SAMPEL PERCUMA

Trial STPM 2020 Mathematics T Semester 1, SMK King George V Seremban

Set penuh: Kertas Percubaan STPM

Sem 1 · Mathematics T

Sampel ini: 8 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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PEPERIKSAAN PERCUBAAN SEMESTER 1
SIJIL TINGGI PERSEKOLAHAN MALAYSIA 2020

SMK KING GEORGE V, SEREMBAN

Instruction to candidates:

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE ALLOWED TO DO SO.

Answer **all** *questions in Section A.*

Answer **one** *question only in Section B.*

Write the answers on the answer sheets provided. Begin each answer on a new page of the answer sheet. All working should be shown.

Scientific calculators may be used. Programmable and graphic display calculators are **not** *allowed.*

Answers may be written either in English or Malay.

This question paper consists of 4 printed pages.

Section A [45 *marks*]
Answer all questions in this section

1. Sketch, on the same axes, the graphs of $y = |2x-1|$ and $y = \frac{1}{|x|}$.

   Hence, solve the inequality $|2x-1| > \frac{1}{|x|}$. [6 *marks*]

2. The rth term, U_r, of a series is given by $U_r = \left(\frac{1}{3}\right)^{2r-3} + \left(\frac{1}{3}\right)^{2r-1}$.

   Express $\sum_{r=1}^{n} U_r$ in the form $A\left(1 - \frac{B}{9^n}\right)$, where A and B are constants that must be evaluated. Hence find the sum to infinity of this series. [9 *marks*]

3. A matrix $\boldsymbol{N}$ is given by $\boldsymbol{N} = \begin{pmatrix} 1 & 2 & 1 \\ 1 & 0 & 2 \\ -1 & 3 & 1 \end{pmatrix}$.

   (a) Find $\boldsymbol{N}^2 - 2\boldsymbol{N} - 6\boldsymbol{I}$. [3 *marks*]

   (b) Show that $\boldsymbol{N}\left(\boldsymbol{N}^2 - 2\boldsymbol{N} - 6\boldsymbol{I}\right) = -9\boldsymbol{I}$ where $\boldsymbol{I}$ is the 3 x 3 identity matrix, and deduce $\boldsymbol{N}^{-1}$. [4 *marks*]

4. The complex number, $1 + i\sqrt{3}$ is denoted by z.

   (a) Express z in the form $r(\cos\boldsymbol{\theta} + i\sin\boldsymbol{\theta})$ where r > 0 and $-\boldsymbol{\pi} < \boldsymbol{\theta} \leq \boldsymbol{\pi}$. Hence, or otherwise, find the modulus and argument of z^3. [3 *marks*]

   (b) Hence, find the values of all the cube roots of $4 + 4i\sqrt{3}$ in the form $r(\cos\boldsymbol{\theta} + i\sin\boldsymbol{\theta})$. [5 *marks*]

5. Find the Cartesian equation of the ellipse with the parametric equations

   $x = 3\cos\boldsymbol{\theta} - 3$, $y = \sin\boldsymbol{\theta} + 2$ [2 *marks*]

   Hence, determine the centre, vertices and foci and sketch the ellipse. [6 *marks*]

6. The equations of two intersecting lines are given by

   $$\boldsymbol{r} = (2\boldsymbol{i} + \boldsymbol{j}) + t(\boldsymbol{i} + \boldsymbol{j} + 2\boldsymbol{k}) \text{ and } x - 2 = \frac{y-2}{2} = z + 1$$

   (a) Determine the coordinates of the point of intersection of two lines. [3 marks]

   (b) Find the angle between the two lines. [4 marks]

Section B [15 *marks*]
Answer any **one** question in this section

7. Write cos x – 2 sin x in the form, $R\cos(x \pm \alpha)$, with $R > 0$ and $0° < \alpha < 90°$, and give the value α correct to nearest 0.1°.

   Find the maximum and minimum values for y = cos x – 2 sin x and give, to the nearest 0.1°, the values of x in the range $0° < x < 360°$ where the maximum and minimum values exist. [5 *marks*]

   (a) Sketch the curve y = cos x – 2 sin x for $0° \leq x \leq 360°$. [2 *marks*]

   (b) Find the range of values x between 0° and 360° that satisfy the inequality,

   cos x – 2 sin $x \geq 2$ [4 *marks*]

   (c) Find the largest value and least value of $\frac{1}{\cos x - 2\sin x + 3}$. [4 *marks*]

8. Given point $P(p^2, 2p)$ and $Q(q^2, 2q)$ are two points on the curve $y^2 = 4x$.

(a) Prove that the equation of the chord joining P and Q is $(p + q)y - 2x = 2pq$. [3 *marks*]

