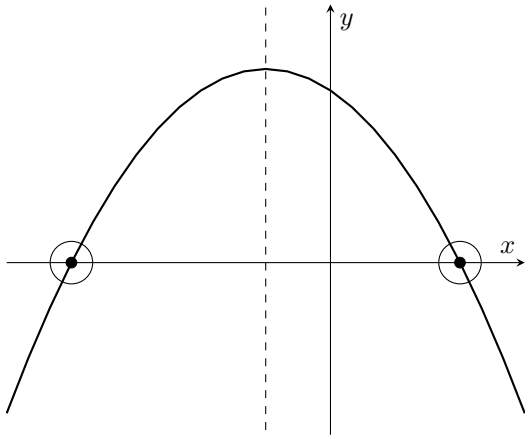
Learning Objectives.

- Find the domain and range of a function arising from real-world applications and set the graphing window accordingly.
- Discover the relationship between the x-intercepts and the vertex of a parabola.

Do Now. *Work on the following problem while the teacher is taking attendance and returning work.*

Dr. Benjamin wants to add a new feature to his video game in which the player can throw a stone toward the enemy. According to your daily experience and common sense, draw the trajectory of the stone as it flies through the air.

Discussion. According to physics, a stone flying through the air follows the path of part of a *parabola*, which is the graph of a quadratic function $y = ax^2 + bx + c$, where $a < 0$. The following figure shows the graph of a typical parabola. Examine the graph and determine the relationships among the x-intercepts, the axis of symmetry, and the maximum point.



Your observations:

Practice. In Algebra I, we learned the quadratic formula. The solutions to the quadratic equation $ax^2 + bx + c = 0$ are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

assuming $b^2 - 4ac \geq 0$.

1. How would you adapt the quadratic formula to solve $ax^2 + bx + c = d$, where $d \neq 0$?

2. Let the ground be on the x-axis. Suppose a stone thrown from a height of 6 units follows part of the parabola $y = f(x) = -\frac{x^2}{6} + \frac{8x}{3} + 6$. Determine the realistic domain and range of the function $f(x)$.

   Hint: First find the x-intercepts. Then use the relationship you discovered in the Discussion section to find the vertex.

3. Use the domain and range you found in the previous problem to set the window on your graphing calculator appropriately, then graph the function $f(x)$.