SAMPEL PERCUMA

Trial STPM 2020 Mathematics T Semester 1 Pahang

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. The functions f and g are defined by $f(x) = 3\ln(x+2)$, $x > -2$ and $g(x) = e^{kx} - 2$, $x \epsilon R$, where k is a constant.
   a) Determine the value of k if f and g are inverse of each other. [3 marks]
   b) Sketch the graphs of f and g on the same axes. Determine R_g [4 marks]

2. The sum of the 2nd and 3rd terms of a G.P is 96. The sum of the 3rd and 4th terms is 48. Find the first term and the common ratio. Hence, determine the least number of terms which must be taken for its sum to exceed 244. Find the sum to infinity. [9 marks]

3. Find the inverse of $A = \begin{pmatrix} 2 & 1 & 0 \\ -4 & -1 & -3 \\ 3 & 1 & 2 \end{pmatrix}$ by using the elementary row operation. [4 marks]

   Verify the result by showing $AA^{-1} = I = A^{-1}A$ [2 marks]

4. If $Z_1 = 4\left(cos\frac{\pi}{5} + isin\frac{\pi}{5}\right)$ and $Z_2 = 2\left(cos\frac{\pi}{6} + isin\frac{\pi}{6}\right)$, find the quotient $\frac{Z_1}{Z_2}$, in the same form.
   Hence simplify $\left(\frac{Z_1}{Z_2}\right)^6$ [6 marks]

5. The general equation of a conic is $25x^2 + 9y^2 + 50x - 36y - 164 = 0$
   a) Determine the standard form of the equation, and identify the conic. [4 marks]
   b) Find the centre and foci of the conic. [3 marks]
   c) Sketch the conic and indicate its centre and foci. [2 marks]

6. a) If **a** = 2**i** – **j** + **k**, **b** = **i** + **j** - 2**k** and **c** = **i** + 3**j** - **k**,
      find λ such that **a** is perpendicular to λ**b** + **c**. [3 marks]
   b) Referred to the origin O, the points A and B have position vectors **a** and **b** such that **a** = **i** – **j** + **k** and **b** = **i** + 2**j**.
      The point C has position vector **c** given by **c** = λ**a** + μ**b**, where λ and μ are positive constants. Given that the area of triangle OAC is $\sqrt{126}$, find the value of μ. [5 marks]

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

7. a) The function f is defined by

$$f(x) = \begin{cases} (x+2)^2 - 1\,, & x < 0 \\ -x + 3\,, & x > 0 \end{cases}$$

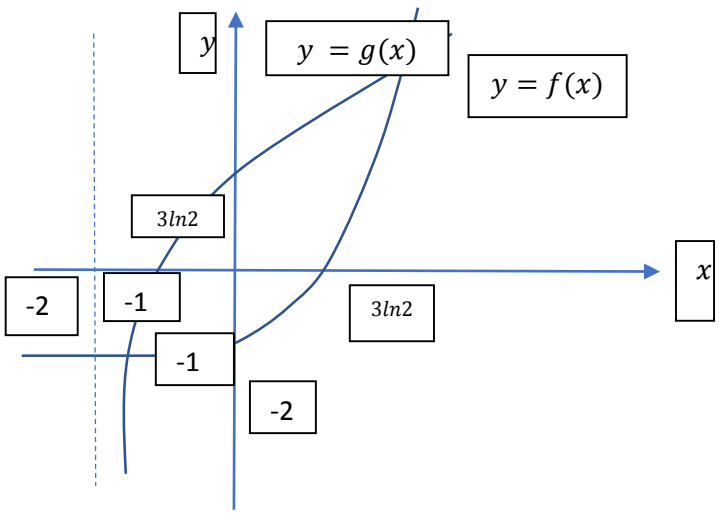
Sketch the graph of f . State the domain and range of f .
State whether f is a one – to – one function or not. Justify your answer. [6 marks]

b) The polynomial $p(x) = ax^4 + 3x^3 + 2x^2 + 6x + b$, where a and b are real constants, is divisible by $(2x - 1)$. When $p(x)$ is divided by $(x - 1)$, the remainder is 9.
Determine a and b .Find the solution set for the inequality $p(x) < 0$. [9 marks]

