SAMPEL PERCUMA

Trial STPM 2019 Mathematics T Semester 1 (2 Set)

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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Sampel bermula di muka surat sebelah

Section A [45 marks]

Answer **all** questions in this section

1. Solve the simultaneous equations

$$log_2 x - log_4 y = 4$$
$$log_2(x - 2y) = 5$$

[6 marks]

2. The *n*th term of a geometric series is u_n , where $u_n = 162\left(\frac{2}{3}\right)^n$.

(a) Find the value of u_1 and the value of u_2 . [2 marks]

(b) Find the sum to infinity of the series. [2 marks]

(c) Find the smallest value of ***k*** for which [3 marks]

$$\sum_{n=k}^{\infty} u_n < 2.5$$

3. (a) Given that the matrices $P = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{pmatrix}$ and $Q = \begin{pmatrix} -1 & 3 & -2 \\ 3 & -3 & 1 \\ -2 & 1 & 0 \end{pmatrix}$, show that

PQ = kI, where k is a constant and I is the 3 X 3 identity matrix. [5 marks]

(b) Hence, determine P^{-1}. [4 marks]

4. (a) Show that $(2 + i)^3$ can be expressed in the form $2 + bi$, where *b* is an integer.

[2 marks]

(b) It is given that $2 + i$ is a root of equations $Z^3 + pZ + q = 0$, where ***p*** and ***q*** are real numbers.

(i) Show that $p = -11$ and find the value of ***q.*** [4 marks]

(ii) Given that $2 - i$ is also a root of $Z^3 + pZ + q = 0$, find a quadratic factor of $Z^3 + pZ + q = 0$ with real coefficients. [2 marks]

(iii) Find the real root of equation $Z^3 + pZ + q = 0$ [2 marks]

5. The ellipse ***D*** has equation $\frac{x^2}{25} + \frac{y^2}{9} = 1$ and the ellipse ***E*** has equation $\frac{x^2}{4} + \frac{y^2}{9} = 1$

(a) Sketch D and E on the same diagram, showing the coordinates o the points where each curve crosses the axes. [3 marks]

(b) The point ***S*** is a focus of ***D*** and the point ***T*** is a focus of ***E.***

Find the length of ***ST.*** [4 marks]

6. It is given that the equation of a plane and a straight line are $x + 2y - z = 3$ *and*

$\frac{x+3}{2} = \frac{y}{-1} = \frac{z+3}{-1}$ respectively.

Find

(a) the intersection point. [4 marks]

(b) the angle [2 marks]

between the plane and the straight line.

Section B [15 marks]

Answer any **one** question in this section .

7. (a) Expand $\frac{1}{(1+3x)\sqrt{1-2x}}$ in ascending powers of x up to and including the terms in x^3 .

[5 marks]

State the range of values o x for which the expansion is valid. [2 marks]

Using $= \frac{1}{10}$, find the approximation of $\sqrt{5}$ in the form $\frac{p}{q}$, where p and q are

positive integers. [3 marks]

(b) Solve the equation $\sqrt{1-20x} - 2\sqrt{x+1} = 3$ [5 marks]

8. (a). Given that the equation of circle is $x^2 + y^2 - 12x - 16y + 75 = 0$.

State

(i) the centre

(ii) the radius

of the circle. [4 marks]

(b). Show that the straight line $4y + 3x = 75$ touches the circle $x^2 + y^2 - 12x - 16y + 75 = 0$.

[4 marks]

Sketch the straight line $4y + 3x = 75$ and the circle $x^2 + y^2 - 12x - 16y + 75 = 0$ on the same graph. [3 marks]

Hence, find the point where the line touches the circle. [4 marks]