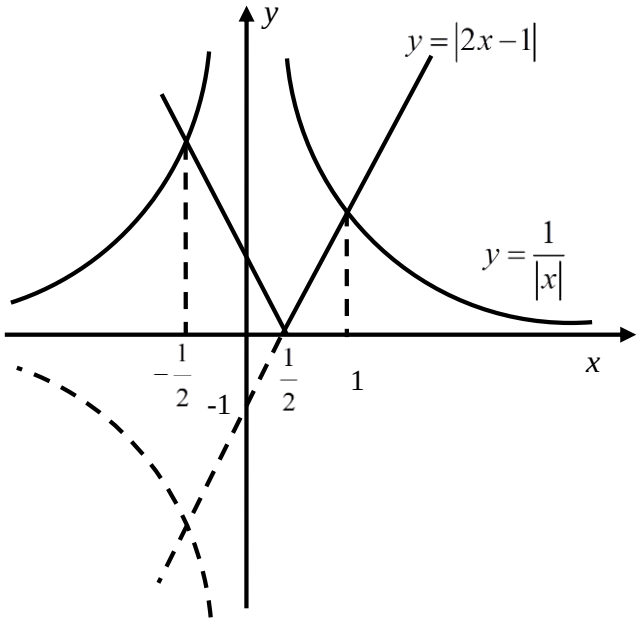
(b) Deduce the equation of the tangent to the curve at P. [2 *marks*]

(c) The chord PQ passes through the fixed point (3, 0). Prove that the mid-point of the chord lies on the curve $y^2 = 2(x - 3)$. [4 *marks*]

(d) The tangents to the curve at P and Q meet at T. Show that the locus of T is a straight line parallel to the y-axis. [6 *marks*]

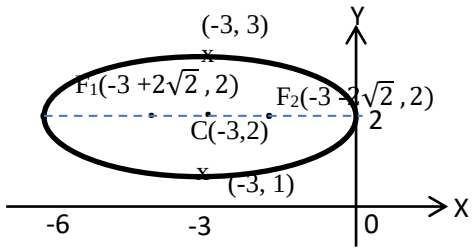
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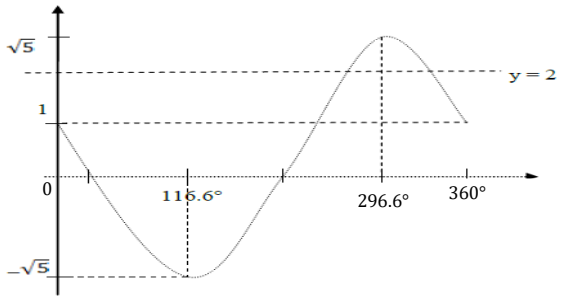
MARKING SCHEME (MATHEMATICS T – PRA-U 1)(2020)

1)	$2x-1=\frac{1}{x}$ $2x^2-x-1=0$ $(2x+1)(x-1)=0$ $x=1,\ x=-\frac{1}{2}$ $y=2x-1=0 \Rightarrow x=\frac{1}{2}$  $\left\{x : x<-\frac{1}{2}\ or\ x>1\right\}$	M1 A1 D1 (1st graph) D1 (2nd graph) D1 (all correct) A1(All D correct) [T:6]
2)	$U_r=\left(\frac{1}{3}\right)^{2r-3}+\left(\frac{1}{3}\right)^{2r-1}$ $=27\left(\frac{1}{3}\right)^{2r}+3\left(\frac{1}{3}\right)^{2r}$ $=30\left(\frac{1}{3}\right)^{2r}$ $\therefore \sum_{r=1}^{n} U_r = \sum_{r=1}^{n} 30\left(\frac{1}{3}\right)^{2r}$	M1 A1 B1