8. The plane p has equation $3x + 2y - z + 1 = 0$.
Line $l_1$has Cartesian equation $\frac{x-4}{-1} = \frac{y+3}{2} = \frac{z-7}{1}$ and
Line l_2 has Vector equation $r = \begin{pmatrix} 0 \\ 10 \\ 7 \end{pmatrix} + \gamma \begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix}$.

a) Show that the line l_1 lies on plane p. [4 marks]
b) Find the angle between the line l_1 and the line l_2. [2 marks]
c) Given that l_2 intersects p at point A. Find the coordinates of A. [6 marks]
d) Determine the Cartesian Equation of the plane p passing through A and perpendicular to l_1. [3 marks]

KERTAS SOALAN TAMAT

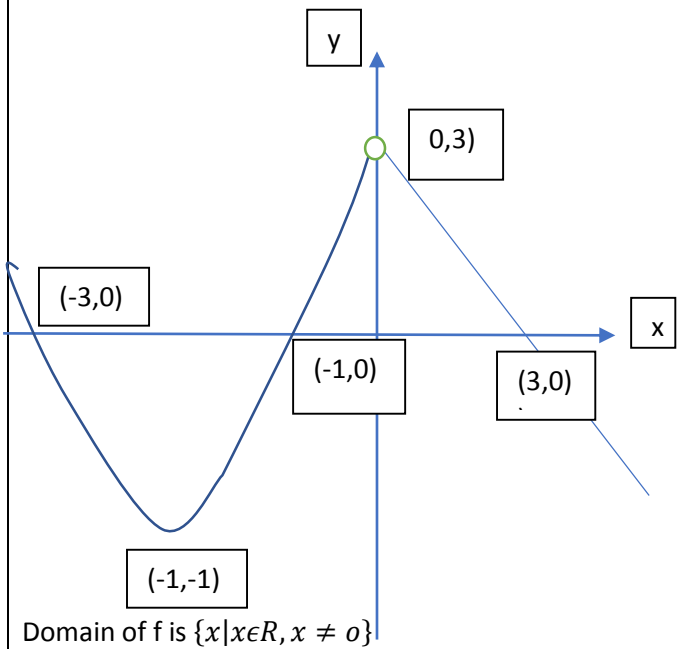
NO	Marking Scheme	Marks
1	Let $y = f^{-1}(x)$ $f(y) = x$ $3\ln(y+2) = x$ $y = f^{-1}(x) = g(x)$ $e^{\frac{x}{3}} - 2 = e^{kx} - 2$	M1A1
	$\therefore k = \frac{1}{3}$	A1
		D1 D1 D1
	$R_f = x > -2$	A1

2	$u_2 + u_3 = 96$ $ar + ar^2 = 96$ $ar(1+r) = 96$ ..... (1)	$u_3 + u_4 = 48$ $ar^2 + ar^3 = 48$ $ar^2(1+r) = 48$ ..... (2)	B1 *(Either one set correct)*
	$\frac{(2)}{(1)}, \frac{ar^2(1+r)}{ar(1+r)} = \frac{48}{96}$ $\therefore r = \frac{1}{2}$ $\therefore a = 128$		M1A1 A1
	$S_n > 244$ $128\left(\frac{1-\left(\frac{1}{2}\right)^n}{1-\frac{1}{2}}\right) > 244$ $1-\left(\frac{1}{2}\right)^n > \frac{61}{64}$ $n\,log\left(\frac{1}{2}\right) < log\left(\frac{3}{64}\right)$ $, n > 4.415$ n = 5		B1 M1 *(Take log both side)* A1
	$S_\infty = \frac{128}{1-\frac{1}{2}}$ = 256		M1 A1
			9 marks

