

HORNSBY GIRLS HIGH SCHOOL

Mathematics Extension

Year 11, Assessment 1 –Assignment
Validation Task 2023

General Instructions

- Working time – 30 minutes
- Answer the questions in the spaces provided
- Write using black pen, pencil may be used for graphs.
- Calculators approved by NESA may be used
- Show relevant mathematical reasoning and/ or calculations

Total Marks – 20 for Extension

Part A - Algebraic Techniques
(6 marks)

Part B – Functions
(14 marks)

Part	A	B	Total
Total	/6	/14	/20

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Part A – Mathematics Extension, Algebraic Techniques (6 marks)

Question 1 (2 Marks)

Factorise $8x^3 + 125$

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Question 2 (2 Marks)

Expand $(x - y)^6$

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Question 3 (2 Marks)

Given $f(x + 1) = x^2 + 2x$, find $f(x)$.

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Part B – Mathematics Extension, Functions (14 marks)

Question 4 (4 Marks)

Consider the circle $x^2 + 4x + y^2 - 2y - 4 = 0$

- i) By completing the square, write the equation in factored form and state the centre and radius of the circle.

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- ii) Find the equation of the upper semi-circle.

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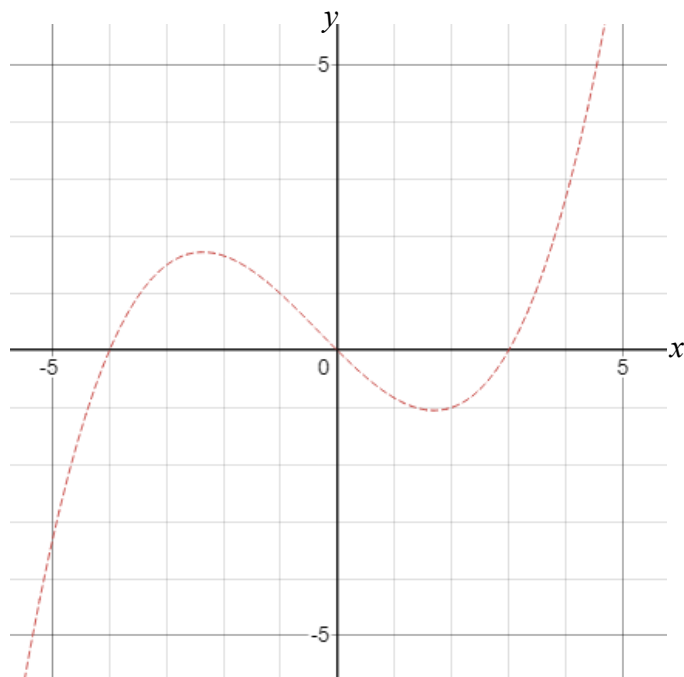
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Question 5 – Mathematics Extension (10 marks)

- (a) (i) Given the graph of $y = f(x)$ below, sketch $y = |f(x)|$ on the same axes.

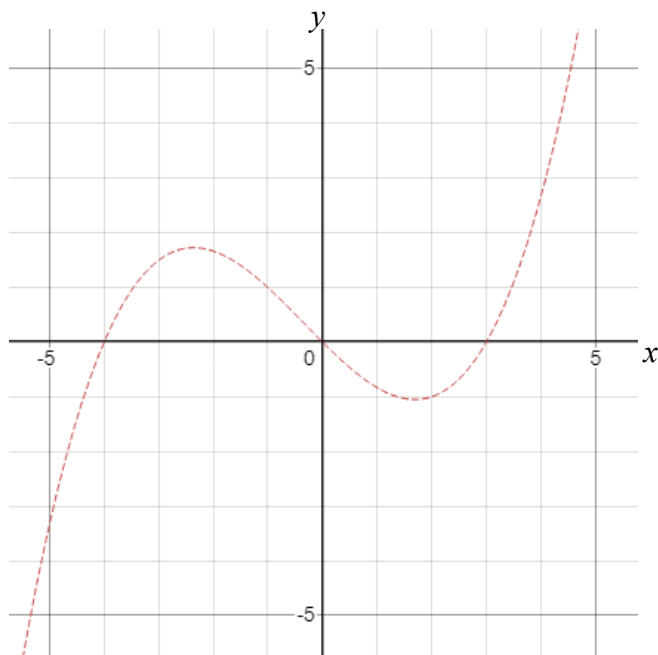
The turning points of $y = f(x)$ are approximately $(-2.4, 1.7)$ and $(1.7, -1)$.



