SAMPEL PERCUMA

Skema Jawapan Trial STPM Math T Semester 1

Set penuh: Kertas Percubaan STPM

Sem 1 · Mathematics T

Sampel ini: 4 muka surat. Set penuh ada:

- 2 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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Sampel bermula di muka surat sebelah

Section A [45 marks]

Answer **all** *questions.*

1. The polynomial $p(x) = x^3 - 4x^2 - \frac{1}{2}x + 2, x \in R$.

   a) Express $p(x)$ as the product of a linear and one quadratic factor [3 marks]

   b) Hence, solve the trigonometric equation

   $cos^3\theta - 4cos^2\theta - \frac{1}{2}cos\theta + 2 = 0$ for $0^\circ \leq \theta \leq 360^\circ$ [5 marks]

2. The sum of the first n terms of a sequence $u_1, u_2, u_3, \ldots$ is given by $S_n = \frac{n}{2}[3+5n]$

   a) Find an explicit formula for u_n. [2 *marks*]

   b) Express u_{n+1} in terms of u_n.

   Hence, deduce that the sequence is an arithmetic progression. [5 *marks*]

3. If $\mathbf{P} = \begin{pmatrix} 5 & 2 & 3 \\ 1 & -4 & 3 \\ 3 & 1 & 2 \end{pmatrix}, \mathbf{Q} = \begin{pmatrix} a & 1 & -18 \\ b & -1 & 12 \\ -13 & -1 & c \end{pmatrix}$ and $\mathbf{PQ} = 2\mathbf{I}$, where $\mathbf{I}$ is the 3×3 identity matrix, determine the values of a, b and c. Hence, find $\mathbf{P}^{-1}$.

   [8 marks]

4. The complex number Z is given by $z = 1 + i\sqrt{3}$

   a) Express Z in polar form [3 marks]

   b) Using de Moivre's theorem , determine $z^{\frac{1}{2}}$ in cartesian form [4 marks]

5. The parametric equations of conic are $x = a\sec\theta + 2$ and $y = b\tan\theta - 3$, where a and b are positive constants and $0 \leq \theta \leq 2\pi$.

   a) Find the standard form for the equation of the conic and identify the type of the conic. [3 *marks*]

   b) If $a = b = 2$, determine and sketch the conic. [3 *marks*]

   c) Determine the general equation of the conic. [2 *marks*]

6. The position vectors of point P, Q and R is given as $2i+j+3k$, $6i-j+7k$ and $2i+4j+7k$ respectively.

a) Show that the angle $QPR = \cos^{-1}\left(\frac{1}{3}\right)$. [4 marks]

b) Find the area of the triangle PQR. [4 marks]

Section B [45 marks]

Answer **one** *question only.*

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 $f(x) = \frac{4}{2x-3}, x \in R, x > \frac{3}{2}$ [3 marks]

b) Find an expression for the inverse function $f^{-1}(x)$, in its simplest form
Hence, state the domain of $f^{-1}(x)$. [4 marks]

c) The function g is given by $g(x) = \ln(x-1), x \in R, x > 1$ [3 marks]

d) Show that $x = 1 + \sqrt{e}$ is the solution of the equation $fg(x) = -2$. [5 marks]

8. A plane $\prod_1$ passes through the points $A(1, 2, -1)$, $B(0, 2, 1)$ *and* $C(2, -4, 1)$ and the Cartesian equation of $\prod_2$ is $2x+2y-z=-5$

A line , l : $r = \begin{pmatrix} -1 \\ 5 \\ -2 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ -5 \\ 1 \end{pmatrix}$ passes through the plane $\prod_2$ at point D.

a) Find the Cartesian equation of the plane $\prod_1$. [5 marks]

b) Find the angle between the line, l and the plane. [3 marks]

c) Find the position vector of point D. [3 marks]

d) Find the line of intersection of the planes $\prod_1$ and $\prod_2$. [4 marks]

Marking Scheme

1.	The polynomial$(x) = x^3 - 4x^2 - \frac{1}{2}x + 2, x \in R$. p a) Express $p(x)$ as the product of a linear and one quadratic factor Let $x = 4$ $$p(4) = 4^3 - 4(4)^2 - \frac{1}{2}(4) + 2 = 0$$ $$\therefore p(x) = (x-4)(x^2 + bx - \frac{1}{2})$$ By any method(insertion/equating the coefficient/ long division $$p(x) = (x-4)(x^2 - \frac{1}{2})$$ b) Hence, solve the trigonometric equation $cos^3\theta - 4cos^2\theta - \frac{1}{2}cos\theta + 2 = 0$ for $0^\circ \leq \theta \leq 360^\circ$ $$cos^3\theta - 4cos^2\theta - \frac{1}{2}cos\theta + 2 = 0$$ $$(\cos\theta - 4)\pi\left(\cos^2\theta - \frac{1}{2}\right) = 0$$ $$cos\theta = 4(rejected)$$ $$cos^2\theta = \frac{1}{2}$$ $cos\theta = \mp\frac{\sqrt{2}}{2}$ (basic angle=45°) $$\theta = 45^\circ, 135^\circ, 225^\circ, 315^\circ$$	B1 (must =0) M1M1 (Find value of b) or other method A1 M1 (Factorise) M1 (M0 if not stated rejected) M1A1 (all correct)

3	**PQ** = 2**I** $\begin{pmatrix}5 & 2 & 3\\ 1 & -4 & 3\\ 3 & 1 & 2\end{pmatrix}\begin{pmatrix}a & 1 & -18\\ b & -1 & 12\\ -13 & -1 & c\end{pmatrix} = 2\begin{pmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{pmatrix}$ $\begin{pmatrix}5a+2b-39 & 0 & -66+3c\\ a-4b-39 & 2 & -66+3c\\ 3a+b-26 & 0 & -42+2c\end{pmatrix} = \begin{pmatrix}2 & 0 & 0\\ 0 & 2 & 0\\ 0 & 0 & 2\end{pmatrix}$ $5a+2b-39=2$ $5a+2b=41 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$ $a-4b-39=0$ $a-4b=39 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$ $(1)\times 2, \quad 10a+4b$ $= 82 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$ $(2)+(3), 11a=121$ $\boldsymbol{a=11}$ Substitute $a=11$ into (2), $11-4b=39$ $\boldsymbol{b=-7}$ $-66+3c=0$ $\boldsymbol{c=22}$ **PQ** = 2**I** $\frac{1}{2}\mathbf{PQ}=\mathbf{I}$ $\mathbf{P}\left(\frac{1}{2}\mathbf{Q}\right)=\mathbf{I}$ $\therefore \mathbf{P}^{-1}=\frac{1}{2}\mathbf{Q}$ $=\frac{1}{2}\begin{pmatrix}11 & 1 & -18\\ -7 & -1 & 12\\ -13 & -1 & 22\end{pmatrix}$	M1 M1 M1 A1 A1 A1 M1 A1	Solve the simultaneous equation

TAMAT SAMPEL

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