	$= 30\sum_{r=1}^{n}\left(\frac{1}{3}\right)^{2r} = 30\left[\left(\frac{1}{3}\right)^{2} + \left(\frac{1}{3}\right)^{4} + \left(\frac{1}{3}\right)^{6} + \cdots + \left(\frac{1}{3}\right)^{2n}\right]$ $= 30\left(\frac{1}{3}\right)^{2}\left[1 + \left(\frac{1}{3}\right)^{2} + \left(\frac{1}{3}\right)^{4} + \cdots + \left(\frac{1}{3}\right)^{2(n-1)}\right]$	M1
	$= \frac{30}{9}\left[\frac{1-\left(\frac{1}{3}\right)^{2n}}{1-\left(\frac{1}{3}\right)^{2}}\right]$ $= \frac{30}{9}\left(\frac{9}{8}\right)\left[1-\left(\frac{1}{3}\right)^{2n}\right]$	M1
	$= \frac{15}{4}\left[1-\left(\frac{1}{3}\right)^{2n}\right] = \frac{15}{4}\left[1-\frac{1}{9^{n}}\right]$ Thus, $A = \frac{15}{4}$, $and\ B = 1$	M1A1
	$$\sum_{r=1}^{\infty} U_r = \lim_{n\to\infty}\sum_{r=1}^{n} U_r = \lim_{n\to\infty}\frac{15}{4}\left[1-\frac{1}{9^{n}}\right] = \frac{15}{4} - 0 = \frac{15}{4}$$	M1 A1 [T:9]
3)	(a) $\boldsymbol{N}^2 - 2\boldsymbol{N} - 6\boldsymbol{I}$ $= \begin{pmatrix}1&2&1\\1&0&2\\-1&3&1\end{pmatrix}\begin{pmatrix}1&2&1\\1&0&2\\-1&3&1\end{pmatrix} - 2\begin{pmatrix}1&2&1\\1&0&2\\-1&3&1\end{pmatrix} - 6\begin{pmatrix}1&0&0\\0&1&0\\0&0&1\end{pmatrix}$	B1
	$= \begin{pmatrix}2&5&6\\-1&8&3\\1&1&6\end{pmatrix} - \begin{pmatrix}2&4&2\\2&0&4\\-2&6&2\end{pmatrix} - \begin{pmatrix}6&0&0\\0&6&0\\0&0&6\end{pmatrix}$	M1
	$= \begin{pmatrix}-6&1&4\\-3&2&-1\\3&-5&-2\end{pmatrix}$	A1
	(b) $\boldsymbol{N}\left(\boldsymbol{N}^2 - 2\boldsymbol{N} - 6\boldsymbol{I}\right)$ $= \begin{pmatrix}1&2&1\\1&0&2\\-1&3&1\end{pmatrix}\begin{pmatrix}-6&1&4\\-3&2&-1\\3&-5&-2\end{pmatrix}$	B1
	$= \begin{pmatrix}-9&0&0\\0&-9&0\\0&0&-9\end{pmatrix}$ $= -9\boldsymbol{I}$	A1

	$\boldsymbol{N^{-1} = -\frac{1}{9}(N^2 - 2N - 6I)}$ $= -\frac{1}{9}\begin{pmatrix} -6 & 1 & 4 \\ -3 & 2 & -1 \\ 3 & -5 & -2 \end{pmatrix} = \begin{pmatrix} \frac{2}{3} & -\frac{1}{9} & -\frac{4}{9} \\ \frac{1}{3} & -\frac{2}{9} & \frac{1}{9} \\ -\frac{1}{3} & \frac{5}{9} & \frac{2}{9} \end{pmatrix}$	B1 A1 [T:7]
4a)	$z = 1 + i\sqrt{3}$ $modulus, \lvert z\rvert = \sqrt{1^2 + \left(\sqrt{3}\right)^2} \qquad argument(z) = \frac{\pi}{3} rad$ $\lvert z\rvert = 2$ $\therefore z = 2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$ $z^3 = 2^3\left[\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right]^3$ $= 8[\cos\pi + i\sin\pi]$ $modulus, \lvert z^3\rvert = 8 \quad argument(z^3) = \pi$	B1 A1 M1 A1
4b)	$w = 4 + 4i\sqrt{3} = 4(1 + i\sqrt{3})$ $= 8\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$ $= 8\left(\cos\left(2\pi k + \frac{\pi}{3}\right) + i\sin\left(2\pi k + \frac{\pi}{3}\right)\right)$ $w^{\frac{1}{3}} = \left(4 + 4i\sqrt{3}\right)^{\frac{1}{3}} = 8^{\frac{1}{3}}\left(\cos\left(2\pi k + \frac{\pi}{3}\right) + i\sin\left(2\pi k + \frac{\pi}{3}\right)\right)^{\frac{1}{3}}$ $= 2\left(\cos\left(\frac{2\pi k}{3} + \frac{\pi}{9}\right) + i\sin\left(\frac{2\pi k}{3} + \frac{\pi}{9}\right)\right), with\ k = 0,1,2$ $k = 0, \ w_0 = 2\left[\cos\left(\frac{\pi}{9}\right) + i\sin\left(\frac{\pi}{9}\right)\right]$ $k = 1, \ w_1 = 2\left[\cos\left(\frac{7\pi}{9}\right) + i\ sin\left(\frac{7\pi}{9}\right)\right]$ $k = 2, \ w_2 = 2\left[\cos\left(\frac{13\pi}{9}\right) + i\ sin\left(\frac{13\pi}{9}\right)\right]$ $= 2\left[\cos\left(-\frac{5\pi}{9}\right) + i\ sin\left(-\frac{5\pi}{9}\right)\right]$	B1 M1 A1 (one correct) A1 (all correct) [T:8]

