Introductory Problem for Quadratics

The purpose of this activity is to introduce students to the shape of a path of a projectile.

Introduction: show the video clip from Terminator 3 with the android running off a cliff and landing on a truck. Conduct a group discussion on whether or not this is a realistic jump. Questions might include

- Would it be possible to conduct a jump like this?
- What are some of the variables that we would have to consider in a jump like this?
- What is the path of her jump? The height of the building? The height of the truck? The timing of the truck? The speed she runs off the building?

After students discuss these issues, the class should then try to answer each of the questions.

Have students guess the path of the android's flight. Most will guess some kind of curve or a parabola. The point is we don't know for sure if the path is a parabola. To answer this question we show a video clip of a ball rolling off a table with a grid in the background. By slowing the video, students should be able to find some data points on the path. Have students graph the points and find a curve that fits it. A quadratic should work best. There may need to be some physical explanations as well, but the idea is that falling objects typically are modeled with quadratics (no air resistance!)

TERMINATOR AND PROJECTILE MOTION

Purpose of this activity is to introduce students to the shape of a path of a projectile.

Introduction: Show the video clip of the android running off a cliff and landing on a moving car. Conduct a group discussion on whether or not this is a realistic jump. Questions might include:

- Would it be possible to conduct a jump like this?
- What are some of the variables that we would have to consider in a jump like this?
- What is the path of her jump? The height of the cliff? The height of the truck? The timing of the truck? The speed she runs off the cliff?

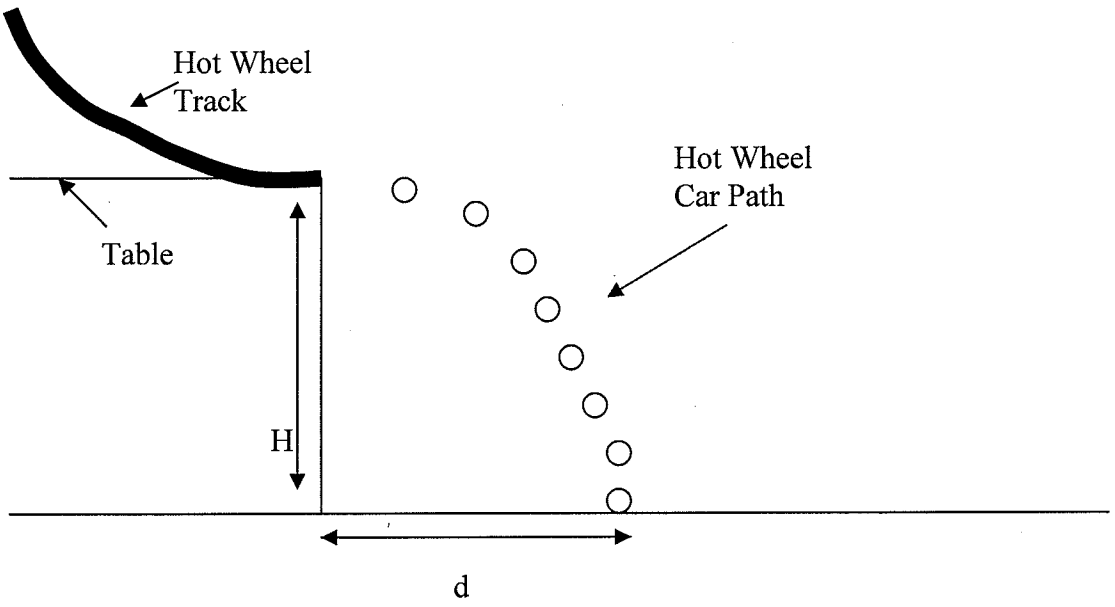
After students discuss these issues, the class should then try to answer each of the questions.

Have students guess the path of the android's flight. Most will guess some kind of curve or a parabola. The point is we don't know for sure if the path is a parabola. To answer this question show the video clip of a ball rolling off a table with a grid in the background. By slowing the video, students should be able to find some data points on the path. Have students graph the points and find a curve that fits it. A quadratic will work.

~~Modeling Unit:~~ Quadratics
Hot Wheels Away!

Marbles

The purpose of this activity is to gather data from a Hot Wheel car rolling off a table and then to find the distance-distance graph that represents its path. From this information a prediction of a future location of the car will allow the car to be caught in a cup by placing the cup (at a pre determined height) on a number line on the floor.



Work in groups.

