POLITEKNIK
MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI DISEMBER 2017

DBM2013 : ENGINEERING MATHEMATICS 2

TARIKH : 04 APRIL 2018
MASA   : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi SEPULUH (10) halaman bercetak.

Bahagian A: Struktur (1 soalan)
Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A: 25 MARKS

BAHAGIAN A: 25 MARKAH

INSTRUCTION:

This section consists of **ONE (1)** structured question that **MUST** be answered.

ARAHAN:

*Bahagian ini mengandungi **SATU (1)** soalan berstruktur yang **WAJIB** dijawab.*

QUESTION 1

SOALAN 1

CLO1
C2

(a)   Express each of the following in the simplest form:

Nyatakan setiap fungsi yang berikut dalam bentuk paling ringkas:

i. $\dfrac{a^{4-3n}}{a^{2n} \times a^{3n+1}}$

[2 marks]

[2 markah]

ii. $5^{n+2} \times 625^{n-1} \div 125^{2n-1}$

[4 marks]

[4 markah]

iii. $3\log a + \dfrac{\log a}{4} - 2\log a$

[4 marks]

[4 markah]

CLO1
C3

(b)   Calculate the following equations using the suitable method:

Kirakan persamaan–persamaan berikut mengikut kaedah yang bersesuaian:

   i. $(25^x)^x = 25 \times 125^x$

[4 marks]

[4 markah]

   ii. $\log_3(5x+1) = 4$

[5 marks]

[5 markah]

   iii. $\log_4(x-2) + 3\log_2 8 = 10$

[6 marks]

[6 markah]

SECTION B: 75 MARKS

BAHAGIAN B: 75 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **THREE (3)** questions only.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **TIGA (3)** soalan sahaja.*

QUESTION 2

SOALAN 2

CLO2
C2

(a)   Differentiate the following with respect to x.

Bezakan yang berikut terhadap x.

i. $y = \ln \dfrac{x}{2}$

[2 marks]

[*2 markah*]

ii. $y = 3x^3 - \dfrac{4}{x^5} + 11$

[3 marks]

[*3 markah*]

iii. $y = x(2x^2 - 5)$

[5 marks]

[*5 markah*]

CLO2 (b)   Use the suitable method to differentiate the following functions.
C3   *Bezakan fungsi – fungsi berikut menggunakan kaedah yang sesuai.*

   i. $y = \sin(3x^4 + 2) - e^{10x+5} + 8x^3$

[5 marks]

[*5 markah*]

   ii. $y = (9x^2 + 3)(x - 4)^6$

[5 marks]

[*5 markah*]

   iii. $y = \dfrac{3e^{2x}}{6x^5 - 10}$

[5 marks]

[*5 markah*]

QUESTION 3

SOALAN 3

CLO2
C2

(a) Differentiate the following equations:

Bezakan persamaan-persamaan berikut:

i. $x^2 + y^2 = e^3 + \ln y$

[5 marks]

[*5 markah*]

ii. $\sin x \cos y = 3$

[5 marks]

[*5 markah*]

CLO2
C3

(b)

i. The parametric equation functions are given as $y = (t+1)^2$ and $x = t + \dfrac{1}{t}$.

Calculate the value of $\dfrac{dy}{dx}$ when $t = 2$.

Fungsi persamaan parametrik diberi sebagai $y = (t+1)^2$ dan $x = t + \dfrac{1}{t}$.

Kirakan nilai bagi $\dfrac{dy}{dx}$ apabila $t = 2$.

[6 marks]

[*6 markah*]

ii. Given $z = (x+y)(x-y)$. Find $\dfrac{\partial z}{\partial x} + \dfrac{\partial z}{\partial y}$.

Diberi $z = (x+y)(x-y)$. Dapatkan $\dfrac{\partial z}{\partial x} + \dfrac{\partial z}{\partial y}$.

