Name: ________________________
Date: ________________________

Ch 4 – Linear Relations Math Lab: Modelling Bounce Height of a Ball

Question: How high would a ball bounce back up if it was dropped from the **Empire State Building**? Take a **guess**.

What would affect bounce height?

What materials might we need to test this?
Materials:

Procedure for Data Collection:

1) Tape a metre stick to the wall, so that the bottom touches the ground. Choose a ball from those provided and record the type at the top of your data table, and your graph.

2) In your group of three, choose roles of: ball dropper, bounce height measurer & recorder, & video maker.

3) Start by holding the ball so that the bottom of it is at 1m (100cm). Release the ball without pushing down. Practice a few times before making the video. Get used to seeing the approximate height the ball bounces up to on the metre stick. Practice measuring the bounce from the **bottom** of the ball.

4) When the group is ready, drop the ball from 1m (100cm) and see where it bounces back to on the metre stick. Record on the table in **cm**. Do this three times to get a total of three readings. Video every trial so you can improve on your measurements. Calculate the average of the three trials, and record on the table.

5) Repeat #4 by dropping from 90cm.

6) Repeat #4 for 80cm, 70cm, 60 cm, 50cm, etc down to 10cm. Also record that a drop height of 0cm will give a bounce height of 0cm

Data:

Data Tables for a ________________ Ball

Drop Height (cm)	Bounce Height (cm)		
	Trial 1	Trial 2	Trial 3
100			
90			
80			
70			
60			
50			
40			
30			
20			
10			
0			

Drop Height (cm)	Average Bounce Height (cm)
100	
90	
80	
70	
60	
50	
40	
30	
20	
10	
0	

Extra Space to Work out Averages:

This is the table you will use to graph your data on the next page. The first column is your ***x*** axis (horizontal), and the second column is your ***y*** axis!

Now, it's time to graph your data! EACH PERSON DOES THEIR OWN GRAPH!
Try to use as much of the grid as possible!
Label your axes!

Bounce Height Graph for a ____________________ Ball

Graph Analysis:

1) Does your graph look like a straight line? It is not a perfect straight line because some error always occurs during labs due to taking measurements.

2) Draw a straight line (with a transparent ruler) that is an average of all the data points. This '*line of best fit'* should have roughly the same number of data points above it as it does below it. Your *line of best fit* should start at (0, 0). Take your time with this step, and draw as accurate of a *line of best fit* as you possibly can.

Questions:

1) Why do you think we did three trials to get an average before using the average on the graph?

2) Describe any errors that may have been made during the experiment (are there any data points far from your line of best fit? Why?).

3) Using ***interpolation*** with your *line of best fit*, what would be the bounce height if the ball was dropped from 85cm? Show the work on your graph (with a ruler).

4) Using ***extrapolation*** with your *line of best fit*, determine the bounce height of your ball (in cm) if it was dropped from 250cm. Show your calculations.

5) Using your *line of best fit*, calculate the ***slope*** of your line. Remember, $slope = \frac{rise}{run}$. Pick a point somewhere on your *line of best fit*, find the bounce height for it (your rise), and then the drop height for it (your run). This will only work correctly if your *line of best fit* starts at (0, 0). Show work below:

6) Now, write the equation for the line in ***y = mx + b*** form.
This is the mathematical equation for the bounciness of your ball!

Discussion Questions With Class:

7) As a class, we will share our equations and write them all on the board at the same time.

a) Why are the slopes of the equations different?

b) What does the slope for the equation tell you about the ball?

8) Now, '*google*' the height of the **Empire State Building** in metres, and using your equation, determine how high your ball will bounce when dropped from the top.

9) Notice that we represented the linear relation of the ball bounciness with a table, a graph, and then an equation. What are the advantages and disadvantages of each method?

Model	Advantages	Disadvantages
table		
graph		
equation		