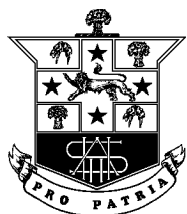


STUDENT NAME: _____

TEACHER: _____



HURLSTONE
AGRICULTURAL
HIGH
SCHOOL

2022

Year 11
Task 1

Mathematics Advanced

Examiners

- Ms L. Yuen, Mr. G. Rawson, Ms. D. Crancher and Ms P. Biczio

**General
Instructions**

- Reading time – 3 minutes
- Working time – 60 minutes
- Write using black pen
- NESA-approved calculator may be used
- A Reference sheet is provided
- In Questions 11 – 14, show relevant mathematical reasoning and/or calculations

**Total marks:
40****Section I – 10 marks**

- Attempt Questions 1 – 10
- Allow about 15 minutes for this section

Section II – 30 marks

- Attempt Questions 11 – 14
- Allow about 45 minutes for this section

SECTION I

10 marks

Attempt Questions 1 – 10

Allow about 15 minutes for this section.

Use the multiple-choice answer sheet for Questions 1 – 10.

Question 1

Which of the following is the fully simplified expression for $(4x + y)^2 - (4x - y)^2$?

- A. 0
- B. $2y^2$
- C. $8xy$
- D. $16xy$

Question 2

Which of the following gives the factorisation of $3t^2 - 5t - 2$?

- A. $(3t + 2)(t - 1)$
- B. $(3t - 2)(t + 1)$
- C. $(3t + 1)(t - 2)$
- D. $(3t - 1)(t + 2)$

Question 3

Which of the following is the simplest form of $2\sqrt{48} - \sqrt{108}$?

- A. $\sqrt{3}$
- B. $2\sqrt{3}$
- C. $3\sqrt{3}$
- D. $4\sqrt{3}$

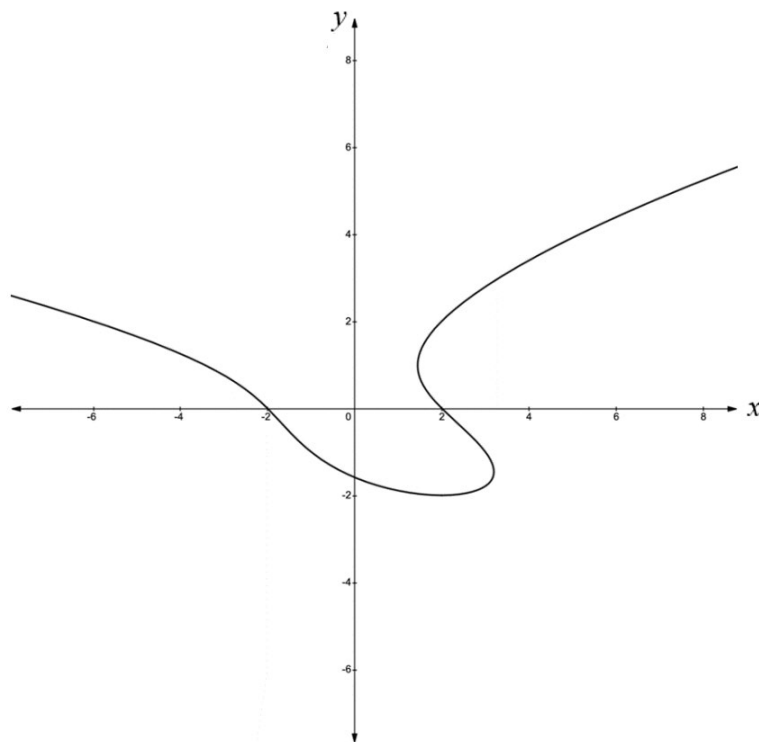
Question 4

What is the domain of the function $f(x) = \sqrt{1-x^2}$?

- A. $(0, 1)$
- B. $[0, 1]$
- C. $(-1, 1)$
- D. $[-1, 1]$

Question 5

Below is a graph of $x^2 + 2xy - y^3 = 4$



What type of relation is this?