[4 marks]

[*4 markah*]

iii. The height, h of a triangle decreasing at the rate of 0.3 cms^{-1} from the actual height of 100 cm. The length, l of its base increasing at a rate of 0.6 cms^{-1} from it actual length of 85 cm. Calculate the rate of change of the area for the triangle. (Given, A= ½ lh)

Tinggi, h sebuah segitiga berkurangan pada kadar 0.3 cms^{-1} daripada ketinggian asal iaitu 100 cm. Panjang tapaknya, l pula bertambah pada kadar 0.6 cms^{-1} daripada panjang asal iaitu 85 cm. Kirakan kadar perubahan bagi luas segitiga tersebut. (Diberi, A= ½ lh)
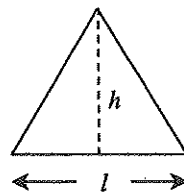

Figure 3 / *Gambarajah 3*

[5 marks]

[*5 markah*]

QUESTION 4

SOALAN 4

CLO2
C2

(a)   Determine the integrals for the following functions:

Tentukan kamiran-kamiran untuk fungsi-fungsi berikut:

i) $\int x^4 + 3x - 9 \, dx$

[2 marks]

[*2 markah*]

ii) $\int \dfrac{4x^{10} - 2x^4 + 15x^2}{x^3} \, dx$

[4 marks]

[*4 markah*]

iii) $\int 3\sqrt[4]{x^3} + \dfrac{7}{x^5} + \dfrac{1}{6\sqrt{x}} \, dx$

[4 marks]

[*4 marks*]

CLO2
C3

(b)   By using substitution method, determine:

Dengan menggunakan kaedah gantian, tentukan:

i. $\int x \sin (x^2) \, dx$

[7 marks]

[*7 markah*]

ii. $\int x^2 \sqrt{1 + x^3} \, dx$

[8 marks]

[*8 markah*]

QUESTION 5

SOALAN 5

CLO2
C2

(a)   By using partial fraction, determine $\int \dfrac{2(x-5)}{x^2-2x-3}\,dx$

Dengan menggunakan pecahan separa, tentukan $\int \dfrac{2(x-5)}{x^2-2x-3}\,dx$

[10 marks]

[*10 markah*]

CLO2
C3

(b)

i.   Figure 5 a) shows a region bounded by the curve $y = 4x - x^2$, and the line $2x + y = 8$. Determine the volume generated when the region R is rotated through 360° about the x-axis.

Rajah 5(a) menunjukkan rantau yang dibatasi oleh lengkung $y = 4x - x^2$ dan garisan $2x + y = 8$. Tentukan isipadu yang dijana apabila rantau R diputar melalui 360° mengenai paksi x.
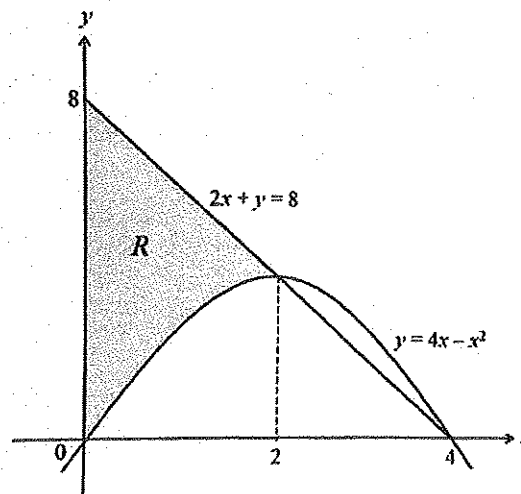

Figure 5(a) / *Rajah 5 (a)*

[8 marks]

[*8 markah*]

ii. By using integration by parts, calculate $\int_0^\pi \dfrac{3}{2} x\,e^{4x}\,dx$

Dengan mengunakan kamiran bahagian demi bahagian, kirakan $\int_0^\pi \dfrac{3}{2} x\,e^{4x}\,dx$

[7 marks]

[7 markah]

