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)

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.*

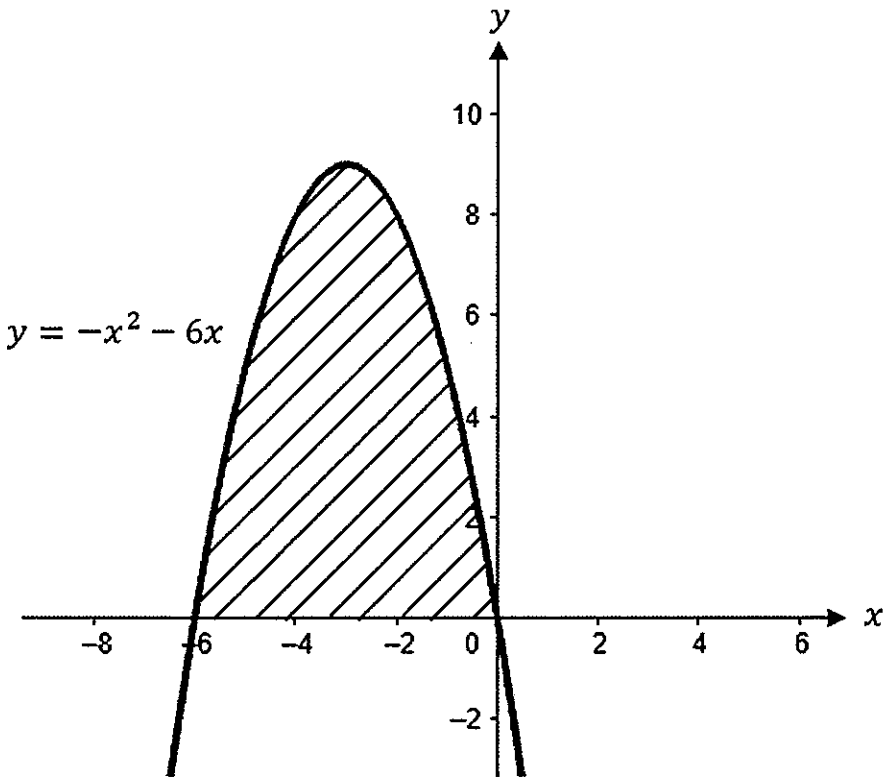

Figure 4(b)i / *Rajah 4(b)i*

[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.

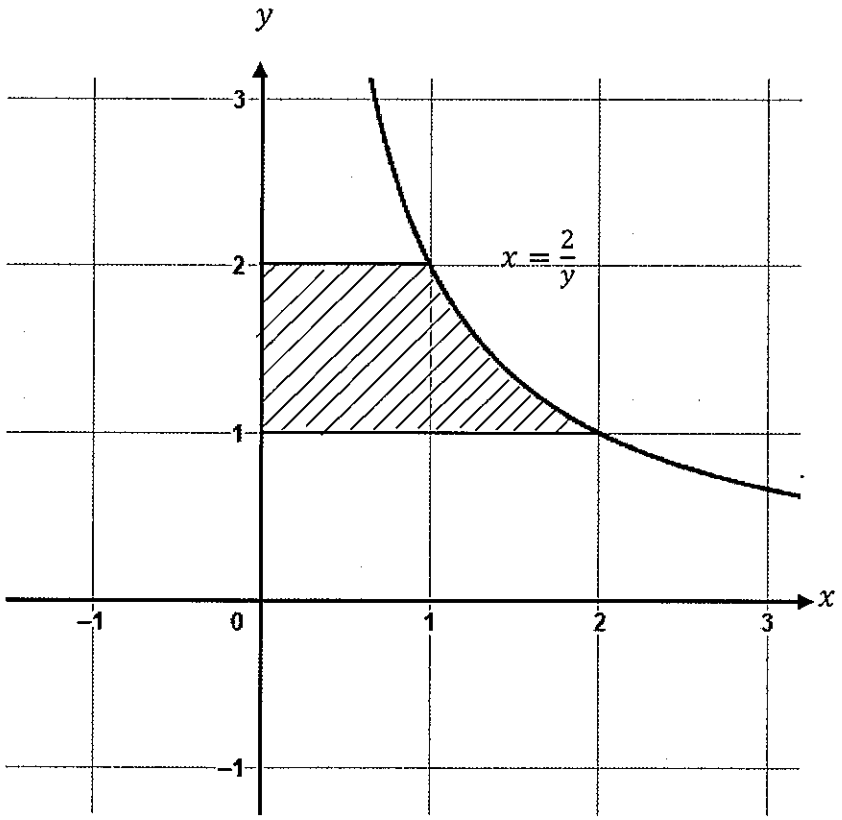

Figure 4(b)ii / *Rajah 4(b)ii*

[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.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	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.	$\frac{d}{dx}(\cos x) = -\sin x$

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.	$\cos 2\theta = 2cos^2\theta - 1$ $= 1 - 2sin^2\theta$ $= cos^2\theta - sin^2\theta$	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.	$cosec\,\theta = \frac{1}{\sin\theta}$
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			
$\int u\,dv = uv - \int v\,du$			

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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		