- A. one-to-one
- B. one-to many
- C. many-to-one
- D. many-to-many

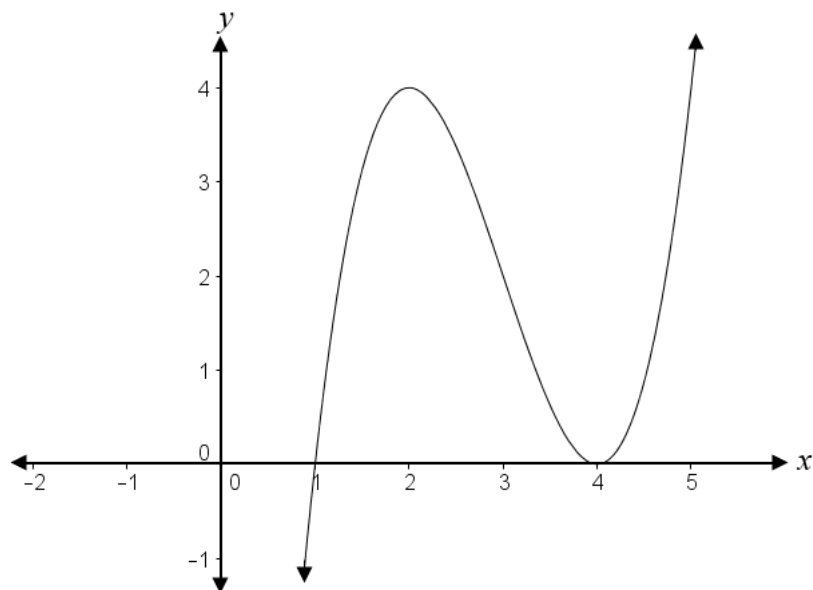
Question 6

Which point represents the vertex of the parabola $y = (x - 1)^2 + 6$?

- A. $(1, 6)$
- B. $(-1, 6)$
- C. $(6, 1)$
- D. $(-6, 1)$

Question 7

Which of the following could be the equation of the cubic function shown below?



- A. $y = x(x - 4)(x + 1)$
- B. $y = (x - 4)^2(x - 1)$
- C. $y = (x + 4)^2(x + 1)^2$
- D. $y = (x - 1)^2(x + 4)$

Question 8

Which of the following coordinates is the centre of the circle $x^2 + 8x + y^2 - 4y - 5 = 0$?

- A. $(4, 2)$
- B. $(-4, 2)$
- C. $(-4, -2)$
- D. $(4, -2)$

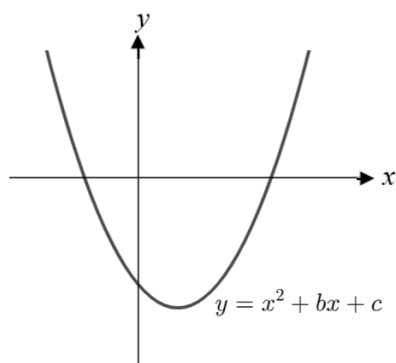
Question 9

Which of the following is the domain of the function $xy = 4$?

- A. $(-\infty, \infty)$
- B. $[-\infty, \infty]$
- C. $(-\infty, 0) \cup (0, \infty)$
- D. $(-\infty, 0) \cap (0, \infty)$

Question 10

The figure below shows the graph of $y = x^2 + bx + c$.
Which of the following is true?



- A. $b < 0$ and $c < 0$
- B. $b < 0$ and $c > 0$
- C. $b > 0$ and $c < 0$
- D. $b > 0$ and $c > 0$

End of Section I



HURLSTONE
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Mathematics Advanced
MULTIPLE CHOICE ANSWER SHEET

2022 Y11 Task 1

Student Name _____

Teacher _____

Select the letter A, B, C or D that best answers the question. Fill in the response oval completely.

Sample $3 + 5 =$ (A) 7 (B) 8 (C) 9 (D) 10

A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☐ B ☒ C ☐ D ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word 'correct' and drawing an arrow as follows:

A ☒ B ☒ C ☐ D ☐
Correct

Question

1. A ☐ B ☐ C ☐ D ☐
2. A ☐ B ☐ C ☐ D ☐
3. A ☐ B ☐ C ☐ D ☐
4. A ☐ B ☐ C ☐ D ☐
5. A ☐ B ☐ C ☐ D ☐
6. A ☐ B ☐ C ☐ D ☐
7. A ☐ B ☐ C ☐ D ☐
8. A ☐ B ☐ C ☐ D ☐
9. A ☐ B ☐ C ☐ D ☐
10. A ☐ B ☐ C ☐ D ☐

Question	Marks
MC	/10
11	/9
12	/7
13	/7
14	/7
Total	/40

Student Name: _____

Teacher: _____



SECTION II

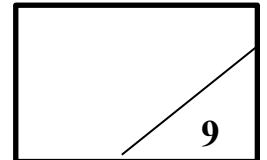
30 marks

Attempt Questions 11 – 14

Allow about 45 minutes for this section

In Questions 11 – 14, your responses should include relevant mathematical reasoning and/or calculations.

- Write your name at the top of each booklet.
- Answer questions in the space provided.
- Extra writing paper is provided. If you use extra writing paper, clearly indicate which part of the question you are answering.



Question 11

Marks

(a) Simplify $\frac{x}{x^2-9} + \frac{3}{x-3}$.