3	$\left(\begin{array}{ccc\|ccc} 2 & 1 & 0 & 1 & 0 & 0 \\ -4 & -1 & -3 & 0 & 1 & 0 \\ 3 & 1 & 2 & 0 & 0 & 1 \end{array}\right)$ $\begin{matrix} R_2 + 2R_1 \to R_2 \\ R_3 - \frac{3}{2}R_{1\to} R_3 \end{matrix} \left(\begin{array}{ccc\|ccc} 2 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & -3 & 2 & 1 & 0 \\ 0 & \frac{-1}{2} & 2 & \frac{-3}{2} & 0 & 1 \end{array}\right)$ $R_3 + \frac{1}{2}R_2 \to R_3 \left(\begin{array}{ccc\|ccc} 2 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & -3 & 2 & 1 & 0 \\ 0 & 0 & \frac{1}{2} & \frac{-1}{2} & \frac{1}{2} & 1 \end{array}\right)$ $R_2 + 6R_{3\to} R_2 \left(\begin{array}{ccc\|ccc} 2 & 1 & 0 & 2 & 0 & 0 \\ 0 & 1 & 0 & -1 & 4 & 6 \\ 0 & 0 & \frac{1}{2} & \frac{-1}{2} & \frac{1}{2} & 1 \end{array}\right)$ $R_1 - R_{2\to} R_1 \left(\begin{array}{ccc\|ccc} 2 & 0 & 0 & 2 & -4 & -6 \\ 0 & 1 & 0 & -1 & 4 & 6 \\ 0 & 0 & \frac{1}{2} & \frac{-1}{2} & \frac{1}{2} & 1 \end{array}\right)$ $\begin{matrix} \frac{1}{2}R_1 \to R_1 \\ 2R_{3\to} R_3 \end{matrix} \left(\begin{array}{ccc\|ccc} 1 & 0 & 0 & 1 & -2 & -3 \\ 0 & 1 & 0 & -1 & 4 & 6 \\ 0 & 0 & 1 & -1 & 1 & 2 \end{array}\right)$ Thus $A^{-1} = \begin{pmatrix} 1 & -2 & -3 \\ -1 & 4 & 6 \\ -1 & 1 & 2 \end{pmatrix}$ $AA^{-1} = \begin{pmatrix} 2 & 1 & 0 \\ -4 & -1 & -3 \\ 3 & 1 & 2 \end{pmatrix}\begin{pmatrix} 1 & -2 & -3 \\ -1 & 4 & 6 \\ -1 & 1 & 2 \end{pmatrix}$ $= \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} = I$ $A^{-1}A = \begin{pmatrix} 1 & -2 & -3 \\ -1 & 4 & 6 \\ -1 & 1 & 2 \end{pmatrix}\begin{pmatrix} 2 & 1 & 0 \\ -4 & -1 & -3 \\ 3 & 1 & 2 \end{pmatrix}$ $= \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} = I$ Hence , verified.	B1 B1 B1 B1 B1 M1A1
		6 marks

6(a)	$\lambda\mathbf{b} + \mathbf{c} = \lambda(\mathbf{i} + \mathbf{j} - 2\mathbf{k}) + (\mathbf{i} + 3\mathbf{j} - \mathbf{k})$ $= (\lambda + 1)\mathbf{i} + (\lambda + 3)\mathbf{j} - (2\lambda + 1)\mathbf{k}$	M1
	$\mathbf{a} \bullet (\lambda\mathbf{b} + \mathbf{c}) = 0$ $(2\mathbf{i} - \mathbf{j} + \mathbf{k}) \bullet ((\lambda + 1)\mathbf{i} + (\lambda + 3)\mathbf{j} - (2\lambda + 1)\mathbf{k}) = 0$	M1
	$2(\lambda + 1) - (\lambda + 3) - (2\lambda + 1) = 0$ $\lambda = -2$	A1
		3 mark
6(b)	$\overrightarrow{OA} = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}, \quad \overrightarrow{OB} = \begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix}$ $\overrightarrow{OC} = \lambda\begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} + \mu\begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix}, \quad \overrightarrow{OC} = \begin{pmatrix} \lambda + \mu \\ -\lambda + 2\mu \\ \lambda \end{pmatrix}$	B1 M1
	$\frac{1}{2}\lvert Area\ of\ \Delta OAC \rvert = \sqrt{126}$ $\lvert \overrightarrow{OA} \times \overrightarrow{OC} \rvert = 2\sqrt{126}$ $\left\lVert \begin{matrix} i & j & k \\ 1 & -1 & 1 \\ \lambda + \mu & -\lambda + 2\mu & \lambda \end{matrix} \right\rVert = 2\sqrt{126}$	M1
	$\left\lVert \begin{pmatrix} -\lambda + \lambda - 2\mu \\ -1(\lambda - \lambda - \mu) \\ -\lambda + 2\mu + \lambda + \mu \end{pmatrix} \right\rVert = 2\sqrt{126}$ $\left\lVert \begin{pmatrix} -2\mu \\ \mu \\ 3\mu \end{pmatrix} \right\rVert = 2\sqrt{126}$	M1
	$\sqrt{4\mu^2 + \mu^2 + 9\mu^2} = 2\sqrt{126}$ $\mu = 6 \ \ or \ \ -6 \ (rejected)$	A1
		8 marks

