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 : 2026/2027

DBM30033: ENGINEERING MATHEMATICS 3

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

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf dan Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

TERBUKA

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) Table 1(a) shows the number of books borrowed by students that have been recorded by the library. Calculate:

Jadual 1(a) menunjukkan *bilangan buku yang dipinjam oleh pelajar yang telah direkodkan oleh perpustakaan. Kirakan:*

Table 1(a) / *Jadual 1(a)*

Number of books borrowed *Bilangan buku yang dipinjam*	Frequency *Kekerapan*
0 – 9	8
10 – 19	11
20 – 29	10
30 – 39	7
40 – 49	9
50 – 59	5

i. Mean

Min

[5 marks]

[*5 markah*]

ii. Median

Median

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[5 marks]

[*5 markah*]

CLO 1

(b) The following data are the achievements of 10 students in the Mathematics quiz. Calculate:

Berikut adalah data pencapaian 10 orang pelajar dalam penilaian kuiz Matematik. Kirakan:

10, 10, 5, 6, 4, 5, 3, 4, 5, 5

i. Variance

Varian

[6 marks]

[*6 markah*]

ii. Standard deviation

Sisihan piawai

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[2 marks]

[*2 markah*]

CLO 1 (c) i. Table 1(c) below shows the number of fruits in a box. Two fruits are selected randomly from the box. Without replacing the fruits, determine the probability of getting the first pick is orange and the second pick is watermelon.

Jadual 1(c) di bawah menunjukkan bilangan buah-buahan di dalam sebuah kotak. Dua biji buah dipilih secara rawak daripada kotak. Tanpa memasukkan semula buah-buahan tersebut, tentukan kebarangkalian mendapat pilihan pertama ialah buah oren dan pilihan kedua ialah buah tembikai.

Table 1(c) / *Jadual 1(c)*

Type of fruits *Jenis buah-buahan*	Watermelon *Tembikai*	Orange *Oren*	Apple *Epal*
Number of fruits *Bilangan buah-buahan*	10	22	18

[3 marks]

[*3 markah*]

ii. A fair die is rolled one time. Calculate the probability of getting a number greater than two or an odd number.

Sebiji dadu yang adil dilambung sekali. Kirakan kebarangkalian mendapat nombor yang lebih daripada dua atau nombor ganjil.

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[4 marks]

[*4 markah*]

QUESTION 2

SOALAN 2

CLO 1

(a) Based on the following linear equations:

Berdasarkan persamaan linear yang berikut:

$$3x - y = 4 + z$$
$$3x + 3y + z = 4$$
$$3x + 3y + 2z = 5$$

i. Calculate matrix L and U by using the Doolittle Method.

Kirakan matriks L dan U dengan menggunakan Kaedah Doolittle.

[10 marks]

[*10 markah*]

ii. Then, calculate the value of x, y and z.

Kemudian, kirakan nilai x, y dan z.

[8 marks]

[*8 markah*]

CLO 1

(b) Solve the non linear equation, $5x^2 + 11x - 17 = 0$ correct to 4 decimal places by using the Newton Raphson's Method where the $x_0 = 1.5$.

Selesaikan persamaan bukan linear, $5x^2 + 11x - 17 = 0$ *tepat kepada 4 tempat perpuluhan dengan menggunakan Kaedah Newton Raphson di mana* $x_0 = 1.5$.

TERBUKA

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO 1 (a) Express the order and degree of the following differential equations:

Nyatakan peringkat dan darjah bagi persamaan pembezaan yang berikut:

i. $\left(\frac{d^3y}{dx^3}\right)^2 + 5y\left(\frac{d^2y}{dx^2}\right) + 7e^x = 0$

[2 marks]
[*2 markah*]

ii. $\left(\frac{dy}{dx}\right)^2 - 7\left(\frac{d^2y}{dx^2}\right)^2 = \cos x$

[2 marks]
[*2 markah*]

CLO 1 (b) Solve the following first order differential equations:

Selesaikan persamaan pembezaan peringkat pertama berikut:

i. $\frac{dy}{dx} + e^{3x} = 18x^2$; Direct Integration
; *Pengamiran Langsung*

[4 marks]
[*4 markah*]

ii. $\frac{dy}{dx} = \frac{x+y}{x}$; Homogenous Equation
; *Persamaan Homogen*

[7 marks]
[*7 markah*]

CLO 1 (c) Solve the following second order differential equations:

