

SULIT



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

JABATAN MATEMATIK SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR

SESI 1:2015/2016

BBM2013: CALCULUS FOR ENGINEERING TECHNOLOGY

TARIKH : 07 JANUARI 2016

MASA : 8.30 AM – 11.30 AM (3 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.
Kertas ini mengandungi 5 Soalan Struktur (**JAWAB SEMUA**).
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 berstruktur. Jawab semua soalan.

QUESTION 1**SOALAN 1**CLO1
C1

a) Given $f(x) = x^3 - 2x^2$ and $g(x) = 2x^2 - 8$. Evaluate $\lim_{x \rightarrow 2} \frac{f(x)}{g(x)}$. [4 marks]

Diberi $f(x) = x^3 - 2x^2$ dan $g(x) = 2x^2 - 8$. Nilaiakan $\lim_{x \rightarrow 2} \frac{f(x)}{g(x)}$. [4 markah]

CLO1
C2

b) Determine whether the functions given are continuous at the indicated points.

Tentukan samada fungsi-fungsi tersebut selanjur pada titik yang dinyatakan.

i)
$$f(x) = \begin{cases} e^x & , \quad x \geq 0 \\ 1 - 4x^2 & , \quad x < 0 \end{cases} \quad \text{at } x = 0$$

[4 marks]

$$f(x) = \begin{cases} e^x & , \quad x \geq 0 \\ 1 - 4x^2 & , \quad x < 0 \end{cases} \quad \text{pada } x = 0$$

[4 markah]

ii) $f(x) = \frac{3}{x+5}$ at $x = -5$ [2 marks]

$f(x) = \frac{3}{x+5}$ pada $x = -5$ [2 markah]

CLO1
C3c) Function $f(x)$ is defined as:*Fungsi $f(x)$ ditakrifkan sebagai:*

$$f(x) = \begin{cases} 1-3x & , \quad x < 4 \\ mx^2 + 2x - 3 & , \quad 4 \leq x \leq 6 \\ -x^2 + 9 & , \quad x > 6 \end{cases}$$

i) Find the constant value of m if $\lim_{x \rightarrow 4} f(x)$ exists. [3 marks]*Cari nilai pemalar, m sekiranya had $f(x)$ wujud.* [3 markah]ii) Determine whether the function is continuous at $x = 6$. [4 marks]*Tentukan samada fungsi tersebut selanjar pada $x = 6$.* [4 markah]iii) Sketch the graph of $f(x)$ for domain $3 \leq x \leq 7$. [3 marks]*Lakarkan graf $f(x)$ bagi domain $3 \leq x \leq 7$.* [3 markah]

QUESTION 2

SOALAN 2

CLO2
C2

- a) Differentiate each of the following functions with respect to
- x
- .

Bezakan setiap fungsi yang berikut terhadap x .

i. $f(x) = \frac{1}{4-x}$ [2 marks]

[2 markah]

ii. $f(x) = \frac{7 - \ln x}{7 + \ln x}$ [3 marks]

[3 markah]

CLO2
C3

- b) Determine the equation of the tangent line to the curve
- $y = \sqrt{x} + 2x$
- at point (4,10). [5 marks]

*Tentukan persamaan garis tangen bagi lengkung $y = \sqrt{x} + 2x$ pada titik (4,10). [5 markah]*CLO2
C3

- c) The equation of a curve is given by
- $2x^2 + 2y^2 = 16x + 4y$
- , where
- $\frac{dy}{dx} = \frac{4-x}{y-1}$
- .

Persamaan bagi sebuah lengkung diberi oleh $2x^2 + 2y^2 = 16x + 4y$, yang

mana $\frac{dy}{dx} = \frac{4-x}{y-1}$.

- i. Calculate the slope of the curve at point
- $\left(\frac{2}{5}, -1\right)$
- . [2 marks]

Kira kecerunan bagi lengkung tersebut pada titik $\left(\frac{2}{5}, -1\right)$. [2 markah]

- ii. Find the equation of the tangent line that passes through
- $\left(\frac{2}{5}, -1\right)$
- .

