

MATH
Conference
2008

Transitions in Math Education

Q UADRATIC CLIFF JUMPING
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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?

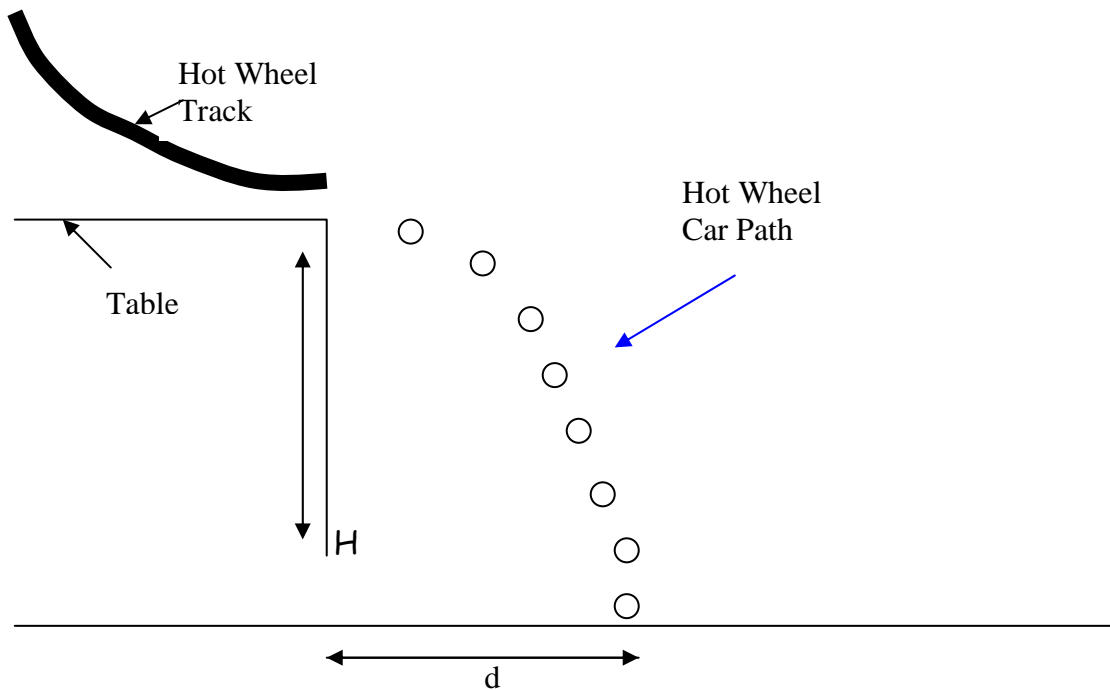
After students discuss these issues, the class should then try to answer each of the questions.

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 basketball being thrown with the data points projected on a screen with a grid in the background. By slowing the video, students should be able to find some data points on the path. The 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!)

Quadratics

Hot Wheels Away!

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.



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.

Strawberry Stuntwoman

An extension activity

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.

