Barbie Bungee

MA.8.S.3.1 & MA.E.1.3.1

Materials

20 Rubber bands (same size and type)
Masking tape
Barbie Bungee Activity Sheet
Yardsticks or measuring tapes
Barbie dolls (or similar)

Optional Activities:

Spread Sheet Option – download template from
http://illuminations.nctm.org/lessons/barbie/barbie-jumprecord.xls

Line of Best Fit graphing activity -
http://illuminations.nctm.org/ActivityDetail.aspx?ID=146

Assessment Options

1. As a journal response, have students answer the Key Questions above. Then, require students to present their solutions to the class and demonstrate that their answers are correct. For instance, if a student says that Barbie can jump safely from a height of 400 cm with 12 rubber bands, then they should demonstrate that Barbie will not hit the ground when 12 rubber bands are used.
2. The following rubric can be used to evaluate student work. You may wish to share this rubric with students prior to completing the lesson, so that they are aware of the criteria on which their performance will be measured.

Barbie Bungee Project – Grading Criteria		Rubric Score
ANALYSIS	○ The project is complete and turned in on-time. ○ The project demonstrates an understanding of the mathematical concepts.	
APPLICATION	○ The procedures checklist is complete. ○ All group members work efficiently during the class period.	

REPRESENTATION	○ The data table is accurate. ○ The scatter plot includes a title, labels, scales, and data points. ○ The sketch of the line of best fit is reasonable. ○ The equation of the line of best fit is accurate, based on the data.	
EXPLANATION	○ The relationship between the variables is clearly stated. ○ The slope and y-intercept are explained in context.	
JUSTIFICATION	○ The predictions are made and their reliability is discussed. ○ The predictions are compared to the original conjecture.	

Extensions

1. Using dolls of different sizes and weights, note the effect on the results. Will more or fewer rubber bands be needed for a jump of the same height?
2. Consider the effects of gravity, and have students consider the speed at which Barbie falls during her jump. What is her speed one second after the jump starts? What is her speed at the bottom of the jump?

Barbie Bungee

NAME _____

In this activity, you will simulate a bungee jump using a Barbie® doll and rubber bands.

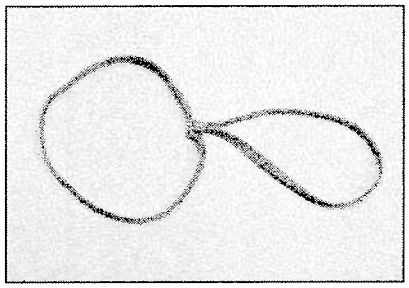
Before you conduct the experiment, formulate a conjecture:

> *I believe that _____ is the maximum number of rubber bands that will allow Barbie to safely jump from a height of 400 cm.*

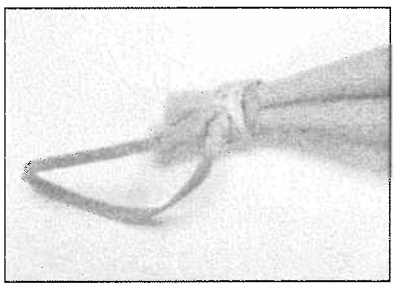
Now, conduct the experiment to test your conjecture.

PROCEDURE:
Complete each step below. As you complete each step, put a check mark in the box to the left.

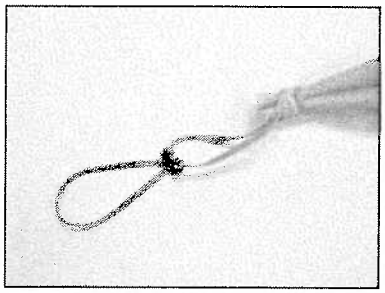
- ❑ Tape a large piece of paper to the wall from the floor to a height of about six feet.
- ❑ Draw a line near the top to indicate the height from which Barbie will make each jump.
- ❑ Create a double-loop to wrap around Barbie's feet. A double-loop is made by securing one rubber band to another with a slip knot, as shown (below left).



- ❑ Wrap the open end of the double-loop tightly around Barbie's feet, as shown (below right).



- Attach a second rubber band to the first one, again using a slip knot, as shown below.



- With two rubber bands now attached, hold the end of the rubber bands at the jump line with one hand, and drop Barbie from the line with the other hand. Have a partner make a mark to the lowest point that Barbie reaches on this jump.

- Measure the jump distance in centimeters, and record the value in the data table in Question 1. You may wish to repeat this jump several times and take the average, to ensure accuracy. Accuracy is important—Barbie's life could depend on it!

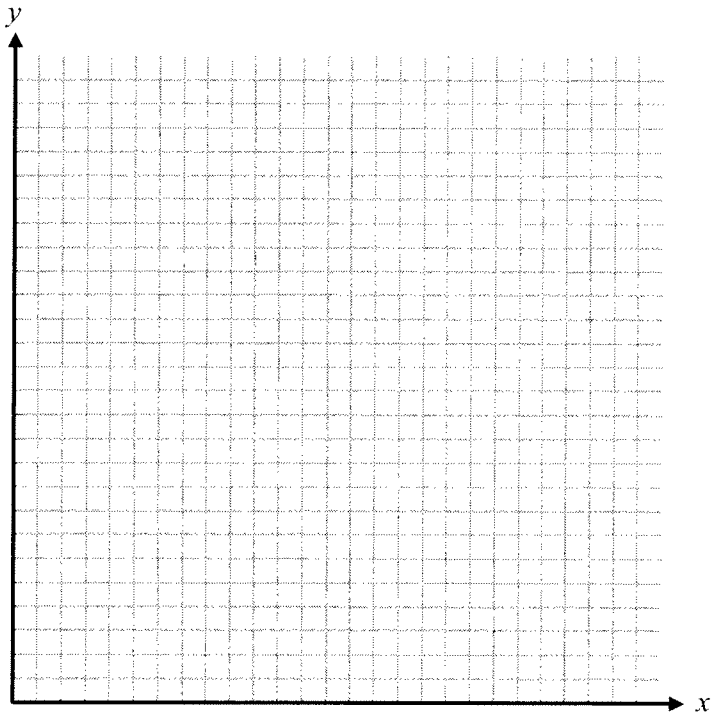
- Repeatedly attach two additional rubber bands for each new jump, measure the jump distance, and record the results in the data table.

- When you've completed the data table, answer Questions 2-12.

1. Complete the data table below.

Number of Rubber Bands (X)	Jump Distance in Centimeters (Y)
2	
4	
6	
8	
10	
12	

2. Make a scatterplot of your data. Indicate the scale on each axis.



3. On the graph above, sketch a line of best fit.

4. What is the relationship between the number of rubber bands and jump distance?

5. What is the equation for your line of best fit? (You may wish to use a graphing calculator for this part of the lesson. Enter the rubber band data in L_1, and enter the jump distance data for L_2.)

6. What is the slope of your equation, and what does it represent in this context?

7. What is the y-intercept of your equation, and what does it represent in this context?

8. Based on your data, what would you predict is the maximum number of rubber bands so that Barbie could still safely jump from 400 cm?

   Using your Line of Best Fit: _____

   Using your Regression Equation: _____

9. Are your predictions reliable? Justify your answer. Be sure to consider your methods of collecting, recording, and plotting data.

10. How do your predictions from Question 8 compare to the conjecture you made before doing the experiment? What prior knowledge did you have (or not have) that helped (or hindered) your ability to make a good conjecture?

11. In what ways did you contribute to the group while working on this project?

12. Use the space below to list any additional comments.