



**Year 11 Mathematics Advanced
Preliminary HSC Assessment Task 1
Term 2, Week 2, 2022**

Name: _____

Thursday 5th May 2022

- Answer all questions on the lined paper provided.
- Start each question on a new page.
- NESA approved calculators are permitted in this task.
- Marks may be deducted for insufficient or illegible work.
- Total possible mark: **32**
- Time allowed: **45 minutes + 2 minutes reading time**

Question 1 (5 marks)

Marks

(a) Factorise fully:

(i) $4f^2 - 16f - 9$

1

(ii) $a^2 - b^2 - 2bc - c^2$.

2

(b) Solve $\frac{x}{x-2} + \frac{3}{x-4} = 1$ for x .

2

Question 2 (6 marks) *Start a new page*

(a) Simplify $\frac{\sqrt{15} \times \sqrt{20}}{\sqrt{12}}$.

1

(b) Solve $2\sqrt{150} - 3\sqrt{24} = \sqrt{x}$ for x .

2

(c) Show that $\frac{3}{2+\sqrt{2}} + \frac{3}{\sqrt{2}}$ is rational.

2

End of Question 2

Question 3 starts on the next page

Question 3 (5 marks) *Start a new page***Marks**

- (a) If $f(x) = \frac{1}{\sqrt{2-x}}$,
- (i) Find $f(2)$. **1**
- (ii) Give the domain of $f(x)$. **1**
- (b) What is the range of $y = 2 - 3^{-x}$. **1**
- (c) (i) Complete the square of the parabola $y = x^2 + 5x$. **1**
- (ii) Hence, or otherwise, give the coordinates of the vertex of the parabola $y = x^2 + 5x$. **1**

Question 4 (5 marks) *Start a new page*

- (a) Sketch the polynomial $y = (2-x)^3(x+1)$ showing its intercepts with the coordinate axes. **2**
- (b) Classify the relation $x^2 - y^2 = 0$ as one-to-one, many-to-one, one-to-many or many-to-many. **1**
- (c) If $f(x) = \sqrt{x}$ sketch $y = -f(x-1)$. **2**

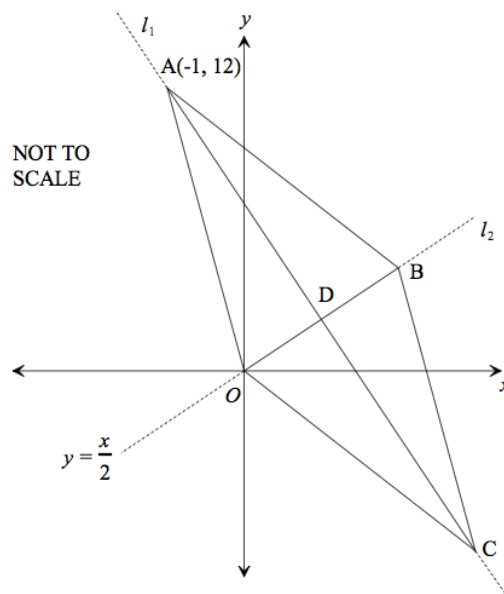
End of Question 4

Question 5 starts on the next page

The diagram below shows the rhombus $OABC$.

The diagonal from the point $A(-1, 12)$ to the point C lies on the line ℓ_1 .

The other diagonal, from the origin O to the point B , lies on the line ℓ_2 , has equation $y = \frac{x}{2}$.



- | | | |
|-----|--|----------|
| (a) | Show that the equation of the line ℓ_1 is $y = -2x + 10$. | 2 |
| (b) | What angle does the line ℓ_1 make with the positive x -axis, correct to the nearest minute? | 1 |
| (c) | The lines ℓ_1 and ℓ_2 intersect at the point D . Find the coordinates of D . | 1 |
| (d) | Find the coordinates of the point B . | 2 |

End of Question 5

Question 6 starts on the next page

Question 6 (5 marks) *Start a new page*

Marks

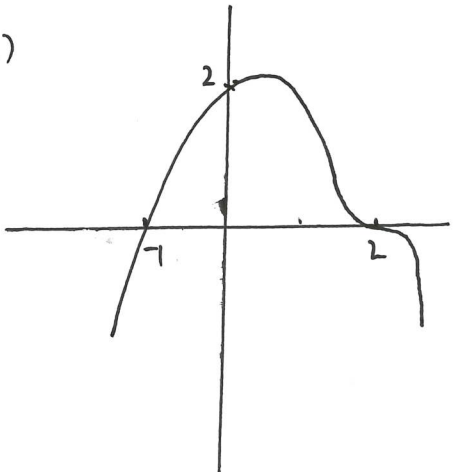
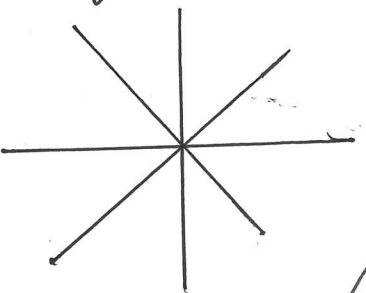
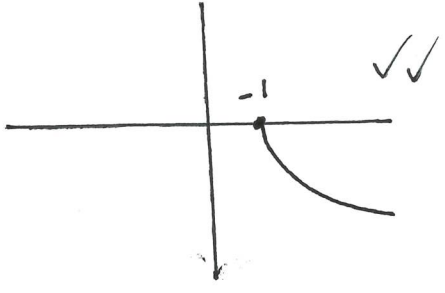
- (a) If $H(x) = \frac{1}{x}$, express $\frac{H(x+h) - H(x)}{h}$ in simplest form. **2**
- (b) Two brothers, each aged between 10 and 90, “combined” their ages by writing them down one after the other to create a four digit number and discovered this number to be a square of an integer. Nine years later they repeated the process (combining their ages in the same order) and found that the combination again was a square of another integer which was nine larger than the previous integer.
- By letting the brothers’ ages be x and y and the integer be n , form simultaneous equations and solve them to find the sum of their original ages. **4**