SOALAN TAMAT

FORMULA SHEET FOR DBM2013

EXPONENTS AND LOGARITHMS

	LAW OF EXPONENTS		LAW OF LOGARITHMS
1.	$a^m \times a^n = a^{m+n}$	8.	$\log_a a = 1$
2.	$\dfrac{a^m}{a^n} = a^{m-n}$	9.	$\log_a 1 = 0$
3.	$(a^m)^n = a^{m \times n}$	10.	$\log_a b = \dfrac{\log_c b}{\log_c a}$
4.	$a^0 = 1$	11.	$\log_a MN = \log_a M + \log_a N$
5.	$a^{-n} = \dfrac{1}{a^n}, a \neq 0$	12.	$\log_a \dfrac{M}{N} = \log_a M - \log_a N$
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.	$\dfrac{d}{dx}(k) = 0, k \text{ is constant}$	2.	$\dfrac{d}{dx}(x^n) = nx^{n-1}$ [Power Rule]
3.	$\dfrac{d}{dx}(ax^n) = anx^{n-1}$	4.	$\dfrac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$
5.	$\dfrac{d}{dx}(uv) = u\dfrac{dv}{dx} + v\dfrac{du}{dx}$ [Product Rule]	6.	$\dfrac{d}{dx}\left(\dfrac{u}{v}\right) = \dfrac{v\dfrac{du}{dx} - u\dfrac{dv}{dx}}{v^2}$ [Quotient Rule]
7.	$\dfrac{dy}{dx} = \dfrac{du}{dx} \times \dfrac{dy}{du}$ [Chain Rule]	8.	$\dfrac{d}{dx}(e^x) = e^x$
9.	$\dfrac{d}{dx}\big(e^{ax+b}\big) = e^{ax+b} \times \dfrac{d}{dx}(ax + b)$	10.	$\dfrac{d}{dx}(\ln x) = \dfrac{1}{x}$
11.	$\dfrac{d}{dx}[\ln(ax + b)] = \dfrac{1}{ax + b} \times \dfrac{d}{dx}(ax + b)$	12.	$\dfrac{d}{dx}(\sin x) = \cos x$
13.	$\dfrac{d}{dx}(\cos x) = -\sin x$	14.	$\dfrac{d}{dx}(\tan x) = \sec^2 x$

15.	$\dfrac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \dfrac{d}{dx}(ax+b)$		
16.	$\dfrac{d}{dx}[\cos(ax+b)] = -\sin(ax+b) \times \dfrac{d}{dx}(ax+b)$		
17.	$\dfrac{d}{dx}[\tan(ax+b)] = \sec^2(ax+b) \times \dfrac{d}{dx}(ax+b)$		
18.	$\dfrac{d}{dx}[\sin^n u] = n\sin^{n-1} u \times \cos u \times \dfrac{du}{dx}$		
19.	$\dfrac{d}{dx}[\cos^n u] = n\cos^{n-1} u \times -\sin u \times \dfrac{du}{dx}$		
20.	$\dfrac{d}{dx}[\tan^n u] = n\tan^{n-1} u \times \sec^2 u \times \dfrac{du}{dx}$		
21.	$\dfrac{d}{dx}(\sin^{-1} u) = \dfrac{1}{\sqrt{1-u^2}}\dfrac{du}{dx}$	**22.**	$\dfrac{d}{dx}(\cos^{-1} u) = \dfrac{-1}{\sqrt{1-u^2}}\dfrac{du}{dx}$
23.	$\dfrac{d}{dx}(\tan^{-1} u) = \dfrac{1}{1+u^2}\dfrac{du}{dx}$	**24.**	$\dfrac{d}{dx}(\cot^{-1} u) = \dfrac{-1}{1+u^2}\dfrac{du}{dx}$
25.	$\dfrac{d}{dx}(\sec^{-1} u) = \dfrac{1}{|u|\sqrt{u^2-1}}\dfrac{du}{dx}$	**26.**	$\dfrac{d}{dx}(\text{co}\sec^{-1} u) = \dfrac{-1}{|u|\sqrt{u^2-1}}\dfrac{du}{dx}$
27.	$\dfrac{dy}{dx} = \dfrac{dy}{dt} \times \dfrac{dt}{dx}$ *[Parametric Equation]*		

