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 1 : 2026/2027

DBM30243 : NUMERICAL ANALYSIS

TARIKH : 04 NOVEMBER 2026
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

TERBUKA

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

CLO1 (a) Calculate the following limits:

Kirakan limit berikut:

i. $\lim_{x \to 3} 5(x^3 - 7)$

[3 marks]

[*3 markah*]

ii. $\lim_{x \to -2} \sqrt[5]{8x^2}$

[3 marks]

[3 *markah*]

CLO2 (b) Solve the following limits:

Selesaikan limit berikut:

i. $\lim_{x \to 5} \frac{x^2 - 7x + 10}{x - 5}$

[6 marks]

[6 *markah*]

ii. $\lim_{x \to 3} \frac{x - 3}{\sqrt{x+6} - 3}$

[6 marks]

[6 *markah*]

iii. $\lim_{x \to \infty} \frac{7x^2 + 1}{x^2 + 2x - 3}$

TERBUKA

[7 marks]

[*7 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Write the derivative $\frac{dy}{dx}$ for the following equations:

Tuliskan pembezaan $\frac{dy}{dx}$ *bagi persamaan berikut*:

i. $y = 5x^3 - \frac{3}{x^2} + \sqrt{8}$

[2 marks]

[2 *markah*]

ii. $y = (3x^2 - 4x + 1)(e^{2x})$

[5 marks]

[5 *markah*]

CLO2 (b) Compute:

Hitungkan:

i. the second derivative $\left(\frac{d^2y}{dx^2}\right)$ of:

terbitan kedua $\left(\frac{d^2y}{dx^2}\right)$ *bagi:*

$y = x^5 - \sin 4x$

[4 marks]

[4 *markah*]

ii. $\frac{\partial z}{\partial x}$, $\frac{\partial z}{\partial y}$ and $\frac{\partial^2 z}{\partial x \partial y}$, where $z = 3x^2y + 5xy^2 - e^{2x}$.

$\frac{\partial z}{\partial x}$, $\frac{\partial z}{\partial y}$ *dan* $\frac{\partial^2 z}{\partial x \partial y}$, *dengan* $z = 3x^2y + 5xy^2 - e^{2x}$.

TERBUKA

[6 marks]

[6 *markah*]

CLO2

(c) Calculate the stationary point of the equation $y = x^3 - 6x^2 + 9x + 4$. Then, determine the nature of the stationary point.

Kirakan titik pegun bagi persamaan $y = x^3 - 6x^2 + 9x + 4$. *Kemudian, tentukan jenis titik pegun tersebut.*

TERBUKA

[8 marks]

[8 *markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Integrate the following functions:

Kamirkan fungsi berikut:

i. $\int 2x\,(x^2 + 6)dx$

[3 marks]

[*3 markah*]

ii. $\int 10e^{2x} - 6sin3x\,dx$

[3 marks]

[3 *markah*]

CLO2 (b) Solve the following functions using integration by parts:

Selesaikan fungsi-fungsi berikut mengunakan kamiran bahagian demi bahagian:

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

[5 marks]

[*5 markah*]

ii. $\int x^3 \cos x\,dx$

TERBUKA

[6 marks]

[6 *markah*]

CLO2 (c) Figure 3(c) shows a shaded region bounded by the curve $y = x^2 - 4$ at the x-axis. Calculate the area of the shaded region.

Rajah 3(c) menunjukan suatu kawasan berlorek yang dibatasi oleh lengkung $y = x^2 - 4$ *pada paksi-x. Hitung luas kawasan berlorek tersebut.*

