

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 II : 2022/2023

DBM20023: ENGINEERING MATHEMATICS 2

TARIKH : 6 JUN 2023

MASA : 8.30 PG - 10.30 PG (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 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

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

Tunjukkan setiap ungkapan yang berikut dalam bentuk yang paling ringkas.

i. $125 \times 5^{2n+6} \div 25^{8n-3}$

[4 marks]

[4 markah]

ii. $\frac{5p^5q^2 \times 3p^2q^6}{15p^2q}$

[3 marks]

[3 markah]

iii. $4 \log_a 3 - 2 \log_a \frac{1}{2}$

[3 marks]

[3 markah]

CLO2

(b) Calculate the following equations using the suitable method:

Kirakan persamaan- persamaan berikut menggunakan kaedah yang sesuai:

i. $2^k \cdot 32^{k+1} = 256$

[4 marks]

[4 markah]

ii. $\log_7 y - \log_7(2y - 3) = 2$

[5 marks]

[5 *markah*]

iii. $\log_2(a + 2) + \log_4(a + 2) = \frac{3}{2}$

[6 marks]

[6 *markah*]

QUESTION 2

SOALAN 2

CLO1

(a)

- i. Calculate $\frac{dy}{dx}$ for equation $y = 5x^3 - \frac{4}{x^2}$

Kirakan $\frac{dy}{dx}$ untuk persamaan $y = 5x^3 - \frac{4}{x^2}$

[3 marks]

[3 markah]

- ii. Compute the **second derivative** for the function $y = 8x^2 + 4x^3 - \frac{3}{x}$

Hitungkan terbitan peringkat kedua bagi fungsi $y = 8x^2 + 4x^3 - \frac{3}{x}$

[5 marks]

[5 markah]

- iii. Compute the first order partial differentiation, $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ for equation $z = 5x^2 - 2xy^2$.

Hitungkan peringkat pertama pembezaan separa, $\frac{\partial z}{\partial x}$ dan $\frac{\partial z}{\partial y}$ bagi persamaan $z = 5x^2 - 2xy^2$.

[4 marks]

[4 markah]

CLO2

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

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

i. $y = 3e^{2+4x^2} + 5e^{-2x}$

[3 marks]

[3 markah]

ii. $y = \ln \frac{5}{(3+2x)^3}$

[4 marks]

[4 markah]

iii. $y = (3x^2 + 3)^3 \sin 5x$

[6 marks]

[6 markah]

QUESTION 3

SOALAN 3

- CLO2 (a) Calculate the stationary points of the equation $y = x^3 - 3x^2 + 1$. Then, determine their nature and sketch the graph.

Kirakan titik-titik pegun bagi persamaan $y = x^3 - 3x^2 + 1$. Kemudian, tentukan sifatnya dan lakarkan graf.

[10 marks]

[10 markah]

- CLO1 (b) Solve the following integrals:
Selesaikan kamiran-kamiran berikut:

i. $\int 3(5x - 7)^{-3} dx$

[4 marks]

[4 markah]

ii. $\int_2^3 (5 + 3x)(3 + 8x) dx$

[6 marks]

[6 markah]

iii. $\int \frac{4x^5}{(x^6 + 6)} dx$

[5 marks]

[5 markah]

QUESTION 4**SOALAN 4**

CLO2

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

Selesaikan kamiran-kamiran berikut menggunakan kamiran bahagian demi bahagian.

i. $\int x e^{5x} dx$

[4 marks]

[4 markah]

ii. $\int x^2 \sin x dx$

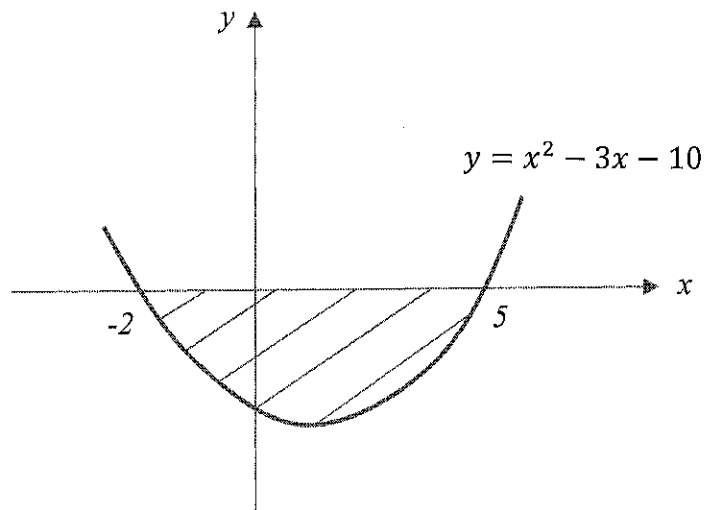
[6 marks]

[6 markah]

CLO1 (b)

- i. The figure 4 (b) i shows an enclosed region between the curve of $y = x^2 - 3x - 10$ and x-axis between $x = -2$ and $x = 5$. Calculate the area bounded by the curves.

