Grade 9 Academi	c	Lesson Plan		Lesson: <u>16</u>
Unit/Chapter:	Linear Relations	_	<b>Topic:</b> _	Two Variable Data

## **t** homework check: Scatter Plots Asmt due now!

## **1** note: Interpreting and Analyzing Two Variable Data

Data tends to fall into two categories: **linear or non-linear**. If we can draw a **line of best fit** to describe the trend in the data, then the **relationship is linear**. If no line can be drawn or **a curve** best describes the data, then the relationship is **non-linear**.

- ▶ show students graphs with linear and non-linear trends
- have students describe the relationships using vocabulary of unit

It is sometimes possible to tell if data is linear or non-linear from a table of values. In order to decide, the left column in the table **must** be increasing at a steady rate. The left column will always represent the **independent variable**, **the values you choose** and the right column will represent the dependent variable. If we can find a constant rate of increase for the **dependent variable**, **those values which depend on what you choose** then the relationship is linear. The values between the dependent entries in the table are called "finite differences" or "first differences". Essentially, if the first differences are constant, then the relationship is linear. If these differences are not constant, then the relationship is non-linear.

- show charts of some varying tables of values
- have students decide whether or not to use the first differences method to decide whether the data is linear or non-linear

**Data can be continuous or discrete**. Data that is *continuous fluctuates throughout a time period* - like your body temperature. A set of *data that cannot be broken into smaller parts is discrete* – like the number of cars in the parking lot. Discrete data is represented by a dotted line on your graph.

- # *class activity:* Interpreting and Analyzing Two Variable Data
- students will work independently on this assignment
- > assignment will be **due next class** (teacher discretion)
- > assignment will be marked for knowledge and communication

LINEAR OR NON-LINEAR?





## **Using Finite Differences**

For each of the following, decide whether the graph will be linear or non-linear. Be sure your method is valid before calculating the first differences.

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Distance (km)	<b>Cost (\$)</b>
0	50.00
50	62.50
	75.00
150	87.50
200	100.00
250	112.50
300	125.00

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Side Length (cm)	Area (cm²)
0	0
1	1
1.5	2.25
2.5	6.25
3	3

0

x	<b>x</b> <sup>2</sup>
0	0
1	1
. 2	4
3	9
4	16

## Interpreting & Analyzing Two Variable Data

1. A stone is dropped off the top of a tall building. The following sets of data are recorded:

Time (s)	Speed (m/s)	First
		Differences
0	0	10 – 0 =
1	10	20 - 10 =
2	20	
3	30	
4	40	
5	50	

Time (s)	Distance (m)	First Differences
0	0	
1	5	
2	20	
3	45	
4	80	
5	125	

i) Using the entries in the first two columns of each table, graph each relationship on a separate grid. When choosing your axes, use time as the independent variable.





ii) a) What is the speed of the stone and the distance fallen when the time is 2.5 seconds?

- b) When would the speed of the stone be 80 m/s?
- c) When would the distance travelled by the stone be 245 m?
- d) Which relation is linear?
- e) For the linear relation, form an equation that models the data.

time (h)	temperature (celsius)	first differences
0	-2	
1	-5	
2	-8	
3	-11	
4	-14	

2. The following data is collected:

- a) Calculate the first difference for the temperature in the chart given above.
- b) Do you think that this data describes a straight line or curve?
- c) Create a scatter plot of the data and draw a line or curve of best fit.

- d) When would the temperature be -20 degrees celcius?
- e) What would be the temperature if the time were 2.5 hours?

3. A cold drink is left out in the sun on a warm day. The graph of its temperature versus time data follows:



- a) Is this graph linear or non-linear?
- b) What pattern should exist in the first differences for this relationship?

c) What decisions will you have to make before you choose points on the curve if you want to create a finite differences table?

d) Use the table provided to record the values of time and temperature for five points on the graph and calculate the first difference for temperature.

Time (mins)	Temperature (Celcius)	First Differences

4. Tara wishes to keep track of the number of kilometres that she travels on a basketball team road trip. She forgets to begin making observations until she is 50 km from home. She begins timing the trip (time equals zero hours) at the 50 km point. The graph below provides distance versus time data for Tara's trip.



a) Is the graph linear or non-linear?

b) What pattern should exist in the first differences for this relationship?

c) Use the table below to record the values of time and distance for five points of your choosing on the graph and calculate the first differences for distance.

Time (hours)	Distance (km)	First Differences

e) Estimate the amount of time that elapsed before Tara began recording observations.