

SULIT



**KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI**

**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI**

JABATAN MATEMATIK, SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR

SESI II: 2024/2025

BBM20133: CALCULUS FOR ENGINEERING TECHNOLOGY

TARIKH : 17 JUN 2025

MASA : 9.00 PAGI – 12.00 T/HARI (3 JAM)

Kertas soalan ini mengandungi **SEMBILAN (9)** halaman bercetak.

Struktur (5 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

INSTRUCTION:

This section consists of **FIVE (5)** structured questions. Answer **ALL** the questions.

ARAHAN:

*Bahagian ini mengandungi **LIMA (5)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1**SOALAN 1**

- CLO1 (a) Calculate the following limit of function.
Kirakan fungsi had berikut.

$$\lim_{x \rightarrow 3} \frac{\sqrt{x+1} - 2}{x^2 - 9}.$$

[4 marks]

[4 markah]

- CLO2 (b) Solve the following limit of infinity.
Selesaikan had infiniti yang berikut.

i. $\lim_{x \rightarrow \infty} \frac{x+5}{2x^2+1}$

[3 marks]

[3 markah]

ii. $\lim_{x \rightarrow \infty} \frac{2x^2+3x+1}{3x^2-5x+2}$

[3 marks]

[3 markah]

CLO2

(c) A function is defined as:

Suatu fungsi ditakrif sebagai:

$$f(x) = \begin{cases} 2x & , \quad x < 1 \\ cx^2 & , \quad 1 \leq x \leq 2 \\ 4x & , \quad x > 2 \end{cases}$$

- i. Calculate the value of c if the function $f(x)$ is continuous at $x = 1$.

Kirakan nilai c jika fungsi $f(x)$ adalah berterusan pada $x = 1$.

[3 marks]

[3 markah]

- ii. Determine whether the function $f(x)$ is continuous at $x = 2$.

Tentukan sama ada fungsi $f(x)$ adalah berterusan pada $x = 2$.

[3 marks]

[3 markah]

- iii. Sketch the graph of function $f(x)$ for domain $0 \leq x \leq 2$.

Lakarkan graf bagi fungsi $f(x)$ untuk julat $0 \leq x \leq 2$.

[4 marks]

[4 markah]

QUESTION 2

SOALAN 2

CLO2

- (a) Solve the first derivative of the following function by using an appropriate method.

Selesaikan terbitan pertama bagi fungsi berikut dengan menggunakan kaedah yang sesuai.

i. $f(x) = x \ln(9x)$

[4 marks]

[4 markah]

ii. $f(x) = \frac{\tan 2x}{\cot x}$

[4 marks]

[4 markah]

CLO2

- (b) i. Given that $x = 2 + t$ and $y = t^2 - 1$ are the parametric equations. Solve the $\frac{d^2 y}{dx^2}$.

Diberi bahawa $x = 2 + t$ dan $y = t^2 - 1$ ialah persamaan parametrik.

Selesaikan nilai $\frac{d^2 y}{dx^2}$.

[4 marks]

[4 markah]

- ii. Solve $\frac{\partial^2 z}{\partial x^2}$, $\frac{\partial^2 z}{\partial y^2}$ and $\frac{\partial^2 z}{\partial x \partial y}$ for the following equation.

Selesaikan $\frac{\partial^2 z}{\partial x^2}$, $\frac{\partial^2 z}{\partial y^2}$ dan $\frac{\partial^2 z}{\partial x \partial y}$ bagi persamaan yang berikut.

$$z = x^2 y^3 + 2x \cos y$$

[8 marks]

[8 markah]

QUESTION 3**SOALAN 3**

- CLO3 (a) Given a curve $y = x + \frac{1}{x}$, find the equation of the tangent to the curve at $x = 2$.
- Diberi satu lengkung $y = x + \frac{1}{x}$, cari persamaan tangen kepada lengkung tersebut pada titik koordinat $x = 2$.*
- [4 marks]
[4 markah]
- CLO3 (b) Given a curve:
- Diberi suatu persamaan lengkung:*
- $$y = x^3 - 10x^2 + 25x + 4$$
- i. Solve all the coordinates of stationary points on the curve above.
Selesaikan semua koordinat bagi titik pegun untuk persamaan lengkung di atas.
- [3 marks]
[3 markah]
- ii. Sketch the curve of stationary point.
Tentukan sifat titik-titik pegun Lakarkan persamaan lengkung di atas berdasarkan titik-titik pegun
- [5 marks]
[5 markah]

CLO3

- (c) The surface area of a sphere decreases at the rate of $6\text{cm}^2\text{s}^{-1}$ at the instant when its radius is 12cm. Solve the rate at which the volume of the sphere is decreasing at that instant.

