Adapted from www.mathlab.com and Laying The Foundation.

Barbie Bungee Challenge

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 *splat*! In this lesson, you model a bungee jump using a Barbie® doll and rubber bands. You will find the relationship between the number of rubber bands and the distance that Barbie falls.

You will be creating a bungee jump for a Barbie® doll. Your objective is to give Barbie the greatest thrill while still ensuring that she is safe (and alive after the activity is complete). This means that she should come as close as possible to the ground without hitting the floor.

You 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 the top of the high school bleachers (15 feet).

Procedure:
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 the top of the high school bleachers.

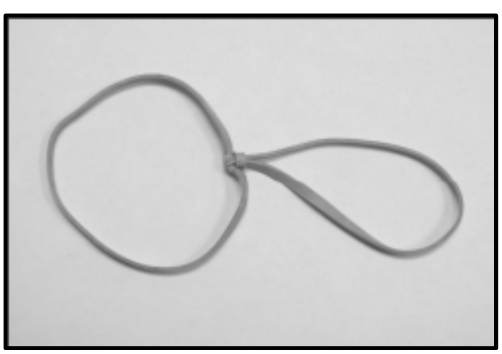
Now, conduct the experiment to test your conjecture. Complete each step below.

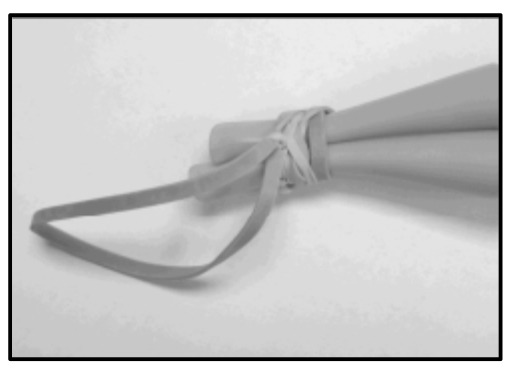
Materials needed: Barbie, rubber bands, yardsticks, recording page

Assign roles to each group member:

1 Rubber band expert 1 Barbie dropper 2 Data recorders

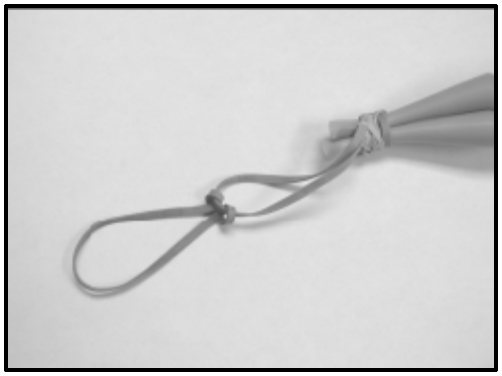
Create a double-loop to wrap around Barbie's feet. A double-loop is made by securing one rubber band to another with a slip knot, as shown below left.





Wrap the open end of the double-loop tightly around Barbie's feet, as shown above right.

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



We will measure Barbie's jump using a yardstick. Hold the yardstick near a wall with zero being the highest number. One person should be holding the yardstick. With two rubber bands now attached, hold the end of the rubber bands at the jump line (top of yardstick) with one hand, and drop Barbie from the line with the other hand. Have the other two group member determine the **lowest point** (not the final position) that Barbie reaches on this jump.

Perform the experiment 3 times with the 2 rubber bands attached and record the values in the data table. Then find the average distance of the three jumps 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, you may begin to answer the questions.

x	**Jump #1**	**Jump #2**	**Jump #3**	***y***
Number of Rubber Bands	Distance Bungeed (in *inches*)	Distance Bungeed (in *inches*)	Distance Bungeed (in *inches*)	Average of 3 Jumps (in *inches*)
2				
4				
6				
8				
10				
12				

Activity B-3: **Barbie Bungee Challenge** Name:

Rewrite your x and y-values below from the data. Then plot the points (x, y) on the graph below.

