International College

MATHEMATICS AND SCIENCE DEPARTMENT

SEMESTER 1, 2022
Year 11 Mathematics Methods ATAR

INVESTIGATION 1

Name [redacted] Date 23/3/2022 40

60 minutes Total marks: 50

In-class validation

Graphs and Transformations

Time allowed for this task: Up to 60 minutes, in-class, under test conditions

Materials required: Standard writing equipment

Other materials allowed: Drawing templates, page of notes with writing on one side
Calculators are **not** permitted

Marks available: **50 marks**

Question 1 **(13 marks)**

(a) **Describe the transformation(s) required to change**

(i) $y=-2x$ to $y=-2(x+1)$ **(1 mark)**

translation to the left by 1 unit ✓ (1)

(ii) $y=(x+1)^2$ to $y=(x-2)^2$ **(1 mark)**

translation to the right by 3 unit ✓ (1)

(iii) $y=-2x$ to $y=2x-4$. **(2 marks)**

- reflect on x axis ✓ (1)
- translation 4 units down ✓ (1)

(b) **Describe the transformation of each of these functions for the given changes to k ($k>0$).**

	Functions	k is doubled	k is multiplied by -1
(i)	$y=kx$	$y=2kx$ be steeper when k is doubled ✓ (1)	$y=-kx$ reflect on the x axis ✓ (1) (3 marks)
(ii)	$y=2x+k$	$y=2x+2k$ move up by $2k$ units ✓ (1)	$y=2x-k$ move down by k units ✓ (1) (3 marks)
(iii)	$y=-4(x-k)+1$	$y=-4(x-2k)+1$ move right by $2k$ units ✓ (1)	$y=-4(x+k)+1$ will be move to the left by $-k$ units ✓ (1) (3 marks)

Question 6 **(8 marks)**

Complete the tables provided by entering the missing data.

(a) **Identify the line of symmetry and the x-intercept for the transformed function.** **(2 marks)**

	Original function $y=x^2$	Transformed function $y=(x+p)^2$
Line of symmetry	$x=0$	$x=-p$ ✓ (1)
x-intercept	(0, 0)	(-p, 0) ✓ (1)

(b) **Identify the turning point and the line of symmetry for the transformed function.** **(2 marks)**

	Original function $y=-k(x-a)^2+12$	Transformed function $y=-k(x-a)^2+3$ down 9
Turning point	(a, 12)	(a, 3) ✓ (1) 12 − 3 = 9
Line of symmetry	$x=a$	$x=a$ ✓ (1)

(c) **For any general point (a, b) on the original function, name the corresponding point on the transformed function.** **(2 marks)**

	Original function $y=-(x-2)^3+4$	Transformed function $y=-(x+2)^3-1$
Point	(a, b)	(a+4, b−5) ✓ (1)

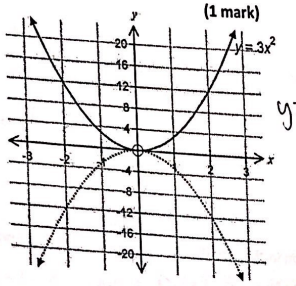
(d) **For any general point (a, b) on the transformed function, name the corresponding point on the original function.** **(2 marks)**

Variables p, m, k and w are positive	Original function $y=(x+p)^2+m$	Transformed function $y=-(x-k)^2-w$
Point	(−a, b−(a+m))	(a, b)

Question 5 (5 marks)

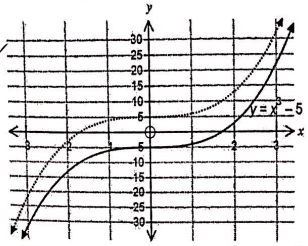
State the equations of the graphs formed by the transformations of the given functions.

(a) (1 mark)



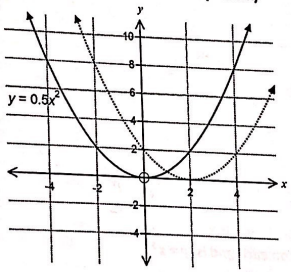
$y=-3x^2$

(b) (1 mark)



$y=x^3+5$

(c) (1 mark)



$y=0.5(x-2)^2$

(a)	(b)	(c)
$y=-3x^2$ ✓ ①	$y=x^3+5$ ①	$y=0.5(x-2)^2$ ✓ ①

$y=(x+2)^3+3$

(d) The graph of $y=(x+2)^3+3$ is reflected in the x-axis and then translated vertically down by 5 units. (2 marks)

$y=$

$y=-(x+2)^3-2$ ① ②

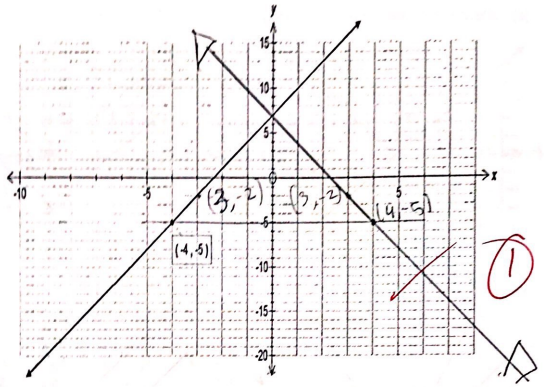
Question 2 (8 marks)

(a) The mid-point of a line segment joining the points (-2, 2) and (6, 18) is (2, 10). The linear rule for the line segment is $y=2x+6$ and the segment is translated so that the rule becomes $y=2x+10$. State the coordinates of the new mid-point. (2 marks)

6 units up

(2, 14) ②

(b) The mid-point of a line segment with the general equation $y=3x+7$ is (-4, -5) as shown on the diagram below.



