

Name: _____



Year 11 2021 Mathematics Advanced Assessment Task 2

Investigative Assignment

Task number: 2

Weighting: 30%

Due Date: Friday 18/6/2021

Outcomes assessed:

- MA11-1 Uses algebraic and graphical techniques to solve, and where appropriate, compare alternative solutions to problems
- MA11-2 Uses the concepts of functions and relations to model, analyse and solve practical problems
- MA11-8 Uses appropriate technology to investigate, organize, model and interpret information in a range of contexts
- MA11-9 Provides reasoning to support conclusions which are appropriate to the context

Nature and description of the task:

As a result of completing this Investigative Assignment, students should know and understand the basic features of the graphs of linear, quadratic, cubic, hyperbolic, polynomial and absolute value functions. They should be able to identify key points of the graphs of these functions including intercepts, turning points, asymptotes and points of inflection. They will have examined dilations including graphs of $y = cf(x)$ and $y = f(dx)$. They will also have had the opportunity to choose and use appropriate technology during the preparation of this investigation.

The Investigative Assignment will consist of two parts:

- Part 1 - Preparation Activity (value = 50% of the overall Investigative Assignment)
 - Completed at home.
 - The suggested time for the Preparation Activity is one week, although you will have 2 weeks to complete it.
 - Where indicated, all answers will need to be completed in this booklet. If you run out of space additional paper can be used and attached to this booklet.
 - The marks allocated to each question are shown next to the question. All necessary working will need to be shown and answers/responses should be correct/detailed to obtain full marks.
 - Graphing calculators/graphing technology e.g. Geogebra or DESMOS can be used during the Preparation Task.
 - **Question 3 will require you to recreate the graphs for $y = f(kx)$ on a different set of the axes.** Please do this on spare paper and attach to the back of your assignment (you can write the summary in the spaces provided)

- Part 2 - Validation Task (value = 50% of the overall Investigative Assignment)
 - To be conducted in class for a period of 90 minutes.
 - The Preparation Activity cannot be used during the Validation Task but will be handed in together with the Validation Task at the conclusion of the task.
 - Graphing calculators/graphing technology cannot be used during the Validation Task and all marks for each question will be clearly shown next to each question on the task.

Non-Completion of Task:

If you know you are going to be away on the day of the Validation Task and are unable to hand in / complete both parts of the Investigative Assignment on the due day, then you must have supportive documentation. *Zero marks will apply if the Assessment Task is submitted/completed late, unless an Illness/ Misadventure or Application for Extension form has been submitted.*

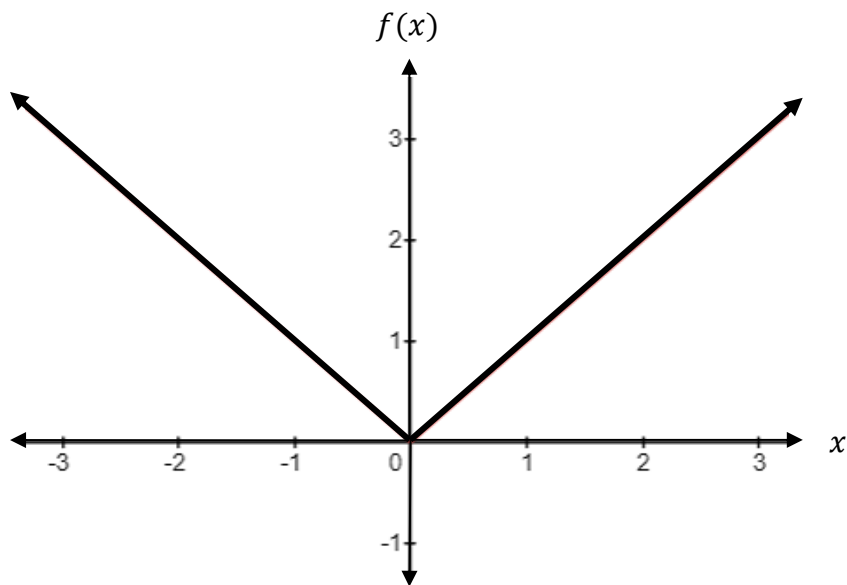
Part 1 Preparation Activity (55 Marks)

Question 1 - Investigation

(9 marks)

The function $f(x) = |x|$ is pictured below. For values such that $-3 \leq x \leq 3$, the function is presented in tabular and graphic form below.

x	-3	-2	-1	0	1	2	3
$f(x)$	3	2	1	0	1	2	3



On the next page, you are going to complete a series of graphs to investigate the transformations for $f(x) = a|x - h| + k$.

