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

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI I : 2022/2023

DBM20023 : ENGINEERING MATHEMATICS 2

TARIKH : 27 DISEMBER 2022
MASA : 8.30 AM – 10.30 AM (2 JAM)

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

This paper consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

Kertas ini mengandungi ***EMPAT (4)*** *soalan berstruktur. Jawab* ***SEMUA*** *soalan.*

QUESTION 1

SOALAN 1

CLO1
C3

(a) Express each of the followings in the simplest form:

Nyatakan setiap fungsi yang berikut dalam bentuk paling ringkas:

i. $a^{3x} \times a^{x-2} \div a^{2x}$

[3 marks]

[*3 markah*]

ii. $3b^3c^4 \div 3b^2c^2$

[3 marks]

[*3 markah*]

iii. $4^{2x} \times 16^{x-2} \times 64^{1-x}$

[4 marks]

[*4 markah*]

CLO2
C3

(b) Calculate the following equations using the suitable method:
Kirakan persamaan-persamaan berikut mengikut kaedah yang bersesuaian:

i. $\log_5 6 + \log_5 4x = 0$

[5 marks]
[*5 markah*]

ii. $3\log_2 8 - \log_2 \mathrm{P} = 5$

[5 marks]
[*5 markah*]

iii. $\log_x 4 + \frac{1}{2}\log_x 16 = 4$

[5 marks]
[*5 markah*]

QUESTION 2

SOALAN 2

CLO1
C3

(a)

i. Calculate $\frac{dy}{dx}$ for equation $y = (3x + 8)^8$ by using **chain rule.**

Kirakan $\frac{dy}{dx}$ *untuk persamaan* $y = (3x + 8)^8$ *dengan menggunakan* ***petua rantai.***

[4 marks]

[*4 markah*]

ii. Compute the **second derivative** for the function $y = -4x^2 + 5x^3 + \frac{3}{x}$

Kirakan pembezaan ***peringkat kedua*** *bagi fungsi* $y = -4x^2 + 5x^3 + \frac{3}{x}$

[4 marks]

[*4 markah*]

iii. The parametric equations are given as $y = 4e^{(3t+3)}$ and $x = 6 - 3t^2$

Calculate $\frac{dy}{dx}$.

Fungsi persamaan parametrik diberi sebagai $y = 4e^{(3t+3)}$ dan $x = 6 - 3t^2$. *Kirakan* $\frac{dy}{dx}$.

[4 marks]

[*4 markah*]

CLO2
C3

(b) Calculate the derivative $\frac{dy}{dx}$ for each of the following equations.

Kira pembezaan $\frac{dy}{dx}$ *bagi setiap fungsi berikut.*

i. $y = 2e^{2x^2+1} + 6e^{-3x}$

[3 marks]

[*3 markah*]

ii. $y = \ln \frac{4}{(6+2x)^5}$

[4 marks]

[*4 markah*]

iii. $y = (2x^2 + 2x)^2 \tan 6x$

[6 marks]

[*6 markah*]

QUESTION 3

SOALAN 3

CLO1
C3

(a)

i. Solve the following integrals $\int 4x^3 + 2x^2 - 5\,dx$

Selesaikan kamiran berikut $\int 4x^3 + 2x^2 - 5\ dx$

[3 marks]

[*3 markah*]

ii. Solve the following definite integrals $\int_2^3 (3x + 6)\,dx$

Selesaikan kamiran-kamiran tentu berikut $\int_2^3 (3x + 6)dx$

[3 marks]

[*3 markah*]

iii. Solve the following integrals by using substitution method

Selesaikan kamiran berikut dengan menggunakan kaedah penggantian.

$$\int 4\cos 2x\,dx$$

[4 marks]

[*4 markah*]

CLO2
C3

(b) Solve the following integrals using integration by parts.