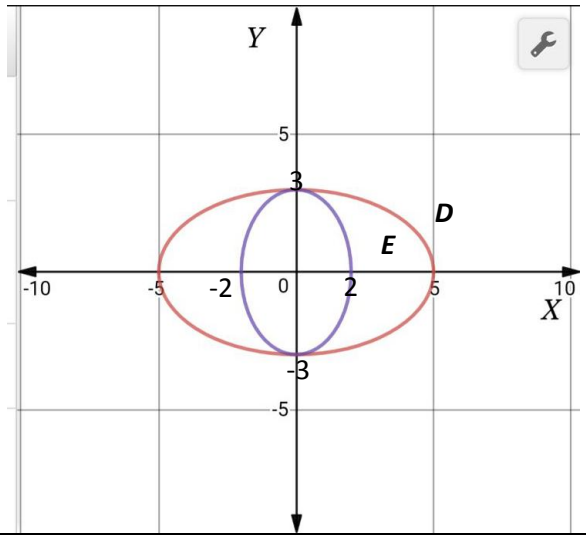
----------END OF QUESTIONS----------

MARKING SCHEME OF MATHEMATICS T 954/1 2019

No of Question	Marking Scheme	Mark
Q1	Solve the simultaneous equations $log_2 x - log_4 y = 4$ $log_2(x - 2y) = 5$ [6 marks]	
	$log_2 x - log_2 y = 4$ $log_2 x - \frac{log_2 y}{log_2 4} = 4$ $log_2 \frac{x^2}{y} = 8$ $x^2 = 256y$…….(1) $log_2(x - 2y) = 5$ $x - 2y = 32$…….(2) $Solve\ eq\ (1) and\ (2)$: $(2y + 32)^2 = 256y$ $(y - 16)^2 = 0$ $y = 16\ , x = 64$	M1 M1 M1 M1 M1 A1-both

Q2	The *n*th term of a geometric series is u_n , where $u_n = 162\left(\frac{2}{3}\right)^n$. (a) Find the value of u_1 and the value of u_2 . [2 marks] (b) Find the sum to infinity of the series. [2 marks] (c) Find the smallest value of ***k*** for which [3 marks] $\sum_{n=k}^{\infty} u_n < 2.5$	
a	$u_1 = 108\ \ , u_2 = 72$	B1B1
b	$S_\infty = \frac{108}{1 - \frac{2}{3}}$ $S_\infty = 324$	M1 A1
c	$\sum_{n=k}^{\infty} u_n = S_\infty - \sum_{n=1}^{k-1} u_n$ $324 - 324\left(1 - \left(\frac{2}{3}\right)^{k-1}\right) < 2.5$ Smallest value of $k\ is$ 13	B1 M1 A1

Q4	(a) Show that $(2+i)^3$ can be expressed in the form $2+bi$, where b is an integer. [2 marks] (b) It is given that $2+i$ is a root of equations $Z^3+pZ+q=0$, where ***p*** and ***q*** are real numbers. (i) Show that $p=-11$ and find the value of ***q***. [4 marks] (ii) Given that $2-i$ is also a root of $Z^3+pZ+q=0$, find a quadratic factor of $Z^3+pZ+q=0$ with real coefficients. [2 marks] (iii) Find the real root of equation $Z^3+pZ+q=0$ [2 marks]	
a	$(2+i)^3 = 2^3+3(2)^2i+3(2)i^2+i^3$ $=2+11i$	M1 Binomial (3 of 4 terms correct) A1
b(i)	$Z^3+pZ+q=0$ $(2+i)^3+p(2+i)+q=0$ $Re: 2+2p+q=0,\ Im: 11+p=0$ $p=-11, \quad q=20$	B1 M1(either real part or imaginary part) A1A1
b(ii)	$=[Z-(2+i)][Z-(2+i)]$ $=Z^2-4Z+5$ Quadratics factor Z^2-4Z+5	M1 A1
b(iii)	$Z^3-11Z+20=(Z^2-4Z+5)(Z+4)$ Real root is -4	M1 A1

Q5	The ellipse ***D*** has equation $\frac{x^2}{25}+\frac{y^2}{9}=1$ and the ellipse ***E*** has equation $\frac{x^2}{4}+\frac{y^2}{9}=1$ (a) Sketch D and E on the same diagram, showing the coordinates o the points where each curve crosses the axes. [3 marks] (b) The point ***S*** is a focus of ***D*** and the point ***T*** is a focus of ***E***. Find the length of ***ST***. [4 marks]	
a		D1 (ellipse ***D***) D1 (ellipse ***E***) D1 (all correct)

