Barbie Bungee

NAME _____

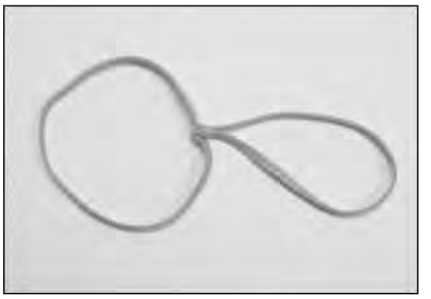
In this activity, you will simulate a bungee jump using a Barbie® doll and rubber bands.
(You can choose to work individually or in a small group for this assignment.)
Before you conduct the experiment, formulate a conjecture:

> *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!

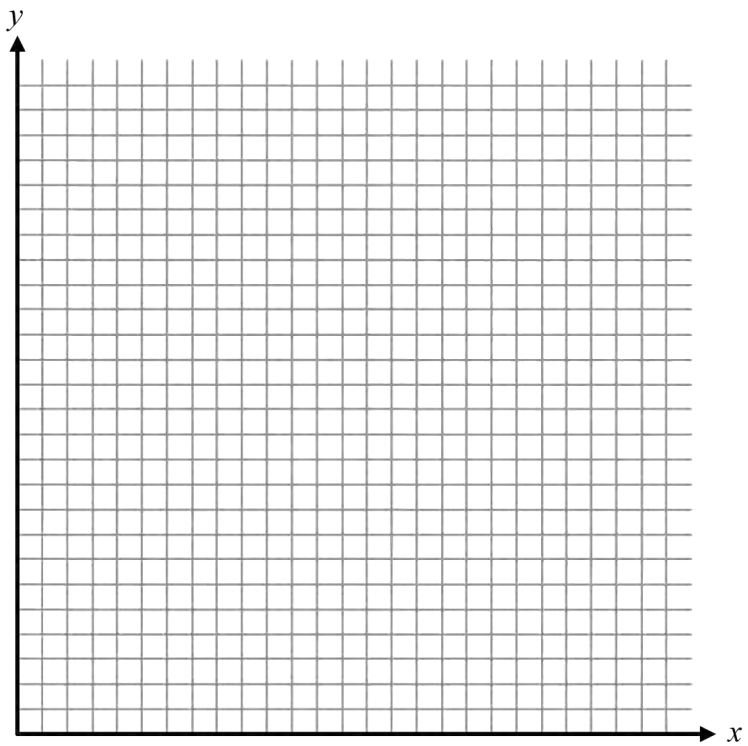
- Repeatedly attach two additional rubber bands for each new jump, measure the jump distance, and record the results in the data table.

- 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.

Barbie® Bungee Student Objectives: (with helpful hints in red)

It's okay if you don't have a Barbie®, use any doll/action figure that is about the size of a Barbie®. Valley Rescue Mission is a great place to find old toys.

All students should:

enjoy mathematics while completing this project with a group or individually.

Make plans to get together with a couple friends. Take pictures. Enjoy!

make predictions.

Make a guess about how many rubber bands it will take to have Barbie® safely bungee jump from 400 cm.

measure length in centimeters.

You should carefully measure in centimeters. Remember that each mark on the centimeter ruler measures a tenth of a centimeter.

average several measurements to reduce variation.

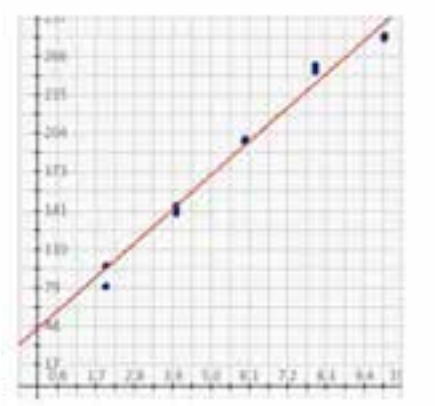
To find the average, take several measurements, add them up, and then divide by the number of measurements.

plot points on a coordinate plane.

Remember that the x-axis is horizontal and the y-axis is vertical. The intersection of the x and y-axis is called the origin and has the ordered pair (0, 0).

draw a line that "best fits" or follows the trend of the data.

After plotting your points, use a ruler (or even a piece of raw spaghetti) to draw a line that follows the trend of your data. The line doesn't have to touch all the points, it doesn't even have to touch one point, but it's okay if it does.



use a ti-84 to determine an equation for the line of best fit and/or use point slope form to write the equation to the student's line of "best fit." These two equations will be somewhat different.

Here is a great video of how to use your calculator.
https://www.youtube.com/watch?v=HTFtogVoLiw

If you've completed Algebra 1 and want to write your equation without using a ti-84, you'll need to pick two points from the line (not necessarily the data points) and use point slope form. First find slope (difference in y-values divided by difference in x-values), then plug the slope along with one point into the point slope form: $y - y1 = m(x - x1)$

interpret slope and y-intercept of a linear equation.

Slope is the change in y divided by the change in x. So if your slope is 3 (the same thing as 3 over 1), we would interpret that to mean that the y-values will go up 3 for every 1 x-value increase.

The y-intercept is the point on the graph where the line crosses the y-axis. This always happens when x=0.

use the line of best fit to predict the maximum number of rubber bands to safely drop Barbie from 400 cm.

Plug in 400 for y and solve for x.

use a search engine or ti-84 user's manual to learn key strokes, if needed.

email Mrs. Brooks at **lizbrooks@calvaryknights.com** with questions.

This activity is intended to be fun, doable yet challenging, and provoke students to look up new terms and calculator functions to spark interest in mathematics.

Once back in the classroom, the teacher will go over the activity differentiating for each course. For example, in Algebra 1 the focus will be on linear relationships and interpreting slope and y-intercept, while in Statistics the idea of Least Square Regression Line will be addressed.