

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 : 2025/2026

BBM20133: CALCULUS FOR ENGINEERING TECHNOLOGY

TARIKH : 15 JULAI 2026

MASA : 9.00 PAGI – 12.00 TENGAH HARI (3 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Subjektif (5 soalan pendek)

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 questions.

ARAHAN:

Bahagian ini mengandungi **LIMA (5)** soalan struktur. Jawab semua soalan

QUESTION 1**SOALAN 1**

CLO1

(a) Solve the following limits:

Selesaikan had-had yang berikut:

i. $\lim_{x \rightarrow 11} \frac{x^2 - 121}{x - 11}$ [4 marks]

[4 markah]

ii. $\lim_{x \rightarrow 0} \frac{x^3 - 8x^2 + 5x}{3x}$ [4 marks]

[4 markah]

iii. $\lim_{x \rightarrow 4} \frac{\sqrt{x} - 2}{x - 4}$ [4 marks]

[4 markah]

CLO2

(b) The function $f(x)$ is defined as:

Fungsi $f(x)$ ditakrifkan sebagai:

$$f(x) = \begin{cases} x^2 + qx, & \text{if } x < 2 \\ 3x - 1, & \text{if } 2 \leq x < 5 \\ 2x + 4, & \text{if } x \geq 5 \end{cases}$$

i. Calculate the value q that make the function continuous at $x = 2$.

Kirakan nilai q yang menjadikan fungsi itu selanjar pada $x = 2$.

[4 marks]

[4 markah]

ii. Demonstrate whether $f(x)$ is continuous at $x = 5$.

Tunjukkan sama ada $f(x)$ selanjar pada $x = 5$.

[4 marks]

[4 markah]

QUESTION 2**SOALAN 2**

- CLO1 (a) Solve $\frac{d^2y}{dx^2}$ for the following functions:

Selesaikan $\frac{d^2y}{dx^2}$ bagi fungsi-fungsi berikut:

i. $y = \frac{x^5}{5} + \sin\sqrt{3}x$

[4 marks]

[4 markah]

ii. $y = 7 \ln\left(\frac{10}{3}x\right)$

[4 marks]

[4 markah]

iii. $y = e^{\frac{5x}{2}} + (x+3)(x-3)$

[5 marks]

[5 markah]

- CLO2 (b) Determine $\frac{\partial^2 z}{\partial x^2}$ and $\frac{\partial^2 z}{\partial y^2}$ for the following equation:

Tentukan $\frac{\partial^2 z}{\partial x^2}$ dan $\frac{\partial^2 z}{\partial y^2}$ bagi persamaan berikut:

$$z = \frac{9x^4 \sin 2y}{3}$$

[7 marks]

[7 markah]

QUESTION 3**SOALAN 3**

- CLO2 (a) The curve $y = 2x^2 - 5x + 6$ intersects the y-axis at point P. Determine the equation of the tangent to the curve at point P.
Lengkung $y = 2x^2 - 5x + 6$ bersilang di paksi-y pada titik P. Tentukan persamaan tangen bagi lengkung di titik P.
[4 marks]
[4 markah]
- CLO2 (b) The equation of a curve is given by $y = x^2(x - 3)$.
Persamaan bagi suatu lengkung diberikan oleh $y = x^2(x - 3)$.
i. Calculate the stationary points of the curve.
Kirakan titik-titik pegun bagi lengkung. [4 marks]
[4 markah]
ii. Determine the nature of each stationary point.
Tentukan sifat bagi setiap titik pegun. [4 marks]
[4 markah]
- CLO2 (c) A cylindrical water tank has a radius of 3 meters and a height of 6 meters. Water is being poured into the tank so that the volume of water increases at a rate of $5.5 \text{ m}^3/\text{s}$.
Sebuah tangki air berbentuk silinder mempunyai jejari 3 meter dan ketinggian 6 meter. Air dituangkan ke dalam tangki tersebut sehingga isipadu air bertambah pada kadar $5.5 \text{ m}^3/\text{s}$.
i. Calculate the value of $\frac{dh}{dv}$.
Kirakan nilai bagi $\frac{dh}{dv}$ [4 marks]
[4 markah]
ii. Calculate the rate at which the height of water increases at that instant.
Kirakan kadar pertambahan ketinggian air pada ketika itu. [4 marks]
[4 markah]