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

1. Sketch the graphs of $y = \cos\theta, y = \sin 2\theta$ for $\theta \in [-\pi, \pi]$ on the same coordinate axes. Hence solve the inequality $\cos\theta \leq \sin 2\theta$. [6 *marks*]

2. The *r*th term , u_r, of an infinite series is given by

$$u_r = \left(\frac{1}{3}\right)^{2r+1} + \left(\frac{1}{3}\right)^{2r-1}$$

   a) Express u_r in the form $\frac{A}{3^{2r+1}}$,where A is a constant. [2 *marks*]
   b) Find the sum of the first n terms of the series and deduce the sum to infinity series. [6 *marks*]

3. The matrices M and N are given by

$$M = \begin{bmatrix} 1 & 1 & 1 \\ a & b & c \\ bc & ac & ab \end{bmatrix}, N = \begin{bmatrix} 4 & 4a & 4bc \\ 1 & c & ab \\ 1 & b & ac \end{bmatrix}$$

   a) Show that $\det M = (a-b)(b-c)(c-a)$, [4 *marks*]
   b) Deduce det *N.* [4 *marks*]

4. Express the complex numbers $1+i$ and $1-i$ in polar form for $0^o \leq \theta \leq 360^o$. Hence by using De Moivre's theorem, evaluate $\frac{(1+i)^5}{(1-i)^7}$. [6 marks]

5. The equation of a hyperbola is $x^2 - y^2 - 4x = 0$.
   a) Find the standard form for the equation of the hyperbola .State the coordinates of the centre and vertices of the hyperbola. [4 marks]
   b) Determine the equations of the asymptotes of the hyperbola, and show that the asymptotes are perpendicular to each other. [4 marks]
   c) Sketch the hyperbola. [2 marks]

6. The line $r = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + \gamma \begin{pmatrix} 3 \\ p \\ 1 \end{pmatrix}$ is perpendicular to the plane $r = \begin{pmatrix} 5 \\ 0 \\ 1 \end{pmatrix} + s \begin{pmatrix} 1 \\ -1 \\ q \end{pmatrix} + t \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix}$,
   where p and q are constants and $\gamma, s, t \in R$.
   a) Determine the values of p and q. [3 marks]
   b) Find the position vector of the point of intersection of the line and the plane. [4 marks]

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

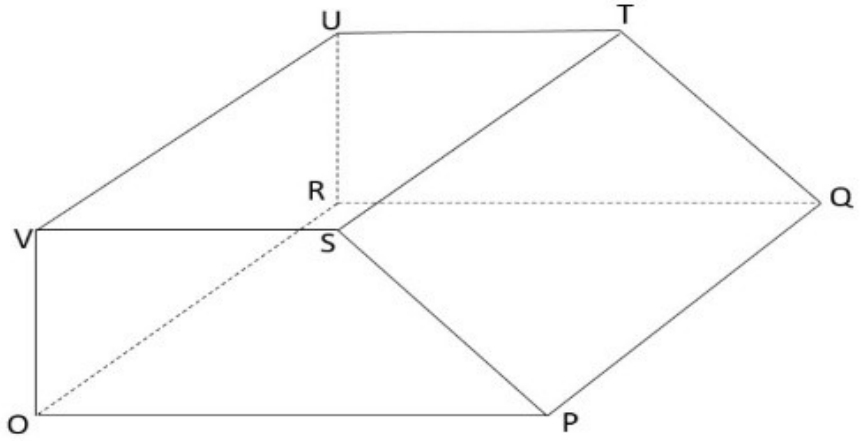
SECTION B [15 *marks*]
*Answer **one** question only*

7. The variables x, y and z satisfy the system of linear equations

$$2x + y + 2z = 1$$
$$4x + 2y + z = k$$
$$8x + 4y + 7z = k^2$$

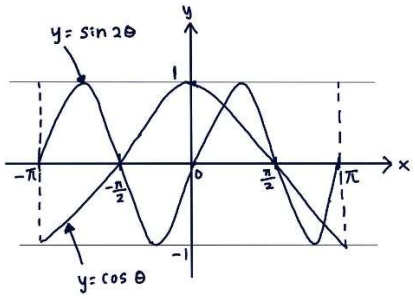
Where *k* is the real constant .
a) Write a matrix equation for the system of linear equations . [1 marks]
b) Reduce the augmented matrix to row – echelon form , and show that the system of linear equations does not have a unique solution . [6 marks]
c) Determine all the values of *k* for which the system of linear equations has infinitely many solutions , and find the solutions in the case when *k* is positive. [6 marks]
d) Find the set of values of *k* for which the system of linear equations is inconsistent. [2 marks]

8. The diagram below shows a ramp with a rectangular top STUV and a horizontal rectangular base OPQR. The planes OPSV, ORUV and RQTU are perpendicular to the base OPQR and the tops STUV.



