Lesson Title: Quadratic Word Problems Part 1 Date:_____

Subject: Algebra I or Algebra II	T**opic:** Quadratic Word Problems Part 1
Grade: 8, 9, or 10	**Designer:** Jessica Ulcickas

Stage 1 – Desired Results

Lesson Overview: This activity walks students through two different scenarios about projectile objects that can be modeled using quadratic equations. Students are required to graph the given parabolas and use the graph of each parabola in order to answer questions about the projectile objects. By the end of the activity, students will be able to identify maximum heights of projectile objects using graphs, and to identify how long a projectile object will be in the air using a graph.

Standards Addressed:

CCSS.Math.Content.HSF-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*

CCSS.Math.Content.HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases

CCSS.Math.Content.HSF-IF.C.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

Enduring Understanding:	**Essential Questions**:
Graphing quadratic functions can be used to model the path of projectile objects due to gravity. When you graph a quadratic function of a projectile object, the x axis often represents time, while the y axis represents the height of the projectile object. The equation given for a projectile object is based on its initial height, initial velocity, and the gravitational constant for acceleration.	How does the equation of a projectile object show its path graphically? How can the graph of the quadratic equation of a projectile object help someone to understand where the object is at a given time?
Students will need to know:	**Students will be able to**:
Students will need to know how to solve for the vertex of a parabola, as well as how to graph a parabola.	• Identify when a projectile object reaches its peak height, given a graph of the objects trajectory. • Identify a projectile object's peak height, given a graph of the objects trajectory.

	• Identify when a projectile object reaches the ground, given a graph of the objects trajectory.
Stage 2 – Assessment Evidence	
Performance Tasks: In this activity: • Asking students to identify the peak height of a projectile object. • Asking students to identify when a projectile object reaches its peak height. • Asking students to identify when a projectile object reaches the ground.	**Other Evidence**: • To be decided by the teacher.
Stage 3 – Learning Plan	
Lesson Procedure: <u>Many Days Before</u>: Students will be introduced to the topic of quadratics. Up to this point students will have learned how to factor and solve quadratic equations as well as how to use the quadratic formula, and to graph parabolas. It is also possible that students will have learned how to complete the square. <u>Day Of</u>: Students will go to the computer lab in order to complete this activity. For the duration of the activity, the teacher will monitor student progress to ensure that students complete the activity properly and do not simply click to complete. The activity will not take all class period, so the remainder of the class period will be at the discretion of the classroom teacher.	Required Materials: • Computers for each student. • Scrap paper.

Possible Discussion Questions for Students: • The number -16 was used in both of the equations in this activity. Where do you think this number comes from? • Can you think of your own example of a projectile object using the formula $s(t) = -\frac{1}{2}a_0t^2 + v_0t + s_0$ • What pieces of the graph of a parabola seem to be the most important when looking at the path of a projectile object?	**Sample Answers to Discussion Questions**: • This number is one half of the gravitational constant of -32 feet second. • Answers may vary. • The y-intercept represents the initial height of the object. The x-intercepts represent when the object hits the ground after being in the air. The vertex represents the peak height that the projectile object will reach.