2	a) Explicit formula $u_n = S_n - S_{n-1}$ $= \frac{n}{2}[3 + 5n] - \frac{n-1}{2}[3 + 5(n-1)]$ $= 5n - 1$ b) $u_{n+1} = 5(n+1) - 1$ $= (5n-1) + 5$ $= u_n + 5$ (in terms of u_n) Hence, $u_{n+1} - u_n = u_n + 5 - u_n$ $= 5$ Since $u_{n+1} - u_n$ is a constant, thus sequence is an Arithmetic progression	M1 A1 M1 M1 A1 M1 A1 Do not accept if candidates not use u_{n+1} and u_n

4. a)

$$Z = 1 + i\sqrt{3}$$

$$|Z| = \sqrt{1^2 + (\sqrt{3})^2}$$

$$= 2$$

M1

$$\arg Z = \tan^{-1}\left(\frac{\sqrt{3}}{1}\right) = \frac{\pi}{3}$$

$$Z = 2\left[\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right]$$

A1

b)

$$Z^{\frac{1}{2}} = 2^{\frac{1}{2}}\left[\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right]^{\frac{1}{2}}$$

M1

$$= \sqrt{2}\left[\cos\frac{1}{2}\left(\frac{\pi}{3} + 2k\pi\right) + i\sin\frac{1}{2}\left(\frac{\pi}{3} + 2k\pi\right)\right]$$

M1

$$= \sqrt{2}\left[\cos\left(\frac{\pi}{6} + k\pi\right) + i\sin\left(\frac{\pi}{6} + k\pi\right)\right]$$

When k = 0, $Z^{\frac{1}{2}} = \sqrt{2}\left[\cos\left(\frac{\pi}{6}\right) + i\sin\left(\frac{\pi}{6}\right)\right]$

M1

$$= \sqrt{2}\left[\frac{\sqrt{3}}{2} + \frac{1}{2}i\right]$$

$$= \frac{1}{2}\left(\sqrt{6} + i\sqrt{2}\right)$$

A1

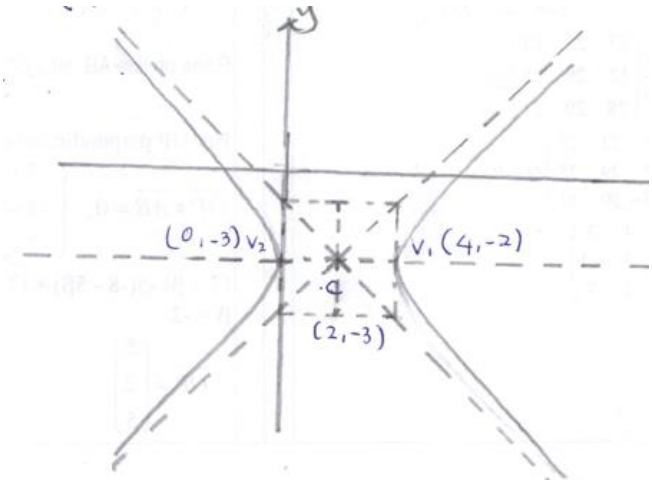
When k = 1 ,

$$Z^{\frac{1}{2}} = \sqrt{2}\left[\cos\left(\frac{\pi}{6} + \pi\right) + i\sin\left(\frac{\pi}{6} + \pi\right)\right]$$

