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 & KOMPUTER

PEPERIKSAAN AKHIR

SESI I : 2023/2024

DBM20023: ENGINEERING MATHEMATICS 2

TARIKH : 29 DISEMBER 2023
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 section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 (a) Show each of the following expression in the simplest form.

Tunjukkan setiap ungkapan berikut dalam bentuk yang paling ringkas.

i. $\dfrac{4\,a^2\,p^4a^3}{16p^2}$

[2 marks]

[*2 markah*]

ii. $7^{2n} \times 49^{3n-1} \div 343$

[4 marks]

[4 *markah*]

iii. $4 + \log_3 m^5 - \log_3 \sqrt{m}$

[4 marks]

[*4 markah*]

CLO2 (b) Solve the following equations.
Selesaikan persamaan berikut.

i. $5^{2x} = 7$

[5 marks]
[*5 markah*]

ii. $\log_2 3x - \log_2 (4x - 1) = 3$

[5 marks]
[*5 markah*]

iii. $3 \log_x 5 + \log_x 5 = 4$

[5 marks]
[*5 markah*]

QUESTION 2

SOALAN 2

CLO1 (a)

i. Calculate $\frac{dy}{dx}$ for equation $y = \frac{3}{x^3} - x^2 - \sqrt{4}$.

Hitung $\frac{dy}{dx}$ *untuk persamaan* $y = \frac{3}{x^3} - x^2 - \sqrt{4}$.

[3 marks]

[*3 markah*]

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

Kira terbitan peringkat kedua bagi fungsi $y = 5 - 2\sqrt{x} + 4x^2$.

[5 marks]

[*5 markah*]

iii. Given $z = xy^2 - 3y^3$. Calculate $\frac{\partial z}{\partial y}$ and $\frac{\partial^2 z}{\partial y\, \partial x}$.

Diberi $z = xy^2 - 3y^3$. *Hitung* $\frac{\partial z}{\partial y}$ *dan* $\frac{\partial^2 z}{\partial y\, \partial x}$.

[4 marks]

[*4 markah*]

CLO2

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

Hitung terbitan $\frac{dy}{dx}$ *bagi persamaan berikut.*

i. $y = 3\tan(2x^5 - 6)$

[3 marks]

[*3 markah*]

ii. $y = \frac{1}{e^{-2+x^3}} + 2e^{-7x}$

[4 marks]

[*4 markah*]

iii. $y = (2x^2 + 3)\ln|2x^2 + 3|$

[6 marks]

[*6 markah*]

QUESTION 3

SOALAN 3

CLO2 (a) Calculate the stationary points of the equation $y = 2x^2 - \frac{2x^3}{3} + 3$. Hence, determine their nature.

Hitung titik pegun bagi persamaan $y = 2x^2 - \frac{2x^3}{3} + 3$. *Seterusnya, tentukan sifatnya.*

[10 marks]

[*10 markah*]

CLO1 (b) Calculate the following integrals:

Hitung kamiran berikut:

i. $\int x(x-2)(x+3)\,dx$

[4 marks]

[*4 markah*]

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

[5 marks]

[*5 markah*]

iii. $\int_{-3}^{0} \sqrt{1-x}\,dx$

[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) Solve the following integrals using integration by parts.

Selesaikan kamiran berikut menggunakan kamiran bahagian demi bahagian.

i. $\int x \cos 2x \, dx$

[5 marks]

[*5 markah*]

ii. $\int x \ln x \, dx$

[5 marks]

[*5 markah*]

CLO1 (b)

i. Figure 4 (b) i shows an enclosed region between the curve $x = y(y-2)$ and y-axis between $y = 0$ and $y = 2$. Calculate the shaded area.

Rajah 4 (b) i menunjukkan kawasan tertutup lengkung $x = y(y-2)$ *dan paksi-y antara y = 0 dan y = 2. Hitung luas kawasan berlorek.*

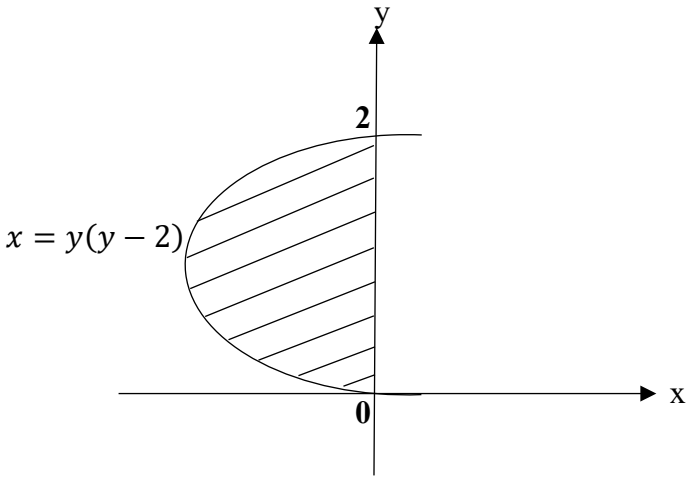

Figure 4 (b) i / *Rajah 4 (b) i*

[7 marks]

[*7 markah*]

ii. Figure 4 (b) ii shows the graph of $y = x + 1$ between $x = -1$ and $x = 3$. Calculate the volume of the shaded region when is rotated $360°$ about x-axis.

Rajah 4 (b) ii menunjukkan graf $y = x + 1$ *antara* $x = -1$ *dan* $x = 3$. *Hitung isipadu kawasan berlorek apabila diputar 360° pada paksi-x.*

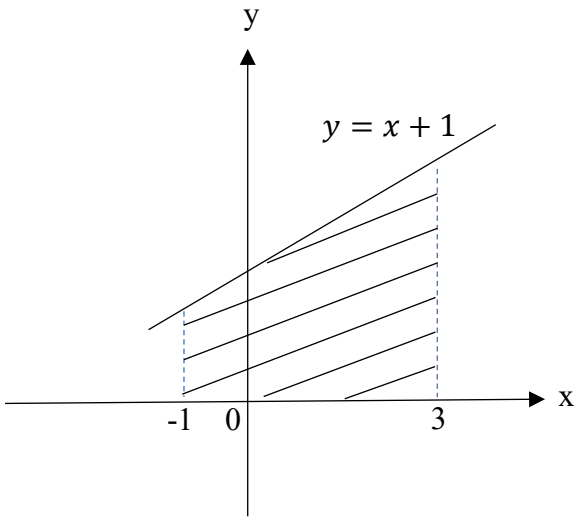

Figure 4 (b) ii / *Rajah 4 (b) ii*

[8 marks]

[*8 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.	$\frac{d}{dx}(k) = 0, k \text{ is constant}$	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.	$\frac{d}{dx}(ln\ \|x\|) = \frac{1}{x}$	11.	$\frac{d}{dx}[\ln\|ax+b\|] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
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			
$\int u\,dv = uv - \int v\,du$			