[2 marks]

Cari persamaan garis tangen yang melalui $\left(\frac{2}{5}, -1\right)$. [2 markah]

- iii. Prove that the curve has horizontal tangent lines at point
- $(4, 1 + \sqrt{17})$
- and
- $(4, 1 - \sqrt{17})$
- . [6 marks]

Buktikan bahawa lengkung tersebut mempunyai garis tangen yang melintang pada titik $(4, 1 + \sqrt{17})$ dan $(4, 1 - \sqrt{17})$. [6 markah]

QUESTION 3

SOALAN 3

CLO2
C2

- a) Consider a function $f(x) = 2x^3 + 6x^2 - x - 2$. In order to get critical values of the function, $f'(x) = 0$. Find these critical values. [5 marks]

Pertimbangkan sebuah fungsi $f(x) = 2x^3 + 6x^2 - x - 2$. Bagi mendapatkan nilai genting bagi fungsi berkenaan, $f'(x) = 0$. Cari nilai genting tersebut. [5 markah]

CLO2
C3

- b) The volume of a cube is decreasing at the rate of $2.25\text{m}^3/\text{s}$. Find the rate at which the length of a side of the cube is decreasing when $V = 0.125\text{m}^3$. [5 marks]

Isipadu sebuah kiub berkurangan pada kadar $2.25\text{m}^3/\text{s}$. Cari kadar apabila panjang sisi kiub tersebut berkurangan apabila $V = 0.125\text{m}^3$. [5 markah]

CLO2
C4

- c) The position function of a prototype electronic toy car is given as $s(t) = t^3 - 9t^2 + 15t + 3$, where $s(t)$ is measured in meters and t in minutes.

Fungsi kedudukan bagi sebuah prototaip kereta mainan elektrik diberi oleh $s(t) = t^3 - 9t^2 + 15t + 3$, dengan $s(t)$ diukur dalam meter dan t dalam minit.

- i. Find the velocity function at time t . [2 marks]
Cari fungsi halaju pada masa t . [2 markah]
- ii. From the time interval of $t = 0$ to $t = 8$, when is the toy car furthest to the left? [3 marks]
Daripada selang masa $t = 0$ hingga $t = 8$, bilakah kereta mainan tersebut berada paling jauh ke arah kiri? [3 markah]
- iii. Calculate the total distance traveled from $t = 0$ to $t = 8$. [5 marks]
Kira jumlah jarak yang dilalui dari $t = 0$ hingga $t = 8$. [5 markah]

QUESTION 4

SOALAN 4

CLO2
C1

a) Determine the following integrals:

Tentukan setiap kamiran berikut:

i)
$$\int \frac{1}{x^2} + \frac{2}{x^3} - \frac{3}{x^4} dx$$
 [2 marks]

[2 markah]

ii)
$$\int (4x - 6)^7 dx$$
 [2 marks]

[2 markah]

CLO2
C2b) By using the substitution $u = \sin 4x$, find $\int \cos^5 4x dx$. [6 marks]*Dengan menggunakan penggantian $u = \sin 4x$, dapatkan $\int \cos^5 4x dx$.*

[6 markah]

CLO2
C3c) i) Express $\frac{14x^2 + 18x + 4}{x(2x+1)^2}$ in partial fractions. [7 marks]*Nyatakan $\frac{14x^2 + 18x + 4}{x(2x+1)^2}$ dalam pecahan separa.* [7 markah]ii) Then, evaluate $\int_1^4 \frac{14x^2 + 18x + 4}{x(2x+1)^2} dx$ and give your answer correct to three decimal places. [3 marks]*Seterusnya, nilaikan $\int_1^4 \frac{14x^2 + 18x + 4}{x(2x+1)^2} dx$ dan beri jawapan tepat**kepada tiga titik perpuluhan.* [3 markah]

QUESTION 5

SOALAN 5

CLO2
C2

- a) A particle passes a fixed point O on a straight line with a velocity of 10 ms^{-1} . Its acceleration, $a \text{ ms}^{-2}$ is given by $a = 4 - t$ where t is the time in seconds after passing O . Find the maximum velocity of the particle. [5 marks]

Sebutir zarah melalui titik pegun O pada satu garis lurus dengan halaju 10 ms^{-1} . Pecutan, $a \text{ ms}^{-2}$ zarah tersebut diberi $a = 4 - t$ yang mana t adalah masa dalam saat selepas melalui O . Dapatkan halaju maksimum zarah tersebut. [5 markah]

CLO2
C3

- b) In Diagram 5b, TRW is a part of a curve $y = 25 - x^2$. $TUVW$ is a rectangle where its area is equal to the area bounded by the curve TRW and the line TW .

