**Projecting Parabolas**

**Date**: February 11th, 2016

**Presenters**: Ms. Moore, Ms. Oltmanns, Ms. Silvas, Ms. Solis

**TEKS**:

(7) Quadratic functions and equations. The student applies the mathematical process standards when using graphs of quadratic functions and their related transformations to represent in multiple ways and determine, with and without technology, the solutions to equations. The student is expected to:

(A) graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including *x*-intercept, *y*-intercept, zeros, maximum value, minimum values, vertex, and the equation of the axis of symmetry;

**Materials needed**:

1. 5- basketballs
2. 5- Tennis Balls
3. 5- footballs
4. 5- measuring tapes
5. Graphing Paper
6. Copies of graphic organizer
7. Copies of Dropping Objects
8. Calculators

**Engage:**

1. **Students will watch video, Sports Science: Stephen Curry** [**https://www.youtube.com/watch?v=HOiH1eVCggw**](https://www.youtube.com/watch?v=HOiH1eVCggw)
2. **Before the video, the teacher will ask students, “What does math have to do with basketball?” After getting a few ideas, she will tell the students to see if the video helps them make more connections between math and basketball.**
3. **After the video, the teacher will repeat her question, “What does math have to do with basketball?”**

**Transition statement: We know that the shape that the ball makes when you make a basket is a parabola. Today’s activity is going to allow us to throw balls and practice making graphs of parabolas.**

**Explore:** In this activity students will be using a variety of balls to test how functions change through the use of experimentation and their prior knowledge.

Instructions for activity:

1. Students will use a basketball, tennis ball, and a football to create their quadratic functions.
2. The teacher will pass out the student hand-out, Exploring Parabolas. She will review all directions.
3. She will then divide the class into five groups. Each group will receive: a tennis ball, football, basketball.
4. The students will then choose a ball and throw it in the shape of a parabola.
5. During this time the students will need to estimate about how high the ball reached before it returned to the ground (maximum). Reference points (every two feet) will be marked with masking tape on the wall.
6. The students will move closer and farther apart and measure the distances as well. This will demonstrate the change in the a-value of the functions. They will throw the ball at 6 feet, 9 feet, and 12 feet.
7. Students will do this with each ball and then graph their parabolas onto graph paper.
8. We will then discuss what the students found and what they noticed about the heights as they moved and as the balls changed.

Focus Questions:

* What are some changes you notice as you move closer together (change the x intercepts and a value)?
* What about when you move farther away?
* Are there any significant changes when you use different types of balls?
* What do those differences affect?
* Are there any other variable that affected the height of the balls?

**Explain**

1. The teacher will give each student a Parabola graphic organizer.
2. The students will use the Parabola Powerpoint to define and label the following terms:
   1. x-intercepts/zeros/roots
   2. y-intercept
   3. line of symmetry
   4. vertex
   5. vertex formula
   6. minimum
   7. maximum

Focus Questions:

* How do we know if a quadratic function will have a minimum or maximum?
* How do we identify the line of symmetry?
* How do we determine the zeros/roots when looking at a graph?

**Elaborate**

1. The students will explore the graphs of dropped objects (apples, balls, free fall rides).
2. The students will use their calculators to put in the formula for dropped objects:
3. where h= height, s=starting height, t=time in seconds
4. The students will then sketch the graph from scenarios using apples, balls and a free fall ride. They will label the x-axis, the y-axis, the vertex, and the line of symmetry.

**Evaluate**:

1. Students will be given a Chapter 9 test that evaluate them on the concepts taught in this lesson.