Selesaikan kamiran-kamiran berikut menggunakan kamiran bahagian demi bahagian.

i. $\int x^2 \cos \mathrm{x}\ dx$

[7 marks]

[*7 markah*]

ii. $\int x^2 e^{3x} dx$

[8 marks]

[*8 markah*]

QUESTION 4
SOALAN 4

CLO2
C3

(a)

i. If the radius of a circle increases at a rate of 0.3 cms^{-1}, calculate the rate of change of area of the circle when its radius is 8 cm. (Given that area of circle $A = \pi r^2$)

Jika jejari bulatan bertambah pada kadar 0.3 cms^{-1}, hitung kadar perubahan luas bulatan apabila jejarinya ialah 8 cm. (Di beri luas bulatan ialah $A = \pi r^2$)

[5 marks]
[*5 markah*]

ii. A curve has the equation $y = 3x^2 + 3x + 4$. Solve the given equation to find the stationary points and their natures.

Sebuah lengkung mempunyai persamaan $y = 3x^2 + 3x + 4$. Selesaikan persamaan tersebut untuk mencari titik pegun dan sifatnya.

[8 marks]
[*8 markah*]

CLO1
C3

(b)

i. Given a graph $y^2 = (2 + x)$. Determine the area under the graph bounded by the curve, y-axis, the line y = 0 and y = 3.

Diberi graf $y^2 = (2 + x)$. Tentukan luas di bawah graf yang dilingkungi oleh lengkungan, paksi –y, garisan y = 0 dan y =3.

[6 marks]
[*6 markah*]

ii. Refer to Figure 4 (b) ii , calculate the generated volume when this shaded region is rotated 360^0 around the y-axis.
Merujuk Rajah 4 (b) ii, kira isipadu janaan apabila kawasan berlorek diputarkan 360º pada paksi-y.

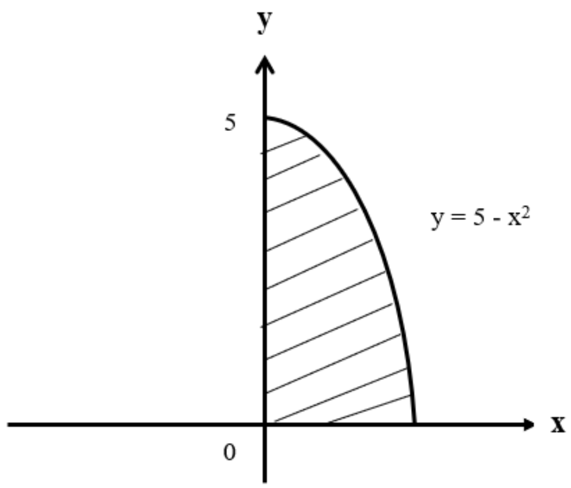

Figure 4 (b) ii / *Rajah 4 (b)ii*

[6 marks]
[*6 markah*]

SOALAN TAMAT

FORMULA SHEET FOR DBM20023

EXPONENTS AND LOGARITHMS			
LAW OF EXPONENTS		LAW OF LOGARITHMS	
1.	$a^m \times a^n = a^{m+n}$	8.	$\log_a a = 1$
2.	$\frac{a^m}{a^n} = a^{m-n}$	9.	$\log_a 1 = 0$
3.	$(a^m)^n = a^{m\times n}$	10.	$\log_a b = \frac{\log_c b}{\log_c a}$
4.	$a^0 = 1$	11.	$\log_a MN = \log_a M + \log_a N$
5.	$a^{-n} = \frac{1}{a^n}$, $a \neq 0$	12.	$\log_a \frac{M}{N} = \log_a M - \log_a N$
6.	$a^{\frac{m}{n}} = (\sqrt[n]{a})^m$	13.	$\log_a N^P = P \log_a N$
7.	$(ab)^n = a^n b^n$	14.	$N = a^x \Leftrightarrow \log_a N = x$