Dalam Rajah 5b, TRW adalah sebahagian daripada lengkung $y = 25 - x^2$. $TUVW$ adalah segi empat tepat yang mana luasnya bersamaan dengan luas yang dicakupi oleh lengkung TRW dan garisan TW .

- i) Calculate the values of h and k . [6 marks]
Kirakan nilai h dan k . [6 markah]
- ii) Find the area of the shaded regions. [4 marks]
Dapatkan luas kawasan berlorek. [4 markah]

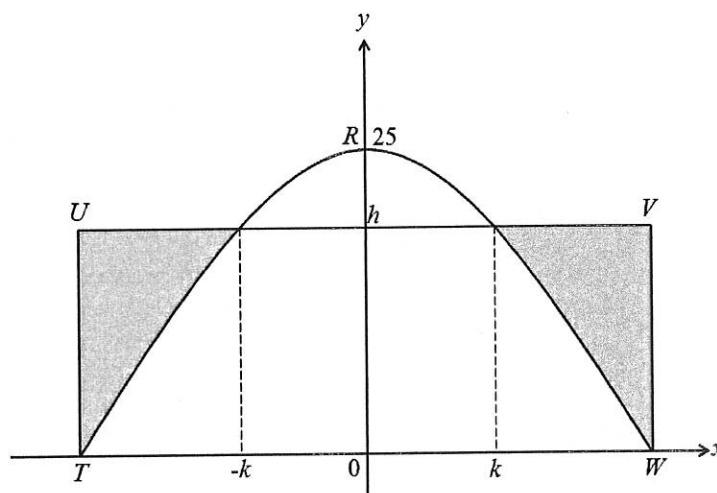


Diagram 5b/ Rajah 5b

CLO2
C4

- c) In Diagram 5c, R is the region bounded by the curve $y = 4x - x^2$, the line $2x + y = 8$ and the y -axis. Find the volume generated when the region R is rotated through 360° about the x -axis. [5 marks]

Berdasarkan Rajah 5c, R adalah kawasan yang dicakupi oleh lengkung $y = 4x - x^2$, garisan $2x + y = 8$ dan paksi- y . Dapatkan isipadu yang terhasil apabila kawasan R diputarkan 360° pada paksi- x . [5 markah]

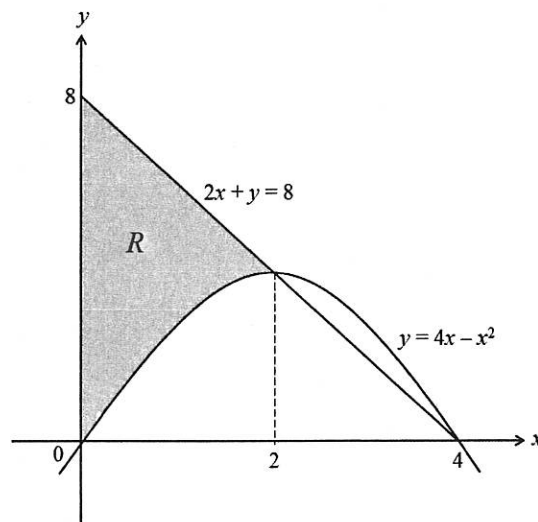


Diagram 5c/ Rajah 5c

SOALAN TAMAT

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

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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
$A = \int_a^b y dx$ $A = \int_a^b x dy$	$V = \pi \int_a^b y^2 dx$ $V = \pi \int_a^b x^2 dy$
TRIGONOMETRIC IDENTITIES	
$\cos^2 x + \sin^2 x = 1$ $\sec^2 x = 1 + \tan^2 x$ $\operatorname{cosec}^2 x = 1 + \cot^2 x$ $\sin 2x = \cos^2 x - \sin^2 x$ $= 1 - 2\sin^2 x$ $= 2\cos^2 x - 1$ $\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$	