SAMPEL PERCUMA

Trial STPM 2019 Mathematics T Semester 1 Johor (Batu Pahat)

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. (a) If $\log x = 2 + \log y = \log \frac{4}{9} - \log \frac{9}{125} + 2\log \frac{9}{5}$, find x and y without using tables or a calculator.

[4 marks]

(b) The expression $ax^3 - 9x^2 + bx + 3a$ is exactly divisible by $x^2 - 5x + 6$. Calculate the values of a and b.

[5 marks]

2. Show that $\left(1+\sqrt{2}\right)^5 + \left(1-\sqrt{2}\right)^5 = 82$. Hence, deduce that $82 < \left(1+\sqrt{2}\right)^5 < 83$.

[6 marks]

3. Given that matrix $A = \begin{pmatrix} 3 & 2x & x \\ 0 & x+1 & 6 \\ 0 & 0 & x \end{pmatrix}$ and $|A| = 60$.

(a) Find the values of x.

[3 marks]

(b) By using the positive value of x obtained in (a), find the inverse of matrix A by using elementary row operations.

[5 marks]

4. Given that $(x + \mathrm{i})$ is a factor of the expression $x^4 - 2x^3 + bx^2 - 2x + 2$, find the value of b. Hence, solve the quartic equation $x^4 - 2x^3 + bx^2 - 2x + 2 = 0$.

[6 marks]

5. Express $4x^2 + y^2 - 24x + 2y + 33 = 0$ in the standard form. State the type of the conic. Find its centre and vertices. Sketch the graph of the conic.

[7 marks]

6. The plane π_1 and π_2 have equations given by $\underline{r} \bullet (\underline{i} + 2\underline{j} + 2\underline{k}) = 2$ and $\underline{r} = (2\underline{i} + \underline{j} - \underline{k}) + \lambda(\underline{i} + 2\underline{j}) + \mu(6\underline{i} + 2\underline{j} - 5\underline{k})$, λ, $\mu \in R$ respectively. The two planes intersect in the line l.

(a) Find the acute angle between π_1 and π_2.

[3 marks]

(b) Show that the vector $6\underline{i} + 2\underline{j} - 5\underline{k}$ is parallel to π_1.

[2 marks]

(c) Find Cartesian equation of the line l.

[4 marks]

*This question paper is CONFIDENTIAL until the examination is over.

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

7. Given that $P = \begin{pmatrix} 5 & 2 & 3 \\ 1 & -4 & 3 \\ 3 & 1 & 2 \end{pmatrix}$ and $Q = \begin{pmatrix} a & 1 & -18 \\ b & -1 & 12 \\ -13 & -1 & c \end{pmatrix}$ and $PQ = 2I$, where I is the 3×3 identity matrix.

(a) Determine the value of a, b and c.

[3 marks]

(b) Hence, find P^{-1}.

[4 marks]

(c) Two groups of workers have their drinks at a stall. The first group comprising ten workers has five cups of tea, two cups of coffee, and three glasses of fruit juice at a total cost of RM11.80. The second group of six workers has three cups of tea, a cup of coffee and two glasses fruit juice at a total cost of RM7.10.The cost of a cup of tea and three glasses of fruit juice is the same as the cost of four cups of coffee. If the costs of a cup of tea, a cup of coffee and a glass of fruit juice are RMx , RMy and RMz respectively, obtain a matrix equation to represent the above information. Hence, determine the cost of each drink.

[8 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]

The chord PQ passes through the fixed point (3, 0).

(c) Prove that the mid-point of the chord lies on the curve $y^2 = 2(x - 3)$.

[4 marks]

The tangents to the curve at P and Q meet at T.

(d) Show that the locus of T is a straight line parallel to the y-axis.

[6 marks]

End of The Question Paper

*This question paper is CONFIDENTIAL until the examination is over.

Marking Scheme Mathematics (T)Paper 1 STPM 2019

Section A [45 *marks*]
Answer **all** *questions in th is section.*

1. (a) If $\log x = 2 + \log y = \log\frac{4}{9} - \log\frac{9}{125} + 2\log\frac{9}{5}$, find x and y without using tables or a calculator.

[4 marks]

(b) The expression $ax^3 - 9x^2 + bx + 3a$ is exactly divisible by $x^2 - 5x + 6$. Calculate the values of a and b.

