

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)

SULIT

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.
$$\frac{4 a^2 p^4 a^3}{16 p^2}$$

[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.

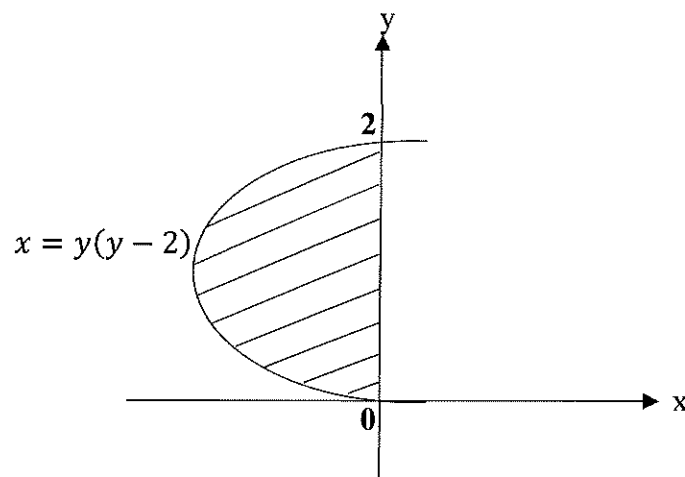


Figure 4 (b) i / Rajah 4 (b) i

[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 .

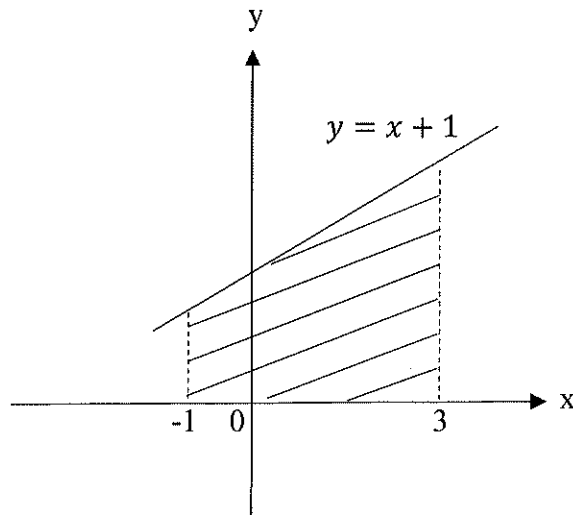


Figure 4 (b) ii / *Rajah 4 (b) ii*

[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.	$\frac{m}{a^n} = (\sqrt[n]{a})^m$	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.	$\frac{d}{dx}(f(x) \pm g(x)) = f'(x) \pm g'(x)$	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.	$\frac{d}{dx}(e^{ax+b}) = e^{ax+b} \times \frac{d}{dx}(ax + b)$
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.	$\int k dx = kx + c, k \text{ is constant}$	4.	$\int_a^b f(x) dx = F(b) - F(a)$
5.	$\int \frac{1}{x} dx = \ln x + c$	6.	$\int \frac{1}{ax + b} dx = \frac{1}{a} \times \ln ax + b + c$
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.	$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$	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.	$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$
7.	$\tan \theta = \frac{\sin \theta}{\cos \theta}$	8.	$\cot \theta = \frac{\cos \theta}{\sin \theta} = \frac{1}{\tan \theta}$
9.	$\sec \theta = \frac{1}{\cos \theta}$	10.	$\operatorname{cosec} \theta = \frac{1}{\sin \theta}$

AREA UNDER CURVE

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

1.	$V_x = \pi \int_a^b y^2 \, dx$	2.	$V_y = \pi \int_a^b x^2 \, dy$
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INTEGRATION BY PARTS

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