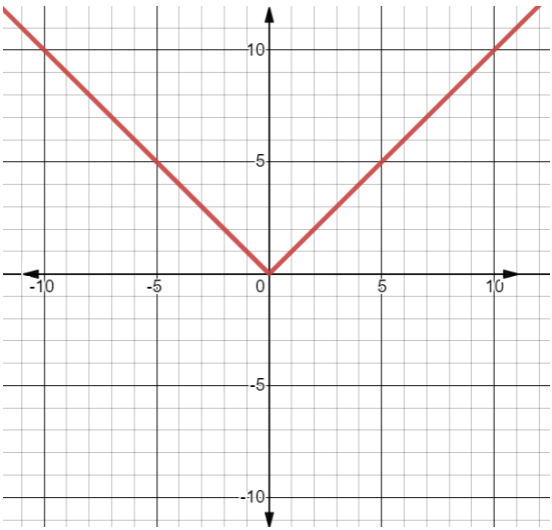
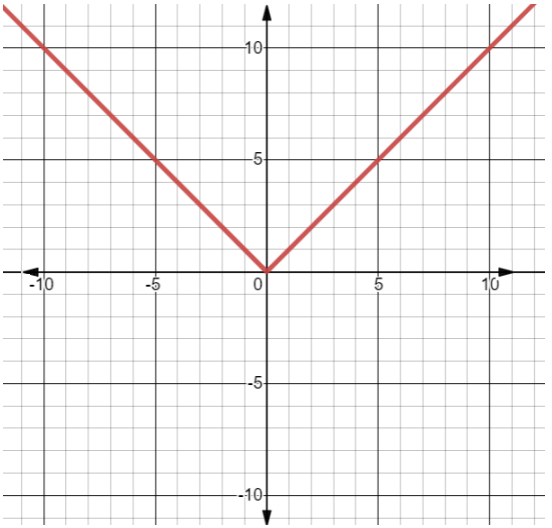
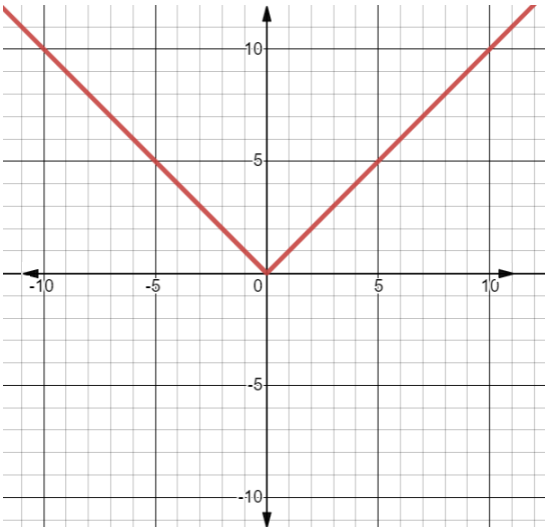
You will summarise your results in the table provided on the next page by

- (a) sketching the transformation **on the axes provided**. (3 marks)
- (b) describing the transformation that has occurred in relation to the values of a , h and k (6 marks)

Note:

- Sketches should be accurate and include key points e.g. intercepts
- Comment on the effects that a , h and k have on the positioning of the graph (in terms of translations, dilations and reflections).

SUMMARY CHART

Value Change	Transformation	Change to Graph
$a = -2$		
$a = \frac{1}{2}$ and $h = 2$		
$h = -3$ and $k = -3$		

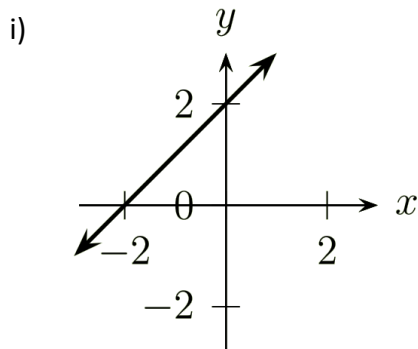
Question 2 – Topic Recap (Show all working)

(22 marks)

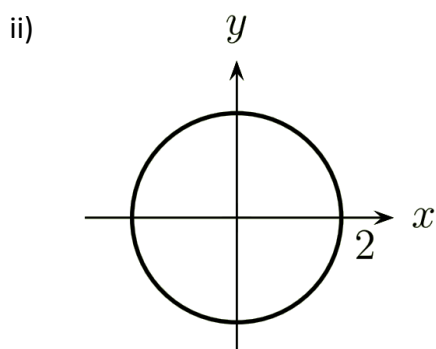
(a) State whether the following are functions or relations (**circle the correct option for each**)

Classify the type of relation (i.e. one-to-one etc).