Selesaikan persamaan pembezaan peringkat kedua berikut:

i. $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 12y = 0$

[5 marks]
[*5 markah*]

ii. $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 11y = 0$

[5 marks]
[*5 markah*]

TERBUKA

QUESTION 4

SOALAN 4

CLO1 (a) Express the **variables, objective function** and **constraints** that meet the description as below:

A company produced two special diet supplements for athletes, X and Y. The profit contributed by supplement X is RM50/unit while supplement Y contributes RM100/unit. Each ounce of supplement X contains 30 units of calcium, 10 units of iron and 30 units of vitamin B. Each ounce of supplement Y contains 10 units of calcium, 10 units of iron and 20 units of vitamin B. The minimum daily requirements for the diet are 400 units of calcium and 150 units of iron and 200 units of vitamin B.

*Ungkapkan **pembolehubah, fungsi objektif** dan **kekangan** yang memenuhi huraian seperti di bawah:*

Sebuah syarikat menghasilkan dua jenis makanan tambahan diet khas untuk ahli sukan, X dan Y. Keuntungan yang disumbang oleh makanan tambahan X adalah RM50/unit manakala makanan tambahan Y menyumbang RM100/unit. Setiap auns makanan tambahan X mengandungi 30 unit kalsium, 10 unit zat besi dan 30 unit vitamin B. Setiap auns makanan tambahan Y pula mengandungi 10 unit kalsium, 10 unit zat besi dan 20 unit vitamin B. Jumlah minima pengambilan setiap hari untuk kalsium adalah 400 unit, untuk zat besi adalah 150 unit dan pengambilan vitamin B adalah 200 unit.

TERBUKA

[5 marks]

[5 markah]

CLO1

(b) i. Draw the graph and shade the region that satisfies the following constraints. (Given scale for both axis is 2 cm: 10 units).

Lukis graf dan lorekkan kawasan yang memenuhi kekangan-kekangan berikut. (Diberi skala bagi kedua-dua paksi adalah 2 cm: 10 unit).

$y \geq 20$

$x + y \leq 75$

$y \leq 2x$

[5 marks]
[5 *markah*]

ii. From the graph in question 4(b)(i), identify the optimal solution for $P_{max} = 8x + 12y$.
Daripada graf dalam soalan 4(b)(i), tentukan penyelesaian optimum bagi $P_{max} = 8x + 12y$.

TERBUKA

[5 marks]
[5 *markah*]

CLO1 (c) Given Linear Programming problem with maximum $Z = p + 3q$ with constraint;
Diberi permasalahan Pengaturcaraan Linear dengan maksimum $Z = p + 3q$ *dengan kekangan;*

$$3p + 4q \leq 20$$
$$2p - 3q \leq 10$$

i. Write the problem in Standard Simplex Form.
Tuliskan pernyataan masalah dalam bentuk Simplex Piawai.

[3 marks]
[*3 markah*]

ii. Solve the given linear programming problem by using Simplex Method.
Selesaikan pengaturcaraan linear yang diberikan dengan menggunakan kaedah Simplex.

[6 marks]
[*6 markah*]

iii. Based on the answer from question 4(c)ii. above, state the value of p and q of this Linear Programming problem.
Berdasarkan jawapan kepada soalan 4(c)ii. di atas, nyatakan nilai p dan q bagi permasalahan Pengaturcaraan Linear tersebut.

[1 mark]
[*1 markah*]

TERBUKA

SOALAN TAMAT

FORMULA DBM30033 - ENGINEERING MATHEMATICS 3

DESCRIPTIVE STATISTICS		
Number of class	*Sturges Rule,* $k = 1 + 3.33 \log n$	*Rule of Thumb,* $2^k > n$
Mean	$\bar{x} = \frac{\sum x}{n}$	$\bar{x} = \frac{\sum (fx)}{\sum f}$
Median	$Median = L_m + \left(\frac{\frac{N}{2} - F}{f_m}\right) C$	
Mode	$Mode = L_{M_o} + \left(\frac{d_1}{d_1 + d_2}\right) C$	
Quartile	$Q_k = L_{Q_k} + \left(\frac{\frac{kN}{4} - F}{f_{Q_k}}\right) C; \quad k = 1, 2, 3$	
Decile	$D_k = L_{D_k} + \left(\frac{\frac{kN}{10} - F}{f_{D_k}}\right) C; \quad k = 1, 2, 3 \ldots 9$	
Percentile	$P_k = L_{P_k} + \left(\frac{\frac{kN}{100} - F}{f_{P_k}}\right) C; \quad k = 1, 2, 3 \ldots 99$	
Mean Deviation	$E = \frac{\sum \lvert x - \bar{x} \rvert}{n}$	$E = \frac{\sum (\lvert x - \bar{x} \rvert f)}{\sum f}$
Variance	$s^2 = \frac{\sum (x - \bar{x})^2}{n}$	$s^2 = \frac{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2}{n}$
	$s^2 = \frac{\sum [(x - \bar{x})^2 f]}{\sum f}$	$s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2$
Standard Deviation	$s = \sqrt{variance}$	