[5 marks]

No	Solutions	Marks
1 (a)	$\lg x = 2 + \lg y = \lg\frac{4}{9} - \lg\frac{9}{125} + 2\lg\frac{9}{5}$	
	$\lg x = 2 + \lg y = \lg\left(\frac{4}{9}\right)\left(\frac{125}{8}\right)\left(\frac{81}{25}\right)$	M1
	$\lg x = \lg 20$	
	$x = 20$	A1
	$\lg x = 2 + \lg y$	
	$\lg 20 = 2 + \lg y$	
	$\lg 20 - 2 = \lg y$	
	$\lg 20 - \lg 100 = \lg y$	
	$\lg\frac{20}{100} = \lg y$	M1
	$y = \frac{1}{5}$	A1
(b)	Factors are $(x-3)$ and $(x-2)$	B1
	$p(x) = ax^3 - 9x^2 + bx + 3a$	
	$p(3) = 27a - 81 + 3b + 3a = 0$	M1 (*both* = 0)
	$10a + b = 27$.....(1)	
	$p(2) = 8a - 36 + 2b + 3a = 0$	M1 (*both eqs*)
	$11a + 2b = 36$.....(2)	M1 (*ways to solve a & b*)
	(1) & (2) $a = 2$ $b = 7$	A1 (*a & b correct*)
1	Total	9

3. Given that matrix $A = \begin{pmatrix} 3 & 2x & x \\ 0 & x+1 & 6 \\ 0 & 0 & x \end{pmatrix}$ and $|A| = 60$.

(a) Find the values of *x*.

[3 marks]

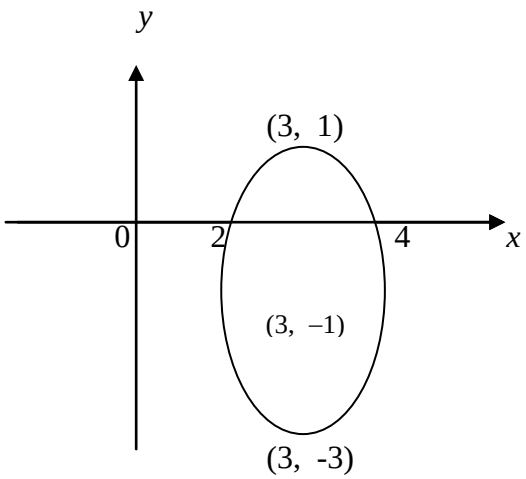
(b) By using the positive value of x obtained in (a), find the inverse of matrix *A* by using elementary row operations.

[5 marks]

No	Solutions	Marks
3 (a)	$\|A\| = 60$ $3\begin{vmatrix} x+1 & 6 \\ 0 & x \end{vmatrix} - 2x\begin{vmatrix} 0 & 6 \\ 0 & x \end{vmatrix} + x\begin{vmatrix} 0 & x+1 \\ 0 & 0 \end{vmatrix} = 60$ $3[x(x+1) - 0] = 60$ $3x^2 + 3x - 60 = 0$ $x^2 + x - 20 = 0$ $(x-4)(x+5) = 0$ $x = 4 \; or \; x = -5$	M1 M1 A1
(b)	When $x = 4$, $A = \begin{pmatrix} 3 & 8 & 4 \\ 0 & 5 & 6 \\ 0 & 0 & 4 \end{pmatrix}$ $\left(\begin{array}{ccc\|ccc} 3 & 8 & 4 & 1 & 0 & 0 \\ 0 & 5 & 6 & 0 & 1 & 0 \\ 0 & 0 & 4 & 0 & 0 & 1 \end{array}\right) \xrightarrow[\frac{1}{5}R_2 \to R_2,\; \frac{1}{4}R_3 \to R_3]{\frac{1}{3}R_1 \to R_1} \left(\begin{array}{ccc\|ccc} 1 & \frac{8}{3} & \frac{4}{3} & \frac{1}{3} & 0 & 0 \\ 0 & 1 & \frac{6}{5} & 0 & \frac{1}{5} & 0 \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array}\right)$ $\xrightarrow[\frac{-6}{5}R_3 + R_2 \to R_2]{\frac{-8}{3}R_2 + R_1 \to R_1} \left(\begin{array}{ccc\|ccc} 1 & 0 & \frac{-28}{15} & \frac{1}{3} & \frac{-8}{15} & 0 \\ 0 & 1 & 0 & 0 & \frac{1}{5} & \frac{-3}{10} \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array}\right)$ $\xrightarrow{\frac{28}{15}R_3 + R_1 \to R_1} \left(\begin{array}{ccc\|ccc} 1 & 0 & 0 & \frac{1}{3} & \frac{-8}{15} & \frac{7}{15} \\ 0 & 1 & 0 & 0 & \frac{1}{5} & \frac{-3}{10} \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array}\right)$ $\therefore A^{-1} = \begin{pmatrix} \frac{1}{3} & \frac{-8}{15} & \frac{7}{15} \\ 0 & \frac{1}{5} & \frac{-3}{10} \\ 0 & 0 & \frac{1}{4} \end{pmatrix}$	M1 M1 M1 M1 A1
3	Total	8

5. Express $4x^2 + y^2 - 24x + 2y + 33 = 0$ in the standard form. State the type of the conic. Find its centre and vertices. Sketch the graph of the conic.

