BIG PICTURE of this UNIT:	• 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?

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.

1. Extend your working with multiple representations and compositions. {13}

   a. Two functions are given below in the form of a data table. Determine values for the following:

   $(i)\ f\circ g(1)\quad (ii)\ g\circ f(2)\quad (iii)\ f\circ g(6)\quad (iv)\ g\circ f(10)\quad (v)\ f\circ g(2)\quad (vi)\ f\circ g^{-1}(-2)$

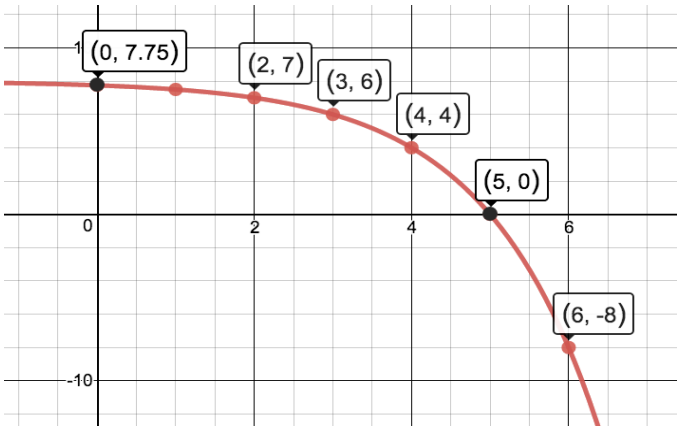
x	-2	-1	0	2	4	6	10
$f(x)$	3	5	-2	-1	½	-8	-3

x	-3	-1	1	2	4	6	8
$g(x)$	6	7	-2	5	-1	0	4

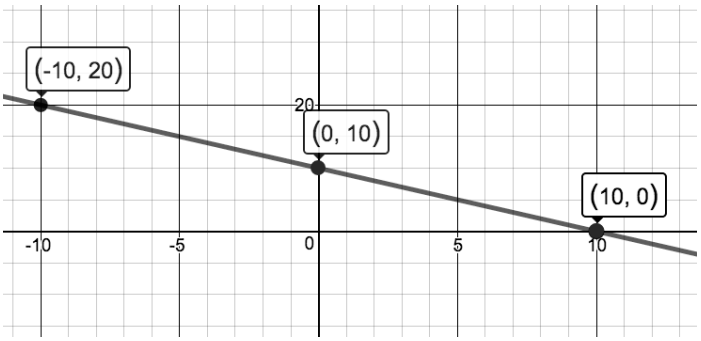
   b. Two functions are given below in the form of a graph. Determine values for the following:

   $(i)\ f\circ g(8)\quad (ii)\ g\circ f(6)\quad (iii)\ f\circ g(2)\quad (iv)\ g\circ f(4)\quad (v)\ f\circ g^{-1}(9)\quad (vi)\ g\circ f^{-1}(6)$

y = f(x)



y = g(x)



2. Given the functions $f(x) = \frac{1}{x}$ and $g(x) = 2x - 6$, {3,9,15,19}
   a. Use your TI-84 to graph $y = f \circ g(x)$ and label the asymptotes. Write the equation for $f \circ g(x)$.
   b. Give one reason why Mr S prefers $g(x) = 2x - 6$ to be written as $g(x) = 2(x - 3)$
   c. The new function, $f \circ g(x)$, represents a transformation of the function $f(x) = \frac{1}{x}$. Which transformations can you identify?
   d. Determine the average rate of change of $y = f \circ g(x)$ between the $x = 4$ and $x = 5$.

3. A hotel has the following rates that apply to groups who rent their ballroom. They charge $400 for any time of 2 hours or less. If the rental time exceeds 2 hours, then an additional rate of $200 per hour are charged. However, if the total rental time is more than 8 hours, they only charge an hourly rate of $100. All rentals are not allowed to exceed 12 hours. {5,13}

   a. What is the independent variable (input)? What would the domain be?
   b. What is the dependent variable (output)? What would the range be?
   c. Would you expect this relation to be a function? Why/why not?
   d. Evaluate $C(7)$ as well as $C(11)$.
   e. Evaluate $1150 = C(t)$ and interpret.
   f. To help draw a graph, complete the following table of values. Then graph this relation.
   g. Write the equation for this relation.

Time									
Cost ($)									

4. A bug moves linearly with constant speed across my graph paper. I first notice the bug when it is at (3, 4). It reaches (9, 8) after two seconds and (15, 12) after four seconds. {16}

   a. Predict the position of the bug after six seconds; after nine seconds; after t seconds.
   b. Is there a time when the bug is equidistant from the x- and y-axes? If so, where is it?

5. I have been observing the motion of a bug that is crawling on my graph paper. When I started watching, it was at the point (-3, 5). Five seconds later it was at (-6, 3). Another five seconds later it was at (-9, 1). After another five seconds it was at (-12, -1). {16}

    a. Draw a picture that illustrates what is happening.
    b. Write a description of any pattern that you notice. What assumptions are you making?
    c. Where was the bug 25 seconds after I started watching it?
    d. Where was the bug 6 seconds **before** I started watching it?

6. Switch your calculator to **parametric** mode and enter these equations: ➔ $X_{1T} = -3 - 3T$ as well as $Y_{1T} = 5 - 2T$. Do a ZOOM 6 and readjust your window settings to Tmin = -10 and Tmax = 10 and Tstep = 1. Describe what you see. How might this graph be related to Q5? {2,16}

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