Barbie Bungee

GRADE: 6-8,9-12

PERIODS: 1

STANDARDS:

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The consideration of cord length is very important in a bungee jump—too short, and the jumper doesn't get much of a thrill; too long, and *ouch*! In this lesson, students model a bungee jump using a Barbie® doll and rubber bands. The distance to which the doll will fall is directly proportional to the number of rubber bands, so this context is used to examine linear functions.

Instructional Plan	Objectives + Standards	Materials	Assessments + Extensions	Questions + Reflection	Related Resources	Print All

Get students' interest by asking, "Do you think the length of the cord and the size of the person matters when bungee jumping? Would it be smart to lie about your height or weight?" Allow students to offer suggestions as to why an accurate estimate of height and weight would be important to conduct a safe bungee jump.

You may also wish to search and show a short video about bungee jumping.

After a brief introduction, set up the lesson by telling students that they will be creating a bungee jump for a Barbie® doll. Their objective is to give Barbie the greatest thrill while still ensuring that she is safe. This means that she should come as close as possible to the ground without hitting the floor.

Explain that students will conduct an experiment, collect data, and then use the data to predict the maximum number of rubber bands that should be used to give Barbie a safe jump from a height of 400 cm. (At the end of the lesson, students should test their conjectures by dropping Barbie from this height. If your school does not have a location that will allow such a drop, then you may wish to adjust the height for this prediction.)

Distribute the Barbie Bungee Activity Packet to each student. In addition, give each group of 3-4 students a Barbie doll, 15-20 rubber bands, a large piece of paper, some tape, and a measuring tool. Be sure that all rubber bands are the same size and thickness. Differences in rubber band elasticity will affect the results.

Barbie Bungee Activity Packet

Before students begin, demonstrate how to create the double-loop that attaches to Barbie's feet. Also show how a slip knot can be used to add additional rubber bands. Then, allow students enough time to complete the experiment and record the results in the data table for Question 1 of the Barbie Bungee Activity Packet.

After all groups have completed the table, ask them to check their data. They should look for numerical irregularities. If any numbers in their table do not seem to fit, they may need to re-do the experiment for the number of rubber bands where the data appears abnormal. (Common student errors include measuring incorrectly and adding too many or too few rubber bands. As students conduct the experiment the first time, circulate and attempt to spot these errors as they occur. It will save time if students fix the errors during the initial experiment instead of having to re-do the experiment later.)

Note that the number of rubber bands in the first column increases by 2. This is so students consider the idea of slope during the experiment. If the number of rubber bands increases by 1, then students are not required to think about what the slope means. When increased by 2, however, students have to realize that the slope of the line actually represents "centimeters per rubber band" instead of "centimeters per two rubber bands."

To create a graph of the data, you may wish to have students use the Illuminations Line of Best Fit activity, or allow them to enter the data in the Barbie Bungee Spreadsheet.

Line of Best Fit

[Barbie Bungee Spreadsheet](#)

At the end of the lesson, take students to a location where Barbie can be dropped from a significant height. Possibilities include a balcony, the top row of bleachers, or even standing on a ladder in an area with a high ceiling. Allow students to test their conjecture about the maximum number of rubber bands that can be used for a jump of 400 centimeters.

- Rubber bands (all the same size and type)
- Yardsticks or measuring tapes
- Masking tape
- Barbie® dolls (or similar)
- [Barbie Bungee Activity Sheet](#)
- [Line of Best Fit Activity](#)
- [Barbie Bungee Spreadsheet](#)

Assessments

1. As a journal response, have students answer the Key Questions from the Barbie Bungee Activity Sheet. 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?

Questions for Students

1. How many rubber bands are needed for Barbie to safely jump from a height of 400 cm?

> [Answers will vary, but students should use the line of best fit and the regression equation to determine an answer.]

2. What is the minimum height from which Barbie should jump if 25 rubber bands are used?

> [Answers will vary, but students should use the line of best fit and the regression equation to determine an answer.]

3. How do you think the type and width of the rubber band might affect the results? Do you think age of the rubber bands would affect the results--that is, what would happen if you used older rubber bands?

> [Rubber bands lose their elasticity with age or when exposed to extreme temperatures. Students would probably choose not to jump from a bridge if the bungee cord were old and brittle.]

Teacher Reflection

- Were students able to explain the meaning of the slope and *y*-intercept within the context of this problem? If not, what other activities would help?
- Was students' level of enthusiasm/involvement high or low? Explain why.
- How did the students demonstrate understanding of the materials presented?
- What, if any, issues arose with classroom management? How did you correct them? If you use this lesson in the future, what could you do to prevent these problems?

Learning Objectives

Students will:

- Collect data using a rubber band bungee cord and a Barbie doll.
- Use the data collected to construct a scatter plot and generate a line of best fit.
- Predict how many rubber bands are needed for Barbie to safely jump from a given distance.

NCTM Standards and Expectations

- Explore relationships between symbolic expressions and graphs of lines, paying particular attention to the meaning of intercept and slope.
- Use graphs to analyze the nature of changes in quantities in linear relationships.
- Use symbolic algebra to represent and explain mathematical relationships.
- Approximate and interpret rates of change from graphical and numerical data.
- Identify trends in bivariate data and find functions that model the data or transform the data so that they can be modeled.

Common Core State Standards – Mathematics

Grade 8, Stats & Probability

- CCSS.Math.Content.8.SP.A.1
  Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Grade 8, Stats & Probability

- CCSS.Math.Content.8.SP.A.2
  Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

Grade 8, Stats & Probability

- CCSS.Math.Content.8.SP.A.3
  Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.