End of Assessment

2022 Year 11 Mathematics Advanced AT1 Solutions

Suggested Solution (s)	Comments	Suggested Solution (s)	Comments
<u>Question 1</u> (a) (i) $4f^2 - 16f - 9$ $= (2f + 1)(2f - 9)$ ✓ (ii) $a^2 - b^2 - 2bc - c^2$ $= a^2 - (b^2 + 2bc + c^2)$ ✓ $= a^2 - (b + c)^2$ $= (a - b - c)(a + b + c)$ ✓ (b) $\frac{x}{x-2} + \frac{3}{x-4} = 1$ $x(x-4) + 3(x-2) = (x-2)(x-4)$ ✓ (combine L.H.S also 1 mark) $x^2 - 4x + 3x - 6 = x^2 - 6x + 8$ $5x = 14$ $x = \frac{14}{5}$ ✓		(c) $\frac{3}{2+\sqrt{2}} + \frac{3}{\sqrt{2}}$ $= \frac{3(2-\sqrt{2})}{4-2} + \frac{3\sqrt{2}}{2}$ ✓ $= \frac{6-3\sqrt{2}+3\sqrt{2}}{2}$ $= \frac{6}{2} = 3$ ✓ which is rational.	
<u>Question 2</u> (a) $\frac{\sqrt{15} \times \sqrt{20}}{\sqrt{12}} = \frac{\sqrt{3} \times \sqrt{5} \times 2\sqrt{5}}{2\sqrt{3}}$ $= 5$ ✓ (b) $2\sqrt{150} - 3\sqrt{24} = \sqrt{x}$ $10\sqrt{6} - 6\sqrt{6} = \sqrt{x}$ ✓ $4\sqrt{6} = \sqrt{x}$ $x = 96$ ✓		<u>Question 3</u> (a) (i) $f(x) = \frac{1}{\sqrt{2-x}}$ $f(2) = \frac{1}{0}$ which is <u>undefined</u> ✓ (ii) D: $2-x > 0$ $x < 2$ ✓ (b) $y < 2$ ✓ (c) i) $y = x^2 + 5x + \left(\frac{5}{2}\right)^2 - \left(\frac{5}{2}\right)^2$ $y = \left(x + \frac{5}{2}\right)^2 - \frac{25}{4}$ ✓ ii) $y + \frac{25}{4} = \left(x + \frac{5}{2}\right)^2$ $\therefore \sqrt{\left(-\frac{5}{2}, -\frac{25}{4}\right)}$ ✓	

2022 Year 11 Mathematics Advanced AT1 Solutions

Suggested Solution (s)	Comments	Suggested Solution (s)	Comments
<u>Question 4</u> (a)  1 mark - <u>all</u> intercepts 1 mark - correct shape (b) $x^2 - y^2 = 0 \Leftrightarrow y = \pm x$  $\therefore$ many-to-many ✓ (c) 1 mark correct shape for $y = \sqrt{x}$ 		<u>Question 5</u> (a) $m_{L_2} = \frac{1}{2} \therefore m_{L_1} = -2$ $AC \perp OB$ (diagonals of Rhombus) perpendicular ✓ $\therefore y - 12 = -2(x - 1)$ $y = -2x + 10$ ✓ (b) $\tan \theta = -2, 90^\circ < \theta < 180^\circ$ $\theta = 116^\circ 54'$ ✓ (c) $\frac{x}{2} = -2x + 10$ $x = 4, y = 2$ $\therefore D(4, 2)$ ✓ (d) $\frac{0+x}{2} = 4, \frac{0+y}{2} = 2$ $\therefore B(8, 4)$ ✓	
		<u>Question 6</u> (a) $\frac{\frac{1}{x+h} - \frac{1}{x}}{h} = \frac{\frac{x-x-h}{x(x+h)}}{h}$ $= \frac{-1}{x(x+h)}$ ✓ (b) 1 mark, any demonstration of two ages eg $1521 = n^2$ 2 marks $100x + y = n^2$ 3 marks $\begin{cases} 100x + y = n^2 \\ \text{and } 100(x+9) + (y+9) = (n+9)^2 \end{cases}$ ② - ① $909 = 18n + 81$ $n = 46$ $46^2 = 2116$ $\therefore 21 + 16 = 37$ ✓	--- ① $(n+9)^2$ --- ②