

**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 : 2025/2026**

**DBM20023 : ENGINEERING MATHEMATICS 2**

**TARIKH : 01 DISEMBER 2025**

**MASA : 8.30 PAGI - 10.30 PAGI (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**

**SECTION A : 100 MARKS*****BAHAGIAN A : 100 MARKAH*****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) Write each of the following in the simplest form:

*Tulis setiap fungsi yang berikut dalam bentuk paling ringkas:*

i)  $2a^{n+2} \times 3a^n \div a^{5n}$

[3 marks]

[3 markah]

ii)  $p^2q^5 \div pq^2$

[3 marks]

[3 markah]

iii)  $2 \log_m 3 + 5 \log_m t - \log_m t^2$

[4 marks]

[4 markah]

CLO2 (b) Solve the following equations using the suitable method.

*Selesaikan persamaan-persamaan berikut menggunakan kaedah yang sesuai.*

i)  $9^{3x+4} = 27^{x+3}$

[5 marks]

[5 markah]

ii)  $3^{3x-2} = 5$

[5 marks]

[5 markah]

iii)  $\log_3(2x - 1) - 2 = 0$

[5 marks]

[5 markah]

**QUESTION 2****SOALAN 2**

CLO1

(a) Compute:

*Hitungkan:*i) first order differentiation,  $\frac{dy}{dx}$  for equation  $y = (2x + 6)(x + 3)$ *pembezaan peringkat pertama,  $\frac{dy}{dx}$  untuk persamaan  $y = (2x + 6)(x + 3)$* 

[3marks]

[3 markah]

ii) first order partial differentiation  $\frac{\delta z}{\delta x}$  and  $\frac{\delta z}{\delta y}$  for equation  $z = 9x^3 + xy^4 - y^7$ *pembezaan separa peringkat pertama,  $\frac{\delta z}{\delta x}$  dan  $\frac{\delta z}{\delta y}$  bagi persamaan*

$$z = 9x^3 + xy^4 - y^7$$

[4 marks]

[4 markah]

iii) second derivative for the function  $y = 8x^2 - \frac{3}{x}$ *terbitan kedua bagi fungsi  $y = 8x^2 - \frac{3}{x}$* 

[5 marks]

[5 markah]

CLO2 (b) Compute the derivatives  $\frac{dy}{dx}$  of the following equations:

*Hitung terbitan  $\frac{dy}{dx}$  bagi fungsi berikut:*

i)  $y = \ln(5x^6 + 3x - 9)$

[3 marks]

[3 markah]

ii)  $y = 7e^{3x}(8 + 2e^{5x})$

[4 marks]

[4 markah]

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

[6 marks]

[6 markah]

## QUESTION 3

## SOALAN 3

- CLO2 (a) Calculate the stationary points of the equation  $y = x^3 - 3x + 2$ , then determine their nature of the point.

*Kira titik-titik pegun bagi persamaan  $y = x^3 - 3x + 2$ , seterusnya tentukan sifatnya.*

[10 marks]

[10 markah]

- CLO1 (b) Solve the following integrals:

*Selesaikan kamiran berikut:*

i)  $\int \frac{3x^2}{5} - 2x + \frac{7}{x^6} dx$

[4 marks]

[4 markah]

ii)  $\int \frac{12}{(3+2x)^4} dx$  (Use substitution method)  
(Guna kaedah penggantian)

[5 marks]

[5 markah]

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

[6 marks]

[6 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)  $\int 2xe^{3x} dx$

[5 marks]

[5 markah]

ii)  $\int x \cos 4x dx$

[5 marks]

[5 markah]

CLO1

(b)

- i) Refer to Figure 4(b)i, calculate the area of the shaded region bounded by the curve  $x = y^2 - 4y + 3$  and  $y = 1, y = 3$

*Merujuk Rajah 4(b)i, kira luas kawasan berlorek yang dibatasi oleh lengkung  $x = y^2 - 4y + 3$  dan garis  $y = 1, y = 3$ .*

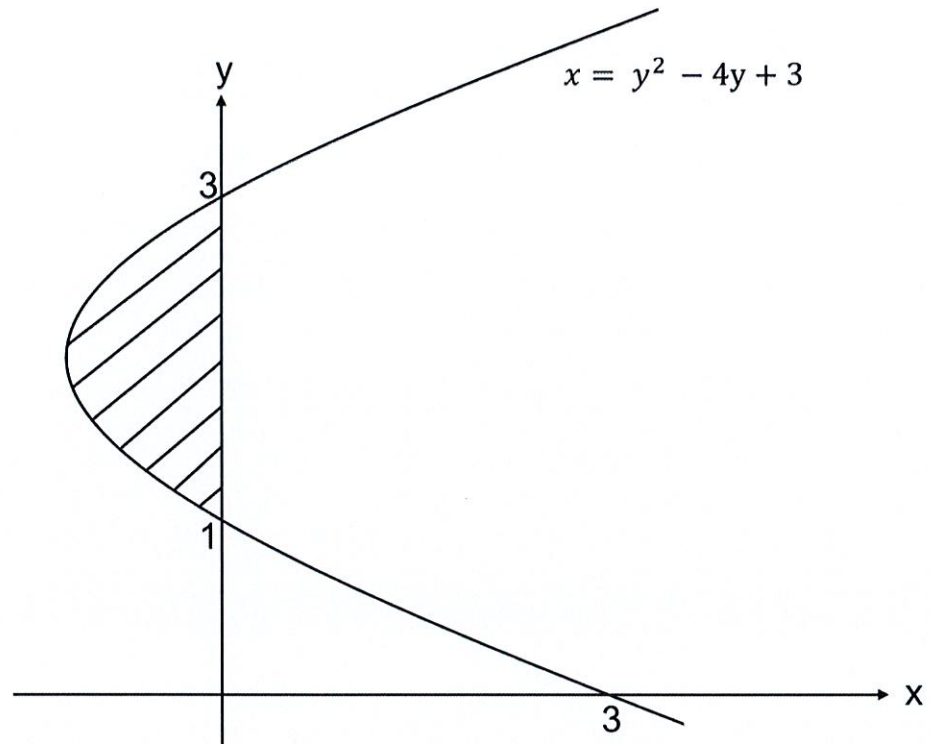


Figure 4(b)i / Rajah 4(b)i

[7 marks]

[7 markah]

- ii) Calculate the volume of the solid formed when the area between the curve  $y = \frac{2}{x^2}$  and the x-axis from  $x = -4$  and  $x = -1$  rotated through  $360^\circ$  about x-axis.

*Kira isipadu pepejal yang terbentuk apabila luas antara lengkung  $y = \frac{2}{x^2}$  dan paksi-x daripada  $x = -4$  dan  $x = -1$  berputar melalui  $360^\circ$*

[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.	$\frac{a^m}{a^n} = (\sqrt[n]{a})^m$	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.	$\frac{d}{dx}(ax+b)^n = n(ax+b)^{n-1} \times \frac{d}{dx}(ax+b)$ [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			
$\int u \, dv = uv - \int v \, du$			