The unit vector ***i*** and ***j*** are parallel to $\overrightarrow{OP}$ and $\overrightarrow{OR}$ respectively, and the unit vector ***k*** is perpendicular to the plane OPQR, where O is origin. Given that the vectors $\overrightarrow{OP}$, $\overrightarrow{OS}$ and $\overrightarrow{OU}$ are $8i, 5i + 3k$ and $10j + 3k$ respectively.
a) Calculate the area of the triangle PSU. [4 marks]
b) Find the perpendicular distance from S to the line PU. [4 marks]
c) Find the equation of the plane PSU in the form $r \bullet n = d$. [3 marks]
d) Calculate the acute angle between the plane PSU and the plane OSU. [4 marks]

KERTAS SOALAN TAMAT

1)	Sketch the graphs of $y=\cos\theta, y=\sin 2\theta$ for $\theta\in[-\pi,\pi]$ on the same coordinate axes. Hence solve the inequality $\cos\theta\le\sin 2\theta$. [6 marks]	
		D1 $\sin 2\theta$ D1 $\cos\theta$
	$\cos\theta-2\sin\theta\cos\theta=0$ $\cos\theta(1-2\sin\theta)=0$	B1 (seen either one)
	$\cos\theta=0,\theta=-\frac{\pi}{2},\frac{\pi}{2}$	M1
	$\sin\theta=\frac{1}{2},\theta=\frac{\pi}{6},\frac{5\pi}{6}$	M1
	Inequality $x\in\left\{x:-\pi\le x\le-\frac{\pi}{2},\frac{\pi}{6}\le x\le\frac{\pi}{2},\frac{5\pi}{6}\le x\le\pi\right\}$	A1
		6 marks

2)	The *r*th term , u_r, of an infinite series is given by $u_r=\left(\frac{1}{3}\right)^{2r+1}+\left(\frac{1}{3}\right)^{2r-1}$ [6 *marks*]	
a)	Express u_r in the form $\frac{A}{3^{2r+1,}}$,where A is a constant. [2 *marks*] $=\frac{1}{3^{2r+1}}+\frac{1}{3^{2r-1}}$ $=\frac{1}{3^{2r+1}}+\frac{1}{3^{2r+1}.3^{-2}}$ $=\frac{1}{3^{2r+1}}+\frac{3^2}{3^{2r+1}}$	M1
	$=\frac{10}{3^{2r+1}}$	A1
		2 marks
b)	Find the sum of the first n terms of the series and deduce the sum to infinity series First term , $a=u_1=\frac{10}{3^{2(1)+1}}=\frac{10}{3^3}=\frac{10}{27}$	B1
	Common ratio , $r=\frac{u_2}{u_1}=\frac{\frac{10}{3^{2(2)+1}}}{\frac{10}{3^{2(1)+1}}}=\frac{3^3}{3^5}=\frac{1}{9}$	B1
	$=\frac{\frac{10}{27}\left[1-\left(\frac{1}{9}\right)^n\right]}{1-\frac{1}{9}}=\frac{10}{27}\left(\frac{9}{8}\right)\left[1-\left(\frac{1}{9}\right)^n\right]=\frac{5}{12}\left[1-\left(\frac{1}{9}\right)^n\right]$	M1A1
	$\lim_{n\to\infty}S_n=\lim_{n\to\infty}\frac{5}{12}\left[1-\left(\frac{1}{9}\right)^n\right]=\frac{5}{12}(1)=\frac{5}{12}$	M1A1
		6 marks
		8 marks

TAMAT SAMPEL

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- 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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