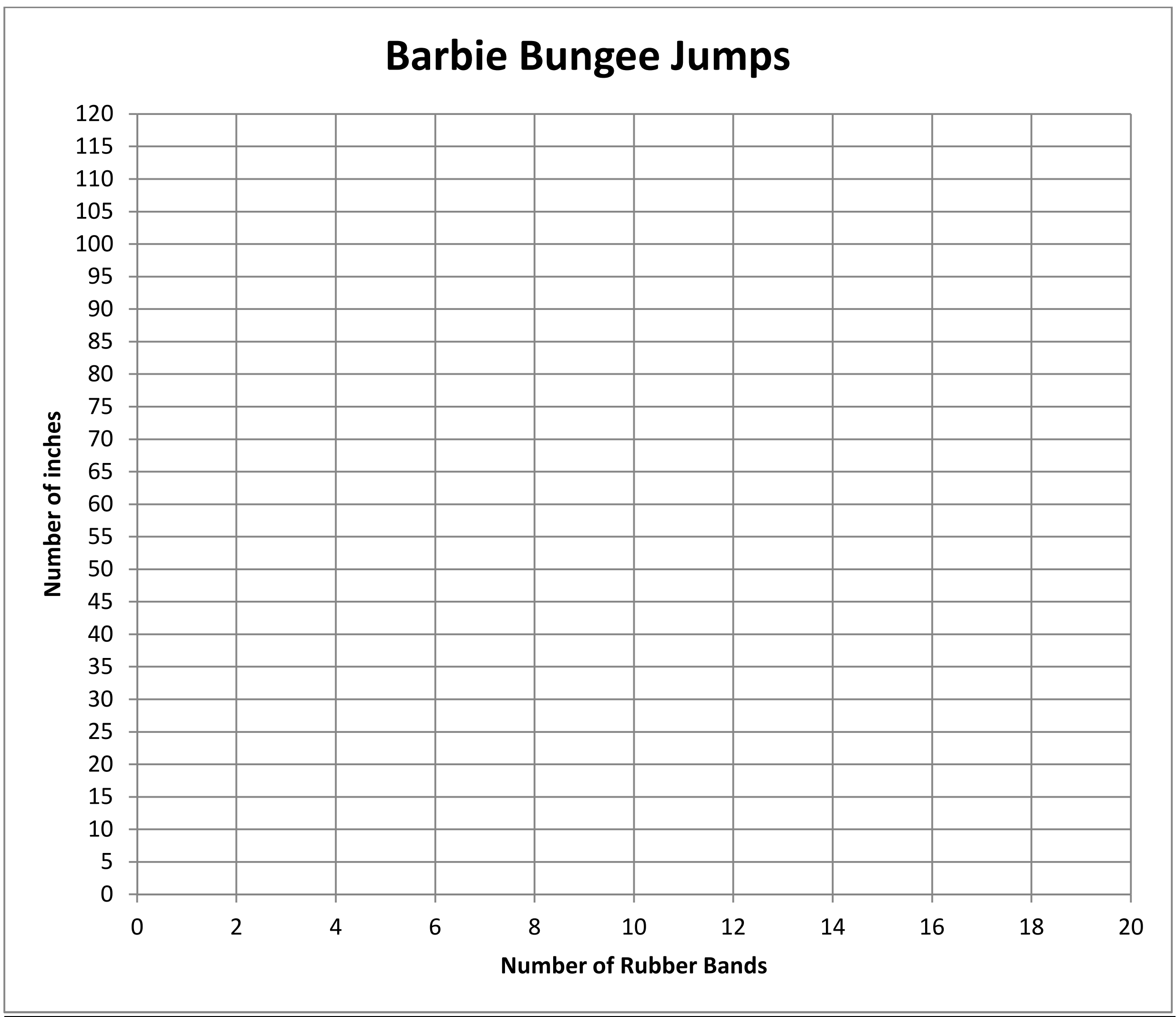
Points to plot (x, y)

x	*y*

Plot the points on the axes below.

Sketch a line that best fits your data.

To do this, pick **TWO** points that best represent the data and draw a **straight** line through these two points. Extend the line to the edges of the graph. Some points should be above the line and some points should be below the line.



Created by Lance Mangham, 6th grade math, Carroll ISD

Activity B-4: **Barbie Bungee Challenge** Name: ______________________

1.	Do you think the length of the cord and the size of the person matters when bungee jumping? Why?
2.	Would it be smart to lie about your height or weight? Why or Why not?
3.	Why is an accurate estimate of height and weight important to conduct a safe bungee jump?
4.	Choose two points that best represent the data that you have collected. Use the **SAME TWO points** you used to draw your line on the graph! The two points are (___, ___) and (___, ___).
5.	Using these two points, find the **slope** of the line through them. Simplify your answer to the nearest tenth. Recall: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{change in } y}{\text{change in } x} = \frac{\text{rise}}{\text{run}}$
6.	What does the slope represent in this context?
7.	Based on your line of best fit what is the y-intercept of the line?
8.	What does the y-intercept represent in this context?
9.	Write an equation in the form of $y = mx + b$ for your Barbie bungee jumps. $y =$ ________ $x +$ ________ (slope) (y-intercept)
10.	**Number of rubber bands** and the **height of Barbie's fall**: Which is the independent variable and which is the dependent variable in this experiment?
11.	Based on your data, what would you predict is the maximum number of rubber bands so that Barbie could still safely jump from the top of the high school bleachers (15 feet)?
12.	How confident are you in your prediction above? Justify your answer. Be sure to consider your methods of collecting, recording, and plotting data.
13.	What is the minimum height from which Barbie should jump if 25 rubber bands are used? (You should use the line of best fit to determine an answer.)

14.	If some weight were added to Barbie, would you need to use more or fewer rubber bands to achieve the same results? Explain your reasoning.
15.	Use your equation to determine what distance Barbie would fall using 50 rubber bands. (Take a moment and think -- will 50 be an x-value or a y-value?)
16.	Use your equation to determine how many rubber bands you would need to use to have Barbie plunge to a distance of 150 inches. (Once again think – is 150 going to be an x-value in your equation or a y-value?)
17.	Barbie wants to bungee off the Eiffel Tower. It is 986 feet tall. How many rubber bands will you need so Barbie just brushes her hair (hopefully not her head) on the ground?

We are now at the moment of truth. Which team has best predicted the maximum number of rubber bands required to give Barbie the bungee jump of a lifetime?

Let the Official Barbie Bungee jumps begin!!!

Our team's minimum Barbie distance from the ground: ______________________

18.	How many rubber bands were actually needed for Barbie to safely jump from the top of the bleachers?
19.	How do your predictions above 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?