CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
22727

Project Title
Is Shorter Faster? Is the Fastest Way to Get from Point A to Point B along a Straight Line?

Abstract

Objectives/Goals
Let A and B be two points at different heights. If the two points are connected by a wire "curve" and a bead is released from the higher point, is there a shape for the wire so that the bead will arrive at the lower point in the shortest time? I plan to measure the time it takes for the bead to go from A to B on four typical curves: an inverted cycloid, a parabola, a circle, and a line.

Methods/Materials
First, draw the four graphs of the curves, using the program Maple 6. Align the four graphs and then glue them onto a black foam board. Screw in eyelet screws above the starting point and at the finishing point on each graph. Put the wires through the two eyes in the screws and shape them so that they line up perfectly with the graphs already pasted on the board. Then mark a starting point from which the bead is to be dropped each time and attach a bead to each wire. Set up a video camera to record the results of the experiment. Drop the beads 5 times for each graph while recording the experiment with a video camera. Replay the video in slow motion and measure the time it took for each bead to drop. Repeat the experiment.

The materials I used for this project were: 1 Heavy Duty Black Foam Board, a Camera, Green Wire, Film, 4 Medium Wooden Beads, a Video Recorder, 1 Box of Eyelet Screws, a VCR, Black Duct Take, and a Stopwatch.

Results
The inverted cycloid consistently produced the fastest time, while the straight line consistently produced the slowest time.

Conclusions/Discussion
I conclude that the fastest way for a bead on a wire to get from point A to another point B which lies below A, but not directly below A, is to follow a path made by the inverted cycloid connecting those two points.

Summary Statement
The purpose of this investigation is to determine the curve for which a bead traveling along a wire will arrive at a point B which is lower, but not directly below, another point A in the shortest time possible.

Help Received
My mother helped produce the computer plots of the graphs using Maple 6. She also helped with the videotaping of the experiment and the timing of the trials.