1

- (ii) Given the graph of $y = f(x)$ below, sketch $y = f(|x|)$ on the same axes.

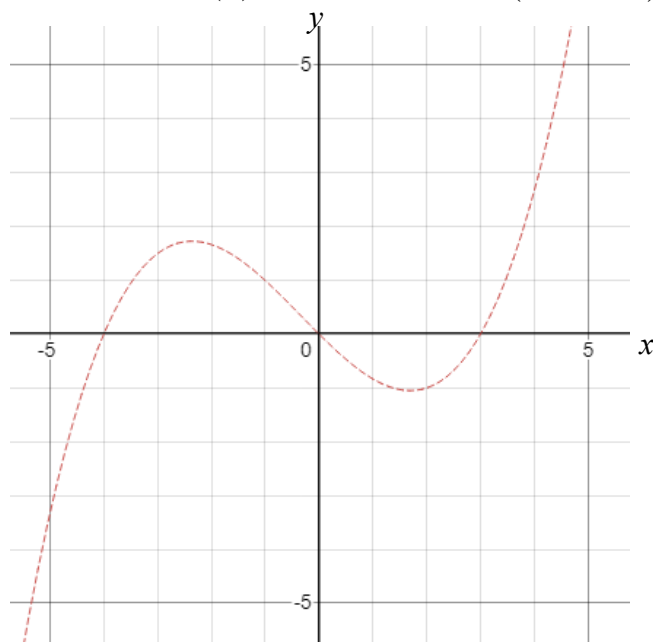
The turning points of $y = f(x)$ are approximately $(-2.4, 1.7)$ and $(1.7, -1)$.



1

- (iii) Given the graph of $y = f(x)$ below, sketch $y = \frac{1}{f(x)}$ on the same axes.

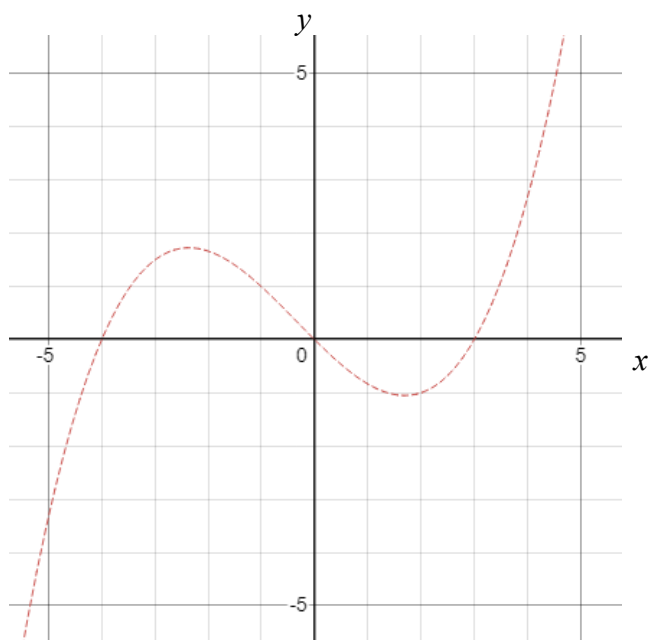
The turning points of $y = f(x)$ are approximately $(-2.4, 1.7)$ and $(1.7, -1)$.



2

- (iv) Given the graph of $y = f(x)$ below, sketch $y = \pm\sqrt{f(x)}$ on the same axes.