PROBABILITY	
$E = pn$	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$P(B\|A) = \dfrac{P(B \cap A)}{P(A)}$	$P(A \cap B) = P(A) \bullet P(B)$
	$P(A \cup B) = P(A) + P(B)$
	$P(A \cap B) = P(A) \bullet P(B\|A)$

NUMERICAL METHOD		
Crout Method	$A = \begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix} \begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$	$Ly = b$ $Ux = y$
Doolittle Method	$A = \begin{pmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{pmatrix} \begin{pmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{pmatrix}$	
Newton Raphson Method	$x_{n+1} = x_n - \dfrac{f(x_n)}{f'(x_n)}$	
False Position Method	$x_0 = \dfrac{1}{y_2 - y_1} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$	

SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION	
Logarithmic $a = e^{\ln a}$ $a^x = e^{x \ln a}$ $\int a^x \, dx = \dfrac{a^x}{\ln a} + c$	**Homogeneous Equation** $y = vx$ and $\dfrac{dy}{dx} = v + x\dfrac{dv}{dx}$ **Linear Factors (Integrating Factors)** $\dfrac{dy}{dx} + Py = Q$ $y \cdot IF = \int Q \cdot IF \, dx$ Where $IF = e^{\int P \, dx}$
GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION	
Equation of the form	$a\dfrac{d^2y}{dx^2} + b\dfrac{dy}{dx} + cy = 0$
Quadratics Formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
1. Real & different roots	$y = Ae^{m_1 x} + Be^{m_2 x}$
2. Real & equal roots	$y = e^{mx}(A + Bx)$
3. Complex roots	$y = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$

DIFFERENTIATION			
1.	$\frac{d}{dx}(k) = 0\,, \quad k \text{ is constant}$	2.	$\frac{d}{dx}(ax^n) = anx^{n-1} \quad [Power\ Rule]$
3.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	4.	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx} \quad [Product\ Rule]$
5.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2} \quad [Quotient\ Rule]$	6.	$\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du} \quad [Chain\ Rule]$
7.	$\frac{d}{dx}(e^x) = e^x$	8.	$\frac{d}{dx}\left(e^{ax+b}\right) = e^{ax+b} \times \frac{d}{dx}(ax+b)$
9.	$\frac{d}{dx}(\ln\|x\|) = \frac{1}{x}$	10.	$\frac{d}{dx}[\ln\|ax+b\|] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
11.	$\frac{d}{dx}(\sin x) = \cos x$	12.	$\frac{d}{dx}(\cos x) = -\sin x$
13.	$\frac{d}{dx}(\tan x) = \sec^2 x$	14.	$\frac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \frac{d}{dx}(ax+b)$
15.	$\frac{d}{dx}[\cos(ax+b)] = -\sin(ax+b) \times \frac{d}{dx}(ax+b)$	16.	$\frac{d}{dx}[\tan(ax+b)] = sec^2(ax+b) \times \frac{d}{dx}(ax+b)$
17.	$\frac{d}{dx}[\sin^n u] = n\sin^{n-1} u \times \cos u \times \frac{du}{dx}$	18.	$\frac{d}{dx}[cos^n u] = n\,cos^{n-1} u \times -\sin u \times \frac{du}{dx}$
19.	$\frac{d}{dx}[tan^n u] = n\,tan^{n-1} u \times sec^2 u \times \frac{du}{dx}$		

INTEGRATION			
1.	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c \quad ;\{n \neq -1\}$	2.	$\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c \;;\{n \neq -1\}$
3.	$\int k\ dx = kx + c, \quad k \text{ is constant}$	4.	$\int_a^b f(x)dx = F(b) - F(a)$
5.	$\int \frac{1}{x}\ dx = \ln\ \|x\| + c$	6.	$\int \frac{1}{ax+b}\ dx = \frac{1}{a} \times \ln\ \|ax+b\| + c$
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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		