SAMPEL PERCUMA

Modul STPM 2021 Mathematics M Semester 1 (Kelantan)

Set penuh: Kertas Percubaan STPM

Sem 1 · Mathematics M

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*** question in this section

1. The polynomial $2x^3 - 3mx^2 + mx + n$ has the factor $(x - 1)$ and when divided by $x + 2$, it result in remainder -54. Find m and n. Then factorise this polynomial.

   Hence, find all the factor of $2x^6 - 9x^4 + 3x^2 + 4$ [9m]

2. The matrix **A** is given by $\mathbf{A} = \begin{bmatrix} 3 & 3 & 2 \\ -2 & 1 & 5 \\ 4 & -3 & -12 \end{bmatrix}$

   By performing elementary row operation on the augmented matrix (**A**|**I**), where **I** is the 3 X 3 identity matrix, find $\mathbf{A}^{-1}$ [5m]

   Hence, solve the equation
   $$x + z = 1$$
   $$-4x + y - z = 2$$
   $$6x - 2y + z = 1$$ [3m]

3. If x is so small that terms in x^n, $n \geq 3$, can be neglected and $\frac{1+px}{1+qx} = (1-x)^{\frac{1}{3}}$, find the values of p and q [8m]

4. (a) The equation of a graph is $\ln(xy) - y^3 = 1$,

   Show that $\frac{dy}{dx} = \frac{y}{x(3y^3-1)}$, [3m]

   (b) Find the coordinates of the point where the tangent to the curve is parallel to the y- axis, giving each coordinate correct to 3 significant figures. [4m]

5. Express $\frac{3}{2x^2 - 5x + 2}$ in partial fractions. [3m]

   Determine the value of p, where $p>4$ such that $\int_4^p \frac{3}{2x^2 - 5x + 2} dx = \ln\frac{7}{6}$. [4m]

6. Solve the differential equation of $x\frac{dy}{dx} = (x+1)(y+1)$, where $x > 0$ and $y > -1$ and $y = 2$ when $x = 1$. Express your answer in the form of $y = f(x)$. [6m]

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

7. The fourth term an arithmetic progression is 9 and the sum of first four terms is 21. Calculate the sum of [7m]

(i) first n term

(ii) first (3n +2) term.

(b) For the geometric series $6 + 3 + \frac{3}{2} +$ ... obtain the smallest value of n if the difference between the sum of the first n + 4 terms and the sum of the first n terms is less than $\frac{45}{64}$ [8m]

8 (a) Sketch, on the same coordinate axes the curves

$y = e^x$ and $y = 4 + 5e^{-x}$ and find coordinates of the points of intersection [7m]

(b) Calculate the area of the region bounded by the y-axis and curves [3m]

(c) Calculate the volume of the solid formed when the region bounded by the y-axis and curves revolved completely about the x-axis. [5m]

1	The polynomial $2x^3 - 3mx^2 + mx + n$ has the factor $(x - 1)$ and when divided by $x + 2$, it result in remainder -54. Find m and n. Then factorise this polynomial. Hence, find all the factor of $2x^6 - 9x^4 + 3x^2 + 4$ [9m]	
	P(x)= $2x^3 - 3mx^2 + mx + n$ P(1) = 2 -3m + m + n = 0 n-2m = - 2 ……① P(-2) = -16 – 12m -2m+ n = -54 n -14m = -38 ……② ① - ②, 12 m = 36 m = 3	M1 M1 A1