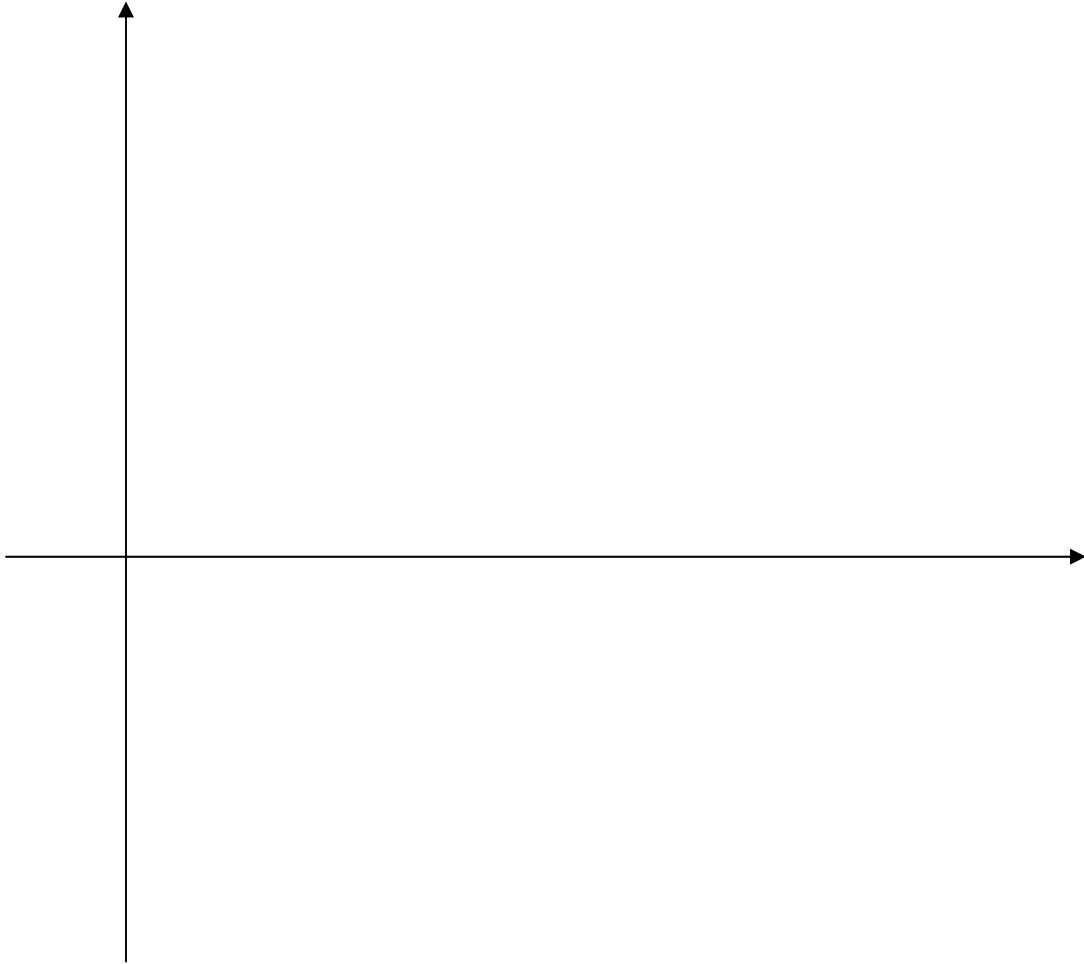
On the day of the jump, the director noticed that the storeowner in the building put up an awning 10 feet from the ground. The awning came out 9 feet from the building. The director was furious because he thought the awning would interfere with Strawberry's jump. If she hit the awning, she would crash 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.

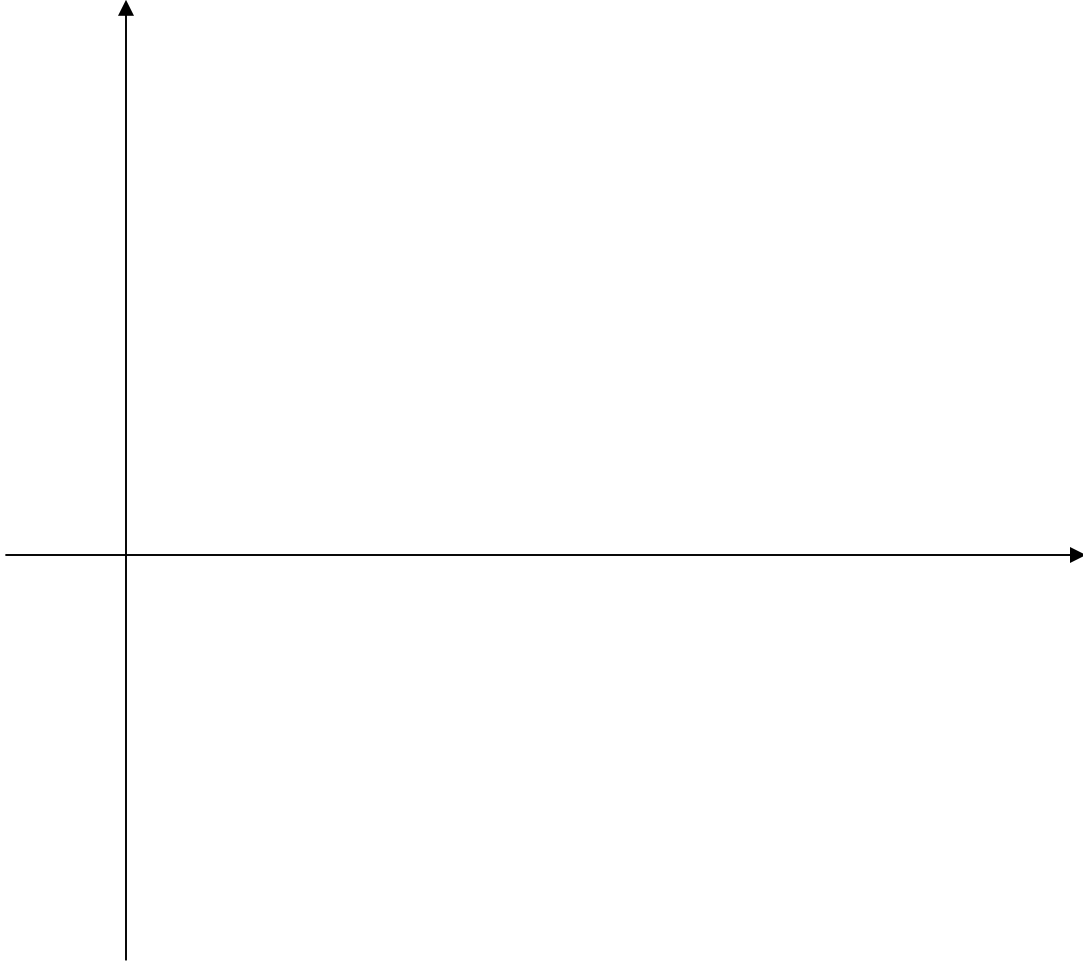
1. Was she correct? Justify your answer.

