



**Year 11 Mathematics Advanced
Preliminary HSC Assessment Task 1
Term 2, Week 2, 2021**

Name: _____

Wednesday 28th April 2021

- 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: **36**
- Time allowed: **45 minutes + 2 minutes reading time**

Question 1 (6 marks)

Marks

(a) Factorise fully:

(i) $f^3 + 4f^2 + 4f + 16$.

1

(ii) $a^2 - 2ab + b^2 - c^2$.

2

(b) Solve $\frac{x+5}{2} - \frac{x-1}{3} = 1$ for x .

1

(c) Solve $(5a-3)(3a+1) = 1$ for a .

2

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

(a) Evaluate $\frac{2.7 \times 10^{-2}}{1.7 \times 10^{-5}}$ correct to three significant figures.

1

(b) Simplify $\frac{6\sqrt{3} \times 8\sqrt{2}}{\sqrt{32} \times \sqrt{54}}$.

1

(c) Solve $\sqrt{44} + \sqrt{99} = \sqrt{x}$ for x .

2

(d) Rewrite $\frac{3\sqrt{2} + \sqrt{5}}{3\sqrt{2} - \sqrt{5}}$ with a rational denominator and hence find

the values of x and y if $\frac{3\sqrt{2} + \sqrt{5}}{3\sqrt{2} - \sqrt{5}} = x + y\sqrt{10}$.

2

End of Question 2

Question 3 starts on the next page

Question 3 (6 marks) *Start a new page***Marks**

- (a) If $f(x) = x^2 - 2x - 4$ find the value of $f(\sqrt{2}) + f(0)$. **1**
- (b) What is the natural domain of $f(x) = \sqrt{5 - 3x}$? **1**
- (c) (i) Sketch the graph of $y = 1 - 2^x$. **1**
- (ii) What is the range of $y = 1 - 2^x$. **1**
- (d) (i) Complete the square of the quadratic $y = -x^2 + 8x - 15$. **1**
- (ii) Hence, or otherwise, give the coordinates of the vertex of $y = -x^2 + 8x - 15$. **1**

Question 4 (6 marks) *Start a new page*

- (a) Sketch the polynomial $y = (1 - x)(x + 3)^2$ showing its intercepts with the coordinate axes. **2**
- (b) Sketch a “One-to-many” relation. **1**
- (c) (i) Sketch the graph of $f(x) = \frac{2}{x}$. **1**
- (ii) Use your answer to part (i) to sketch $y = -f(x - 1)$ on a separate number plane. **2**

End of Question 4

Question 5 starts on the next page

Question 5 (7 marks) *Start a new page*

Marks

- (a) Show that $f(x) = \frac{3x}{x^2 - 9}$ is an odd function. **1**
- (b) Consider the points $A(1, 0)$, $B(0, 8)$ and $C(7, 4)$.
- (i) Find the angle of inclination of line AC . **1**
- (ii) Derive the equation of line AC in general form. **1**
- (iii) Find the coordinates of M , the midpoint of AC . **1**
- (iv) Show that AC is perpendicular to BM . **1**
- (v) Find the area of triangle ABC . **1**
- (vi) Write down the coordinates of D such that parallelogram $ABCD$ is a rhombus. **1**

End of Question 5

Question 6 starts on the next page

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

Marks

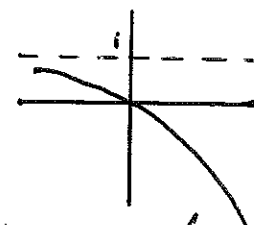
(a) Find the value of $\frac{a^2}{b^2}$ if $\frac{a+b}{a-b} = \frac{7}{4}$. **2**

- (b) The average age of the participants at a student mathematics camp would increase by one year if five 9 year olds left the group or if five 17 year olds joined the group (but not both).

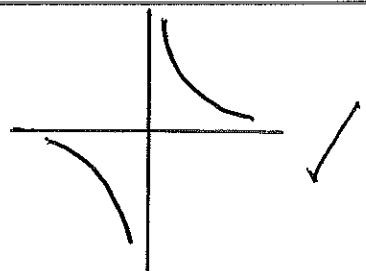
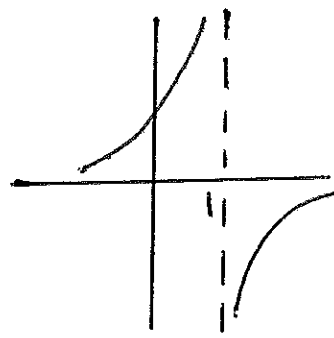
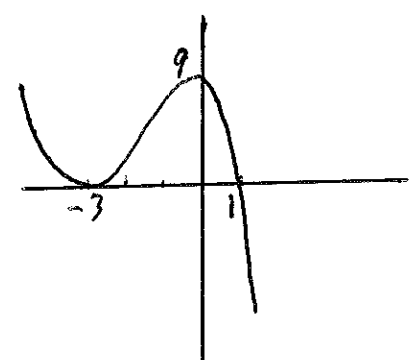
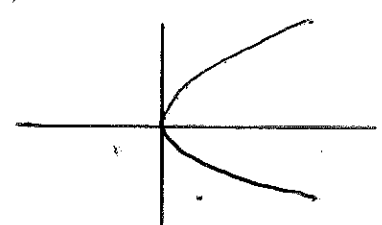
By first forming and then solving simultaneous equations, determine how many students are presently at the mathematics camp. **3**