QUESTION 4**SOALAN 4**

CLO1

(a) Solve the following integrals:

Selesaikan kamiran-kamiran berikut:

i.
$$\int \left(10x^4 + \sin 5x + \cos \frac{x}{3} \right) dx$$

[4 marks]

[4 markah]

ii.
$$\int \left(e^{4x} - e^{-\frac{7}{2}x} \right) dx$$

[4 marks]

[4 markah]

iii.
$$\int_0^3 \left(\frac{x^2-16}{x-4} \right) dx$$

[5 marks]

[5 markah]

CLO2

(b) Solve the following integral using the Integration by Substitution Method:

Selesaikan kamiran berikut menggunakan Kaedah Kamiran dengan Penggantian:

$$\int \frac{2x+3}{\sqrt{x^2+3x+1}} dx$$

[7 marks]

[7 markah]

QUESTION 5**SOALAN 5**

CLO2

- (a) An object moves in a straight line with an acceleration, $a \text{ ms}^{-2}$ given by $a = 6 - t$, where t is time in seconds. The object starts from rest at point O.

Satu objek bergerak dalam garis lurus dengan pecutan, $a \text{ ms}^{-2}$ diberikan oleh $a = 6 - t$ di mana t ialah masa dalam saat. Objek tersebut bermula dari keadaan rehat pada titik O.

- i. Solve the velocity, v of the object as a function of time, t
Selesaikan halaju, v objek sebagai fungsi masa, t

[3 marks]

[3 markah]

- ii. Calculate the displacement of the object from O when the object reaches its maximum velocity at $t = 5\text{s}$.

Kirakan sesaran objek tersebut dari titik O apabila objek mencapai halaju maksimum pada $t = 5\text{s}$.

[3 marks]

[3 markah]

CLO2 (b)

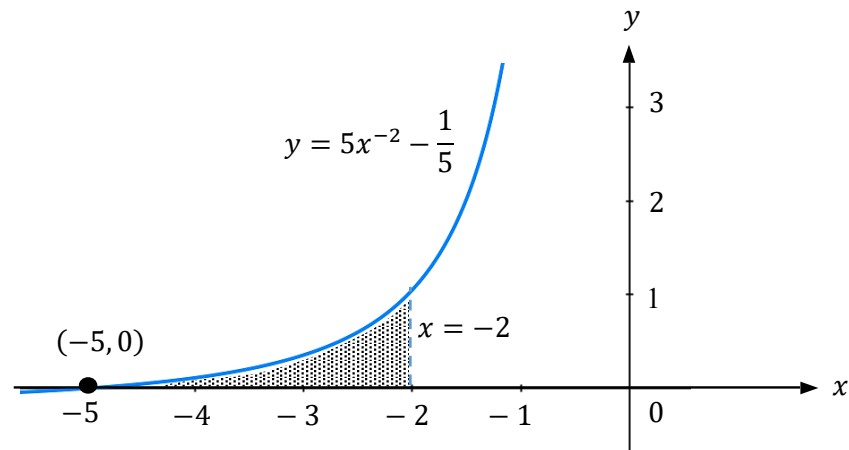


Figure 5(b)

Rajah 5(b)

Figure 5(b) shows a shaded region bounded by the curve $y = 5x^{-2} - \frac{1}{5}$, the line $x = -2$, the point $(-5, 0)$ and the x -axis. Calculate the area of the shaded region.

Rajah 5(b) menunjukkan rantau berlorek dibatasi oleh lengkung $y = 5x^{-2} - \frac{1}{5}$, garis $x = -2$, titik $(-5, 0)$ dan paksi- x . Kira luas rantau berlorek.

