SAMPEL PERCUMA

Trial STPM 2017 Mathematics T Semester 1 Terengganu

Set penuh: Kertas Percubaan STPM

Sem 1 · Mathematics T

Sampel ini: 7 muka surat. Set penuh ada:

- 3 fail PDF
- 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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JABATAN PENDIDIKAN TERENGGANU

MATHEMATICS (T)
PAPER 1
TRIAL 2017
One and a half hours

SIJIL TINGGI PERSEKOLAHAN MALAYSIA
(MALAYSIA HIGHER SCHOOL CERTIFICATE)

MARKING SCHEME

1.Find the values of x and y such that

$$5y - x = 0$$

$$(1 - \log_5 y)\log_x 5 = 1$$

[4 marks]

2. Find the expansion of $\sqrt[3]{\frac{1 - 3x}{1 + x}}$ in ascending powers of x until the term in x^3. Suggest one value of x that enables $\frac{1}{\sqrt[3]{3}}$ to be estimated using the above expansion.

[5 marks]

Hence, estimate $\frac{1}{\sqrt[3]{3}}$ accurate to four decimal places. [3 marks]

3.(a) Matrix P is given by $P = \begin{pmatrix} 3 & 2 \\ -1 & -1 \end{pmatrix}$.

Find the values of m and n such that $P^2 + mP + nI = O$, where I and O is an 2×2 identity matrix and null matrix respectively.

Hence, find the inverse matrix of P. [5 marks]

(b) Given matrix $Q = \begin{pmatrix} 1 & 2 & -1 \\ 2 & 4 & -2 \\ 3 & 3 & -2 \end{pmatrix}$

Show that matrix Q is a singular matrix. [3 marks]

4.a) The complex numbers z and w are such that $w = 1 + ia$, $z = -b - i$. Where a and b are real and positive. Given that $wz = 3 - 4i$, find the exact values of a and b .

b) The complex numbers z and w are such that $|z| = 2$, $\arg(z) = -\frac{2}{3}\pi$, $|w| = 5$, $\arg w = \frac{3}{4}\pi$.

Find the exact values of

i) the real part of z and the imaginary part of z ,

ii) the modulus and argument of $\frac{w}{z^2}$. [9 marks]

5.The parametric equations of a conic is defined as $x = 3\tan\theta - 6$ and $y = 4\sec\theta + 5$.

(a). Show the Cartesian equation of the conic represents a hyperbola. [3 marks]

(b). Find the coordinates of the centre , vertices , foci and asymptotes of the hyperbola. [4 marks]

6. The planes π_1 and π_2 are defined by

$$\pi_1 : \mathbf{r} \cdot \begin{pmatrix} 3 \\ 3 \\ 1 \end{pmatrix} = 8 , \qquad \pi_2 : \mathbf{r} \cdot \begin{pmatrix} 2 \\ 4 \\ 3 \end{pmatrix} = 4$$

(a) Find the acute angle between the two planes. [3 marks]

(b) Obtain a vector equation and the Cartesian equation of L, the line of intersection of the two planes. [6 marks]

Scheme:

1.Find the values of x and y such that

$5y - x = 0$

$(1 - \log_5 y)\log_x 5 = 1$ [4 marks]

NO	ANSWER	MARKS	NOTES
	Given that $5y - x = 0$ $x = 5y$..... .....(1) Given that $(1 - \log_5 y)\log_x 5 = 1$ $1 - \log_5 y = \frac{1}{\log_x 5}$ $= \log_5 x$ $= \log_5 5y$ substit. $x = 5y$ $1 - \log_5 y = \log_5 5 + \log_5 y$ $= 1 + \log_5 y$ $2\log_5 y = 0$; $\log_5 y = 0$ $y = 5^0 = 1$ From (1) , $x = 5 \times 1 = 5$	M1 A1 M1	

		A1 (both)	
			4 marks

2. Find the expansion of $\sqrt[3]{\frac{1-3x}{1+x}}$ in ascending powers of x until the term in x^3. Suggest one value of x that enables $\frac{1}{\sqrt[3]{3}}$ to be estimated using the above expansion.