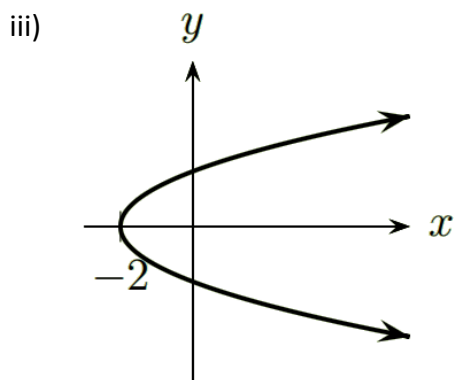
(6 marks)



- Function/relation
- Type:
- Domain:
- Range:



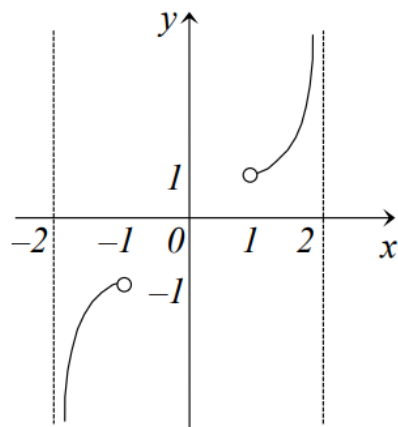
- Function/relation
- Type:
- Domain:
- Range:



- Function/relation
- Type:
- Domain:
- Range:

(b) Find the domain and range of the following function.

(2 marks)



(c) State whether the function $f(x) = \frac{4x}{x^2+4}$ is even, odd or neither. Prove with working. **(2 marks)**

(d) Find the range of values of k for which the expression $x^2 - 2x + (3 - 2k)$ is always positive. **(2 marks)**

(e) Fred has made an electrical circuit in which the current varies inversely with the resistance. When the resistance is 10 units, the current is 8.6 units. What is the current when the resistance is 12 units? **(2 marks)**

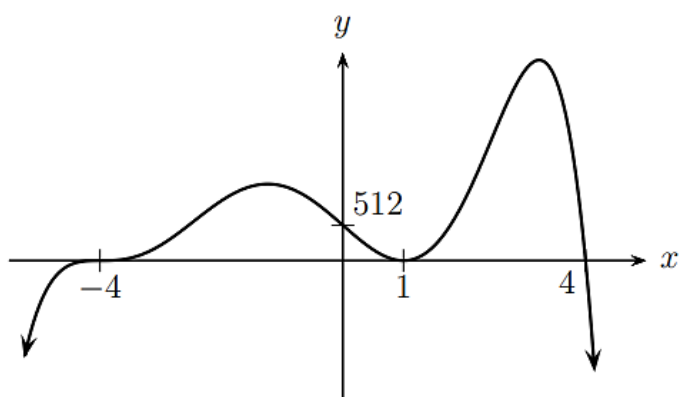
(f) Hussein finds that for a certain species of fish the mass of a fish is directly proportional to the cube of the length of the fish. For this species, if a fish of length 25 cm has a mass of 870 g, what is the length of a fish that has a mass of 1.3 kg? **(2 marks)**

(g) Sketch the graph $y = x^3 + 2x^2 - x - 2$, labelling all intercepts.

(3 marks)

(h) Write down the equation of the lowest degree for the polynomial pictured below:

(3 marks)