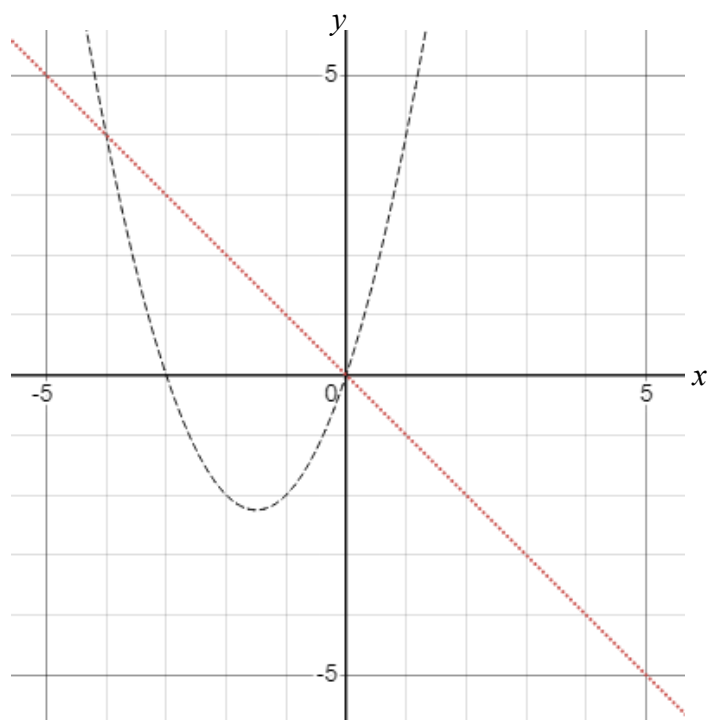
The turning points of $y = f(x)$ are approximately $(-2.4, 1.7)$ and $(1.7, -1)$.



2

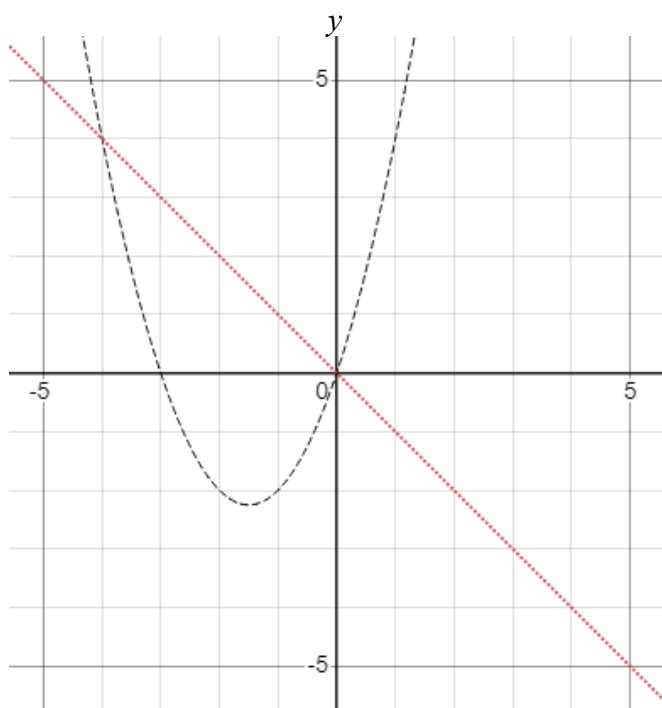
(b) Given $f(x) = x(x+3)$ and $g(x) = -x$

(i) Sketch $y = f(x) + g(x)$.



2

(ii) Sketch $y = f(x) \times g(x)$.