5	$x = 3\cos\theta - 3$, $\cos\theta = \frac{x+3}{3}$, $y = \sin\theta + 2$, $\sin\theta = y - 2$ $sin^2\theta + cos^2\theta = 1$ $\frac{(x+3)^2}{9} + \frac{(y-2)^2}{1} = 1$ a=3 , b=1 $c = \sqrt{3^2 - 1^2} = \sqrt{8} = 2\sqrt{2}$ Centre (-3,2) Vertices (0,2) and (-6,2) Foci (-3 +2$\sqrt{2}$, 2) and (-3 - 2$\sqrt{2}$, 2)  	M1 A1 M1 A1 A1 (both correct) A1 (both correct) D1 (shape & centre,2nd quadrant) D1 (vertices correct) [T:8]
6(a)	$r_1 = r_2 \rightarrow \begin{pmatrix} 2+t \\ 1+t \\ 2t \end{pmatrix} = \begin{pmatrix} 2+s \\ 2+2s \\ -1+s \end{pmatrix}$ $t = s\,, 1+s = 2+2s\,, s = -1\,, 2s = -1+s,$ $t = s = -1$ Intersection point : $(1, 0, -2)$	B1 (all correct) M1 (try to solve and get his *s* and *t*) A1 (in coordinate form)
6(b)	$\lvert b_1\rvert = \sqrt{1+1+4} = \sqrt{6}$; $\lvert b_2\rvert = \sqrt{1+4+1} = \sqrt{6}$ $b_1 \cdot b_2 = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} = 1+2+2 = 5$ $\cos\theta = \frac{5}{\sqrt{6}\sqrt{6}} = \frac{5}{6}$ $\theta = 33.56°$	B1 (both) M1(dot product) M1 A1 [T:7]
7	Let cos *x* – 2 sin *x* ≡ *R* cos (*x* + *α*) ≡ *R* cos *x* cos *α* – *R* sin *x* sin *α* Hence, *R* sin α = 2 *R* cos α = 1 tan α = 2 , α = 63.43° = 63.4° (to 0.1 degree) $R^2(sin^2\alpha + cos^2\alpha) = 2^2 + 1^2$ $R = \sqrt{5}$ Hence, cos *x* – 2 sin *x* = $\sqrt{5}$ cos (x + 63.4°) Maximum value of y is $\sqrt{5}$ when *x*+ 63.4° = 360° i.e. *x* = 296.6° Minimum value of y is $-\sqrt{5}$ when *x*+ 63.4° =180° i.e. *x* =116.6 °	M1 2 equations A1 α and R values A1 B1 B1

7a)	When $x = 0°$, $y = 1$ When $x = 360°$, $y = 1$  	D1 shape D1 Max & min point Start and end points
7b)	Solve $\cos x - 2\sin x \geq 2$ Let $\sqrt{5}\cos(x + 63.43°) = 2$ $\cos(x + 63.43°) = \frac{2}{\sqrt{5}}$ $x + 63.43° = 333.43°,\ 386.57°$ $x = 270°,\ 323.14°$ Hence the range of values x such that is $\{x : 270° \leq x \leq 323.1°\}$	D1 draw line y = 2 on graph M1 A1 A1
7c)	From $\cos x - 2\sin x = \sqrt{5}\cos(x + 63.4°)$ and $-1 \leq \cos(x + 63.4°) \leq 1$ $-\sqrt{5} \leq \cos x - 2\sin x \leq \sqrt{5}$ $3 - \sqrt{5} \leq \cos x - 2\sin x + 3 \leq 3 + \sqrt{5}$ $\frac{1}{3+\sqrt{5}} \leq \frac{1}{\cos x - 2\sin x + 3} \leq \frac{1}{3-\sqrt{5}}$ The greatest value of $f(x) = \frac{1}{3-\sqrt{5}} = \frac{3+\sqrt{5}}{(3-\sqrt{5})(3+\sqrt{5})} = \frac{3+\sqrt{5}}{4}$ The least value of $f(x) = \frac{1}{3+\sqrt{5}} = \frac{3-\sqrt{5}}{(3+\sqrt{5})(3-\sqrt{5})} = \frac{3-\sqrt{5}}{4}$	M1 M1 A1 A1 [T:15]

TAMAT SAMPEL

Suka sampel ini?

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