

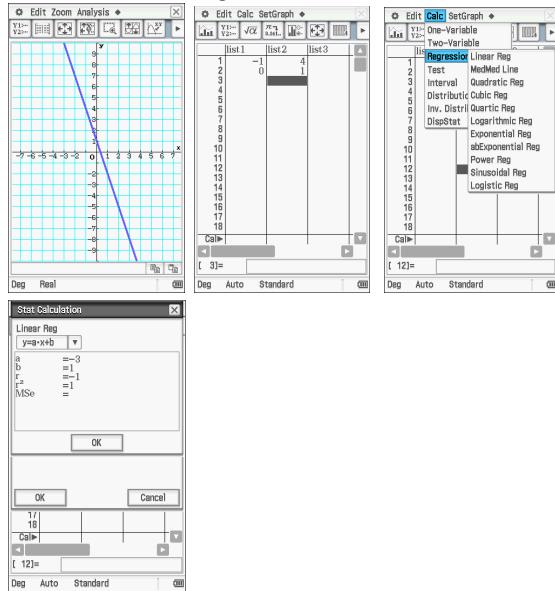
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INVESTIGATION 1: Transformation	
2021 Year 11 Mathematics Methods	
Calculator Assumed	
TAKE HOME SECTION	
NAME: _____	TEACHER: _____
DUUE DATE: Wednesday 17 March 2021	
Complete this take home section BEFORE the inclass validation on the morning of Wednesday 17 March.	
Bring your ClassPad and this completed take home section with your working out for the validation.	
You will have access to this take home section plus an additional two pages of notes in the validation.	



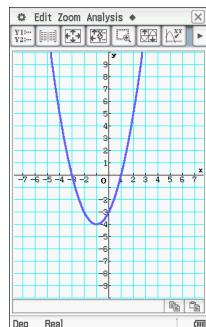
To find a linear equation using regression line (line of best fit).

- Find two or more clear points on the graph.
- (-1,4), (0,1) and (1,-2)
- Enter the co-ordinates into list 1 and list 2 in Statistics
- Calculate the Linear Regression line



Therefore line of best fit is $y = -3x + 6$, notice $r^2 = 1$, indicating a perfect fit.

Use the same methodology to find the quadratic equation for the following graph. Note a quadratic will need at least three clear points.



g) State the Reflector Dish function in terms of $f(x)$

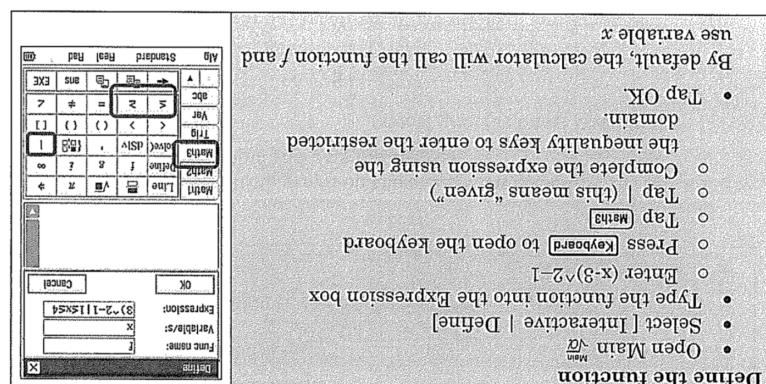
Expression	ClassPad output	By hand explanation
$f(1)$	8	$f(1) = (3-1)^2 - 1 = 2^2 - 1 = 4 - 1 = 3$
$f(2)$		
$f(3)$		
$f(4)$		
$f(5)$		
$f(6)$		
$f(7)$		
$f(8)$		
$f(9)$		
$2f(3-2)$		

1. Complete the table.

d) Calculate b to (1 decimal place)

c) Calculate a (to 4 decimal places)

Use the turning point form: $y = a(x-h)^2 - k$



Consider the function $f(x) = (x-3)^2 - 1$ with restricted domain $1 \leq x \leq 4$.

b) State the coordinate of the vertex for the Reflector Dish Function

a) State the coordinate of all intercepts.

For the function that represents the Reflector Dish, as shown on the graph on the previous page,

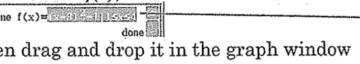
d) If $f(x) = x^2$, State the transformations required to make $f(x)$ transform into the Reflector Dish Function.