2

End of Extension Validation Task

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Part A - Algebraic Techniques
(6 marks)

Part B – Functions
(14 marks)

Part	A	B	Total
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Part A – Mathematics Extension, Algebraic Techniques (6 marks)

Question 1 (2 Marks)

Factorise $8x^3 + 125$

$(2x+5)(4x^2 - 10x + 25)$ Some errors giving $20x$

Lots of errors with the operation symbols

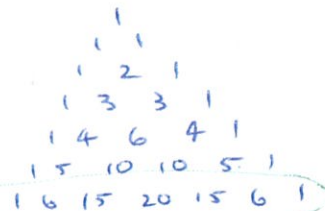
Learn the formula $(a^3 \pm b^3) = (a \pm b)(a^2 \mp ab + b^2)$

↑ same as Q ↑ opposite to Q ← NOT $2ab$

2

Question 2 (2 Marks)

Expand $(x-y)^6$



$x^6 - 6x^5y + 15x^4y^2 - 20x^3y^3 + 15x^2y^4 - 6xy^5 + y^6$

Needed correct - powers of x and y

- coefficients

- operation symbols

2

There were some students who did not attempt to use Pascal's Triangle coefficients. They had little success. Some students knew to use Pascal's Triangle coefficients but could not apply it properly.

Question 3 (2 Marks)

Given $f(x+1) = x^2 + 2x$, find $f(x)$.

$f(x) = (x-1)^2 + 2(x-1)$ ✓
 $= x^2 - 2x + 1 + 2x - 2$
 $= x^2 - 1$

OR

$f(x+1) = x^2 + 2x$
 $= x^2 + 2x + 1 - 1$
 $f(x+1) = (x+1)^2 - 1$

This method is more efficient

$\therefore f(x) = x^2 - 1$

was used by most students and

was quite well done.

2

A common error was

$f(x) = (x-1)^2 - 2(x-1)$
 Error should be +

or

$(x-1)^2 + 2$

or

$(x-1)^2 + 2x$

Part B – Mathematics Extension, Functions (14 marks)

Question 4 (4 Marks)

Consider the circle $x^2 + 4x + y^2 - 2y - 4 = 0$

- i) By completing the square, write the equation in factored form and state the centre and radius of the circle.

$$x^2 + 4x + 4 + y^2 - 2y + 1 = 4 + 5$$

$$(x+2)^2 + (y-1)^2 = 9$$

centre $(-2, 1)$, radius 3 units

2

- ii) Find the equation of the upper semi-circle.

$$(y-1)^2 = 9 - (x+2)^2$$

$$y-1 = \pm \sqrt{9 - (x+2)^2}$$

$$y = 1 \pm \sqrt{9 - (x+2)^2}$$

the upper semi-circle has equation

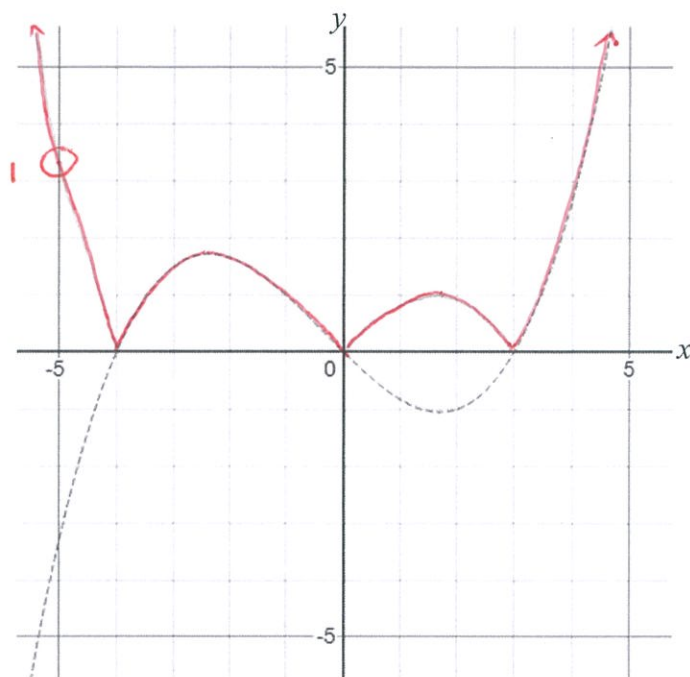
$$y = 1 + \sqrt{9 - (x+2)^2}$$

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Question 5 – Mathematics Extension (10 marks)

- (a) (i) Given the graph of $y = f(x)$ below, sketch $y = |f(x)|$ on the same axes.

