

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 I : 2024/2025

DBM20023: ENGINEERING MATHEMATICS 2

TARIKH : 02 DISEMBER 2024

MASA : 2.30 PTG – 4.30 PTG (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** 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**

- CLO 1 (a) Write each of the following expression below in the simplest form.

Tuliskan setiap ungkapan berikut dalam bentuk yang paling ringkas.

i. $(x^2y^2)^3 \times xy^{-2}$

[3 marks]

[3 markah]

ii. $27^n \div 3^{2n-1} \times 9^{-3n}$

[3 marks]

[3 markah]

iii. $3 \log m - \log n + \log \sqrt{m}$

[4 marks]

[4 markah]

CLO 2 (b) Solve the following equations:

Selesaikan persamaan – persamaan berikut:

i. $3^{x-6} \times 27^{x+4} = 1$

[5 marks]

[5 markah]

ii. $\log_{x+1} 16 = 2$

[5 marks]

[5 markah]

iii. $\log(1 + 3x) - \log 5 = \log(x - 3)$

[5 marks]

[5 markah]

QUESTION 2**SOALAN 2**

CLO 1

- (a) i. Calculate $\frac{dy}{dx}$ for equation $y = 3(6x + 4)^4$.

Kirakan $\frac{dy}{dx}$ bagi persamaan $y = 3(6x + 4)^4$.

[4 marks]

[4 markah]

- ii. Calculate the second order derivative for the function.

$$y = 7x - \frac{5}{x^3}$$

Kirakan pembezaan peringkat kedua bagi persamaan.

$$y = 7x - \frac{5}{x^3}$$

[4 marks]

[4 markah]

- iii. Compute $\frac{\partial z}{\partial x}$ and $\frac{\partial^2 z}{\partial x^2}$ for the function $z = 8x^4 - 6x^3y^4$.

Kirakan $\frac{\partial z}{\partial x}$ dan $\frac{\partial^2 z}{\partial x^2}$ bagi persamaan $z = 8x^4 - 6x^3y^4$.

[4 marks]

[4 markah]

CLO 2 (b) Calculate the derivative $\frac{dy}{dx}$ for each of the following functions:

Kirakan pembezaan $\frac{dy}{dx}$ bagi setiap fungsi berikut:

i $y = \ln(8x + 6)^3$

[3 marks]

[3 markah]

ii $y = 4\cos^3(5x + 6)$

[4 marks]

[4 markah]

iii $y = 3e^{2x}(\sin 4x)$

[6 marks]

[6 markah]

CLO 1

QUESTION 3**SOALAN 3**

- (a) Determine the stationary point of the curve $y = -3x^2 + 12x - 8$ and its nature. Then, sketch the graph.

Tentukan titik pegun dan sifatnya bagi lengkung $y = -3x^2 + 12x - 8$.

Kemudian, lakarkan graf.

[10 marks]

[10 markah]

- (b) Solve the following integrals:

Selesaikan kamiran – kamiran berikut:

i. $\int 12x^3 - \frac{1}{3}x^2 - 20 \, dx$

[3 marks]

[3 markah]

ii. $\int_1^2 (3x - 7)(2 + 4x) \, dx$

[6 marks]

[6 markah]

iii. $\int \frac{6x}{x^2 + 7} \, dx$ [use Substitution Method]

[6 marks]

[6 markah]

QUESTION 4***SOALAN 4***

CLO 2

(a) Solve the following integrals using the Integration by Parts.

Selesaikan kamiran-kamiran berikut menggunakan kamiran bahagian demi bahagian.

i. $\int x \sin x \, dx$

[5 marks]

[5 markah]

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

[5 marks]

[5 markah]

CLO 1

- (b) i. Figure 4(b) i shows an enclosed region between the curve of $y = -x^2 - 6x$ and x - axis between $x = 0$ and $x = -6$. Calculate the area of the shaded region.

Rajah 4(b)i menunjukkan kawasan tertutup antara lengkung $y = -x^2 - 6x$ dan paksi- x antara $x = 0$ dan $x = -6$. Kira luas kawasan berlorek.