End of Assessment

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Suggested Solution (s)	Comments	Suggested Solution (s)	Comments
① a) i) $f^3 + 4f^2 + 4f + 16$ $= f^2(f+4) + 4(f+4)$ $= (f^2 + 4)(f+4)$ ✓ ii) $a^2 - 2ab + b^2 - c^2$ $= (a-b)^2 - c^2$ ✓ $= (a-b-c)(a-b+c)$ ✓ b) $\frac{x+5}{2} - \frac{x-1}{3} = 1$ $3(x+5) - 2(x-1) = 6$ $3x+15-2x+2=6$ $x = -11$ ✓ c) $(5a-3)(3a+1) = 1$ $15a^2 + 5a - 9a - 3 = 1$ $15a^2 - 4a - 4 = 0$ $(5a+2)(3a-2) = 0$ ✓ $a = -\frac{2}{5}$ or $\frac{2}{3}$	✓	c) $\sqrt{44} + \sqrt{99} = \sqrt{x}$ $2\sqrt{11} + 3\sqrt{11} = \sqrt{x}$ ✓ $\therefore \sqrt{x} = 5\sqrt{11}$ $x = 275$ ✓ d) $\frac{3\sqrt{2} + \sqrt{5}}{3\sqrt{2} - \sqrt{5}}$ $= \frac{3\sqrt{2} + \sqrt{5}}{3\sqrt{2} - \sqrt{5}} \times \frac{3\sqrt{2} + \sqrt{5}}{3\sqrt{2} + \sqrt{5}}$ $= \frac{(3\sqrt{2} + \sqrt{5})^2}{13}$ or $\frac{23 + 6\sqrt{10}}{13}$ ✓ $\therefore x = \frac{23}{13}, y = \frac{6}{13}$ ✓	
② a) 1590 (3 sig fig) b) $\frac{6\sqrt{3} \times 8\sqrt{2}}{\sqrt{32} \times \sqrt{54}}$ $= \frac{26\sqrt{3} \times 28\sqrt{2}}{4\sqrt{2} \times 3\sqrt{6}}$ $= \frac{4\sqrt{3}}{\sqrt{6}}$ or $\frac{4}{\sqrt{2}}$ or $2\sqrt{2}$	✓	③ a) If $f(x) = x^2 - 2x - 4$ $f(\sqrt{2}) = 2 - 2\sqrt{2} - 4$ $= -2 - 2\sqrt{2}$ $f(0) = -4$ $\therefore f(\sqrt{2}) + f(4) = -6 - 2\sqrt{2}$ ✓ (b) D: $5 - 3x \geq 0$ ✓ $x \leq \frac{5}{3}$ (c) i)  ✓ must have 1. asymptote $y=1$ 2. pass thru origin 3. correct shape. ii) R: $y < 1$ ✓	

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③ continued (d) (i) $y = -(x^2 - 8x + 15)$ $= -[(x-4)^2 - 1]$ $= 1 - (x-4)^2$ ii) $V = (4, 1)$ ✓	✓	(c) i)  ii)  ✓ for horizontal shift ✓ for reflection in x-axis.	
④ (a)  ✓ must have • correct shape at x-intercepts ✓ correct solution. (b) for example  Most - "pass" horizontal line test - "fail" vertical line test. } ✓		⑤ (a) $f(-x) = \frac{-3x}{x^2 - 9}$ $= -f(x)$ ✓ $\therefore$ Odd (b) i) $\tan \theta = m_{AC}$ $= \frac{2}{3}$ $\therefore \theta \doteq 33.7^\circ$ ii) $y - 0 = \frac{2}{3}(x - 1)$ $3y = 2x - 2$ $\therefore 2x - 3y - 2 = 0$ ✓ iii) $M(4, 2)$ ✓	

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⑤ continued (iv) $m_{BM} = \frac{8-2}{0-4}$ $= -\frac{3}{2}$ Since $m_{AC} \times m_{BM}$ $= \frac{3}{2} \times -\frac{3}{2}$ $= -1 \therefore AC \perp BM$ (v) Since $AC \perp BM$ $Area = \frac{1}{2} \times AC \times BM$ $= \frac{1}{2} \times \sqrt{6^2 + 4^2} \times \sqrt{4^2 + 6^2}$ $= \frac{1}{2} \times (36 + 16)$ $= 26 \text{ units}^2$ (vi) $(8, -4)$		(b) Let N be number of students. Let S be sum of their ages. $\therefore \frac{S - (5 \times 9)}{N - 5} = \frac{S}{N} + 1 \dots \textcircled{1}$ and $\frac{S + (5 \times 17)}{N + 5} = \frac{S}{N} + 1 \dots \textcircled{2}$ from $\textcircled{1}$ $NS - 45N = NS + N^2 - 5S - 5N$ from $\textcircled{2}$ $NS + 85N = NS + N^2 + 5S + 5N$ which simplify to $N^2 + 40N = 5S \dots \textcircled{3}$ $N^2 - 80N = -5S \dots \textcircled{4}$ $\textcircled{3} + \textcircled{4}:$ $2N^2 - 40N = 0$ $N(N - 20) = 0$ $\therefore N = 20 \ (N \neq 0) \checkmark$	$\textcircled{1}$ and $\textcircled{2}$ are grouped together with a bracket and a checkmark. $\textcircled{3}$ and $\textcircled{4}$ are grouped together with a bracket and a checkmark. The final result $N = 20$ is also checked.
⑥ (a) $\frac{a+b}{a-b} = \frac{7}{4}$ $4a + 4b = 7a - 7b$ $3a = 11b$ ✓ $\frac{a}{b} = \frac{11}{3}$ $\therefore \frac{a^2}{b^2} = \frac{121}{9}$ ✓ $= 13\frac{4}{9}$			

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