[The surface of the Area and Volume of the Sphere is $4\pi r^2$ and $\frac{4}{3}\pi r^3$].

Luas permukaan sfera semakin berkurangan pada kadar $6\text{cm}^2\text{s}^{-1}$ pada saat itu juga jejari sfera itu adalah 12cm.

[Luas Permukaan dan Isipadu Sfera ialah $4\pi r^2$ dan $\frac{4}{3}\pi r^3$].

[8 marks]

[8 markah]

QUESTION 4**SOALAN 4**

CLO1

(a) Show each of the following function.

Tunjukkan setiap yang berikut.

i.
$$\int (9 \cos x - 8x^3 + 2) dx$$

[3 marks]

[3 markah]

ii.
$$\int_1^3 \frac{5x^6 + 6x^3 - x^2}{x^2} dx$$

[3 marks]

[3 markah]

CLO2

(b) Calculate $\int \frac{3x^2}{2x^3 + 1} dx$ by using substitution method.*Hitungkan $\int \frac{3x^2}{2x^3 + 1} dx$ dengan menggunakan kaedah penggantian.*

[7 marks]

[7 markah]

CLO2

(c) Solve the following integration by using suitable integration techniques.

Selesaikan yang berikut menggunakan teknik pengamiran yang sesuai.

$$\int_1^2 \int_0^3 x^2 y \, dx dy$$

[7 marks]

[7 markah]

QUESTION 5

SOALAN 5

CLO3

- (a) A particle is moving on the x-axis. At time $t = 0$, the particle is at the point where $x = 5$. The velocity of the particle at time t second is $v = 6t - t^2$. Solve the distance of the particle when $t = 6$.

Suatu zarah sedang bergerak pada paksi -x. Pada masa $t = 0$, zarah berada pada titik $x = 5$. Halaju zarah pada masa t saat adalah $v = 6t - t^2$. Selesaikan jarak bagi zarah itu apabila $t = 6$.

[6 marks]

[6 markah]

CLO3

- (b) Figure 5(b) shows a curve and a straight line with respective equations $y = x^2 - 8x + 17$ and $y = 10$. The points A and B are the points of intersection between the straight line and the curve. Calculate the area of shaded region.

Rajah 5(b) menunjukkan garis lengkung dan garis lurus dengan persamaan masing-masing $y = x^2 - 8x + 17$ dan $y = 10$. Di mana titik A dan titik B ialah titik persilangan antara garis lengkung dan garis lurus. Hitungkan luas kawasan yang berlorek.

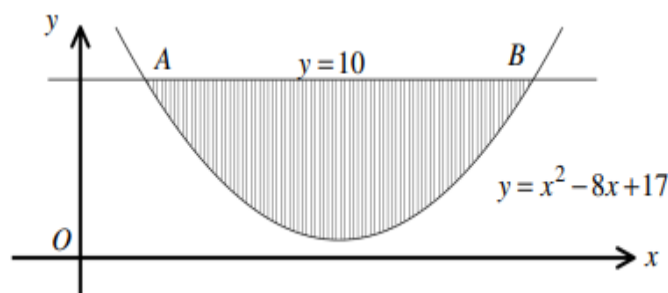


Figure 5(b)/ Rajah 5(b)

[6 marks]

[6 markah]

CLO3

- (c) Figure 5(c) shows the curve, $y = 4 - x^2$. Calculate the volume of the solid generated when the shaded region R is revolved through 360° about the x -axis.

Rajah 5(c) menunjukkan graf lengkung, $y = 4 - x^2$. Kira isipadu yang dijana apabila kawasan berlorek R diputarkan melalui 360° pada paksi- x .

