CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
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Project Number
J1612

Project Title
Calculating a Projectile's Trajectory

Abstract

Objectives/Goals
Our experiment was conducted for the purpose of determining which angle of a projectile launcher will achieve the greatest distance. We derived a mathematical formula to calculate the optimum angle and built a model projectile launcher to test the results.

Methods/Materials
To perform our experiment, we built a launcher that projected a ball bearing up to 2.5 meters. We tested our experiment by launching the ball bearing at seven different predetermined angles, with velocity as a constant. We conducted ten launches at each angle, measured the distance of each launch, created a chart showing each result, and calculated an average distance for each of the predetermined angles. Using this data, we derived a quadratic graph and equation that best matched the data.

Results
Using the graph's equation, we were able to determine which angle resulted in projecting the ball bearing the greatest distance. At an angle of approximately 34.73°, the projectile traveled its peak distance of approximately 210.13 cm. In addition, we were able to use the derived equation to predict the distance of future launches using different angles.

Conclusions/Discussion
Using calculations from a formula found in our initial research, we expected that a launch angle of 45° would result in the optimum distance of the launched projectile. Using our projectile launcher, we completed a set of test data and derived a formula that we compared against the formula from our research. Our outcome proved that the optimum angle was approximately 35°, significantly less than the predicted 45°. We concluded that this discrepancy was due to the fact that the established formula presumed conditions that did not include dynamics such as air resistance, friction, launcher inconsistency, and human error. The test conditions for our experiment included all of these factors. However, using the test data, we were able to derive our own mathematical formula that accurately predicted launch outcomes in our test environment.

Summary Statement
Our project tested which angle would provide the optimum distance on a homemade projectile launcher, and if we could derive a formula that can accurately predicte launch outcomes in our test environment.

Help Received
Mother and Father helped with our written material and kept us on track