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 II : 2024/2025

DBM20023 : ENGINEERING MATHEMATICS 2

TARIKH : 13 MEI 2025
MASA : 8.30 PAGI - 10.30 PAGI (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)

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) Write each of the following expression in the simplest form.

Tuliskan setiap ungkapan berikut dalam bentuk yang paling ringkas.

i. $\dfrac{4wk^2 \times w^{-2}}{24\,w^3k}$

[3 marks]

[*3 markah*]

ii. $243 \div 3^{-2+n} \times 81^{4n}$

[3 marks]

[*3 markah*]

iii. $\log_a 2^5 - 3 + \log_a \sqrt{p^2}$

[4 marks]

[*4 markah*]

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

Selesaikan persamaan-persamaan berikut menggunakan kaedah yang sesuai:

i. $2^{m-2} \times 16^{m} = 512$

[4 marks]

[*4 markah*]

ii. $1 + 2\ log_7 x = log_7(5x + 6)$

[5 marks]

[*5 markah*]

iii. $5^{x-2} = 15$

[6 marks]

[*6 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) i. Solve the differentiation of $y = 2(-4x^2 - \frac{3}{x^3})$

Selesaikan pembezaan bagi $y = 2(-4x^2 - \frac{3}{x^3})$

[3 marks]

[*3 markah*]

ii. Compute the second derivative for the function $y = \sqrt{5x + 7}$

Hitungkan terbitan peringkat kedua bagi fungsi $y = \sqrt{5x + 7}$

[5 marks]

[*5 markah*]

iii. Compute the first order partial differentiation $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ for the function $z = 7x^3y^5 - 3x^4y$

Hitungkan pembezaan separa peringkat pertama $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ *bagi fungsi* $z = 7x^3y^5 - 3x^4y$

[4 marks]

[*4 markah*]

CLO2 (b) Solve the derivative $\frac{dy}{dx}$ for each of the following equations.

Selesaikan pembezaan $\frac{dy}{dx}$ *bagi setiap fungsi berikut.*

i. $y = \frac{4}{5}\, e^{-3x^2} + 6e^{x}$

[3 marks]

[*3 markah*]

ii. $y = \ln\left(\frac{3x-7}{-8+2x^3}\right)$

[4 marks]

[*4 markah*]

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

[6 marks]

[*6 markah*]

QUESTION 3

SOALAN 3

CLO2 (a) Calculate the stationary points for $y = x^3 - 3x^2 + 5$, then identify the nature of the stationary points.

Kirakan titik-titik pegun bagi persamaan $y = x^3 - 3x^2 + 5$, *kemudian kenalpasti sifat titik-titik tersebut.*

[10 marks]

[*10 markah*]

CLO1 (b) Calculate the following integrals:

Kirakan kamiran berikut:

i. $\int_0^2 (x+5)(2-x)dx$

[5 marks]

[*5 markah*]

ii. $\int \frac{3e^{7x} + 6e^{6x} - 12e^{5x}}{e^{4x}} dx$

[5 marks]

[*5 markah*]

iii. $\int \frac{2x}{x^2+5} dx$ (Using Substitution Method)

[5 marks]

[*5 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) Solve the following integrals using integration by parts:

Selesaikan kemiran-kamiran berikut menggunakan kamiran bahagian demi bahagian:

i. $\int 3x \sin 3x \, dx$

[5 marks]

[*5 markah*]

ii. $\int 2xe^{5x} \, dx$

[5 marks]

[*5 markah*]

CLO1 (b) i. Given a graph $y = (x + 1)(2x - 5)$. Calculate the area under the graph bounded by the curve, x-axis, the lines $x = 3$ *and* $x = 6$.

Diberi graf $y = (x + 1)(2x - 5)$. *Kirakan luas di bawah graf yang dilingkungi oleh lengkungan itu, paksi-x, garisan* $x = 3$ *dan* $x = 6$.

[7 marks]

[*7 markah*]

CLO2

ii. Figure 4(b) shows an enclosed region between the curve $x = y^2 - 3y$ and y-axis between $y = 0$ and $y = 3$. Calculate the volume of the shaded region when rotated 360° about y-axis.

Rajah 4(b) menunjukkan kawasan tertutup antara lengkung $x = y^2 - 3y$ *dan paksi- y antara* $y = 0$ *dan* $y = 3$. *Kirakan isipadu kawasan berlorek apabila diputar 360° pada paksi y.*

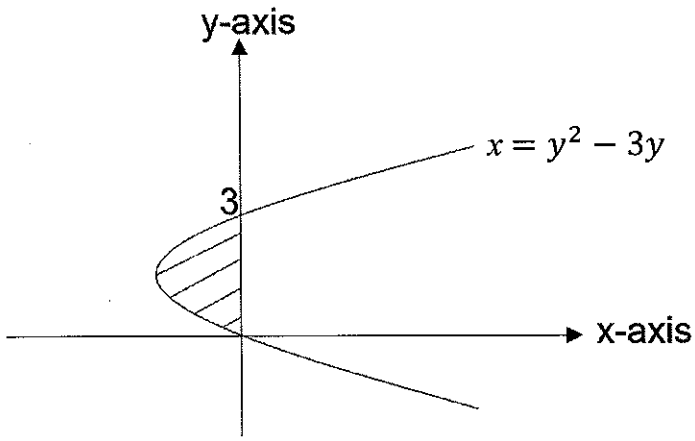

Figure 4(b)
Rajah 4(b)

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

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