CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Lauren E. Kelly

Project Number
J1521

Project Title
Coastin' the Curves: Is the Shortest Path Always the Fastest Path between Two Points?

Abstract

Objectives/Goals
The objective is to determine if the path with the shortest distance between two horizontal planes is necessarily the path which will take the least amount of time to travel and will this path create the fastest rate of travel, i.e., speed.

Methods/Materials
Four geometric curves were graphed, (a cycloid, parabola, circle, and straight line) projected onto poster board and traced, cut out and then traced onto plywood. These were then cut out using a saber saw and sanded to smooth the curve. A channel was cut down the middle of each curve and the curves were mounted to a plywood base. Finally, I used adhesive caulking to attach plastic tubing along each side of the channel on each curve. The tubing created an elevated track along which the steel ball would run down the curve. A light gate was placed at each end of the curve and set to measure the time it took the steel ball to travel between the two points. This was recorded and repeated ten times for each ramp. Each data set of ten recorded times was averaged. The length of each curve was found by laying a piece of string along the path the steel ball traveled when it went from the first light gate to the second one. The string was then measured along a meter stick. The measured distance for each curve and its respective average time were used to determine the average speed of the steel ball along each curve.

Results
The circle curve had the longest distance. Its average time was the shortest of all four curves with an average of 0.00885 seconds. This resulted in the circle creating the fastest average speed for the steel ball, 86.4407 m/sec. The straight line, on the other hand, had the shortest distance to travel yet its average time was the longest. This resulted in the straight line creating the slowest average speed for the steel ball, 52.6394 m/sec.

Conclusions/Discussion
I can conclude that the shortest distance between two points does not guarantee the fastest time. Whether in designing roads, creating roller coasters, or designing ski jumps and skateboarding ramps, you need to check the math!

Summary Statement
Is the shortest path always the fastest path between two points?

Help Received
Father cut the plywood and helped me build the curved ramps; used light gates from Reedley College Physics Dept, courtesy of Lauren Novatne (instructor)