2

(b) Fully factorise $2a^2 - 2ab - 4ac + 4bc$

2

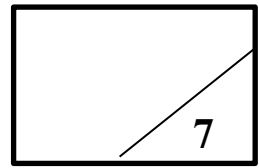
Question 11 continues on page 10



Student Name: _____

Teacher: _____

- Write your name at the top of each booklet.
- Answer questions in the space provided.
- Extra writing paper is provided. If you use extra writing paper, clearly indicate which part of the question you are answering.



Question 12

Marks

(a) Let $g(x) = \frac{1}{\sqrt{x-9}}$.

2

State the domain and range of $g(x)$.

(b) Determine whether the function $f(x) = \frac{x^3}{x^2-1}$ is odd, even or neither.
Justify your answer.

2

Question 12 continues on page 12

(c) The function f is defined by $f(x) = 2 + \sqrt{x-3}$ for $x \geq 3$.

The function g is defined by $g(x) = \frac{12}{x} + 2$ for $x > 0$.

Write an expression for the composite function $h(x) = g(f(x))$,
and hence find a value (in simplest terms) for $g(f(12))$.

[illegible]

(d) Give an example of a “Many to One” function.

This image shows a blank sheet of white paper with ten horizontal dashed lines, evenly spaced from top to bottom. These lines are typical of primary-ruled notebook paper used for teaching handwriting or basic writing skills. There are no margins, text, or other markings on the page.

End of Question 12

Teacher: _____

-

Marks

2

[illegible]

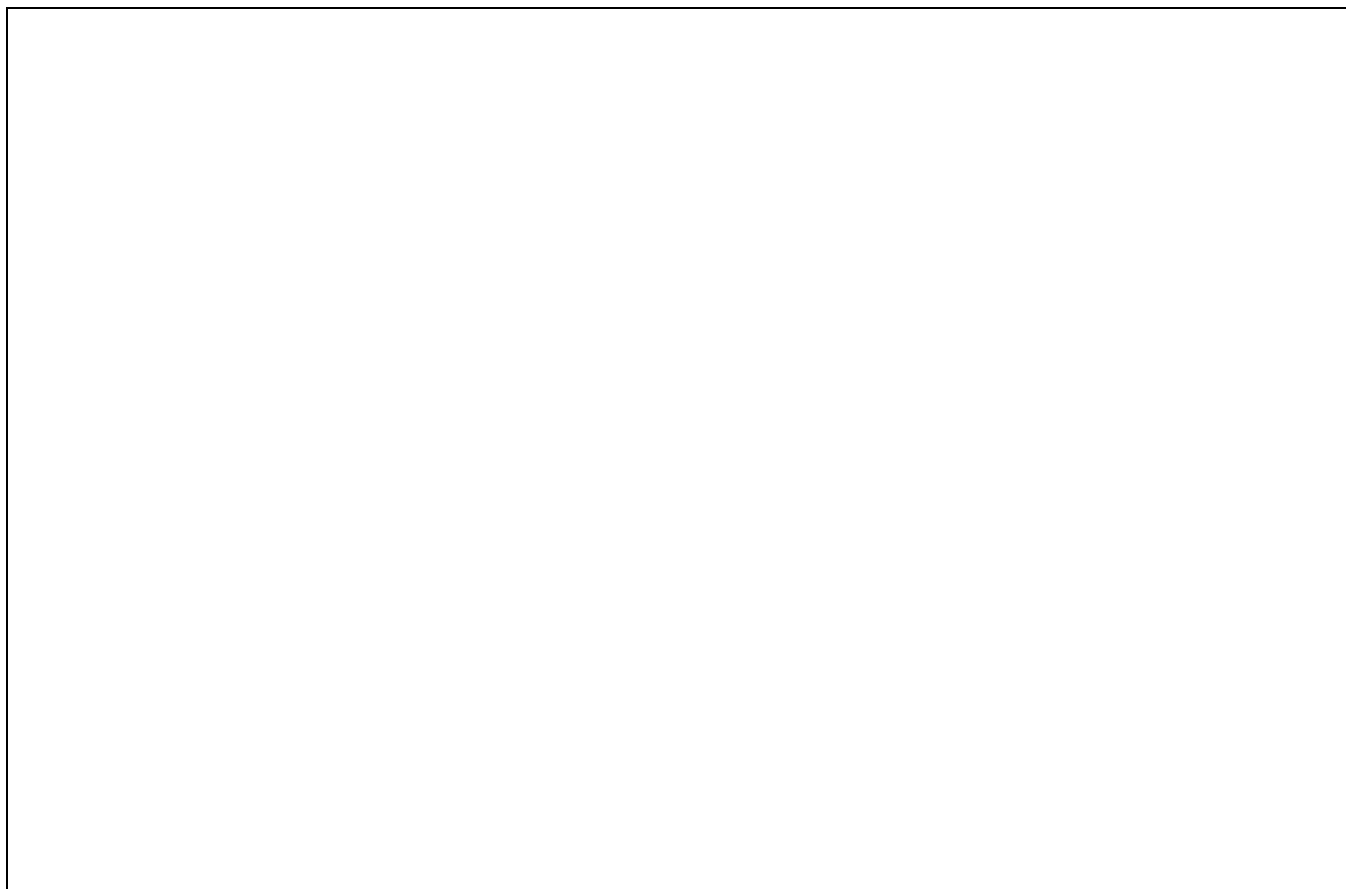
Page | 13

- (b) If the graph of $y = x^2 - x + 4 - k$ touches the x -axis at only one point, find the value of k .

