Lab Name : Egg Drop Contest

Subject Area: Mathematics [How to find distance ...](https://www.instructables.com/id/Distance-measurement-with-radio-waves/)

Grade: 12

Course: Calculus

Topic: Instantaneous rate of change

Experiment Title: Finding and understanding the different rates of change through the balls journey.

Goal: Is to design an apparatus that will sustain the least impact when hitting the ground.

Hardware:

Constructed a plastic ball to reflect the egg and placed a sensor with battery inside it.

Software:

Micro:bit

Number of Sessions to teach the topics: 1 - 2 days for experimentation and to do calculations.

Educational standards to be addressed:

Cosmos concepts to be used for the lab:

K12 Educational Goals (How the educational goals are achieved through teaching using the experiment, how the topic is connected to the COSMOS concepts used)

Short Description and Walk-through of the experiment

Testbed mapping of the experiment

Students go through 4 phases.

**Phase 1:**

Students will research a model of an apparatus that in theory will house an egg. For this experiment, students will use a plastic ball with a sensor in it to gather information in real time instead of an egg. A simple apparatus will be designed that will cushion the balls fall. Students can design their apparatus using popsicle sticks, rubber bands, toothpicks, paper clips, straws, styrofoam cups, bubble wrap ... This is for a math class and not a Physics class. The emphasis of this experiment is for students to determine the math behind the objects path. Students will be given set goals that they must achieve. Students will calculate their predictions including velocity, average velocity and acceleration. Students should have prior knowledge of using the quotient rule.

Students will:

* Find the quadratic equation to describe the path of the projectile motion.

Your design and calculations should be approved first before proceeding to Phase 2.

**Phase 2:**

Students will construct the apparatus that they chose to design.

**Phase 3:**

Students will bring in their apparatus and test them during class with the sensor. After, students will use the ball senor from COSMOS. Students will see if there instantaneous rate of change for which they predicted is close to the actual real world application. Students can find a new equation based upon the experiment and then compare it to there predicted equation.

* Students will find the gravitational force, impact and speed of the apparatus. Using the micro:bit it will give its position relative to x, y and z. It also gives the acceleration value of milli-g, which is 1/1000 of a g. A g is as much acceleration as you get from Earth’s gravity.

<https://www.convertunits.com/from/millig-unit/to/g-unit>

* Students must take into account the height of where it is being dropped.

**Phase 4:**

Students will make conclusions and compare their predicted model with their actual test.

<https://m.wikihow.com/Calculate-Instantaneous-Velocity>

* Construction of a simple catapult.
* Using a protractor to find the best angle that will give the further distance.
* Students can do a simulation first to determine at what angle would be suit them to reach their distance. <https://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion_en.html>
* Students will have to find the area under the curve using left, right, middle Riemann sum

Was thinking of changing the experiment to an egg drop contest.