Quadratic Function Task Names

**Purpose:** Develop a function to approximate the flight path of a projectile.

Introduction: Setting Up the Mathematical Task In this activity, you will investigate the relationship between the path traveled by projectiles and quadratic functions. In nature, projectiles such as bullets, balls being thrown, cannons, etc. follow a parabolic path. This path can be explained mathematically by a quadratic function. Students will work in groups of three to conduct an experiment that involves launching an object an unknown distance and determining the quadratic function that describes the path of their object knowing only how long it took. The quadratic function will be found in two different ways and the results will be compared to each other to see how closely they resemble. For ease of hand calculations, some rounding is necessary.

**View the following videos:**

<http://www.youtube.com/watch?v=H-Y4PcV_mto>

<http://www.youtube.com/watch?v=hlW6hZkgmkA&list=PLE65DF8D0F83FF77E&index=3>

<http://www.youtube.com/watch?v=N0H-rv9XFHk&list=PLE65DF8D0F83FF77E&index=4>

<http://www.youtube.com/watch?v=LT8K9r4FnJo&list=PLE65DF8D0F83FF77E&index=5>

Student Activity 1: Data Collection

Draw a picture of the object toss.

Be sure to label the height and time of the object on the axes of your drawing.

Time for the ball to travel from student 1 to student 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Questions:**

1. What is the path of a projectile in nature?

2. How many different components of velocity does a projectile have at any point in its path?

3. Which component of velocity remains constant?

4. Which component of velocity is always changing?

5. What force causes one of the components of velocity to change?

6. What is the vertical component of velocity when the projectile is at its peak?

Formula for Free Fall: 𝑑 = ½ 𝑡2, where d=distance, g=32 feet/second2 , and t=time in seconds.

7. Calculate the vertex of your ball.

8. Which variable in the formula represents the y-value?

**Collecting Data:**

Set up a procedure to determine height distance and time for the flight path of your object. (Hint: You may use your personal electronic device)

|  |  |  |
| --- | --- | --- |
| Time (s) | x (ft) | y (ft) |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Finding the Function Directions:

Find the function that represents the path of the ball in two ways. Make a table of values for the function found using each method to determine the height of the ball in .25 second increments.

|  |  |
| --- | --- |
| Time (s) | y (ft) |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Coordinates of Vertex of ball flight (round second to nearest tenth and height to nearest whole number):\_\_\_\_\_\_\_\_\_\_\_\_\_

x-intercepts of ball flight:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Method 1 System of Equations Height as a function of time for tennis ball:

|  |  |
| --- | --- |
| t | f(t) |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Height as a function of time for tennis ball:

Method 2: Vertex Form 𝑦 = (𝑥 − ℎ)2 + 𝑘, 𝑤ℎ𝑒𝑟𝑒 (ℎ, 𝑘)𝑖𝑠 𝑡ℎ𝑒 𝑣𝑒𝑟𝑡𝑒𝑥 𝑜𝑓 𝑡ℎ𝑒 𝑝𝑎𝑟𝑎𝑏𝑜𝑙𝑎

Vertex (\_\_,\_\_)

x-intercepts :

|  |  |
| --- | --- |
| t | f(t) |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Height as a function of time for tennis ball:

9. Do you notice any difference in the tables of values for your two functions?

10. What could explain these differences?

11. Do you think the two functions are equal? If so, show your work.