SCHEMA MATHEMATICS M SEMESTER 1 2021

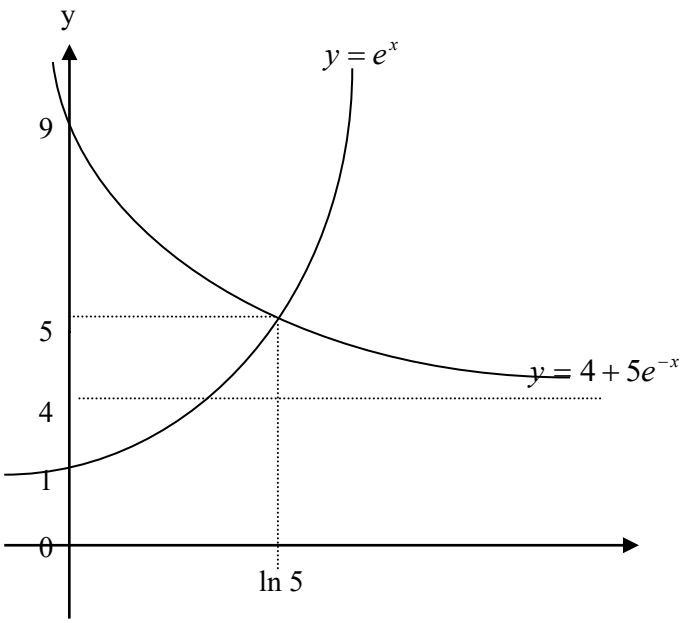
1	The polynomial $2x^3 – 3mx^2 + mx + n$ has the factor $(x – 1)$ and when divided by $x + 2$, it result in remainder -54. Find m and n. Then factorise this polynomial. Hence, find all the factor of $2x^6 – 9x^4 + 3x^2 + 4$ [9m]	
	$P(x)= 2x^3 – 3mx^2 + mx + n$ $P(1) = 2 -3m + m + n = 0$ $n-2m = - 2$ ……① $P(-2) = -16 – 12m -2m+ n = -54$ $n -14m = -38$ ……② ① - ②, $12 m = 36$ $m = 3$ $n = 4$ $2x^3 – 9x^2 + 3x + 4 = (x – 1) (2x^2 -7x – 4)$ $= (x – 1)(x – 4)(2x + 1)$ $2x^6 – 9x^4 + 3x^2 + 4 = 2(x^2)^3 – 9(x^2)^2 +3x^2 + 4$ $= (x^2 -1)(x^2 -4)(2x^2 + 1)$ $= (x + 1)(x - 1)(x + 2)(x - 2)(2x^2+1)$	M1 M1 A1 A1 M1 for $(2x^2 -7x – 4)$ A1 M1 M1 A1

2	The matrix **A** is given by $\mathbf{A} = \begin{bmatrix} 1 & 0 & 1 \\ -4 & 1 & -1 \\ 6 & -2 & 1 \end{bmatrix}$ By performing elementary row operation on the augmented matrix (**A**|**I**), where **I** is the 3 X 3 identity matrix, find $\mathbf{A}^{-1}$ [5m] Hence, solve the equation [3m] x + z = 1 -4x + y –z = 2 6x -2y + z = 1	
	The augmented matrix is $(\mathbf{A} \mid \mathbf{I}) = \begin{bmatrix} 1 & 0 & 1 \\ -4 & 1 & -1 \\ 6 & -2 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ $\begin{matrix} \mathrm{R2} + 4R1 \rightarrow \mathrm{R2} \\ R3 - 6\mathrm{R1} \rightarrow \mathrm{R3} \end{matrix} \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 3 \\ 0 & -2 & -5 \end{bmatrix}\begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ -6 & 0 & 1 \end{bmatrix}$ $\mathrm{R3} + 2\mathrm{R2} \rightarrow \mathrm{R3} \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 2 & 2 & 1 \end{bmatrix}$ $\begin{matrix} R1 - R3 \rightarrow R1 \\ \mathrm{R2} - 3\mathrm{R3} \rightarrow \mathrm{R2} \end{matrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}\begin{bmatrix} -1 & -2 & -1 \\ -2 & -5 & -3 \\ 2 & 2 & 1 \end{bmatrix}$ $\mathbf{A}^{-1} = \begin{bmatrix} -1 & -2 & -1 \\ -2 & -5 & -3 \\ 2 & 2 & 1 \end{bmatrix}$ AX = B $\mathrm{X} = \mathrm{A}^{-1}\mathrm{B}$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -1 & -2 & -1 \\ -2 & -5 & -3 \\ 2 & 2 & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$ $= \begin{bmatrix} -1-4-1 \\ -2-10-3 \\ 2+4+1 \end{bmatrix}$ $= \begin{bmatrix} -6 \\ -15 \\ 7 \end{bmatrix}$	B1 M1 M1 M1 A1 B1 M1 A1

