

TITLE: Barbie Bungee

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Goal: The goal of this lesson is to have students use linear regression to determine a function relating the number of rubber bands to the distance that Barbie falls. The students will then use this function to estimate how many rubber bands will be needed to give Barbie the most thrilling bungee jump from the top of the door frame.

Grade and Course: 9th, 10th, 11th, or 12th grade algebra and geometry classes

KY Standards: MA-HS-4.2.1 (Data Analysis and Probability: Characteristics of Data Sets)
MA-HS-4.2.3 (Data Analysis and Probability: Characteristics of Data Sets)
MA-HS-5.3.1 (Algebraic Thinking: Equations and Inequalities)
MA-HS-5.3.3 (Algebraic Thinking: Equations and Inequalities)

Objectives: The objective of this lesson is to have students plot the data they collected on a coordinate plane and then find a best fit linear equation. Using this linear equation, students will be expected to determine the number of rubber bands required to give Barbie the most thrilling bungee jump from the top of the door frame.

Resources/materials needed: Worksheets, Barbies, Rubber Bands, Rulers, and Yard Sticks

Description of Plan: Students will work in small groups of 3-5 students. The groups will then be given a worksheet and packet containing the materials for the activity. As students complete the worksheet/task, the Algebra Cubed fellow and the teacher mentor will help guide the students through the activity.

Lesson Source: This lesson is adapted from the Barbie Bungee activity given on the website www.themathlab.com.

Instructional Mode: Group activity

Date Given: 10/19/06

Estimated Time: 50 minutes

Date Submitted to Algebra³: 11/15/06

Barbie Bungee

Our goal is to create a bungee line for Barbie that will give her the most thrilling, yet safe, fall from the top of the door frame.

Barbie is an adventure seeker to the max. She loves the thrill of death defying activities. She believes the adrenaline rush makes her hair more lustrous and her waistline thinner; so she is willing to pay big bucks to the company which can give her the most thrilling ride. In the back of her mind though, she wants to be sure that she is really safe.

To design the best bungee line, following the steps below.

Step #1: Empty the contents of your supply bag. Make sure it contains the following materials:

1. 20 rubber bands (all the same size)
 2. A yardstick
 3. A Barbie doll
 4. A ruler
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Step #2: Connect two rubber bands with a slipknot. See the picture below:



Now wrap one end repeatedly around Barbie's ankles (see picture below). Make sure the rubber band is on tight enough not to fall off when she is being dropped.



Step #3: We will measure Barbie's height without rubber bands, then we will drop Barbie from the top of a yardstick and measure the lowest point that her head reaches. We will do this six times, adding a rubber band each time.

The more bands we add, the lower she will drop. Record your data in the table below:

Number of Rubber Bands (x)	Lowest Point Barbie's Head Reaches in cm (y)
0	
1	
2	
3	
4	
5	
6	

- Some Tips:
1. Hold the yardstick against a wall with zero being the highest number.
 2. You may want to have one person hold the yardstick, one person drop the doll, and one person take the measurements.
 3. You will need to do an initial measurement. This means you record the height of the doll without any rubber bands (see picture below). Be sure that she is stretched out completely with her hands at her sides. Record this amount next to the zero rubber bands in the table above.



Next we drop her with one rubber band attached to her ankles. Hold the band tight at the top of the yardstick, and simply let Barbie drop from the head-down position you see in the picture above. She won't swing; she will just lightly bounce.

This is the tricky part. You need to observe the lowest spot her head reaches during the bounce. The final resting spot is NOT the lowest spot. You will probably have to drop her two or three times to get an accurate lowest reading.



Now it is time to start adding more rubber bands. Once again use a slipknot to connect a second rubber band to the bungee line. (Remember, the band wrapped around her ankles does not count in the length of the line.)



Drop her with the two rubber bands attached to her ankles. Hold the band tight at the top of the yardstick, and simply let Barbie drop from the head-down position. She should bounce a bit more than she did with just one rubber band. The amount of bounce will get bigger and bigger as you add bands!

Step #4: Now that you have your table filled out, set up a titled and labeled graph (a piece of graph paper is attached to the back of this packet). Plot the data from your table on the graph.

Step #5: Draw a line that best fits the data you graphed in Step #4.

Step #6: Select two points on your line, write their coordinates, and determine the slope of your line using these two points and the formula for slope, $m = \frac{y_2 - y_1}{x_2 - x_1}$.

Step #7: Substitute the slope you found in Step #6 and one of your two points into the equation $y = mx + b$, and solve for b . Then write the equation for your line in $y = mx + b$ form.

Step #8: Use your equation from Step #7 to determine how many rubber bands you would need to drop Barbie from the top of the door frame to the floor. (Hint: you will need to measure this distance in cm).

Step #9: Now consider the SAFETY issue vs. the THRILL issue.

If you put the number of rubber bounds that you found in Step #8, her head will reach the floor, she will crack open her skull, and die. You will then be sued for negligence and will lose your business and owe her family millions of dollars that you don't have.

On the other hand, if you shorten the bungee line too much, the ride may not be thrilling enough, and Barbie will pay her big bucks to your competitor. You will lose clients and your business will suffer.

So make a decision on how many rubber bands you want to use, then attach that many bands to Barbie's line using slipknots like above. Explain your reasoning.

Step #10: Now it is time to drop her and see if she dies or has a great time.