DIFFERENTIATION			
1.	$\frac{d}{dx}(k) = 0, k\ is\ constant$	2.	$\frac{d}{dx}(ax^n) = anx^{n-1}$ $[Power\ Rule]$
3.	$\frac{d}{dx}(ax+b)^n) = an(ax+b)^{n-1}$ $[Composite\ Rule]$		
4.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	5.	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$ $[Product\ Rule]$
6.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ $[Quotient\ Rule]$	7.	$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$ $[Chain\ Rule]$
8.	$\frac{d}{dx}(e^x) = e^x$	9.	$\frac{d}{dx}\left(e^{ax+b}\right) = e^{ax+b} \times \frac{d}{dx}(ax+b)$
10.	$\frac{d}{dx}(ln\ \lvert x\rvert) = \frac{1}{x}$	11.	$\frac{d}{dx}[\ln\lvert ax+b\rvert] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
12.	$\frac{d}{dx}(\sin x) = \cos x$	13.	$\frac{d}{dx}(\cos x) = -\sin x$

14.	$\frac{d}{dx}(\tan x) = \sec^2 x$	15.	$\frac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \frac{d}{dx}(ax+b)$
16.	$\frac{d}{dx}[\cos(ax+b)] = -\sin(ax+b) \times \frac{d}{dx}(ax+b)$	17.	$\frac{d}{dx}[\tan(ax+b)] = sec^2(ax+b) \times \frac{d}{dx}(ax+b)$
18.	$\frac{d}{dx}[\sin^n u] = n \sin^{n-1} u \times \cos u \times \frac{du}{dx}$	19.	$\frac{d}{dx}[cos^n u] = n\, cos^{n-1} u \times -\sin u \times \frac{du}{dx}$
20.	$\frac{d}{dx}[tan^n u] = n\, tan^{n-1} u \times sec^2 u \times \frac{du}{dx}$		

INTEGRATION			
1.	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c;\ \{n \neq -1\}$	2.	$\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c;\ \{n \neq -1\}$
3.	$\int k\ dx = kx + c, k\ is\ constant$	4.	$\int_a^b f(x)dx = F(b) - F(a)$
5.	$\int \frac{1}{x}\ dx = \ln\ \lvert x \rvert + c$	6.	$\int \frac{1}{ax+b}\ dx = \frac{1}{a} \times \ln\ \lvert ax+b \rvert + c$
7.	$\int e^x\ dx = \ e^x + c$	8.	$\int e^{ax+b}\ dx = \frac{1}{a} \times e^{ax+b} + c$
9.	$\int \sin x\ dx = \ -\cos x + c$	10.	$\int \cos x\ dx = \sin x + c$
11.	$\int sec^2\, x\ dx = \ \tan x + c$		
12.	$\int \sin(ax+b)\ dx = \ -\frac{1}{a} \times \cos(ax+b) + c$		
13.	$\int \cos(ax+b)\ dx = \ \frac{1}{a} \times sin(ax+b)\ + c$		
14.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times\ \tan(ax+b) + c$		

IDENTITY TRIGONOMETRY			
1.	$cos^2\,\theta + sin^2\,\theta = 1$	2.	$1 + tan^2\,\theta = sec^2\,\theta$
3.	$1 + cot^2\theta = \;cosec^2\,\theta$	4.	$\sin 2\theta = 2\sin\theta\cos\theta$
5.	$\cos 2\theta = 2\,cos^2\theta - 1$ $= 1 - 2\,sin^2\theta$ $= cos^2\theta - sin^2\theta$	6.	$\tan 2\theta = \dfrac{2\tan\theta}{1 - tan^2\,\theta}$
7.	$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$	8.	$\cot\theta = \dfrac{\cos\theta}{\sin\theta} = \dfrac{1}{\tan\theta}$
9.	$\sec\theta = \dfrac{1}{\cos\theta}$	10.	$cosec\;\theta = \dfrac{1}{\sin\theta}$

AREA UNDER CURVE			
1.	$A_x = \int_a^b y\,dx$	2.	$A_y = \int_a^b x\,dy$

VOLUME UNDER CURVE			
1.	$V_x = \pi\int_a^b y^2\,dx$	2.	$V_y = \pi\int_a^b x^2\,dy$

INTEGRATION BY PARTS
$\int u\,dv = uv - \int v\,du$