$$= \sqrt{2}\left[-\frac{\sqrt{3}}{2} - \frac{1}{2}i\right]$$

$$= -\frac{1}{2}\left(\sqrt{6} - i\sqrt{2}\right)$$

A1

5 (a)	$x = a\ \sec\theta + 2$ $\qquad$ $y = b\ \tan\theta - 3,$ $\sec\theta = \dfrac{x-2}{a}$ ----(1) $\qquad$ $\tan\theta = \dfrac{y+3}{b}$ ----(2) By using trigonometric equation, $\sec^2\theta - \tan^2\theta = 1$ $\left(\dfrac{x-2}{a}\right)^2 - \left(\dfrac{y+3}{b}\right)^2 = 1$ $\dfrac{(x-2)^2}{a^2} - \dfrac{(y+3)^2}{b^2} = 1$ The equation shows the standard form of equation of hyperbole. Therefore, the conic is a hyperbola.	M1 A1 A1
5 (b)	If $a = b = 2$, $\dfrac{(x-2)^2}{2^2} - \dfrac{(y+3)^2}{2^2} = 1$ Centre : $C(2,-3)$ Vertices : $V_1(0,-3)$ and $V_2(4,-3)$  	D1 - Centre and intersect of axis of symmetry. D1 - Label D1 - All correct
5 (c)	$\dfrac{(x-2)^2}{2^2} - \dfrac{(y+3)^2}{2^2} = 1$ $\dfrac{(x-2)^2}{4} - \dfrac{(y+3)^2}{4} = 1$ $(x-2)^2 - (y+3)^2 = 4$ $(x^2 - 4x + 4) - (y^2 + 6y + 9) = 4$ $x^2 - y^2 - 4x - 6y - 9 = 0$	 M1 A1

6a.	$\overrightarrow{PQ} = \begin{pmatrix} 6 \\ -1 \\ 7 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix} = \begin{pmatrix} 4 \\ -2 \\ 4 \end{pmatrix}$	M1
	$\overrightarrow{PR} = \begin{pmatrix} 2 \\ 4 \\ 7 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix} = \begin{pmatrix} 0 \\ 3 \\ 4 \end{pmatrix}$	M1
	$\cos\theta = \dfrac{\begin{pmatrix} 4 \\ -2 \\ 4 \end{pmatrix} \bullet \begin{pmatrix} 0 \\ 3 \\ 4 \end{pmatrix}}{\sqrt{36} \times \sqrt{25}}$	M1
	$\theta = \cos^{-1}\left(\dfrac{1}{3}\right)$	**A1**

6b.	$\overrightarrow{PQ} \times \overrightarrow{PR} = \begin{pmatrix} 4 \\ -2 \\ 4 \end{pmatrix} \times \begin{pmatrix} 0 \\ 3 \\ 4 \end{pmatrix}$	M1
	$= -20i - 16j + 12k$	A1
	$Area = \dfrac{1}{2} \times \left\lvert -20i - 16j + 12k \right\rvert$	M1
	$= \dfrac{1}{2} \times \sqrt{800}$	
	$= 10\sqrt{2}$ *or* $14.14\ unit^2$	A1

7. The function f is defined as $f(x) = \frac{1}{x+2} + \frac{2x+11}{2x^2+x-6}, x \in R, x > \frac{3}{2}$

a) Show clearly that $f(x) = \frac{4}{2x-3}, x \in R, x > \frac{3}{2}$

$$f(x) = \frac{1}{x+2} + \frac{2x+11}{2x^2+x-6} = \frac{1}{x+2} + \frac{2x+11}{(x+2)(2x-3)} \quad \text{M1}$$

$$= \frac{2x-3+2x+11}{(x+2)(2x-3)}$$

$$= \frac{4x+8}{(x+2)(2x-3)} \quad \text{M1}$$

$$= \frac{4(x+2)}{(x+2)(2x-3)} \quad \text{M1}$$

$$= \frac{4}{2x-3} \quad \text{A1}$$

b) Find an expression for the inverse function $f^{-1}(x)$, in its simplest form

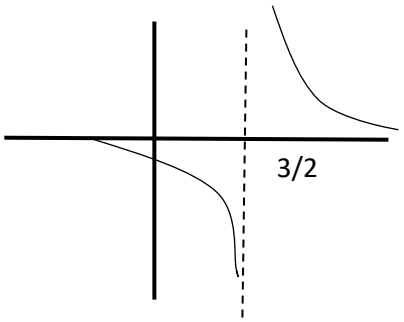
$$y = \frac{4}{2x-3}$$

$$2xy - 3y = 4 \quad \text{M1}$$

$$x = \frac{3y+4}{2y} \quad \text{M1}$$

$$\therefore f^{-1}(x) = \frac{3x+4}{2x} \quad \text{A1}$$

c) State the domain of $f^{-1}(x)$



D1

(OR other method)