[7 marks]

No	Solutions	Marks
5	$4x^2 - 24x + y^2 + 2y + 33 = 0$ $4(x^2 - 6x) + (y^2 + 2y) + 33 = 0$ $4[(x-3)^2 - 9] + [(y+1)^2 - 1] + 33 = 0$ $4(x-3)^2 - 36 + (y+1)^2 - 1 + 33 = 0$ $4(x-3)^2 + (y+1)^2 = 4$ $(x-3)^2 + \frac{(y+1)^2}{4} = 1$ ∴ the conic is an ellipse. Centre = (3, –1) Vertices = (3, 1) and (3, –3)  	M1 [Used completing the square] M1 [Standard Form] A1 A1 A1 D1 (shape) D1 (all correct)
5	Total	7

6. The plane π_1 and π_2 have equations given by $\underline{r} \bullet (\underline{i} + 2\underline{j} + 2\underline{k}) = 2$ and $\underline{r} = (2\underline{i} + \underline{j} - \underline{k}) + \lambda(\underline{i} + 2\underline{j}) + \mu(6\underline{i} + 2\underline{j} - 5\underline{k})$, λ, $\mu \in R$ respectively. The two planes intersect in the line *l*.

(a) Find the acute angle between π_1 and π_2. [3 marks]

(b) Show that the vector $6\underline{i} + 2\underline{j} - 5\underline{k}$ is parallel to π_1. [2 marks]

(c) Find Cartesian equation of the line *l*. [4 marks]

No	Solutions	Marks
6 (a)	$\pi_1 : \underline{r} : \begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix} = 2$, $n_1 = \begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix}$ $\pi_2 : \underline{r} : \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix} + \mu \begin{pmatrix} 6 \\ 2 \\ -5 \end{pmatrix}$, $n_2 = \begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix} \times \begin{pmatrix} 6 \\ 2 \\ -5 \end{pmatrix} = \begin{pmatrix} -10 \\ 5 \\ -10 \end{pmatrix}$ $Cos\theta = \dfrac{\begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix} \bullet \begin{pmatrix} -10 \\ 5 \\ -10 \end{pmatrix}}{\sqrt{1^2 + 2^2 + 2^2} \times \sqrt{(-10)^2 + 5^2 + (-10)^2}}$ $\theta = 63.61°$ $\therefore$ The acute angle between π_1 and π_2 is $63.61°$.	B1(n_2) M1 A1
(b)	If the vector $6\underline{i} + 2\underline{j} - 5\underline{k}$ is parallel to π_1, then $n_1 \bullet \begin{pmatrix} 6 \\ 2 \\ -5 \end{pmatrix} = 0$. $\begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix} \bullet \begin{pmatrix} 6 \\ 2 \\ -5 \end{pmatrix} = 6 + 4 + (-10) = 0$ Since $n_1 \bullet \begin{pmatrix} 6 \\ 2 \\ -5 \end{pmatrix} = 0$, therefore the vector $6\underline{i} + 2\underline{j} - 5\underline{k}$ is parallel to π_1.	M1 A1

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

7. Given that $P = \begin{pmatrix} 5 & 2 & 3 \\ 1 & -4 & 3 \\ 3 & 1 & 2 \end{pmatrix}$ and $Q = \begin{pmatrix} a & 1 & -18 \\ b & -1 & 12 \\ -13 & -1 & c \end{pmatrix}$ and $PQ = 2I$, where I is the 3×3 identity matrix.

(a) Determine the value of a, b and c.

[3 marks]

(b) Hence, find P^{-1}.

[4 marks]

(c) Two groups of workers have their drinks at a stall. The first group comprising ten workers has five cups of tea, two cups of coffee, and three glasses of fruit juice at a total cost of RM11.80. The second group of six workers has three cups of tea, a cup of coffee and two glasses fruit juice at a total cost of RM7.10.The cost of a cup of tea and three glasses of fruit juice is the same as the cost of four cups of coffee. If the costs of a cup of tea, a cup of coffee and a glass of fruit juice are RMx , RMy and RMz respectively, obtain a matrix equation to represent the above information. Hence, determine the cost of each drink.

[8 marks]

No	Solutions	Marks
7 (a)	Given that $PQ = 2I$ $\begin{pmatrix} 5 & 2 & 3 \\ 1 & -4 & 3 \\ 3 & 1 & 2 \end{pmatrix}\begin{pmatrix} a & 1 & -18 \\ b & -1 & 12 \\ -13 & -1 & c \end{pmatrix} = 2\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ Equating the elements of x_{11} from both sides, $5a + 2b - 39 = 2$ $5a + 2b = 41$……(1) Equating the elements of x_{21} from both sides, $a - 4b - 39 = 0$ $a + 4b = 41$……(2) Equating the elements of x_{13} from both sides, $-66 + 3c = 0$ $c = 22$ Solving (1) and (2) , $a = 11, b = -7$	B1 (2/3 equations correct) M1 (solving the equations) A1 (All answers correct)

TAMAT SAMPEL

Suka sampel ini?

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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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