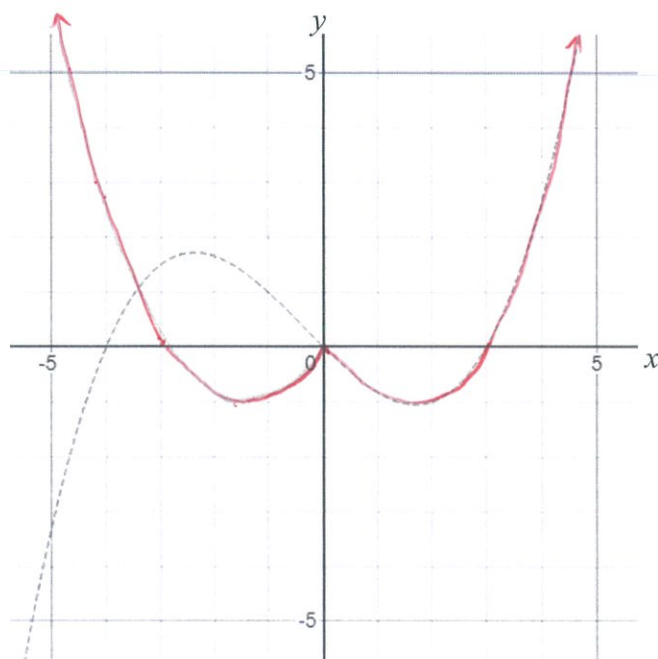
The turning points of $y = f(x)$ are approximately $(-2.4, 1.7)$ and $(1.7, -1)$.



① Mostly well done. Just like students to pay attention to the fact that it is a reflection over the x -axis, that the y value of $x = -5$ reflected should be as closely resemble that of the original graph.

- (ii) Given the graph of $y = f(x)$ below, sketch $y = f(|x|)$ on the same axes.

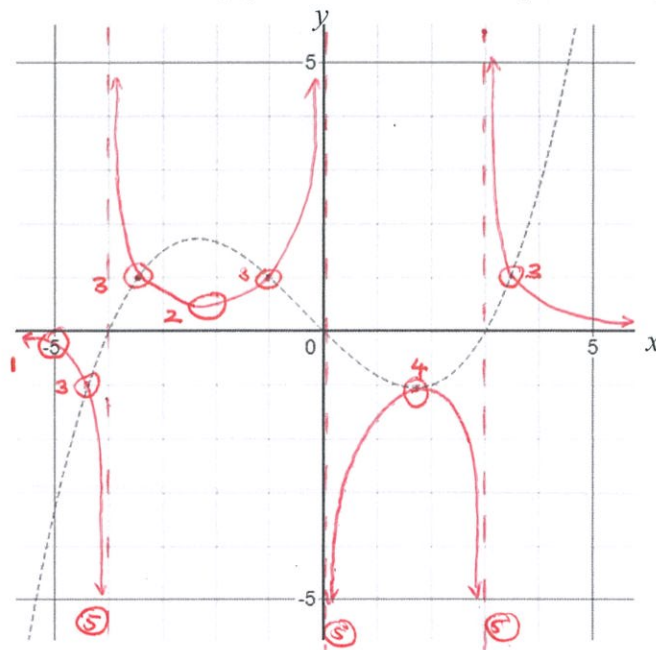
The turning points of $y = f(x)$ are approximately $(-2.4, 1.7)$ and $(1.7, -1)$.



mostly done well.

- (iii) Given the graph of $y = f(x)$ below, sketch $y = \frac{1}{f(x)}$ on the same axes.

The turning points of $y = f(x)$ are approximately $(-2.4, 1.7)$ and $(1.7, -1)$.

