SAMPEL PERCUMA

Trial STPM Sem 1 Mathematics M Kuala Lumpur 2018

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

Nama : ..... Kelas:

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SMK (L) METHODIST KUALA LUMPUR

950/1 **STPM**

PEPERIKSAAN PERCUBAAN PENGGAL 1 STPM 2018

MATHEMATICS (M)
PAPER 1

One and a half hours

PenggubalSoalan: Yong Wai Ping

Disemakoleh:	Disahkanoleh:	Disahkanoleh:
……	.....	……
(Kee Lai Yee)	(GanSwit Peng)	
RakanPanitiaMatematik T6	PenolongKananTingkatan 6	Pengetua MBSSKL

Instruction to candidates:

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

Answer **all** *questions in Section A and* **one** *question only in Section B. You may answer all the questions* **but**, *only the first answer will be marked.*

All working should be shown.

Non-exact numerical answers may be given correct to three significant figures, or one decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

Scientific calculators may be used. Programmable and graphic display calculators are prohibited.

A list of mathematical formulae is provided on page 5 of this question paper.

This question paper consists of 4 printed pages.

Section A

[45 *marks*]

*Answer***all***questions in this section*

1. The functions f and g are defined by

$$f(x) = 2 + e^{-2x},$$

$$g(x) = \sqrt{x-3}\ .$$

(a) State the domains of f and g. [2 *marks*]

(b) Determine the domain for the composite function gf(x) to exist. Find the function and state its range. [6*marks*]

2. For a geometric series $6 + 3 + \frac{3}{2} + \ldots$, 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 $\frac{45}{64}$. [6 *marks*]

3. Find the inverse matrix of $\mathbf{A} = (1\ 1\ 2\ 2\ 1\ 0\ 1\ 2\ 2)$ using row operations and verify it. [9 *marks*]

4. Determine if the limits exist and find the limits.

(a) $\frac{\sqrt{x}-5}{x-25}$. [3 *marks*]

(b) $\frac{|x-4|}{x-4}$. [4 *marks*]

5. Express $\frac{2x+1}{(x^2+1)(2-x)}$ as a partial fraction. [4 *marks*]

Hence, evaluate $\int_0^1 \frac{2x+1}{(x^2+1)(2-x)}\,dx$. [4 *marks*]

6. Find the particular solution of the differential equation

$$e^x \frac{dy}{dx} - y^2 (x + 1) = 0$$

For which $y = 1$ when $x = 0$. Hence express y in terms of x. [7 *marks*]

Section B

[15 *marks*]

Answer **one** *question only in this section*

7. If $= \frac{\ln \ln x}{x}$, with $x > 0$, determine the set of values of x such that $\frac{dy}{dx} > 0$ and the set of values where $\frac{dy}{dx} < 0$. Hence show that the maximum value of y is $\frac{1}{e}$. [7 *marks*]

   (a) Sketch the curve $= \frac{\ln \ln x}{x}$, $x > 0$. [3 *marks*]

   (b) Determine the area bounded by the curve $= \frac{\ln \ln x}{x}$, x – axis and the line $x = \frac{1}{e}$. Show that this area is the same size as the area bounded by the curve $= \frac{\ln \ln x}{x}$, x – axis and the line $x = e$. [5 *marks*]

8. Using the substitution of $u = \ln y$, show that the differential equation

$$x\frac{dy}{dx} + (3x + 1)\, y \ln y = y\, e^{-2x}$$

   can be transformed into

$$x\frac{du}{dx} + (3x + 1)\, u = e^{-2x}.$$

[4 *marks*]

Solve this differential equation, and hence, find the solution of the original differential equation, given that $y = 1$ when $x = 1$. [9 *marks*]

Find the limiting value of y as $x \to \infty$. [2 *marks*]

Section A [45 marks]

Answer **all** the questions

1. Given that $f(x) = 4 - e^{3-2x}$

   (a) Find the inverse function , f^{-1}. [3 marks]

   (b) State the domain of the inverse function, f^{-1}. [1 marks]

   (c) Sketch the graphs of f and f^{-1} on the same coordinate axes. [3 marks]

2. The first term of an arithmetic series is $\ln a$ and the r^{th} term is $\ln(ab^{r-1})$.

   (a) Show that the sum of the first n terms of the series is $S_n = \frac{n}{2}\ln(a^2b^{n-1})$. [2 marks]

   (b) If $b = 1$, show that the series $e^{S_1} + e^{S_2} + e^{S_3} + \cdots + e^{S_n}$ is a geometric series. Hence, find the sum of the series. [7 marks]

3. Find the value of the constant k for which the system of equation

$$\begin{aligned} 2x - 3y + 4z &= 1 \\ 3x - y \quad\quad &= 2 \\ x + 2y + kz &= 1 \end{aligned}$$

   does not have a unique solution. [2 marks]

   For this value of k, solve the system of equation. [4 marks]

4. Given that $f(x) = x^3 - 12x + 2$.

   (a) Determine the range of values of x on which $f(x)$ is increasing or decreasing. Hence, state the turning points. [6 marks]

   (b) Sketch the graph of $f(x)$ [3 marks]

5. Given that

$$\frac{18-4x-x^2}{(4-3x)(1+x)^2} \equiv \frac{A}{4-3x} + \frac{B}{1+x} + \frac{C}{(1+x)^2}$$

show that $A = 2$ and determine the values of B and C. [3 marks]

Hence, show that

$$\int_0^1 \frac{18-4x-x^2}{(4-3x)(1+x)^2}\,dx = \frac{7}{3}\ln 2 + \frac{3}{2}$$

[4 marks]

6. Find the particular solution for the differential equation

$$\frac{dy}{dx} = xy(y-2)$$

if $y = 4$ when $x = 0$. [7 marks]

Section B [15 marks]

Answer **one** *question only*

You may answer all the questions **but**, *only the first answer will be marked.*

7. Expand $\frac{1}{\left(1+\frac{x}{n}\right)^n}$, $n \in Z^+$, in ascending powers of x up to and including the term in x^3.

