

**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)**

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Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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**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]

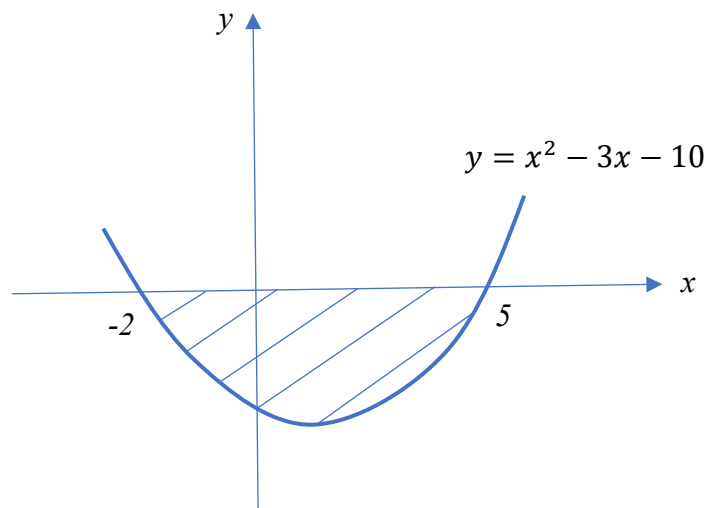
[6 markah]

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  $360^\circ$  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  $360^\circ$  pada paksi-x.*

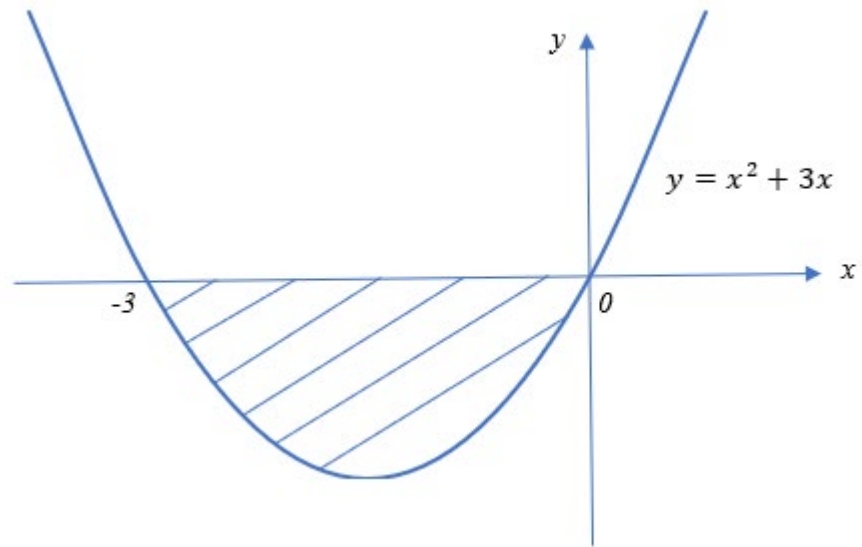


Figure 4 (b) ii / *Rajah 4 (b) ii*

[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.	$a^{\frac{m}{n}} = (\sqrt[n]{a})^m$	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.	$\frac{d}{dx}(f(x) \pm g(x)) = f'(x) \pm g'(x)$	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.	$A_y = \int_a^b x \, dy$
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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**

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