

<p>BIG PICTURE of this UNIT:</p>	<ul style="list-style-type: none"> • How do we WORK WITH & EXTEND the concept of “functions” • Why are linear equations written in different forms? • How do we EXTEND our knowledge of LINEAR functions, beyond the basics of IM2?
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This lesson will be based upon a STUDENT DIRECTED DISCUSSION model in your groups, you should be having DISCUSSIONS about how to think and work through and then present the solutions to the following questions. The questions will involve basic ideas from IM2 Linear Relations UNIT including (i) functions, (ii) linear functions, (iii) GEOGEBRA and Co-ordinate Geometry. EVERY LESSON this semester will involve **spiralling through** these 4 major concepts as you will be given the opportunity to deepen and extend your conceptual knowledge & skill set on these 4 major themes as you see them multiple times in our lessons.

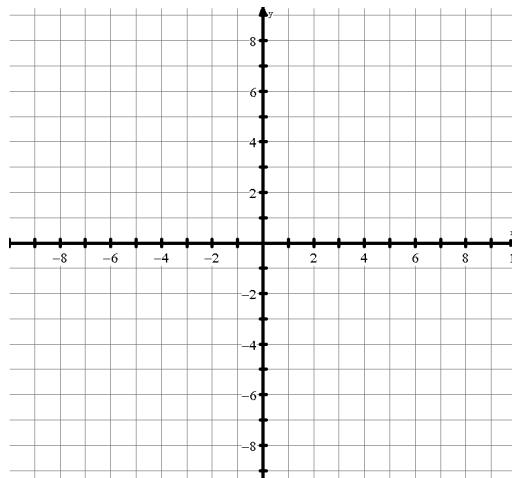
So, in your group, discuss & prepare solutions to the following questions. Record the key ideas of your discussions/solutions in your notebook. Then, once you have had your discussions, present your solutions on the board. Solutions do NOT necessarily NEED to be correct – they simply form the basis for DISCUSSIONS !!!! If your group has (i) multiple solutions that lead to the same answers OR (ii) same/different solutions that lead to different answers, present them ANYWAY!!

1. Given the following equation, draw a graph on the grid provided. {14}

Prepare a table of values for $g(x)$ and use it to graph the function.

$$g(x) = \begin{cases} 1 + x & \text{if } x < 0 \\ 5 - 2x & \text{if } x \geq 0 \end{cases}$$

Explain why this would be called a piecewise function.



(i) State the domain and range of this function.

(ii) Draw the graph AFTER it has been reflect the function over the line $y = x$

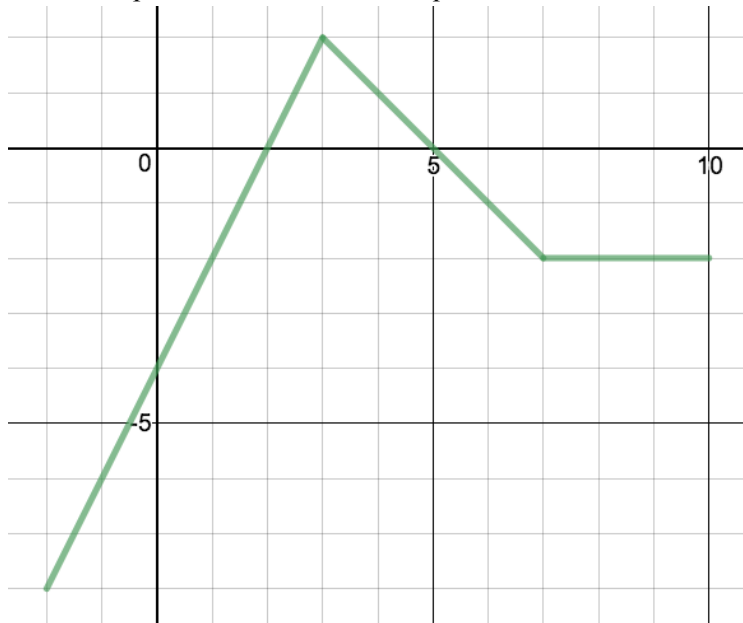
(iii) Does the new graph represent a function? Why or why not.

2. For $g(x) = 4 - 5x$, determine the: {1,4}

- input for x when the output for $g(x)$ is (i) -6 (ii) 2 (iii) 0.6
- the slope of the line

c. the x - and y -intercepts. HENCE, write the linear equation in the form $\frac{x}{a} + \frac{y}{b} = 1$

3. A freight delivery company charges \$4.00/kg for any order less than 100 kg and \$3.50/kg for any order of at least 100 kg. {5}
- Why must this relation be a function?
 - What is the domain of this function? What is its range?
 - Graph the function.
 - What suggestions can you offer to the company for a better pricing structure? Support your answer.
4. Have your group in unison clap out a rhythm given the following characteristics: 5 claps, two of which are “short” and three of which are “long”. How many such rhythms can be composed? Explain/show the reasoning that leads to your answer. {P1}
5. Given the graph of the function provided, determine an equation. Use DESMOS to verify your equation. {13}



6. Let $f(x) = 3x + 1$ and let $g(x) = 2 - x$. {1,6,9}
- Determine a value of K such that $f(K) = g(K)$. Explain the significance of K .
 - Determine a value for M such that $f(M^2) = g(2M)$.
 - Evaluate: (i) $f(3)$ (ii) $g(-1)$ (iii) $f(g(-1))$ (iv) $g(f(-2))$ (v) $f(f(3))$ (vi) $f(f(-2))$

7. Given the function defined by $f(x) = \begin{cases} 2 - x & \text{if } x < 4 \\ 5 & \text{if } 4 \leq x \leq 6 \\ \frac{1}{2}x + 2 & \text{if } x > 6 \end{cases}$. {14}

- Graph the function, without the use of technology.
- Then, use DESMOS to graph the function.
- Functions can be described as being **continuous** and/or **discontinuous**. Given the graph of $y = f(x)$, would you describe the function as being continuous or discontinuous? Explain why.
- On what interval are the function values of $f(x)$ **increasing**?



Higher Level Questions for More Complex Concepts OR an EXTENSION of basic concepts involved with linear relations and functions in general.

1. If $f(x) = \frac{1}{2}(4)^x$, determine the following values

a. $\frac{f(3) - f(1)}{3 - 1}$.

b. $\frac{f(2) - f(1)}{2 - 1}$

c. $\frac{f(1.5) - f(1)}{1.5 - 1}$

d. $\frac{f(1.1) - f(1)}{1.1 - 1}$

e. $\frac{f(1.01) - f(1)}{1.01 - 1}$

f. Offer an explanation as to the significance of what you have just calculated. {20}

g. PREDICT the slope of the curve $f(x) = \frac{1}{2}(4)^x$ at the point (1,2).

2. The diagram below (from GEOGEBRA) shows the points A(1,1), B(8,1) and C(8,5) and the triangle ABC. {4,T1}
- Explain how you would ALGEBRAICALLY prove that the angle at vertex B is a right triangle.
 - use right triangle trigonometry (SOHCAHTOA) to determine the measure of angle BAC.
 - You had to use a special key on the GDC in order to determine the measure of the angle. Which key did you use. Now explain the role of the “inverse” concept.
 - Determine the slope of the line segment AC.
 - Determine the tangent ratio. Compare this ratio to your answer from 12d. Explain WHY!
 - Reflect this triangle over the line $y = x$ and state the new co-ordinates of point A, B and C.