[3 marks]

Given that the coefficient of x^3 is $-\frac{10}{27}$, determine the value of n. [2 marks]

With this value of n, expand $\frac{\sqrt{1-x}}{\left(1+\frac{x}{n}\right)^n}$ in ascending powers of x up to and including the term in x^3.

[6 marks]

Hence, by taking $x = \frac{1}{10}$, estimate $\sqrt{10}$ correct to three decimal places.

[4 marks]

8. The equation of a curve is

$$y = \frac{2x-3}{(x-1)(x+3)}$$

(a) Find the equations of the asymptotes of the curve [2 marks]

(b) Find the coordinates where the curve intersects the axes. [2 marks]

(c) Determine the stationary points of the curve and state whether it is a maximum or minimum point. [5 marks]

(d) Sketch the curve. [4 marks]

(e) Determine the values of k for which the equation $2x - 3 = k(x-1)(x+3)$ has only one real root. [2 marks]

END OF QESTION PAPER

$$\left(\begin{array}{ccc|c} 2 & -3 & 4 & 1 \\ 3 & -1 & 0 & 2 \\ 1 & 2 & -4 & 1 \end{array}\right) \xrightarrow{R_1 \rightleftarrows R_3} \left(\begin{array}{ccc|c} 1 & 2 & -4 & 1 \\ 3 & -1 & 0 & 2 \\ 2 & -3 & 4 & 1 \end{array}\right) \xrightarrow{R_2 = -3R_1 + R_2} \left(\begin{array}{ccc|c} 1 & 2 & -4 & 1 \\ 0 & -7 & 12 & -1 \\ 2 & -3 & 4 & 1 \end{array}\right)$$

$$\xrightarrow{R_3 = -2R_1 + R_3} \left(\begin{array}{ccc|c} 1 & 2 & -4 & 1 \\ 0 & -7 & 12 & -1 \\ 0 & -7 & 12 & -1 \end{array}\right) \xrightarrow{R_3 = -R_2 + R_3} \left(\begin{array}{ccc|c} 1 & 2 & -4 & 1 \\ 0 & -7 & 12 & -1 \\ 0 & 0 & 0 & 0 \end{array}\right)$$ ← Infinitely many solution

Let $z = t, t \in \mathbb{R}$

$-7y + 12t = -1$ $\quad x + 2y - 4z = 1$

$y = \frac{12}{7}t + \frac{1}{7}$ $\quad x = 1 - 2\left(\frac{12}{7}t + \frac{1}{7}\right) - 4t$ $\quad z = t$

$= \frac{4}{7}t + \frac{5}{7}$

4. (a) $f(x) = x^3 - 12x + 2$

$f'(x) = 3x^2 - 12$

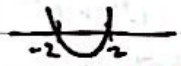
$f(x)$ is increasing when

$f'(x) > 0$

$3x^2 - 12 > 0$

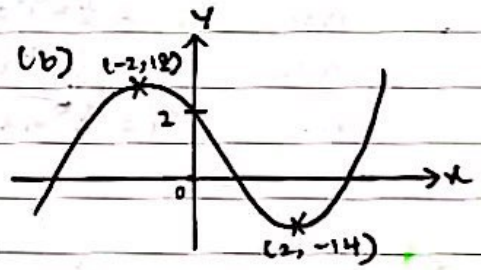
$x^2 - 4 > 0$

$(x+2)(x-2) > 0$



$\therefore x < -2$ or $x > 2$

(b)



$f(x)$ is decreasing when $-2 < x < 2$.

$\therefore$ Turning points are $(2, -14)$ and $(-2, 18)$

5. Let $\frac{18 - 4x - x^2}{(4-3x)(1+x)^2} = \frac{A}{4-3x} + \frac{B}{1+x} + \frac{C}{(1+x)^2}$

$18 - 4x - x^2 = A(1+x)^2 + B(4-3x)(1+x) + C(4-3x)$

$x = \frac{4}{3}$, $\frac{98}{9} = \frac{49}{9}A$ $\quad x = -1$, $18 + 4 - 1 = 7C$ $\quad 3B = 3$

$A = 2$ $\quad C = 3$ $\quad B = 1$

$$\int_0^1 \frac{18 - 4x - x^2}{(4-3x)(1+x)^2}\,dx = \int_0^1 \left[\frac{2}{4-3x} + \frac{1}{1+x} + \frac{3}{(1+x)^2}\right] dx$$

$$= -\frac{2}{3}\int_0^1 \frac{-3}{4-3x}\,dx + \int_0^1 \frac{1}{1+x}\,dx + 3\int_0^1 \frac{1}{(1+x)^2}\,dx$$

$$= \left[-\frac{2}{3}\ln(4-3x) + \ln(1+x) - \frac{3}{1+x}\right]_0^1$$

$$= \left(\ln 2 - \frac{3}{2}\right) - \left(-\frac{2}{3}\ln 4 - 3\right)$$

$$= \ln 2 - \frac{3}{2} + \frac{2}{3}\ln 4 + 3$$

$$= \ln 2 + \frac{4}{3}\ln 2 + \frac{3}{2} = \frac{7}{3}\ln 2 + \frac{3}{2}$$

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TAMAT SAMPEL

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