[4 marks]

Hence, estimate $\frac{1}{\sqrt[3]{3}}$ accurate to four decimal places. [4 marks]

NO	ANSWER	MARKS	NOTES
	$\sqrt[3]{\frac{1-3x}{1+x}} = (1-3x)^{\frac{1}{3}}(1+x)^{-\frac{1}{3}}$	M1	
	$= \left[1 + \frac{1}{3}(-3x) + \frac{\left(\frac{1}{3}\right)\left(-\frac{2}{3}\right)}{2}(-3x)^2 + \frac{\left(\frac{1}{3}\right)\left(-\frac{2}{3}\right)\left(-\frac{5}{3}\right)}{6}(-3x)^3 + \ldots\right] X$ $\left[1 - \frac{1}{3}(x) + \frac{\left(-\frac{1}{3}\right)\left(-\frac{4}{3}\right)}{2}(x)^2 + \frac{\left(-\frac{1}{3}\right)\left(-\frac{4}{3}\right)\left(-\frac{7}{3}\right)}{6}(x)^3 + \ldots\right]$	M1M1	
	$= \left(1 - x - x^2 - \frac{5}{3}x^3 - \ldots\right)\left(1 - \frac{1}{3}x + \frac{2}{9}x^2 - \frac{14}{81}x^3 + \ldots\right)$	M1	
	$= 1 - \frac{4}{3}x - \frac{4}{9}x^2 - \frac{140}{81}x^3 - \ldots$	A1	
	Let $\left(\frac{1-3x}{1+x}\right)^{\frac{1}{3}} = \left(\frac{1}{3}\right)^{\frac{1}{3}}$	B1	
	$\frac{1-3x}{1+x} = \frac{1}{3}$		
	$x = \frac{1}{5}$	A1	
	When $x = \frac{1}{5}$, $\left(\frac{1}{3}\right)^{\frac{1}{3}} = 1 - \frac{4}{3}\left(\frac{1}{5}\right) - \frac{4}{9}\left(\frac{1}{5}\right)^2 - \frac{140}{81}\left(\frac{1}{5}\right)^3$	A1	

Find the exact values of

i) the real part of z and the imaginary part of z ,

ii) the modulus and argument of $\frac{w}{z^2}$. [9 marks]

NO	ANSWER	MARKS	NOTES
4(a)	$w = 1 + ia, \quad z = -b - i$ $wz = 3 - 4i$ $(1 + ia)(-b - i) = 3 - 4i$ $-b - i - abi + a = 3 + 4i$ $(a - b) - (1 + ab)i = 3 - 4i$ $a - b = 3 \ldots\ldots (1)$ $1 + ab = 4 \ldots\ldots (2)$ $\Rightarrow a = \frac{3 + \sqrt{21}}{2}, \quad b = \frac{3 \pm \sqrt{21}}{2}$ Given that $a, b \in R^+ \therefore a = \frac{3 + \sqrt{21}}{2}, \quad b = \frac{-3 + \sqrt{21}}{2}$	M1 B1 M1 A1	(subt) for the 2 equations solving a and b both
(b)	$\lvert z\rvert = 2, \quad \arg(z) = -\frac{2}{3}\pi, \Rightarrow z = 2\,cis\left(-\frac{2}{3}\pi\right)$ $\lvert w\rvert = 5, \quad \arg(w) = \frac{3}{4}\pi, \Rightarrow w = 5\,cis\left(\frac{3}{4}\pi\right)$ (i). $R_i(z) = 2\cos\left(-\frac{2}{3}\pi\right) = 2\left(-\frac{1}{2}\right) = -1$ $\mathrm{Im}_i(z) = 2\sin\left(-\frac{2}{3}\pi\right) = -2\left(\frac{\sqrt{3}}{2}\right) = -\sqrt{3}$ (ii). $\frac{w}{z^2} = \frac{5\left[\cos\left(\frac{3}{4}\pi\right) + i\sin\left(\frac{3}{4}\pi\right)\right]}{\left[2\left(\cos\left(\frac{-2}{3}\pi\right) + i\sin\left(\frac{-2}{3}\pi\right)\right)\right]^2}$ $\left\lvert\frac{w}{z^2}\right\rvert = \frac{5}{4},$	B1 B1 M1	

(b) Find the zeros of P(x). [2 marks]

(c) Find all the real roots of $ax^6 - 29x^4 + bx^2 + 9 = 0$ [3 marks]

(d) Determine the set of values of x such that $P(x) < 5(2 + 3x - 5x^2)$ [5 marks]