2

- (c) Sketch the parabola $y = -x^2 - x + 6$ showing the coordinates of the x -intercepts, the coordinates of the y -intercept and the coordinates of the vertex.

3



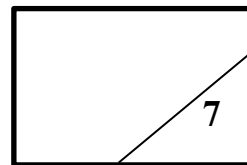
End of Question 13



Student Name: _____

Teacher: _____

- Write your name at the top of each booklet.
- Answer questions in the space provided.
- Extra writing paper is provided. If you use extra writing paper, clearly indicate which part of the question you are answering.



Question 14

Marks

(a)(i) Sketch the graph $y = |x - 3|$

1

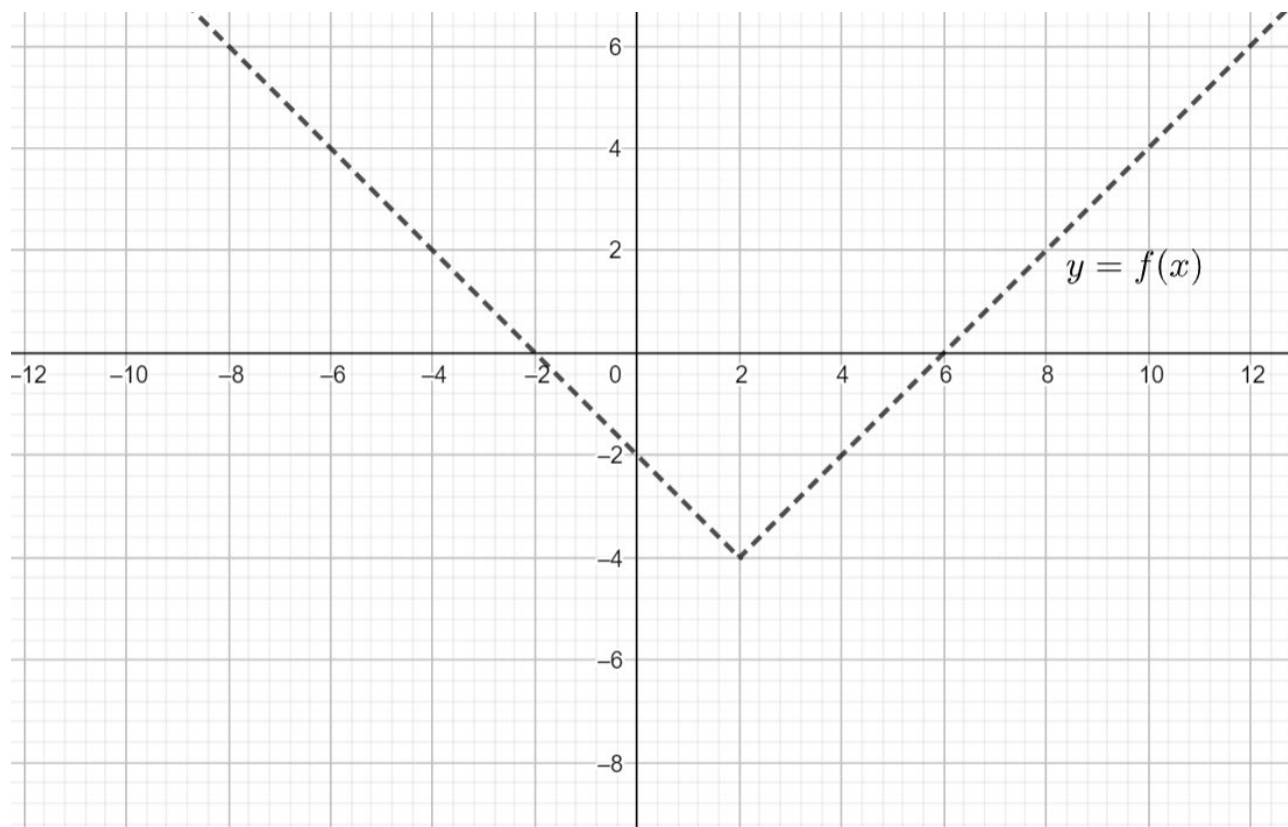
(ii) Hence, show on your graph the solutions to the equation $|x - 3| = 1$