INTEGRATION

1.	$\displaystyle\int ax^n dx = \dfrac{ax^{n+1}}{n+1} + c \quad ;\{n \neq -1\}$	**2.**	$\displaystyle\int (ax+b)^n dx = \dfrac{(ax+b)^{n+1}}{\dfrac{d}{dx}(ax+b)(n+1)} + c \;;\{n \neq -1\}$
3.	$\displaystyle\int k\,dx = kx + c, k \text{ is constant}$	**4.**	$\displaystyle\int_a^b f(x)dx = F(b) - F(a)$
5.	$\displaystyle\int \dfrac{1}{x}\,dx = \ln x + c$	**6.**	$\displaystyle\int \dfrac{1}{ax+b}\,dx = \dfrac{1}{\dfrac{d}{dx}(ax+b)} \times \ln(ax+b) + c$
7.	$\displaystyle\int e^x\,dx = e^x + c$	**8.**	$\displaystyle\int e^{ax+b}\,dx = \dfrac{1}{\dfrac{d}{dx}(ax+b)} \times e^{ax+b} + c$
9.	$\displaystyle\int \sin x\,dx = -\cos x + c$	**10.**	$\displaystyle\int \cos x\,dx = \sin x + c$
11.	$\displaystyle\int \sec^2 x\,dx = \tan x + c$		
12.	$\displaystyle\int \sin(ax+b)\,dx = -\dfrac{1}{\dfrac{d}{dx}(ax+b)} \times \cos(ax+b) + c$		
13.	$\displaystyle\int \cos(ax+b)\,dx = \dfrac{1}{\dfrac{d}{dx}(ax+b)} \times \sin(ax+b) + c$		

14.	$\int \sec^2(ax+b)\,dx = \dfrac{1}{\dfrac{d}{dx}(ax+b)} \times \tan(ax+b) + c$
15.	$\int \dfrac{1}{\sqrt{a^2 - u^2}}\,du = \sin^{-1}\dfrac{u}{a} + c$
16.	$\int \dfrac{-1}{\sqrt{a^2 - u^2}}\,du = \cos^{-1}\dfrac{u}{a} + c$
17	$\int \dfrac{1}{a^2 + u^2}\,du = \dfrac{1}{a}\tan^{-1}\dfrac{u}{a} + c$
18.	$\int \dfrac{-1}{a^2 + u^2}\,du = \dfrac{1}{a}\cot^{-1}\dfrac{u}{a} + c$
19.	$\int \dfrac{1}{u\sqrt{u^2 - a^2}}\,du = \dfrac{1}{a}\sec^{-1}\dfrac{u}{a} + c$
20.	$\int \dfrac{-1}{u\sqrt{u^2 - a^2}}\,du = \dfrac{1}{a}\operatorname{cosec}^{-1}\dfrac{u}{a} + c$

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.	$\begin{aligned}\cos 2\theta &= 2\cos^2\theta - 1 \\ &= 1 - 2\sin^2\theta \\ &= \cos^2\theta - \sin^2\theta\end{aligned}$	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.	$\operatorname{cosec}\theta = \dfrac{1}{\sin\theta}$

AREA UNDER CURVE

1.	$A_x = \displaystyle\int_a^b y\,dx$	2.	$A_y = \displaystyle\int_a^b x\,dy$

VOLUME UNDER CURVE

1.	$V_x = \pi\displaystyle\int_a^b y^2\,dx$	2.	$V_y = \pi\displaystyle\int_a^b x^2\,dy$

INTEGRATION BY PARTS

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