Lab: Quadratic Functions in Real Life *(Instructor Version)*

*This lab will take one 90-minute class period. Students will work in groups with a suggested group size of 4 to 5.*

**Motivation:** Graphing a parabola given an equation of a quadratic function is a topic covered in most algebra courses. But, where do parabolas exist in real life and how do we find their equations?

**Objectives**: Students will generate or observe parabolas in real life (projectiles) and model these by finding the equations of the quadratic functions from observed data points.

**Materials**:

1. Tennis ball
2. Yard Stick / Tape measure
3. Post-it note pad
4. Cell phone / ipad
5. Computer
6. Quad graphing paper
7. Clear plastic sheets (for tracing from a computer or iPad)
8. Markers

**Activity 0**: Instructor-led initial discussion with entire class *(15 minutes)*

1. What are the different forms for the equation of a quadratic function?
2. How many data points determine a unique quadratic function?
3. What are the important points on the graph of a quadratic function?
4. How is the equation of a quadratic function determined from data points?
5. What information can be harvested from the equation of a quadratic function?

**Activity 1**: Groups Design the Experiment *(20 minutes)*

*As the groups brainstorm, you can walk around and monitor the discussions. You can guide them with the following scenarios in mind: tossing a ball while stand next to a wall and mark the heights with post-its, find a video online of someone hitting a baseball and tracing the path of the ball, or taking a video of someone throwing a ball and then tracing its path. A few links to videos demonstrating these scenarios are listed below.*

1. Groups brainstorm on how to create a parabola with the materials provided.
2. Groups assign roles for the experiment – who does what?
3. Groups determine what data to collect and who will record it.
4. Get the instructor’s ok for your idea.

**Activity 2**: Groups Conduct the Experiment *(20 minutes)*

1. Create a parabola
2. Record the data

**Activity 3**: Repeat the experiment to get a second parabola *(10 minutes)*

1. Create a second parabola
2. Record the data

**Activity 4**: Final Group Discussion *(20 minutes)*

1. With the data collected, find the quadratic functions that model the 2 parabolas.
2. List important aspects of the functions: vertex and intercepts.
3. Theorize what factors determine the differences in the functions that result.

Videos (sample experiments)

Throwing a ball: <https://www.youtube.com/watch?v=qMP7yd-bwWI>

Football example: <https://www.youtube.com/watch?v=HB4ws7RoA3M>

Basketball example: <https://www.youtube.com/watch?v=0ISx0445xXc>