1

Question 14 continues on page 16

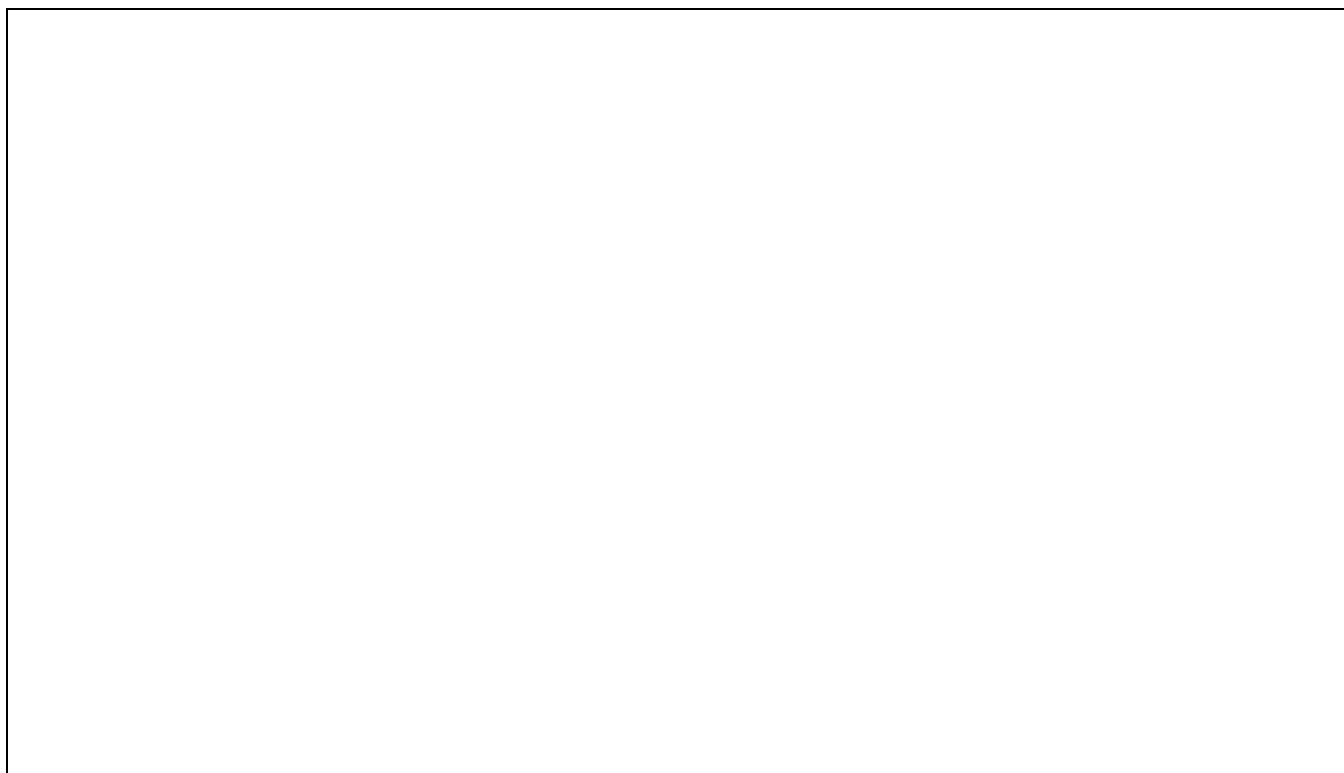
(b) Given $y = f(x)$ as shown in the diagram below, sketch $y = f(-x)$.

1



(c) Sketch the function $y = -\sqrt{4 - x^2}$ showing all important features.

1



Question 14 continues on page 17

(d) Consider the function $P(x) = (2 - x)(x + 1)^3$

(i) State the degree.

1

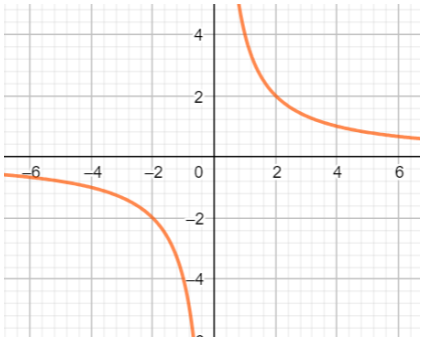
(ii) Sketch $y = P(x)$, showing any intercepts with the x and y axes

2

End of paper

Extra writing paper for Q14 ONLY.