[6 marks]

[6 markah]

CLO2 (c)

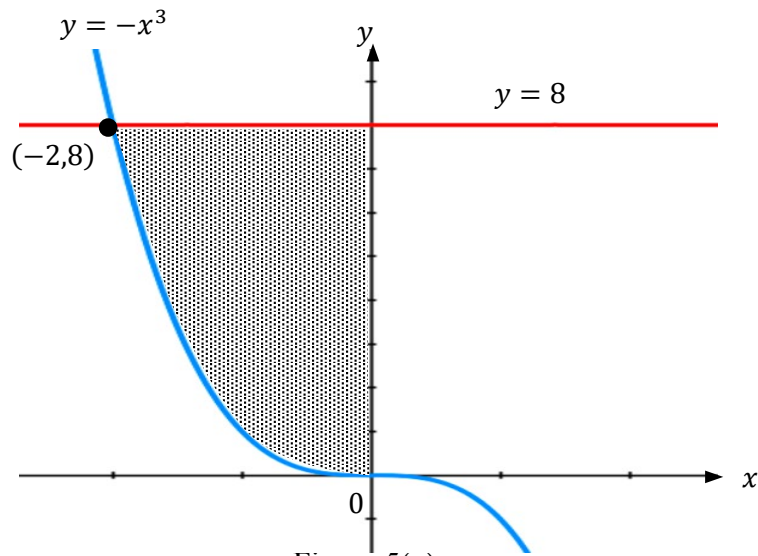


Figure 5(c)

Rajah 5(c)

Figure 5(c) shows a shaded region bounded by the curve $y = -x^3$, the line $y = 8$, the point $(-2, 8)$ and the y -axis. Calculate the volume of the solid generated when the shaded region is rotated 360° at the y -axis.

Rajah 5(c) menunjukkan rantau berlorek dibatasi lengkung $y = -x^3$, garis $y = 8$, titik $(-2, 8)$ dan paksi- y . Kirakan isipadu bagi pepejal yang dijana apabila rantau berlorek diputar 360° pada paksi- y .

[8 marks]

[8 markah]

SOALAN TAMAT

FORMULA: BBM20133 CALCULUS FOR ENGINEERING TECHNOLOGY

LIMIT & 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
$\frac{d}{dx}(k) = 0; k = \text{constant}$ $\frac{d}{dx}(x^n) = nx^{n-1}$ $\frac{d}{dx}(\ln u) = \frac{1}{u} \cdot \frac{du}{dx}$ $\frac{d}{dx}(e^u) = e^u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\cos u) = -\sin u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\sin u) = \cos u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\tan u) = \sec^2 u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\cot u) = -\operatorname{cosec}^2 u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\sec u) = \sec u \tan u \cdot \frac{du}{dx}$ $\frac{d}{dx}(\operatorname{cosec} u) = -\operatorname{cosec} u \cot u \cdot \frac{du}{dx}$	$\int k \, dx = kx + C; k = \text{constant}$ $\int x^n \, dx = \frac{x^{n+1}}{n+1} + C; n \neq -1$ $\int \frac{1}{u} \, du = \frac{\ln u }{du/dx} + C$ $\int e^u \, du = \frac{e^u}{du/dx} + C$ $\int \sin u \, du = \frac{-\cos u}{du/dx} + C$ $\int \cos u \, du = \frac{\sin u}{du/dx} + C$ $\int \sec^2 u \, du = \frac{\tan u}{du/dx} + C$ $\int \operatorname{cosec}^2 u \, du = \frac{-\cot u}{du/dx} + C$ $\int \sec u \tan u \, du = \frac{\sec u}{du/dx} + C$ $\int \operatorname{cosec} u \cot u \, du = \frac{-\operatorname{cosec} u}{du/dx} + C$

FORMULA: BBM20133 CALCULUS FOR ENGINEERING TECHNOLOGY

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 PARTS	
$\int u dv = uv - \int v du$	