3	If x is so small that terms in x^n, n ≥ 3, can be neglected and $\frac{1+px}{1+qx} = (1-x)^{\frac{1}{3}}$, find the values of p and q [8m]	
	$\frac{1+px}{1+qx} = (1+px)(1+qx)^{-1}$	B1
	$= (1+px)\left[1 - qx + \frac{(-1)(-2)}{2!}(qx)^2 + \cdots\right]$	M1
	$= (1+px)(1 - qx + q^2x^2 + \ldots)$	
	$= 1 - qx + q^2x^2 + px - pqx^2 + \ldots$	
	$= 1 + (p-q)x + (q-p)qx^2 + \ldots$	A1
	$(1-x)^{\frac{1}{3}} = 1 - \frac{1}{3}x + \frac{\frac{1}{3}(-\frac{2}{3})}{2!}(-x)^2 + \ldots$	M1
	$= 1 - \frac{1}{3}x - \frac{1}{9}x^2$	A1
	$p - q = -\frac{1}{3}$	B1 – both equation correct
	$(q-p)q = -\frac{1}{9}$	
	$q(\frac{1}{3}) = -\frac{1}{9}$	M1
	$q = -\frac{1}{3}$	
	$p = -\frac{2}{3}$	A1 (Both correct)

4	(a) The equation of a graph is $\ln(xy) - y^3 = 1$, Show that $\frac{dy}{dx} = \frac{y}{x(3y^3-1)}$, [3m] (b) Find the coordinates of the point where the tangent to the curve is parallel to the y-axis, giving each coordinate correct to 3 significant figures. [4m]	
	(a) $\ln(xy) - y^3 = 1$ Differentiate w.r.t .x $\frac{1}{xy}\left(x\frac{dy}{dx} + y\right) - 3y^2\frac{dy}{dx} = 0$ $\frac{1}{y}\frac{dy}{dx} + \frac{1}{x} - 3y^2\frac{dy}{dx} = 0$ $3y^3\frac{dy}{dx} - \frac{dy}{dx} = \frac{y}{x}$ $(3y^3 - 1)\frac{dy}{dx} = \frac{y}{x}$ $\therefore \frac{dy}{dx} = \frac{y}{x(3y^3-1)}$ (b) when tangent parallel with y-axis, $x(3y^3 - 1) = 0$ But $x \neq 0, \therefore 3y^3 - 1 = 0$ $y = \sqrt[3]{\frac{1}{3}} = 0.693$ Substitute into the equation $\ln 0.693x - \frac{1}{3} = 1$ $0.693x = e^{\frac{4}{3}}$ $x = 5.47$ $\therefore$ Coordinate $= (5.47, 0.693)$	M1 M1 A1 A1 M1 M1 A1

	$12(-\frac{1}{2^n x\ 16}+\frac{1}{2^n})<\frac{45}{64}$ $12(\frac{1}{2^n})\ (-\frac{1}{16}+1)<\frac{45}{64}$ $2^n > 16$ $n > 4$ Hence, the smallest value of n is 5	 M1 M1 A1 A1

8	(a) Sketch, on the same coordinate axes the curves $y = e^x$ and $y = 4 + 5e^{-x}$ and find coordinates of the points of intersection [7m] (b) Calculate the area of the region bounded by the y-axis and curves [3m] (c) Calculate the volume of the solid formed when the region bounded by the y-axis and curves revolved completely about the x-axis. [5m]	
	Solution  D1-asymptote y=0, graph $y = e^x$ D1D1D1 D1=asymptote y=4, graph $y = 4 + 5e^{-x}$ D1- showing the point of intersection and the graph cut the y-axis at y=1 and y=9 $e^x = 4 + 5e^{-x}$	

TAMAT SAMPEL

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