Title: Applications of parabolas

Objectives: Students will use their knowledge of quadratic equations and parabolas to solve problems.

***Materials*:** Meter stick, paper, pencil, worksheets, graphing calculators

Introduction: (Engage and Explore): Some students tend to get anxious about word problems, so begin the lesson by putting the quadratic equation $y = -4.9t^2$ on the board. Explain to them that this is the equation of an object in free-fall released from a height of zero, where y is measured in meters and t is in seconds. Let students get in pairs and give each pair a meter stick. Explain to them that one student is to hold the meter stick vertically in the air so that the zero end of the stick is about shoulder height. The other student is to take his thumb and index finger and spread them apart about 1.5 inches and place the opening such that the zero edge of the meter stick is the same height as the top of his finger/thumb. Without any notice, the student holding the meter stick lets go and the other person pinches his fingers together and grabs the stick. The reading at the top of the finger is taken from the meter stick. Then the roles are reversed. The students are then asked to convert the measurements to meters and let this value be y in the equation. Then let them solve for t (ask them which one is correct, the positive or the negative value and why). Tell them that they have calculated their reaction time! Students generally enjoy this activity a great deal. Let them repeat it several times and talk about the mean and median values. This activity incorporates many great topics.

***Procedures*:** There are many examples of the uses of parabolas in real life applications. Have students call out things they believe are made of parabolas. Examples could be suspension bridges, a slack rope, the trajectory of a ball tossed across the room, the trajectory of a rocket, satellite dishes, head lights, flashlights, parabolic mirrors, Le Four Solaire at Font-Romeur (a parabolic solar reflector), and parabolic reflector heaters. (The links below are excellent resources on applications of parabolas.) Introduce to the class the quadratic equation that governs the height of a projectile: $y = \frac{1}{2}gt^2 + v_0t + s_0$ where v_0 is the initial velocity, s_0 is the initial height of the object, g is acceleration due to gravity. Allow students to pick an application and write a report. Guide the students when they are picking their topic to be sure that they are appropriate. If the class has access to a computer, visit the websites listed below and read them as a class.

Some information that students find interesting: Each side of the Golden Gate Bridge (North and South) of the main towers is a parabola. The total distance on