

Projectile Measurement Project

General Information

Course: Math Academy I

Chapter: three

Assigned: Monday, October 31

Due: Tuesday, November 8

Points: 30

Group Size: 3 or 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: For up to +15% each, do one or both of the bonus throws on the back.

Directions

1. Throw an object a premeasured distance to another person, and time the throw. Make sure the release and catch are made at the same height as each other.
2. In the first white row on the chart on the back of this sheet, fill in the throw's initial 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, and use h , k , and a to write the equation of the object's height after traveling x feet horizontally.
5. Use the second white row of the chart to repeat steps 1-4 on a second throw.
6. 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.) The last two questions will each have two answers, one on the way up and one on the way down.
7. Include your chart on the poster.
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] Your formulas, calculations, and sketch are accurate.

- 10 All calculations are correct and shown clearly, and your sketch is drawn to scale and easy to understand.
- 8-9 There are errors in your formulas or calculations, but they are not conceptual errors and all your answers and sketch are reasonable.
- 5-7 There are significant conceptual errors in your formulas or calculations, or your answers or sketch are clearly not realistic.
- 1-4 Much of your work is fundamentally incorrect.

[X] All steps are completed.

- 10 All stated directions are followed.
- 1-9 One or more aspects of the project is omitted or incomplete.

[Y] The final product is attractive.

- 10 The poster is neat, colorful, and attractive.
- 1-9 The aesthetic quality of the poster is not superior.

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

a) It has a maximum height of 30 feet.

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