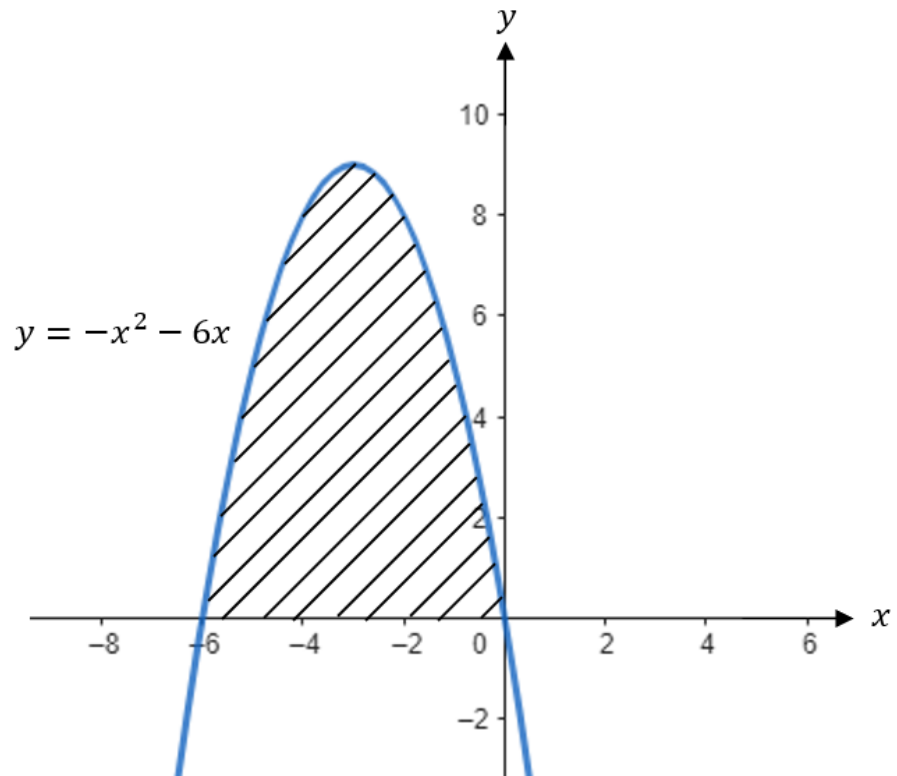


Figure 4(b)i / Rajah 4(b)i

[7 marks]

[7 markah]

- ii. Figure 4(b)ii shows the graph of $x = \frac{2}{y}$ between $y = 1$ and $y = 2$.

Calculate the volume of the shaded region when it is rotated 360° about y -axis.

Rajah 4(b)ii menunjukkan graf $x = \frac{2}{y}$ antara $y = 1$ dan $y = 2$.

Hitung isipadu kawasan berlorek apabila diputar 360° pada paksi y .

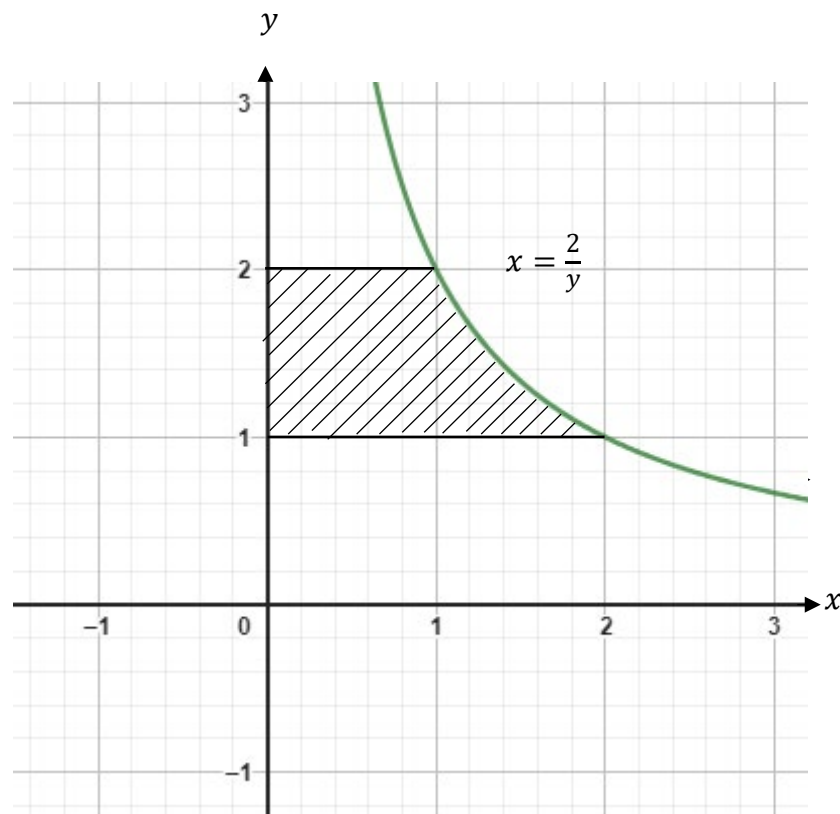


Figure 4(b)ii / *Rajah 4(b)ii*

[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.	$\frac{d}{dx}(f(x) \pm g(x)) = f'(x) \pm g'(x)$	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.	$A_y = \int_a^b x \, dy$
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			
$\int u \, dv = uv - \int v \, du$			