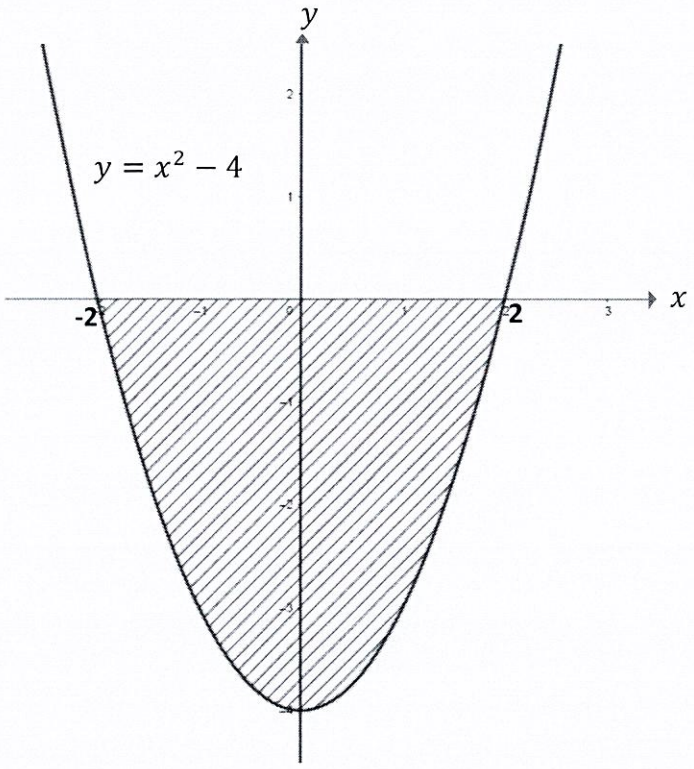

Figure 3(c) / *Rajah 3(c)*

TERBUKA

[8 marks]

[8 *markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Expand $f(x) = x^3$ about $x_0 = 2$ using the Taylor series up to the first three terms.

Kembangkan $f(x) = x^3$ *pada* $x_0 = 2$ *dengan menggunakan siri Taylor sehingga tiga sebutan pertama.*

[6 marks]

[6 *markah*]

CLO2 (b) Expand the following functions:

Kembangkan fungsi-fungsi berikut:

i. $f(x) = \sqrt{2x + 3}$ using the Taylor series about $x_0 = 3$ up to the first three terms.

$f(x) = \sqrt{2x + 3}$ *dengan menggunakan siri Taylor* $x_0 = 3$ *sehingga tiga sebutan pertama.*

[7 marks]

[7 *markah*]

ii. $f(x) = 2e^{3x}$ using the Maclaurin series up to the first five terms.

$f(x) = 2e^{3x}$ *dengan menggunakan siri Maclaurin sehingga lima sebutan pertama.*

[12 marks]

[12 *markah*]

TERBUKA

SOALAN TAMAT

FORMULA SHEET FOR NUMERICAL ANALYSIS (DBM30243)

LIMIT (Properties)			
1.	$\lim_{x\to a} c = c$; c *is a constant*	2.	$\lim_{x\to a} x^n = a^n$; n *is any positive integernumbers*
3.	$\lim_{x\to a}[f(x) \pm g(x)] = \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x)$	4.	$\lim_{x\to a}[f(x).g(x)] = \lim_{x\to a} f(x).\lim_{x\to a} g(x)$
5.	$\lim_{x\to a}\left[\frac{f(x)}{g(x)}\right] = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}$, $\lim_{x\to a} g(x) \neq 0$	6.	$\lim_{x\to a}[cf(x)] = c\lim_{x\to a} f(x)$, c *is a constant*
7.	$\lim_{x\to a}\sqrt[n]{f(x)} = \sqrt[n]{\lim_{x\to a} f(x)}$, $n =$ *positive integer*, $\lim_{x\to a} f(x) \geq 0$		

DIFFERENTATION			
1.	$\frac{d}{dx}(k) = 0, k$ *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.	$\frac{d}{dx}(\ln\lvert x\rvert) = \frac{1}{x}$	11.	$\frac{d}{dx}(\ln\lvert ax+b\rvert) = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
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.	$\int sec^2(ax + b) \, dx = \frac{1}{a} \times \tan(ax + b) + c$
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			
$\int u \, dv = uv - \int v \, du$			

TAYLOR SERIES
$f(x) = f(x_o) + f'(x_0)(x - x_0) + \frac{f''(x_0)}{2!}(x - x_0)^2 + \frac{f'''(x_0)}{3!}(x - x_0)^3 + \cdots$
MACLAURIN SERIES
$f(x) = f(0) + f'(0)x + \frac{f''(0)}{2!}x^2 + \frac{f'''(0)}{3!}x^3 + \cdots$

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.	$N = a^x \Leftrightarrow log_a \, N = x$