NO	ANSWER	MARKS	NOTES
7	a) $P(1) = a(1)^3 - 29(1)^2 + b(1) + 9 = 0$ $a + b = 20$ $P(2) = a(2)^3 - 29(2)^2 + b(2) + 9 = -49$ $4a + b = 29$ $a = 3, b = 17$	B1 B1 M1 A1A1	 Try to solve a,b
	b) $P(x) = 3x^3 - 29x^2 + 17x + 9$ $P(x) = (x - 1)(x - 9)(3x + 1)$ $x = 1, x = 9, x = -\frac{1}{3}$	 M1 A1	 All correct
	c) $3x^6 - 29x^4 + 17x + 9 = 0$ $(x^2 - 1)(x^2 - 9)(3x^2 + 1) = 0$ $(x^2 - 1) = 0$ $(x^2 - 9) = 0$ $(3x^2 + 1) = 0$ $x = \pm 1$ $x = \pm 3$ $(x^2) \neq -\frac{1}{3}$ no real root Hence , all the real roots of x = -3, -1, 1 dan 3	 B1 M1 A1	 Try to get of x All correct
	d) $3x^3 - 29x^2 + 17x + 9 < 5(2 + 3x - 5x)$ $3x^3 - 4x^2 + 2x - 1 < 0$ $(x - 1)(3x^2 - x + 1) < 0$ $3(x - 1)[\left(x - \frac{1}{6}\right)^2 + \frac{11}{36}] < 0$ Since $[\left(x - \frac{1}{6}\right)^2 + \frac{11}{36}]$ always > 0, $(x - 1) < 0$ $x < 1$ The set of values of x is $\{x : x < 1\}$	 M1 M1 M1 B1 A1	 Mention only x-1 real factor

NO	ANSWER	MARKS	NOTES

8a

Solution	Mark	Total	Comment
Row 2 → row 2 − row 1 Row 3 → row 3 − row 1			
$= \begin{vmatrix} 1 & x & x^2 \\ 0 & y-x & y^2-x^2 \\ 0 & z-x & z^2-x^2 \end{vmatrix}$			
$= (y \quad x)(z \quad x)\begin{vmatrix} 1 & y+x \\ 1 & z \mid x \end{vmatrix}$	M1 A1		Finding one factor correctly Two factors correct correct work
$= (y-x)(z-x)(z-y)$	m1 A1	4	Complete method to find third fact All correct – any equivalent form
$(y-x)(z-x)(z-y) - (z^2-y^2) \times \det \mathbf{B}$	M1		Use of $\det \mathbf{AB} = \det \mathbf{A} \times \det \mathbf{B}$ – al are $\det \mathbf{A} = \det \mathbf{AB} \times \det \mathbf{B}^{-1}$ or $\det (\mathbf{AB})^{-1} = \det \mathbf{B}^{-1} \times \det \mathbf{A}^{-1}$
Hence $\det \mathbf{B} = \dfrac{(y-x)(z-x)(z-y)}{(z-y)(z+y)}$			
$\det \mathbf{B}^{-1} = \dfrac{(z-y)(z+y)}{(y \quad x)(z \quad x)(z \quad y)}$	M1		Correct use of $\det \mathbf{B}^{-1} = \frac{1}{\det \mathbf{B}}$ to ob expression for $\det \mathbf{B}^{-1}$ Numerator need to be factorised.
$\det \mathbf{B}^{-1} = \dfrac{(z+y)}{(y-x)(z-x)}$	A1	3	CSO - Fully correct with factor ca

8b

i.

Solution	Mark	Total	Comment
$\det \mathbf{M} = \begin{vmatrix} k & 3 \\ k & 1 \end{vmatrix} - 3\begin{vmatrix} 4 & 2 \\ k & 1 \end{vmatrix} + 2\begin{vmatrix} 4 & 2 \\ k & 3 \end{vmatrix}$	M1		Correct expansion by row or column
$= (k - 3k) - 3(4 - 2k) + 2(12 - 2k)$			
$= 12$	A1		CAO
(Constant/Independent of k and) therefore can never equal zero – hence non singular	E1	3	Explanation must refer to non-zero answer and M1A1 must have been scored

ii.

$\left(\begin{array}{ccc|c} 1 & 4 & 2 & 25 \\ 3 & k & 3 & 3 \\ 2 & k & 1 & 2 \end{array}\right)$ augment matrix -B1

TAMAT SAMPEL

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