[illegible]

Year 11	Mathematics Advanced	2022 Y11 Task 1
Question MC	Solutions and Marking Guidelines	
Outcomes Addressed in this Question		
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		
MA11-9 provides reasoning to support conclusions which are appropriate to the context		
Outcome	Solutions	Marking Guidelines
	1. $(4x + y)^2 - (4x - y)^2$ Ans D $= (4x + y + 4x - y)(4x + y - 4x + y)$ $= 8x \times 2y$ $= 16xy$ 2. $3t^2 - 5t - 2$ Ans C 3. $2\sqrt{48} - \sqrt{108}$ Ans B $= 2 \times 4\sqrt{3} - 6\sqrt{3}$ $= 2\sqrt{3}$ 4. $1 - x^2 \geq 0$ Ans D $1 \geq x^2$ $-1 \leq x \leq 1$ 5. Ans D 6. Ans A 7. Ans B 8. $(x + 4)^2 + (y - 2)^2 = 5 + 16 + 4$ Ans B $(x + 4)^2 + (y - 2)^2 = 25$ 9.  Ans C 10. Axis of symmetry is $x = \frac{-b}{2}$, observing the graph, the axis of symmetry is on the right-hand side of the y-axis. So, $x = \frac{-b}{2} > 0$, $b < 0$. And c is the y-intercept. Ans A	

Year 11 Mathematics Advanced Task 1 2022
Question No. 11 Solutions and Marking Guidelines

Outcomes Addressed in this Question

MA11-1 uses algebraic and graphical techniques to solve, and where appropriate, compare alternative solutions to problems

MA11-9 provides reasoning to support conclusions which are appropriate to the context

Solutions	Marking Guidelines
(a) $\frac{x}{x^2-9} + \frac{3}{x-3}$ $= \frac{x}{(x-3)(x+3)} + \frac{3(x+3)}{(x-3)(x+3)}$ $= \frac{x+3x+9}{(x-3)(x+3)}$ $= \frac{4x+9}{(x-3)(x+3)}$ (b) $2a^2 - 2ab - 4ac + 4bc$ $= 2a(a-b) - 4c(a-b)$ $= 2(a-2c)(a-b)$ (C) $x - y = 2 \quad \dots eq \ 1$ $3x + 2y = 1 \quad \dots eq \ 2$ $(eq1 \times 2) \quad 2x - 2y = 4 \quad \dots eq \ 3$ $(eq2 + eq3) \quad 5x = 5$ $x = 1$ $y = -1$ (d) $x^2 + (x+1)^2 = (x+2)^2$ $x^2 + x^2 + 2x + 1 = x^2 + 4x + 4$ $x^2 - 2x - 3 = 0$ $(x-3)(x+1) = 0$ $x = 3 \text{ or } x = -1$ $\therefore x = \underline{\underline{3}} \text{ as } x > 0$	(2 marks for correct solutions, 1 mark for correct denominator) (2 marks for correct solutions 1 mark for some progress correct) (2 marks for correct solutions, 1 mark for substantial progress) 3 marks for correct solutions, 1 mark for apply Pythagoras' theorem correctly 1 mark for $x > 0$

Year 11 Mathematics Advanced Task 1 2022
Question No. 12 Solutions and Marking Guidelines

Outcomes Addressed in this Question

MA11-2 uses the concepts of functions and relations to model, analyse and solve practical problems

Solutions	Marking Guidelines
(a) Domain: $(9, \infty)$ or $x > 9$ Range: $(0, \infty)$ or $y > 0$ (b) $f(-x) = \frac{(-x)^3}{(-x)^2 - 1}$ $= \frac{-x^3}{x^2 - 1}$ $= -f(x)$ The function is Odd. (c) $h(x) = g(f(x))$ $h(x) = g(2 + \sqrt{x-3})$ $= \frac{12}{2 + \sqrt{x-3}} + 2$ $g(f(12)) = h(12)$ $= \frac{12}{2 + \sqrt{12-3}} + 2$ $= \frac{12}{5} + 2$ $= \frac{22}{5}$ (d) multiple possible answers here. Please note, it <i>did</i> need to be clear that what was stated was actually a function. For example, just stating “parabola” is not enough, as some parabolas can be concave sideways. Stating $y = x^2$ is clear and unambiguous.	2 marks: correct solution 1 mark: substantially correct solution 2 marks: correct solution 1 mark: substantially correct solution 3 marks: correct solution 2 marks: substantially correct solution 1 mark: significant progress towards correct solution 1 mark: giving a correct and <u>unambiguous</u> answer

note: the word 'hence' is important here... it means you *must* use what was previously found. ie, you need to use $h(x)$

finding $f(12)$, and then substituting this result into $g(x)$, is ignoring the word (and concept of) 'hence'.