1. Each group has three rolls of the car down the track. Keep a record of where the car lands. Using a small dot mark each landing spot so that you can average these distances. Measure the distance from the edge of the table to the ground and from that spot on the ground to the spot on the floor where the ball lands. Try to roll the car so it hits at nearly the same spot each time.

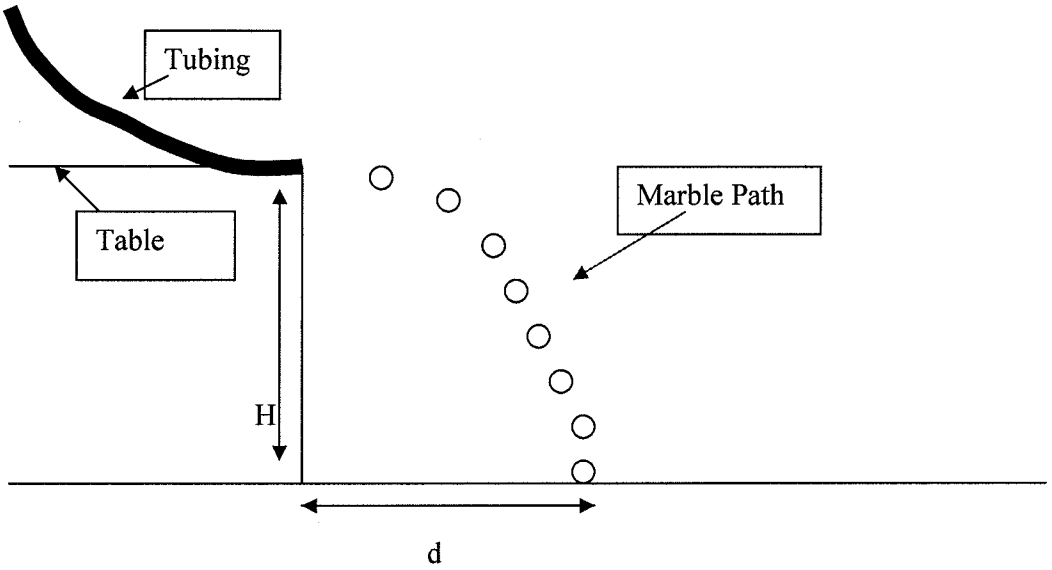
2. Using the data from the experiment, find the quadratic equation that fits the data. Graph this equation to be able to trace along it.

3. Once the graph is done, the group comes up to test accuracy. The teacher will place a cup at a certain height (or distance from the table base). Measure the height of the cup (or the distance the cup is from the table base) and from the equation, place the stand on the number line (or at the correct vertical height) so that it will catch the car.

4. One roll of the car is allowed to catch the car rolled down the track. If it is caught on the first try, your grade is an A, the second try, a B, and so forth.

MARBLE EXPERIMENT

The purpose of this activity is for students to gather data from a marble rolling off a table and the find the distance-distance graph that represents its path. From this information the students should be able to catch the marble in a cup by placing the cup (at a pre-determined height) on a number line on the floor.



Students are to work in groups of 4.

1. Have each group roll a marble three times down the tube and keep track of where it lands. Make a number line out from the table on the floor. It works well to use masking tape. Students should try to roll the marble so they hit at nearly the same spot each time.
2. Using the data from the experiment, students should input the data into a graphing calculator to find the equation that best fits. They should graph this equation so that they can trace along it.
3. Once students have the graph, the group then comes up to test their accuracy. The teacher uses a beaker stand from chemistry to place a cup at a certain height. The group measures the height of the cup and from their work on the calculator they place the stand on the number line so that it will catch the marble.
4. Students have one shot at catching the marble rolled down the tube. If they catch it on the first try, A, the second try, a B, and so forth.

STRAWBERRY STUNTWOMAN

Strawberry Stuntwoman has been preparing for a stunt in a new Chuck Norris/Kevin Federline action movie. Strawberry has to run off the roof of a 30-foot building. After simulating the jump with her computer and with 100-pound dummies, she tried the jump herself and found that she landed perfectly on the cushions 12 feet from the base of the building.

On the day of the jump, the director noticed that the storeowner in the building put up an awning 10 feet from the ground. The awning came out 9 feet from the building. The director was furious because he thought the awning would interfere with Strawberry's jump. If she hit the awning, she would crash through and miss the safety cushions. She was too valuable for any kind of accident.

Strawberry was an excellent mathematician, however, and she assured the director she would miss the awning and would be okay.

1. Was she correct? Justify your answer.

2. a) If she misses it, how much longer could the awning be?

Or

b) If she hits it, how much shorter should the awning be so that she clears the awning?