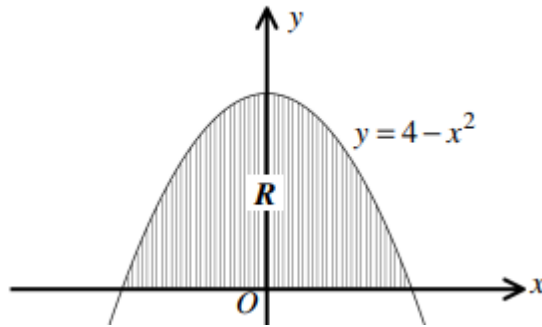


Figure 5(c)/ Rajah 5(c)

[8 marks]

[8 markah]

SOALAN TAMAT

FORMULA BBM20133: CALCULUS FOR ENGINEERING TECHNOLOGY

LIMIT AND FUNCTION	
$\lim_{x \rightarrow a} c = c$ $\lim_{x \rightarrow a} x^n = a^n$ $\lim_{x \rightarrow a} [f(x) \pm g(x)] = \lim_{x \rightarrow a} f(x) \pm \lim_{x \rightarrow a} g(x)$	$\lim_{x \rightarrow a} [f(x) \cdot g(x)] = \lim_{x \rightarrow a} f(x) \cdot \lim_{x \rightarrow a} g(x)$ $\lim_{x \rightarrow a} \left[\frac{f(x)}{g(x)} \right] = \frac{\lim_{x \rightarrow a} f(x)}{\lim_{x \rightarrow a} g(x)}, \lim_{x \rightarrow a} g(x) \neq 0$ $\lim_{x \rightarrow a} [cf(x)] = c \lim_{x \rightarrow a} f(x)$
DIFFERENTIATION	TRIGONOMETRIC IDENTITIES
$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$ $\frac{d}{dx}(u \cdot v) = u \frac{dv}{dx} + v \frac{du}{dx}$ $\frac{d}{dx} \left(\frac{u}{v} \right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$ $\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$	$\cos^2 x + \sin^2 x = 1$ $\sec^2 x = 1 + \tan^2 x$ $\operatorname{cosec}^2 x = 1 + \cot^2 x$ $\sin 2x = \cos^2 x - \sin^2 x$ $ = 1 - 2\sin^2 x$ $ = 2\cos^2 x - 1$ $\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$
DIFFERENTIATION	INTEGRATION
$\frac{d}{dx}(k) = 0; k = \text{constant}$ $\frac{d}{dx}(x^n) = nx^{n-1}$ $\frac{d}{dx}(\ln u) = \frac{1}{u} \cdot \frac{du}{dx}$ $\frac{d}{dx}(e^u) = e^u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\cos u) = -\sin u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\sin u) = \cos u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\tan u) = \sec^2 u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\cot u) = -\operatorname{cosec}^2 u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\sec u) = \sec u \tan u \cdot \frac{du}{dx}$	$\int k \, dx = kx + C; k = \text{constant}$ $\int x^n \, dx = \frac{x^{n+1}}{n+1} + C; n \neq -1$ $\int \frac{1}{u} \, du = \frac{\ln u }{du/dx} + C$ $\int e^u \, du = \frac{e^u}{du/dx} + C$ $\int \sin u \, du = \frac{-\cos u}{du/dx} + C$ $\int \cos u \, du = \frac{\sin u}{du/dx} + C$ $\int \sec^2 u \, du = \frac{\tan u}{du/dx} + C$ $\int \operatorname{cosec}^2 u \, du = \frac{-\cot u}{du/dx} + C$ $\int \sec u \tan u \, du = \frac{\sec u}{du/dx} + C$ $\int \operatorname{cosec} u \cot u \, du = \frac{-\operatorname{cosec} u}{du/dx} + C$

TANGENT LINE EQUATION	NORMAL LINE EQUATION
$y - y_1 = m(x - x_1)$	$y - y_1 = -\frac{1}{m}(x - x_1)$
AREA BOUNDED BY AXIS	VOLUME REVOLVED AROUND AXIS
$A = \int_a^b y dx$ $A = \int_a^b x dy$	$V = \pi \int_a^b y^2 dx$ $V = \pi \int_a^b x^2 dy$
INTEGRATION BY PART	
$\int u dv = uv - \int v du$	