Year 11 Mathematics Advanced Task 1 2022
Question No. 13 Solutions and Marking Guidelines

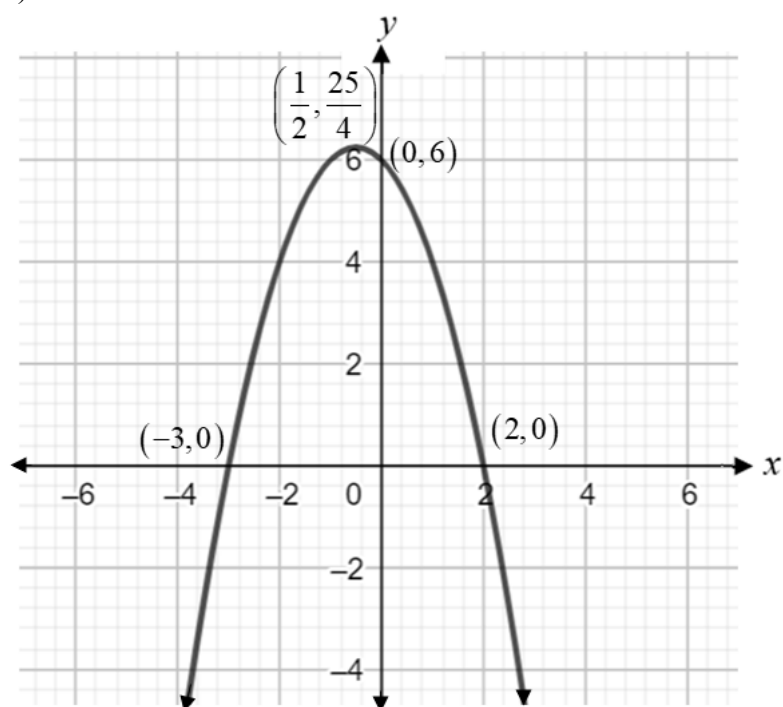
Outcomes Addressed in this Question

MA11-1 uses algebraic and graphical techniques to solve, and where appropriate, compare alternative solutions to problems

Solutions	Marking Guidelines
Q13 a) $ay + 6x + 5 = 0$ $ay = -6x - 5$ $y = \frac{-6x}{a} - \frac{5}{a}$ $\therefore m_1 = \frac{-6}{a}$ and $y - 5x + 4 = 0$ $y = 5x - 4$ $\therefore m_2 = 5$ If the two lines are parallel, then $m_1 = m_2$ $\frac{-6}{a} = 5$ $a = \frac{-6}{5}$ Q13 b) Discriminant formula: $\Delta = b^2 - 4ac$ For $x^2 - x + 4 - k = 0$ $\Delta = (-1)^2 - 4(1)(4 - k)$ $= 1 - 16 + 4k$ $= 4k - 15$ For one point of intersection $\Delta = 0$ (equal roots) $\therefore 4k - 15 = 0$ $k = \frac{15}{4}$	2 marks awarded for complete correct solution 1 mark awarded for finding a gradient of one of the lines 2 marks awarded for complete correct solution 1 mark awarded for recognising that $\Delta = 0$ (equal roots)

Q13

c)



1 mark awarded for
correct shape of graph

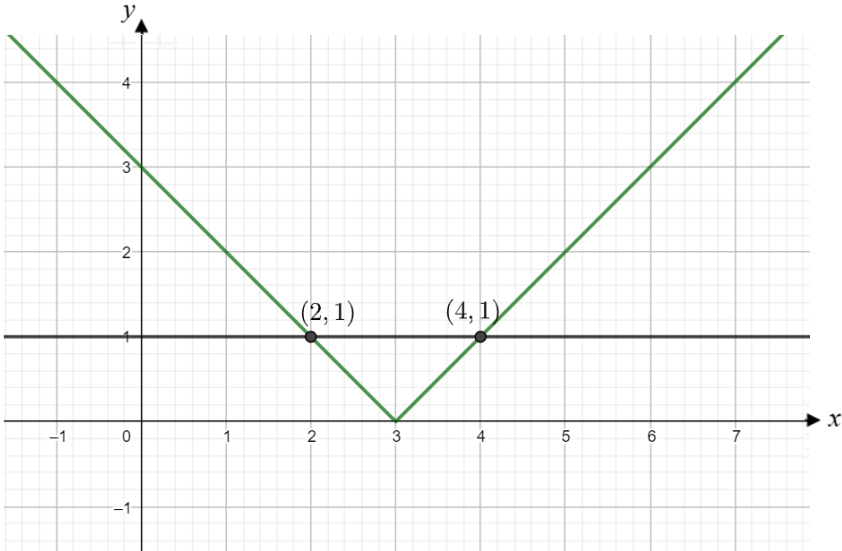
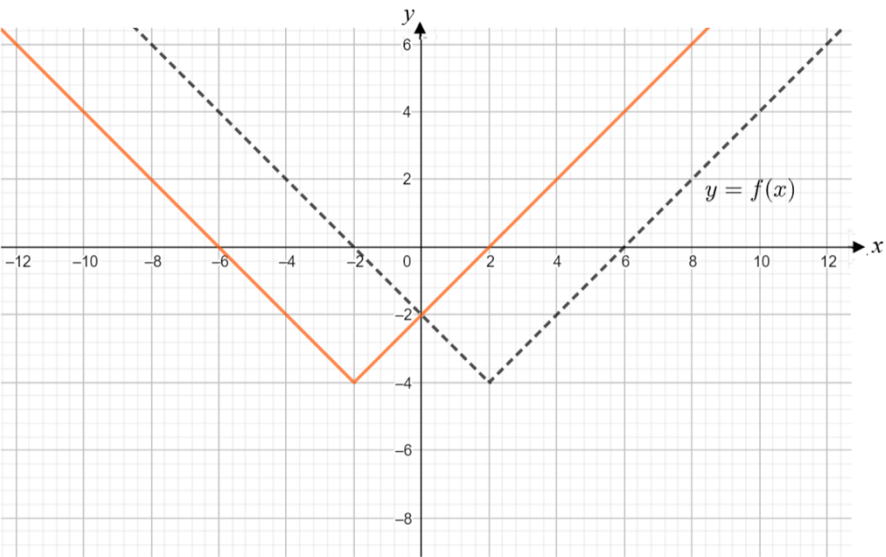
1 mark awarded for
finding correct
coordinates for the
intercepts