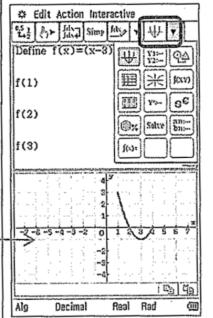
e) Calculate k to (nearest unit).

g) State the Reflector Dish function in terms of $f(x)$

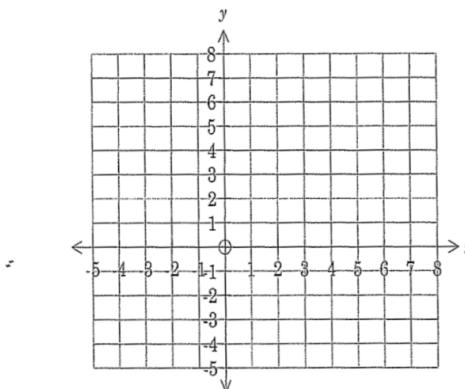
Graph the function

Bring up a graphing window

- Select from the pull down menu (if required)
- Tap
- Select [Zoom | Initialize]
- Tap back in the Main window, select the definition of $f(x)$,

- then drag and drop it in the graph window



- 2.
- a) Draw the resulting graph on the axes below, labelling the key features (i.e. turning point and axis intercepts).



- b) State the range of the function over its restricted domain.
- c) Use the graph to find the approximate solution to the equation $f(x) = 2$.
- d) Give an example of an equation involving $f(x)$ that would have:
 - i) exactly two solutions;
 - ii) no solution.

Modelling with Transformations

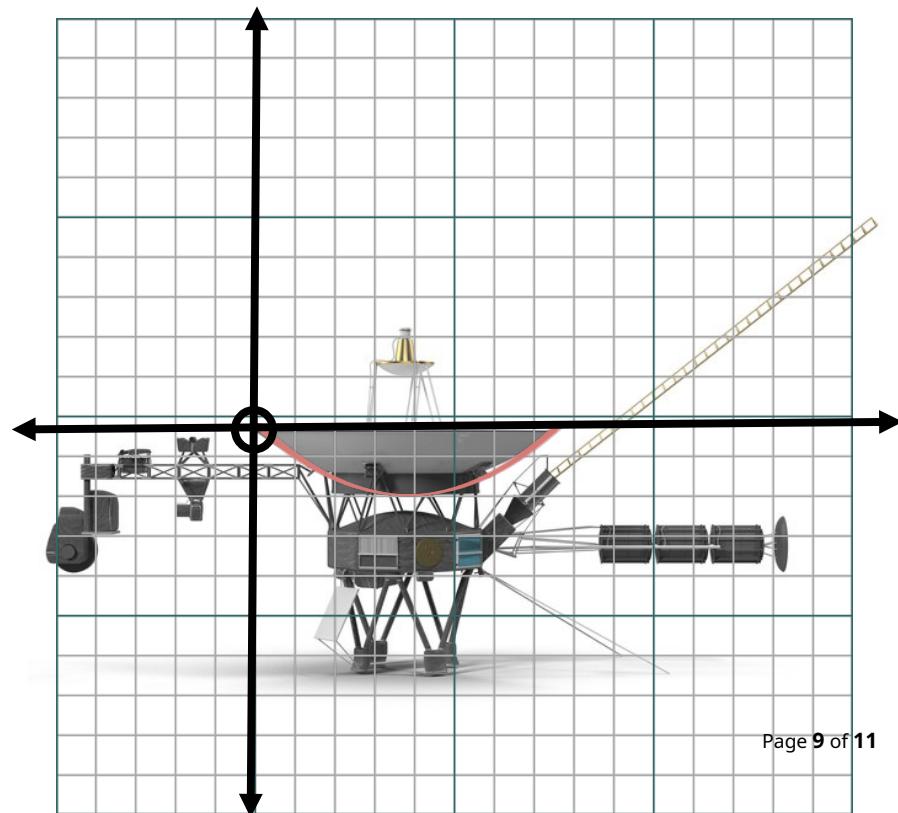
10. Using the transformations of functions we are able to model real world objects. This is useful in modern engineering to simulate and test designs before starting expensive building processes.



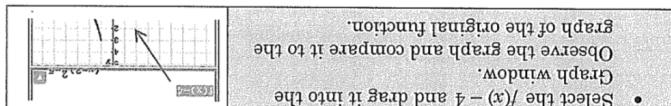
this exercise we will use the Voyager 1 spacecraft as an example. This space craft was launched by NASA in 1977 and in 2012 become the first human built object to pass Heliopause and move into interstellar space. It is expected that Voyager 1 will continue to provide scientific data until 2025.

One of the defining features of Voyager 1 is the large parabolic reflector dish mounted on it. This dish is part of the communications system and supports the extreme long range communication.

Given the parabolic dish has a diameter of 3.66 meters and depth of 0.8 meters (use these values for this exercise).



3. **Translations**
- We can easily apply transformations to the function in the Main screen using the function notation.
- a) Type $f(x) - 4$ into the Main screen and press **EXE**.
- b) Observe the graph window. Observe the graph and compare it to the graph of the original function.
- c) The domain is unchanged. Write down the range of $y = f(x) - 4$.
- d) Select the $f(x)$ and drag it into the Graph window. Observe the graph and compare it to the graph of the original function.
- e) Describe the transformation using appropriate mathematical language.
- f) Explain why the restricted domain is now $-3 \leq x \leq 0$.



