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)

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

[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. $\int xe^{5x}dx$

[4 marks]

[*4 markah*]

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

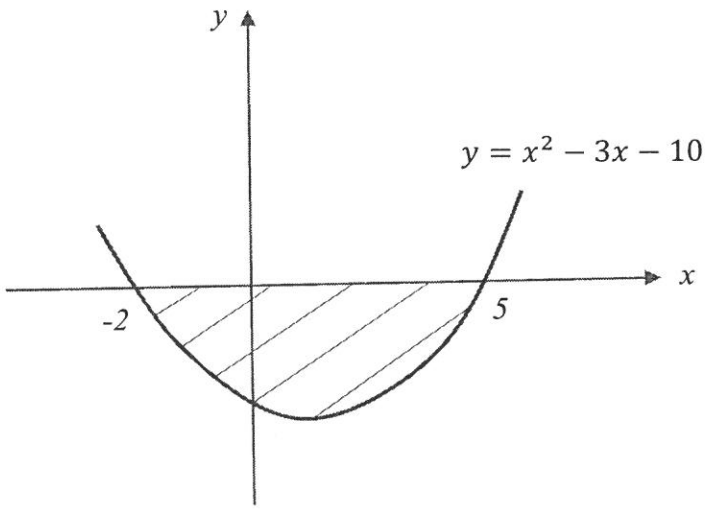
[6 marks]

[*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 360^0 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* 360^0 *pada paksi-x.*

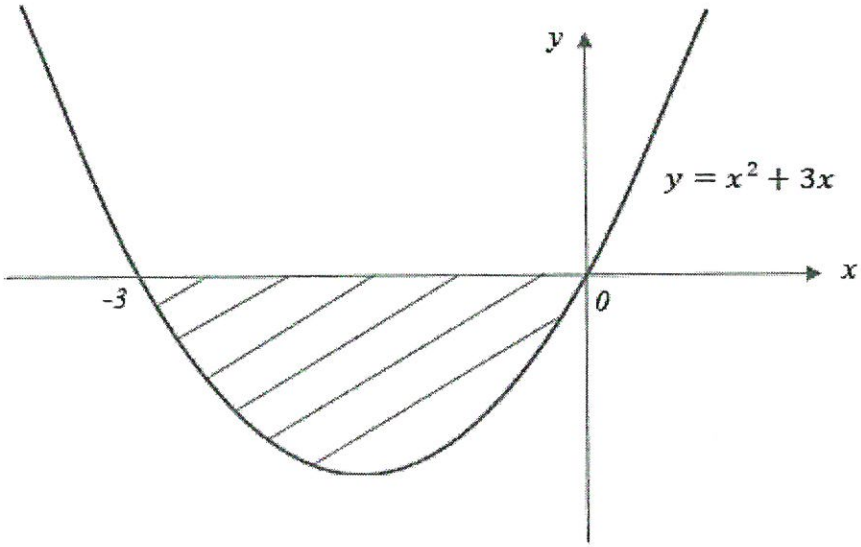


Figure 4 (b) ii / *Rajah 4 (b) ii*

[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.	$a^{-n} = \frac{1}{a^n}, a \neq 0$	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.	$\frac{d}{dx}(\cos x) = -\sin x$

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