Question 3 - Investigation

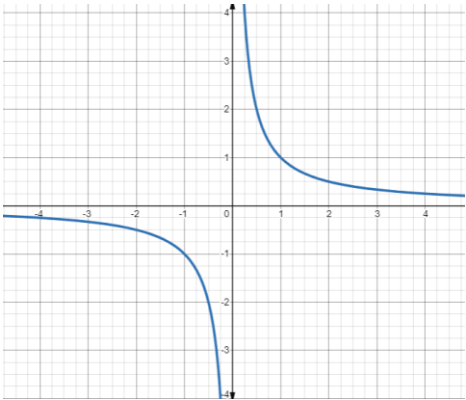
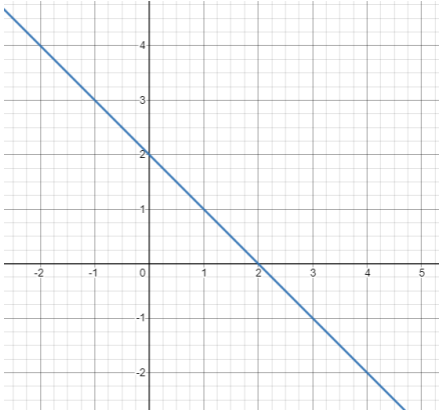
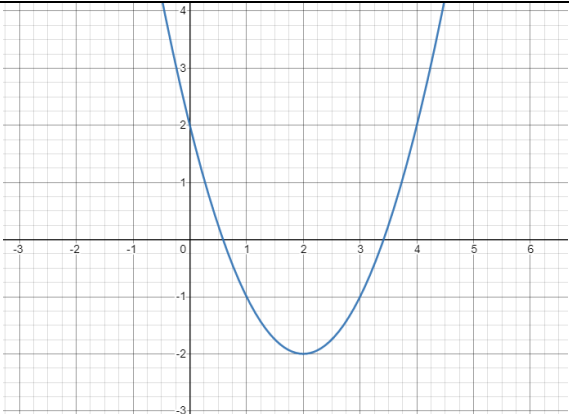
(24 marks)

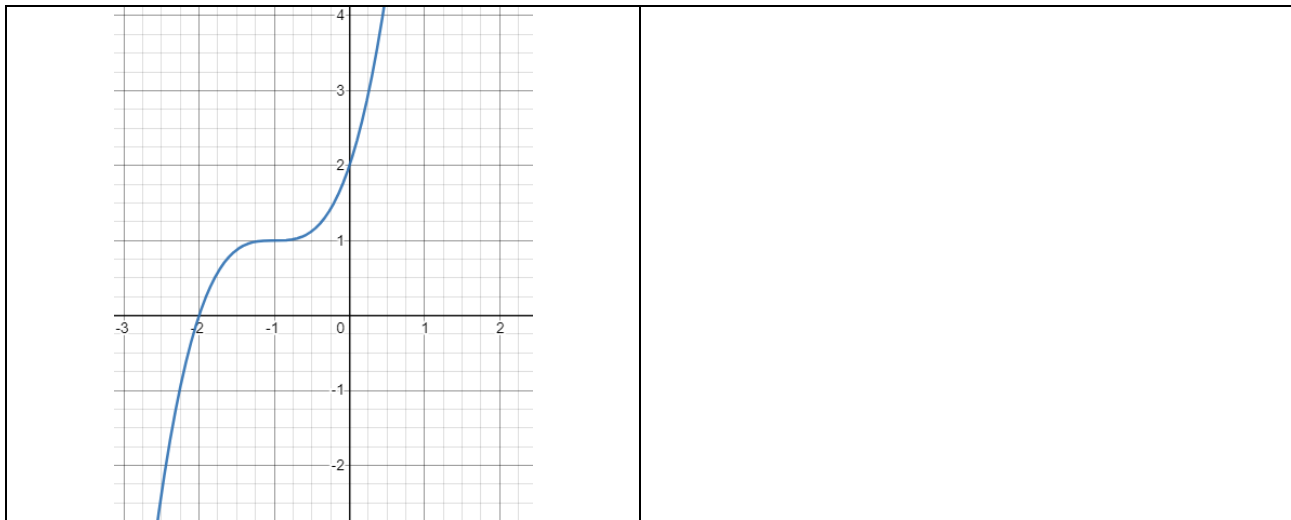
You are to investigate the transformation $y = f(kx)$ for each of the functions below:

- $f(x) = \frac{1}{x}$
- $f(x) = (x - 2)^2 - 2$
- $f(x) = 2 - x$
- $f(x) = (x + 1)^3 + 1$

(a) Consider a value of k such that $k > 1$:

- **Sketch** $y = f(kx)$ for each function where $y = f(x)$ is located. (This is to be done on separate paper and attached to your assignment) (4 marks)
- **Summarise** the effect of k on the graphs and on key points on the graphs (4 marks)