①

$y=mx+c$
$-2=m3+7$
$-5=m4+7$
$-9=3m$
$m=-3$
$-12=m4$
$m=-3$

(i) Reflect the line over the y-axis and draw the result. (1 mark)

ok

(ii) State the equation of the transformed line. (1 mark)

$y=-3x+7$ ①

(ii) State the mid-point of the transformed segment. (2 marks)

$(y=5)$ ✓ ②

(c) A line segment with the general equation $y=mx+b$ was translated so that the new rule is $y=m(x+a)+b$, $a>0$ and the new mid-point is (x, y). What was the mid-point originally? (2 marks)

left a units
up b units

$(x+a, y-5)$ ①

$y=-3\times(5)-7$
$y=-15-7$
$y=-3x-3$
$y=y-7$

$y=-3\times4-7$
$y=-12-7$

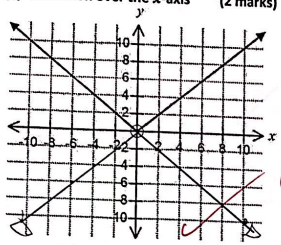
$y=-3\times4+7$
$y=-12+7$
$y=5$

$y=-3\times(x)-7$
$y=-3x-7$
$y=19+7$

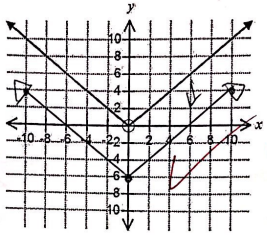
Question 3 **(10 marks)**

You are provided with graphs of the function $y=|x|$ on each grid. Draw the resulting graphs for the transformations given.

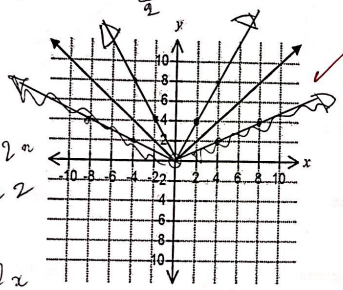
(a) reflection over the x-axis (2 marks)



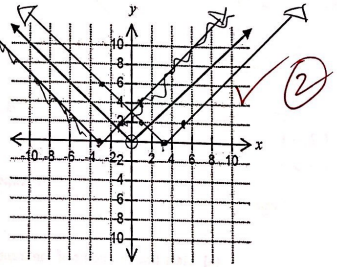
(b) translation 6 units down (2 marks)



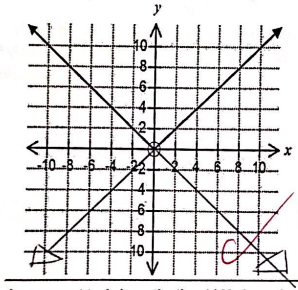
(c) $y=2|x|$ (1 mark)



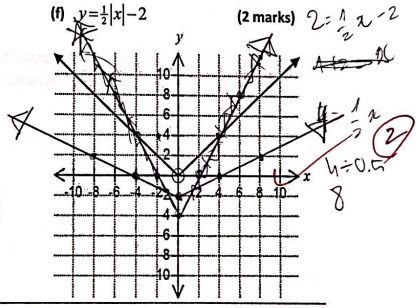
(d) $y=|x-3|$ (2 marks)



(e) $y=-|x|$ (1 mark)



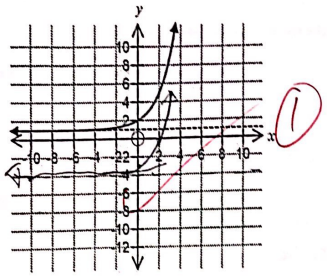
(f) $y=\frac{1}{2}|x|-2$ (2 marks)



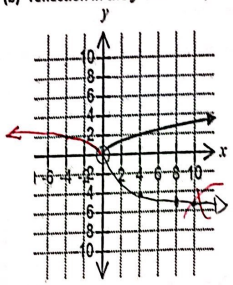
Question 4 **(6 marks)**

Draw graphs to represent the transformations described.

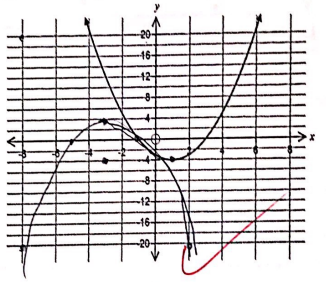
(a) vertical translation by 5 units down (1 mark)



(b) reflection in the y-axis (1 mark)

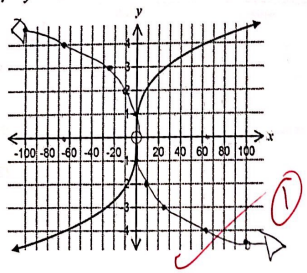


(c) translation left by 4 units followed by a reflection in the x-axis (2 marks)



(d) the graph already drawn on each grid is $y=x^{\frac{1}{3}}$ (2 marks)

(i) $y=-x^{\frac{1}{3}}$



(ii) $y=(x-20)^{\frac{1}{3}}$