2.If she misses the awning, how much longer could the awning be and allow her to still miss it? OR If she hits the awning, how much shorter should it be so that she is able to clear the awning?

Ball Toss Graphs



Ball Toss Graphs



Terminator 3

We see from the video clip that TX lands on the hearse. Is this physically possible?

To answer these questions we look at the video clip slide by slide to gather the necessary information. Here is what we have determined:

- TX is running at 7.9 m/s as she jumps from the cliff.
- The distance horizontally from the top edge of the cliff to a point directly above the hearse (where she needs to land) is 10.3 meters.
- The distance the truck covers from when TX spots it as she leaps off the cliff until the truck is directly in her path is 26 meters.
- The truck is travelling a constant velocity of 20 m/s.
- The vertical distance from the top of the cliff to the top of the hearse is 8.3 meters.

Is it possible for the android to actually land on the roof of the truck?

Technology Designed with Teachers in Mind

<http://www.vernier.com/>

Vernier co-founder, David Vernier, had been a [high school physics and physical sciences teacher](#) for eight years when he began programming his first Precision Timer software application. David's creativity and his passion for science education, combined with his wife Christine's business acumen, were the driving forces behind the early years of Vernier Software & Technology. Since those days, Dave and Christine – and now nearly 100 employees at Vernier Software & Technology – have been creating world-class data-collection solutions for teachers. Today, we offer a full line of [award-winning](#) interfaces, sensors, software, and curriculum that help engage and excite students through hands-on scientific exploration.

Support

When you're in the middle of a lab, you have 25 noisy students waiting, and a sensor that's acting up, Vernier will be there for you. On the phone or on your campus, our support team—won't rest until they find the best solution for you and your Vernier product—whether you bought it years ago, or just last week.

Site-Licensing Model

As former teachers ourselves, we know your technology budget is slim. With Vernier's exclusive site-licensing model, when you purchase one copy of any of our software applications, you're free to distribute it throughout your school (and to your students and teachers for home use). No need to track which copy is "legal," and which one isn't. And, selected Vernier lab books arrive with a CD containing the original Microsoft Word files, so you can customize, copy, and publish your own labs in whatever way works best for you.

LoggerPro: One Program does It All



For only \$179, Logger *Pro* includes a generous site license that allows a school or a college department to install Logger *Pro* on every school computer, all instructor computers, AND the students' home computers.

Cool Features of LoggerPro

Video Capture

Logger *Pro* now captures video from many devices. Connect a DV camcorder, a [web camera](#) or [ProScope HR](#), and make your own movies for later analysis. You can make a time-lapse movie, synchronized with sensor data, and play both the movie and the sensor data back at high speed. Or just make a video recording of your experiment to go along with your data. Videos are automatically inserted after capture, so there's no import process to worry about. You can even insert a still photo of your experiment. Learn more about Logger *Pro*'s video features by downloading our [Video and Logger Pro Guide](#).

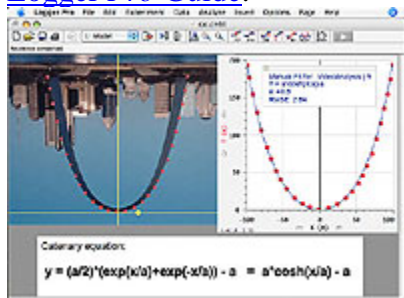


Image Analysis

Use the power of video analysis to analyze a photo. Record the shape of an object, and set the scale of the photo. Don't miss the cool catenary curve example included in Logger *Pro* 3.

Auto Graph Match Generator

Do you like using graph-matching exercises with your students? While it's always been possible to create your own additional exercises, now Logger *Pro* offers a toolbar button that automatically generates a new exercise.

Auto-configured Data Collection

For many purposes, you don't need to configure Logger *Pro* at all. Connect a sensor, such as a [Go! Motion](#) or [Go! Temp](#), or a [LabPro](#) with a sensor, and launch Logger *Pro*. Logger *Pro* detects your setup, and creates a graph, data table, and digital readout. Data collection parameters are set automatically, so you're ready to collect data.