Since range of $f(x) > 0, x > \frac{3}{2}$, M1

$\therefore$ domain of $f^{-1}(x), \{x: x > 0)\}$ A1

The function g is given by $g(x) = \ln(x-1), x \in R, x > 1$
Show that $x = 1 + \sqrt{e}$ is the solution of the equation $fg(x) = -2$.

$fg(x) = -2.$

$= \frac{4}{2g(x)-3} = -2$ M1

$\frac{4}{2\ln(x-1)-3} = -2$

$4 = 6 - 4\ln(x-1)$ M1 M1

$4\ln(x-1) = 2$

$\ln(x-1) = \frac{1}{2}$ M1

$x - 1 = e^{\frac{1}{2}}$

$x = e^{\frac{1}{2}} - 1 = 1 + \sqrt{e}$ (shown) A1

8a)	$\overrightarrow{AC} = \begin{pmatrix} 2 \\ -4 \\ 1 \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix}$ $= \begin{pmatrix} 1 \\ -6 \\ 2 \end{pmatrix}$ $\overrightarrow{AB} = \begin{pmatrix} 0 \\ 2 \\ 1 \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix}$ $= \begin{pmatrix} -1 \\ 0 \\ 2 \end{pmatrix}$	**M1 (Either one)**
	$n = \begin{pmatrix} 1 \\ -6 \\ 2 \end{pmatrix} \times \begin{pmatrix} -1 \\ 0 \\ 2 \end{pmatrix}$	M1
	$= -12i - 4j - 6k$	A1
	$r \bullet \begin{pmatrix} -12 \\ -4 \\ -6 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix} \bullet \begin{pmatrix} -12 \\ -4 \\ -6 \end{pmatrix}$	M1
	$r \bullet \begin{pmatrix} -12 \\ -4 \\ -6 \end{pmatrix} = -14$ $-12x - 4y - 6z = -14$ *or* $6x + 2y + 3z = 7$	A1
8b)	$\sin\theta = \dfrac{\begin{pmatrix} 3 \\ -5 \\ 1 \end{pmatrix} \bullet \begin{pmatrix} 6 \\ 2 \\ 3 \end{pmatrix}}{\sqrt{9+25+1} \times \sqrt{36+4+9}}$	M1 (His values)
	$= \dfrac{11}{\sqrt{35} \times \sqrt{49}}$	M1
	$= 15.40^\circ$	A1

8c)	$\prod_2 = 2x + 2y - z = -5$ $x = -1 + 3\lambda$, $y = 5 - 5\lambda$, $z = -2 + \lambda$ $2(-1+3\lambda) + 2(5-5\lambda) - (-2+\lambda) = -5$ $\lambda = 3$ $x = 8$, $y = -10$, $z = 1$ $D(8, -10, 1)$ Or $8i - 10j + k$	M1 **M1** A1
8d)	$\prod_1 = 6x + 2y + 3z = 7$ $\prod_2 = 2x + 2y - z = -5$ Find the value of x , y and z by solving the simultaneous equations. *Let* $z = 0$, $x = 3$, $y = -\frac{11}{2}$ (*any suitable values*) $n = \begin{pmatrix} 6 \\ 2 \\ 3 \end{pmatrix} \times \begin{pmatrix} 2 \\ 2 \\ -1 \end{pmatrix}$ $n = -8i + 12j + 8k$ $r = \begin{pmatrix} 2 \\ -\frac{11}{2} \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} -8 \\ 12 \\ 8 \end{pmatrix}$	**M1 (Check his steps)** **A1** **M1** A1

Suka sampel ini?

Kertas Percubaan STPM

Sem 1 · Mathematics T

- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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