1 mark awarded for
finding the correct
coordinates for the
vertex

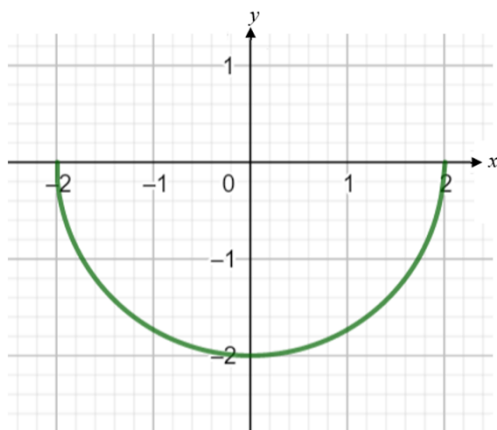
Year 11 Mathematics Advanced Task 1 2022
Question No. 14 Solutions and Marking Guidelines

Outcomes Addressed in this Question

MA11-1 uses algebraic and graphical techniques to solve, and where appropriate, compare alternative solutions to problems

Solutions	Marking Guidelines
(a) (i)  (ii) $x = 2, 4$ (b) 	1 mark 1 mark 1 mark

(c)



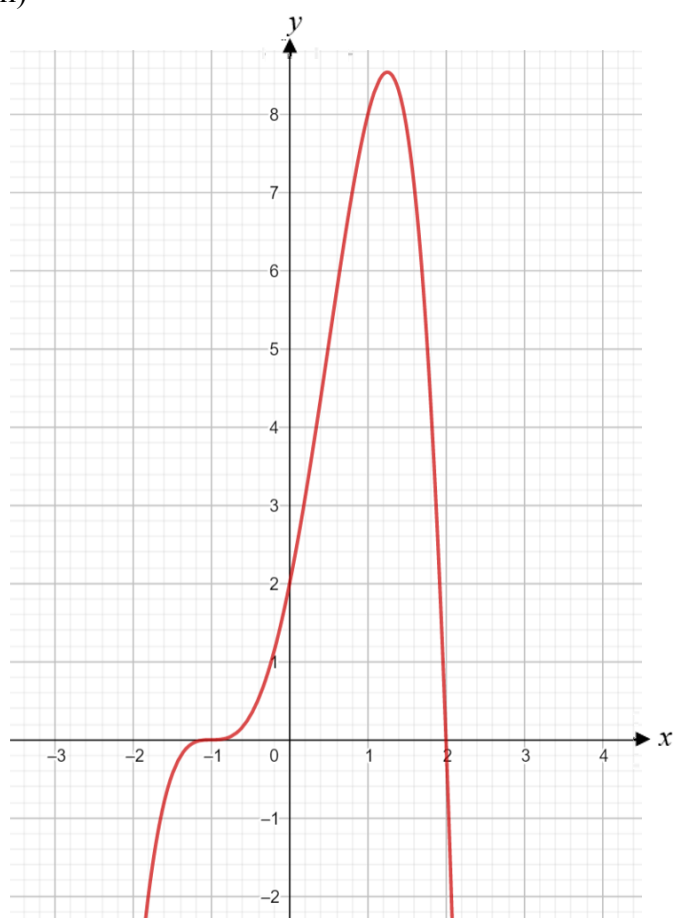
1 mark

(c) (i)

Degree of 4

1 mark

(ii)



1 mark where graph
cuts x-axis correctly
and starts graph from
lower right
2 marks for correct
solution

~End of paper~