Rajah 4 (b) i menunjukkan kawasan tertutup lengkung $y = x^2 - 3x - 10$ dan paksi-x antara $x = -2$ dan $x = 5$. Kira luas yang dibatasi oleh lengkung.



[7 marks]

[7 markah]

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

- ii. The figure 4 (b) ii shows the graph of $y = x^2 + 3x$ between $x = -3$ and $x = 0$. Calculate the volume when the shaded region is rotated 360° about x- axis.

Rajah 4 (b) ii menunjukkan graf $y = x^2 + 3x$ antara $x = -3$ dan $x = 0$. Kira isipadu apabila kawasan berlorek diputar 360° pada paksi-x.

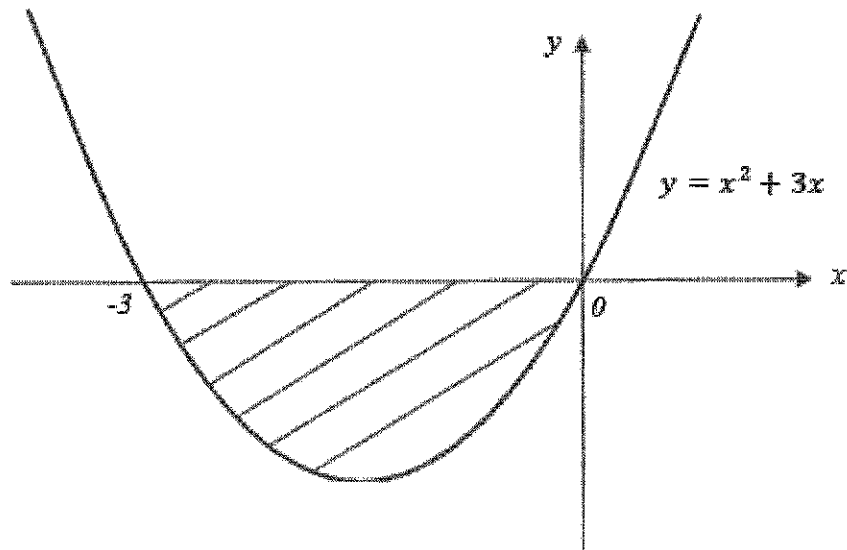


Figure 4 (b) ii / Rajah 4 (b) ii

[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.	$a^{-n} = \frac{1}{a^n}, \quad a \neq 0$	12.	$\log_a \frac{M}{N} = \log_a M - \log_a N$
6.	$\frac{a^m}{a^n} = (\sqrt[n]{a})^m$	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.	$\frac{d}{dx}(f(x) \pm g(x)) = f'(x) \pm g'(x)$	4.	$\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$ [Product Rule]
5.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$ [Quotient Rule]	6.	$\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}$ [Chain Rule]
7.	$\frac{d}{dx}(e^x) = e^x$	8.	$\frac{d}{dx}(e^{ax+b}) = e^{ax+b} \times \frac{d}{dx}(ax+b)$
9.	$\frac{d}{dx}(\ln x) = \frac{1}{x}$	10.	$\frac{d}{dx}[\ln ax+b] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
11.	$\frac{d}{dx}(\sin x) = \cos x$	12.	$\frac{d}{dx}(\cos x) = -\sin x$
13.	$\frac{d}{dx}(\tan x) = \sec^2 x$	14.	$\frac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \frac{d}{dx}(ax+b)$

15.	$\frac{d}{dx} [\cos(ax + b)] = -\sin(ax + b) \times \frac{d}{dx} (ax + b)$	16.	$\frac{d}{dx} [\tan(ax + b)] = \sec^2(ax + b) \times \frac{d}{dx} (ax + b)$
17.	$\frac{d}{dx} [\sin^n u] = n \sin^{n-1} u \times \cos u \times \frac{du}{dx}$	18.	$\frac{d}{dx} [\cos^n u] = n \cos^{n-1} u \times -\sin u \times \frac{du}{dx}$
19.	$\frac{d}{dx} [\tan^n u] = n \tan^{n-1} u \times \sec^2 u \times \frac{du}{dx}$	20.	$\frac{d}{dx} (\cot x) = -\operatorname{cosec}^2 x$
21.	$\frac{d}{dx} (\sec x) = \sec x \tan x$	22.	$\frac{d}{dx} (\operatorname{cosec} x) = -\operatorname{cosec} x \cot x$

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