7 a)



D1

D1

Domain of f is $\{x|x\epsilon R, x \neq o\}$ B1

Range of f is $\{x|x\epsilon R, x \neq 3\}$ B1

f is not a one-to-one function . A straight line drawn to the x – axis wil cut the graph at more than one point. B1B1 [6]

7 b)

$$p(x) = ax^4 + 3x^3 + 2x^2 + 6x + b$$

$p(x)$ is divisible by $(2x - 1)$, $p\left(\frac{1}{2}\right) = 0$

$$a\left(\frac{1}{2}\right)^4 + 3\left(\frac{1}{2}\right)^3 + 2\left(\frac{1}{2}\right)^2 + 6\left(\frac{1}{2}\right) + b = 0$$

$$\frac{1}{16}a + \frac{3}{8} + \frac{1}{2} + 3 + b = 0$$

$$a + 6 + 8 + 48 + 16b = 0$$

$a + 16b = -62$.....(1)

When $p(x)$ is divided by $(x - 1)$, the remainder is 9.

So , $p(1) = 9$.

$$a + 3 + 2 + 6 + b = 9$$

$a + b = -2$.....(2) M1M1

(1)-(2) ; $15b = -60$

$b = -4$

Substitute $b = -4$ into (2)

$a - 4 = -2$

$a = 2$ A1A1

	$p(x) = 2x^2 + 3x^3 + 6x - 4$ $= (2x - 1)(x^3 + 2x^2 + 2x + 4)$ Let $q(x) = x^3 + 2x^2 + 2x + 4$ $q(-2) = -8 + 8 - 4 + 4 = 0$ $(x + 2)$ is a factor of $q(x)$ $q(x) = (x + 2)(x^2 + 2)$ $p(x) = (2x - 1)(x + 2)(x^2 + 2)$ For $p(x) < 0, (2x - 1)(x + 2)(x^2 + 2) < 0$ since $(x^2 + 2) > 0$ for all real values of x, $(2x - 1)(x + 2) < 0$ The solution set is $\left\{x: -2 < x < \frac{1}{2}\right\}$	M1A1 B1 M1A1	[9]
			15 marks

8 a)	VE of the plane p : $r \cdot (3i + 2j - k) = -1$ VE of the line l_1 : $4i - 3j + 7k + \lambda(-i + 2j + k)$ $sin\theta = \frac{\begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} 3 \\ 2 \\ -1 \end{pmatrix}}{\lvert\sqrt{6}\rvert\lvert\sqrt{14}\rvert}$; $\theta = 0^o$ $\therefore shown$	B1 B1 M1A1	
			4 marks
b)	VE of the line l_1 : $4i - 3j + 7k + \lambda(-i + 2j + k)$ VE of the line l_2 : $10j + 7k + \gamma(i + 3j + 2k)$ $cos\ \theta = \frac{\begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix}}{\lvert\sqrt{6}\rvert\lvert\sqrt{14}\rvert}, \theta = 40.20^o$	M1A1	
			2 marks
c)	Equation of line l_2 $r = (10j + 7k) + \gamma(i + 3j + 2k)$ $r = \gamma i + (10 + 3\gamma)j + (7 + 2\gamma)k$	B1 M1	
	Intersection point A $3(\gamma) + 2(10 + 3\gamma) - (7 + 2\gamma) = -1$ $\gamma = -2$ Point A= $(-2,4,3)$	M1 M1 M1A1	All correct
			6 marks
d)	Normal vector (n) $= -i + 2j + k$ $r \cdot (-i + 2j + k) = (-2i + 4j + 3k) \cdot (-i + 2j + k)$ $r \cdot (-i + 2j + k) = 13$ Cartesian form : $-x + 2y + z = 13$	M1 M1 A1	
			3 marks
		Total	15 marks

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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