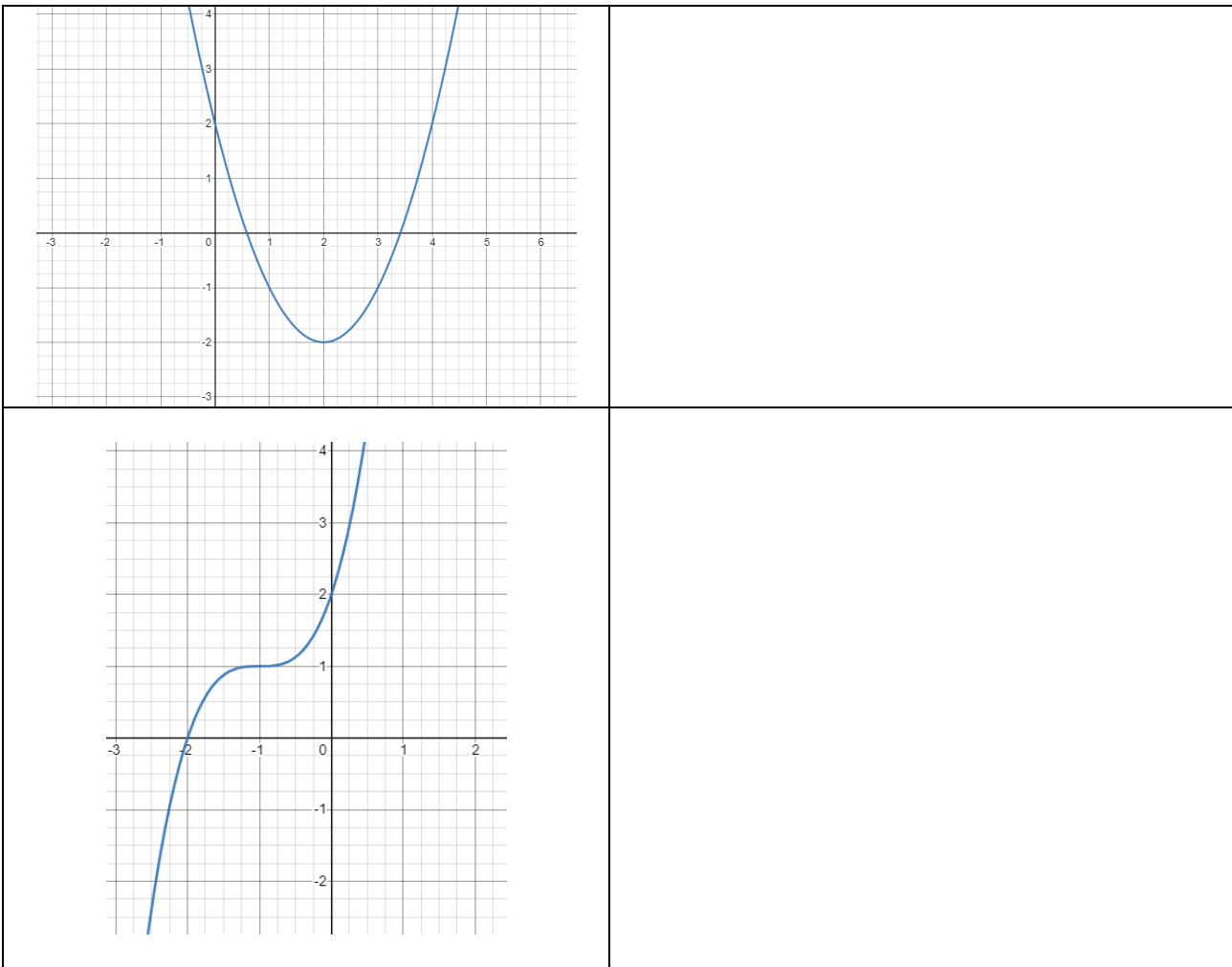
Sketch transformed function: $k > 1$	Summary of the effect of k
	
	
	



(b) Consider a value of k such that $0 < k < 1$.

