

Projectile Measurement Project

General Information

Course: Math Academy 1

Chapter: three

Assigned: Wednesday, November 18

Due: Monday, November 30

Group Size: 2 to 4 people

Format: poster and chart

Summary: Use a tape measure and a stopwatch to find the equations of projectiles, and use the equations to calculate the heights and distances at given points.

Bonus: Achieve one or both of the bonus throws. (They need to be timed by me to count.)

Directions

1. Throw or bounce an object a premeasured distance to another person, and time the throw. Make sure the initial height and final height of the object are equal. State the object that was thrown and how it was thrown (e.g., bounced off the ground, thrown underhand, etc.).
2. In the first white row on the chart on the back of this sheet, fill in the throw's initial and final height, length of time, and distance. Measure in feet.
3. Calculate v_0 for the time parabola, and calculate h , k , and a for the distance parabola.
4. Use v_0 to write the equation of the object's height after t seconds. (t will remain as a variable in the equation).
5. Use h , k , and a to write the equation of the object's height after traveling x feet horizontally (x will remain as a variable in the equation).
6. Use the second white row of the chart to repeat steps 1-5 on a second throw.
7. For the second throw, calculate the maximum height, the height after traveling 10 feet horizontally, the times at which it was 10 feet high, and the horizontal distances at which it was 15 feet high. (Redo the throw if it is not more than 15 feet high.) Clearly show all work.
8. Draw a picture of the situation for the second throw, with a sketch of parabola $g(x)$ to scale. Label the coordinates of the throw, the catch, and the vertex.

Scoring

[A] Content: ____ / 20

- 2 The criterion is clearly met.
1 The criterion is addressed to a meaningful but limited extent.
0 The criterion is not addressed in a meaningful way.

1 2

- The calculated parameters v_0 , h , k , and a are correct.
 The equations are correct.
 The height after traveling 10 feet horizontally is calculated correctly with work that is easy to follow.
 The times at which $y = 10$ are calculated correctly with work that is easy to follow.
 The horizontal distances at which $y = 15$ are calculated correctly with work that is easy to follow.
 The sketch is accurate.
 The sketch is drawn to scale.
 The sketch and all answers are reasonable.
 The object thrown and its measurements are appropriate for the mathematical model.
 The project is complete and shows that you have an understanding of the concepts.

[B] Presentation: ____ / 10

- 3 The project is impressive in this aspect, and it appears carefully planned and created.
2 The project is reasonable in this aspect.
1 The project looks like it was done in a hurry in this aspect.
0 The project is difficult to follow because of this aspect.

1 2 3

- The poster is neat.
 The poster is attractive.
 The poster uses color effectively.
 Your names are on the back of the poster but not on the front.

[C] Bonus: ____ / 0

- +5% This aspect is true to a meaningful but limited extent.
+10% Your work is exemplary in this aspect.

5 10

- You show an understanding of the concepts explored.
 The goal has been achieved.
 The final product is impressive.

y_0	s	d	$v_0 = 16s$	$h = \frac{d}{2}$	$k = 4s^2 + y_0$	$a = \frac{y_0 - k}{h^2}$	$f(t) = -16t^2 + v_0t + y_0$	$g(x) = a(x - h)^2 + k$	
Initial and Final Height		Total Time In Air	Total Horizontal Distance Traveled	Initial Upward Velocity	Horizontal Position of Vertex	Vertical Position of Vertex	Shape of Path	Height After t seconds	Height After Traveling x Feet Horizontally

For your second throw, calculate the following. (Rethrow if needed.)

a) The maximum height.

b) The height after traveling 10 feet horizontally.

c) The times when it was 10 feet high.

d) The horizontal travel distances when it was 15 feet high.

Bonus. Make the following throws. Show your calculations.

a) It has a maximum height of 25 feet.

b) It is 20 feet high at the point it has traveled 15 feet forward.