- a) Write down the calculator output for $f(x) - 4$.

3.

- Type $f(x) - 4$ into the Main screen and press **EXE**

9. **Combine transformations**

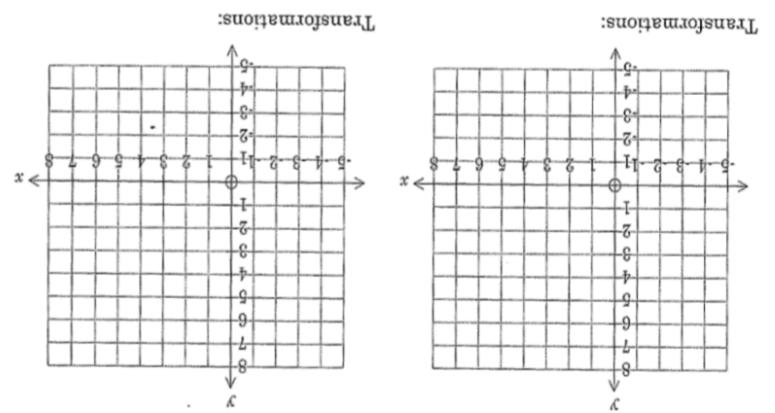
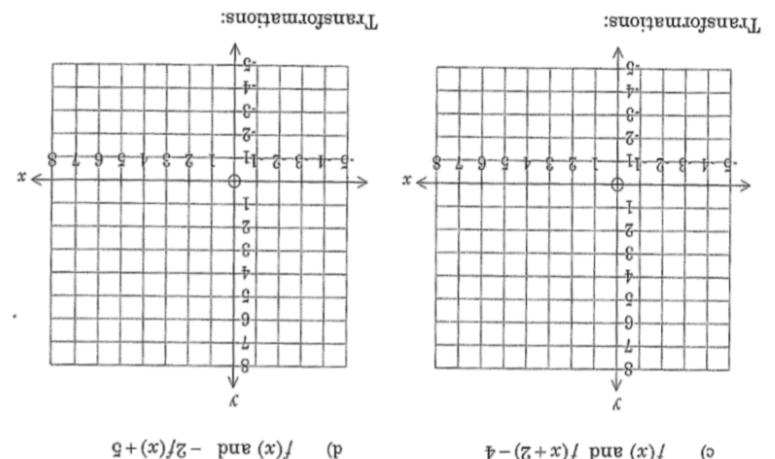
We can easily apply transformations to the function in the Main screen using the function notation.

- a) $f(x)$ and $2f(x) - 3$

- b) $f(x)$ and $f(2(x+3))$

g. Draw each pair of functions and describe the transformations required to move $f(x)$ to the second function.

9. Draw each pair of functions and describe the transformations required to move $f(x)$ to the second function.



Dilations

5. Type $2f(x)$ into the Main screen and tap [EXE].
a) Write down the calculator output for $2f(x)$.

- b) Generate the graph then describe the transformation using appropriate mathematical language.

- c) Write down the range of $y = 2f(x)$.

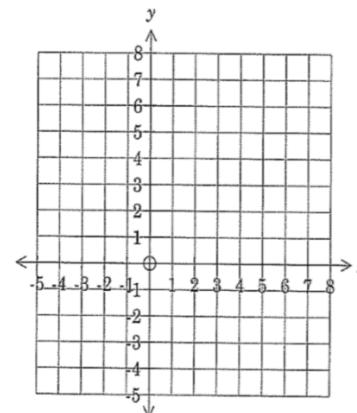
6. Type $f(2x)$ into the Main screen and tap [EXE].
a) Write down the ClassPad output for $f(2x)$.

- b) Generate the graph then describe the transformation using appropriate mathematical language.

- c) Write down the domain and explain why this should be the case.

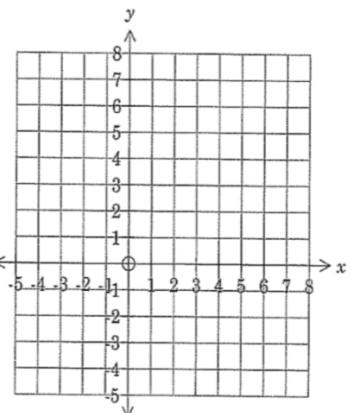
7. Graph $y = f(x)$ on the axes below.

- a) Draw, in different colours, the graphs of $y = 3 + f(x)$ and $y = f(x - 2)$. Pay particular attention to the location of the key points that you labelled in Q1.



8. Graph $y = f(x)$ on the axes below.

- a) Draw, in different colours, the graphs of $y = 2f(x)$ and $y = -f(x)$.



- b) Describe the transformations of:
i) $f(x) \rightarrow 3 + f(x)$

ii) $f(x) \rightarrow f(x - 2)$

- b) Describe the transformations of:
i) $y = f(x) \rightarrow y = 2f(x)$

ii) $y = f(x) \rightarrow y = -f(x)$