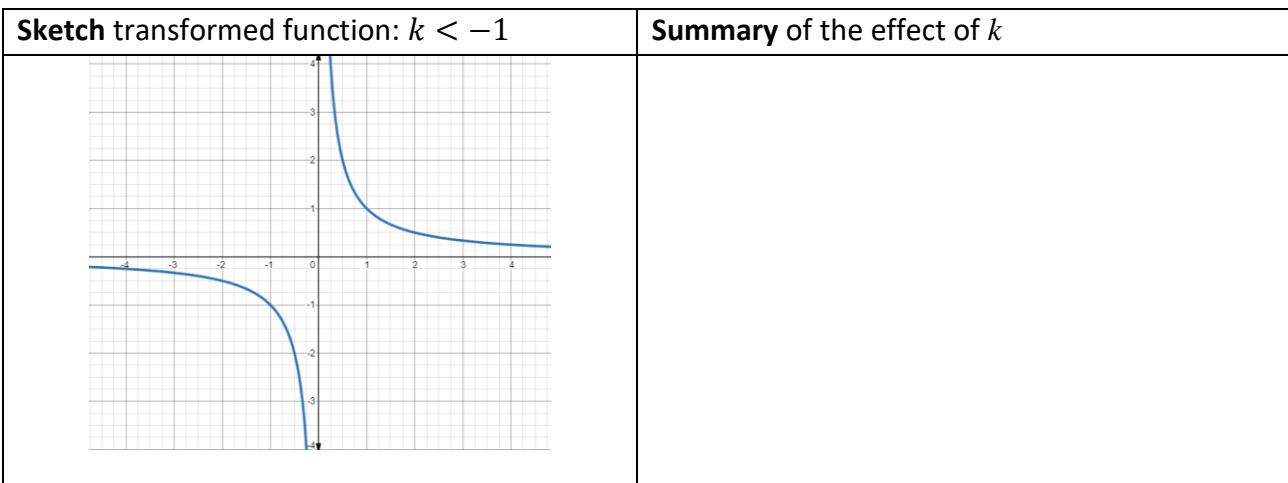
- **Sketch** $y = f(kx)$ for each function where $y = f(x)$ is located. (This is to be done on separate paper and attached to your assignment) **(4 marks)**
- **Summarise** the effect of k on the graphs and on key points on the graphs. **(4 marks)**
 - $f(x) = \frac{1}{x}$
 - $f(x) = (x - 2)^2 - 2$
 - $f(x) = 2 - x$
 - $f(x) = (x + 1)^3 + 1$

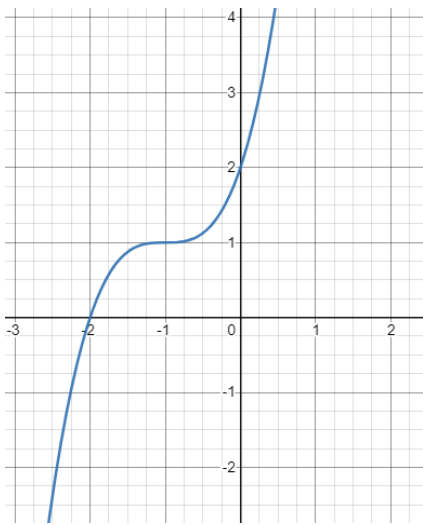
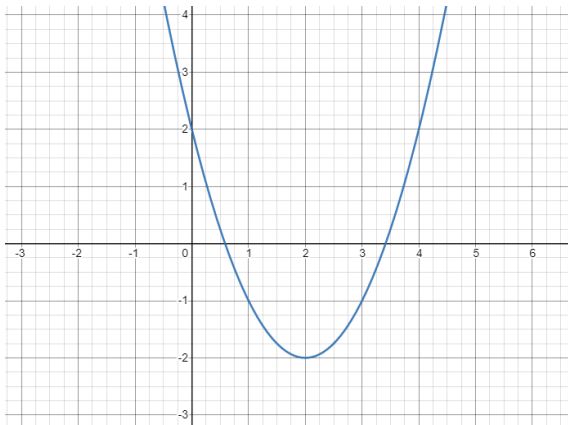
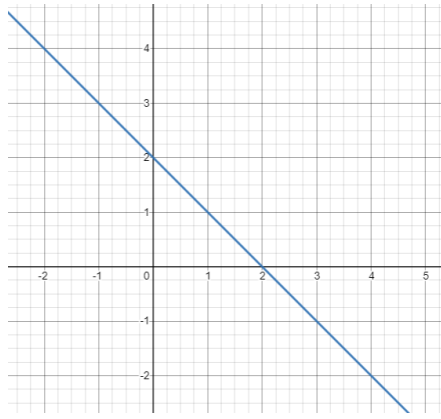
Sketch transformed function: $0 < k < 1$	Summary of the effect of k



(c) Consider a value of k such that $k < -1$

- **Sketch** $y = f(kx)$ for each function where $y = f(x)$ is located. (This is to be done on separate paper and attached to your assignment) **(4 marks)**
- **Summarise** the effect of k on the graphs and on key points on the graphs. **(4 marks)**
 - $f(x) = \frac{1}{x}$
 - $f(x) = 2 - x$
 - $f(x) = (x - 2)^2 - 2$
 - $f(x) = (x + 1)^3 + 1$





End of Preparation Activity