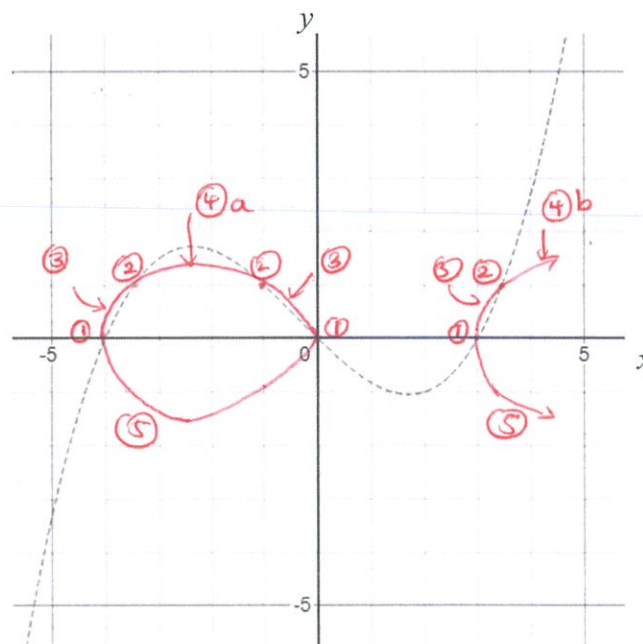


Key features:

- ① the y-intercept is a key feature. A few student did not pay attention to where it should be.
- ② Student should use the calculator to find $\frac{1}{1.7} \approx 0.6$. A few student had that turning point much lower.
- ③ Many did this well and careful that the reciprocal graph intersect exact at these point
- ④ A few student had the turning point $y \geq -1$.
- ⑤ Mostly indicated these asymptotes clearly

- (iv) Given the graph of $y = f(x)$ below, sketch $y = \pm\sqrt{f(x)}$ on the same axes.

The turning points of $y = f(x)$ are approximately $(-2.4, 1.7)$ and $(1.7, -1)$.

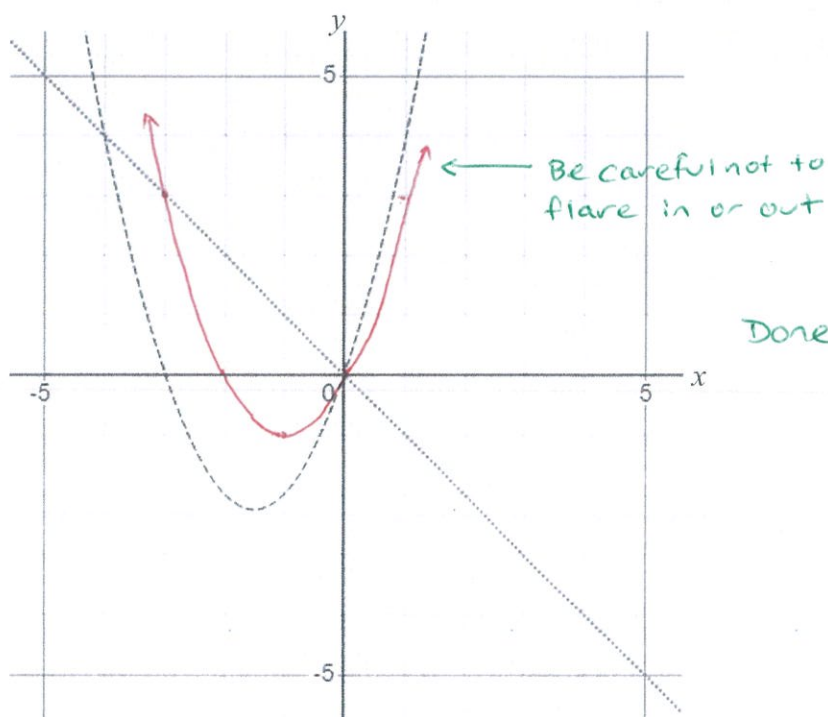


Key features:

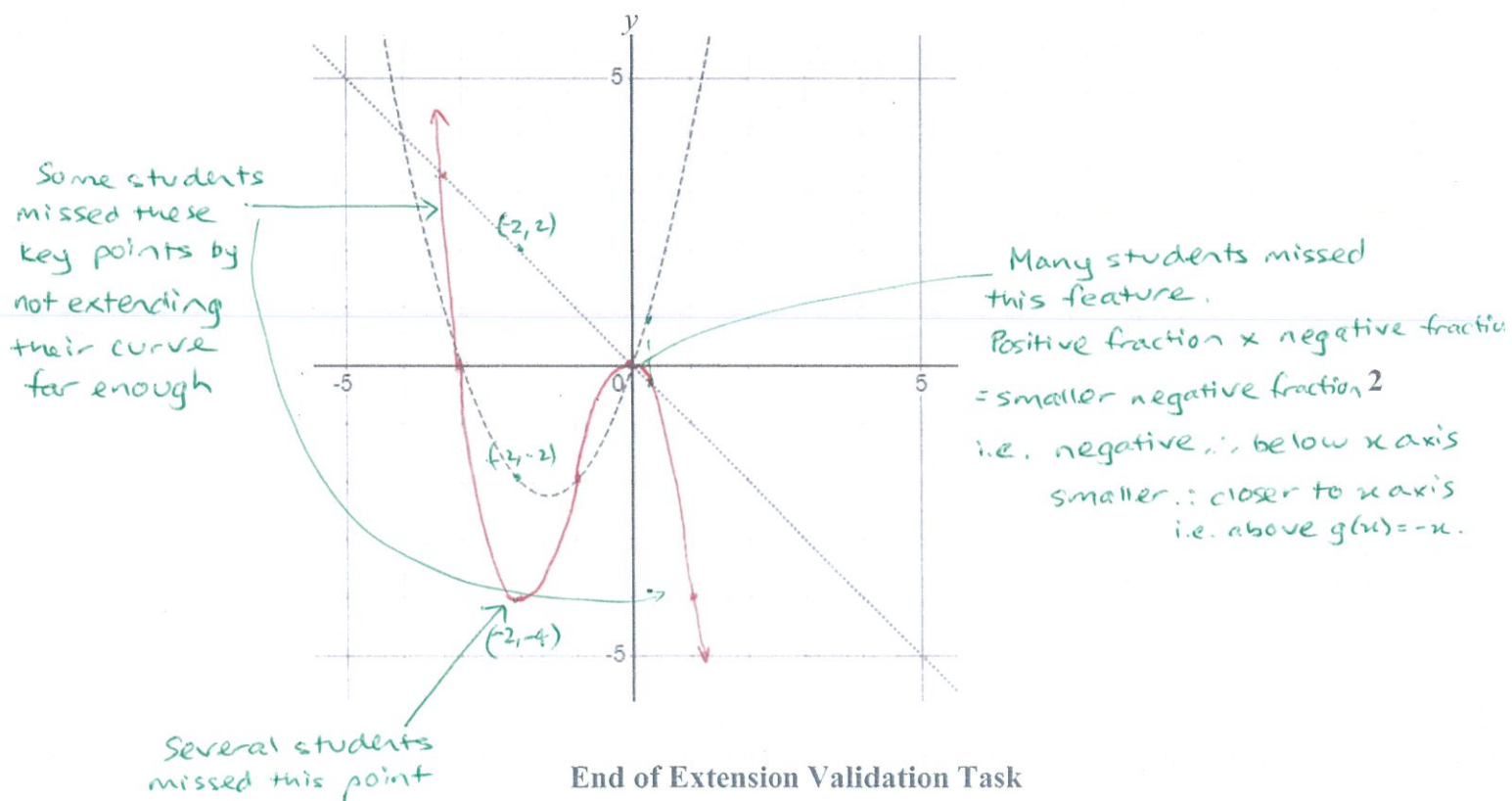
- ① Mostly done well
- ② Mostly done well
- ③ Shapes mostly done well. A few students instead of "puff out" features, had "dented in" features. Lack of conceptual knowledge
- ④a Mostly done well
- ④b A few students had the y values much higher, therefore had the curves "flared" out
- ⑤ A few students forget to sketch $y = -\sqrt{f(x)}$

(b) Given $f(x) = x(x+3)$ and $g(x) = -x$

(i) Sketch $y = f(x) + g(x)$.



(ii) Sketch $y = f(x) \times g(x)$.



End of Extension Validation Task