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 : 2025/2026

DBM30183: ENGINEERING MATHEMATICS 3

TARIKH : 29 APRIL 2026
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula & Kertas Graf

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

TERBUKA

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answers **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan struktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO 1

(a) Table 1(a) shows the sales of a type of T-shirt produced by a particular factory.
Jadual 1(a) menunjukkan jualan bagi sejenis kemeja-T yang dihasilkan oleh kilang tertentu.

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

Size *Saiz*	4	6	8	10	12
Frequency, f *Frequency, f*	27	20	24	30	25

Calculate :

Kira :

i. mode
mod

[2 marks]
[*2 markah*]

ii. median
median

[4 marks]
[*4 markah*]

iii. mean
min

[4 marks]
[*4 markah*]

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CLO 2 (b) Table 1(b) shows the distribution of time taken to assemble a mechanical component by a sample of 50 engineering students in a workshop.
Jadual 1(b) menunjukkan taburan masa yang diambil untuk memasang satu komponen mekanikal oleh 50 orang pelajar kejuruteraan di sebuah bengkel.

Table 1(b) / *Jadual 1(b)*

Time Taken (minutes) *Masa (minit)*	Frequency *Kekerapan*
10 – 14	4
15 – 19	6
20 – 24	12
25 – 29	15
30 – 34	8
35 – 39	5

Based on the table, calculate:
Berdasarkan jadual, kirakan:

i. mean
min

[4 marks]
[*4 markah*]

ii. variance
varians

[6 marks]
[*6 markah*]

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CLO 2 (c) In an engineering laboratory, two production machines are used to manufacture electronic components. The probability that Machine R produces a component that meets the quality specification is $\frac{3}{4}$, while the probability that Machine A produces a component that meets the quality specification is $\frac{2}{3}$. One component is randomly selected from each machine. Calculate the probability that only one component meets the quality specification.

Di sebuah makmal kejuruteraan, dua mesin pengeluaran digunakan untuk menghasilkan komponen elektronik. Kebarangkalian Mesin R menghasilkan komponen yang memenuhi spesifikasi kualiti ialah $\frac{3}{4}$*, manakala kebarangkalian Mesin A menghasilkan komponen yang memenuhi spesifikasi kualiti ialah* $\frac{2}{3}$*. Pilih satu komponen secara rawak daripada setiap mesin. Kirakan kebarangkalian bahawa hanya satu komponen memenuhi spesifikasi.*

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[5 marks]
[*5 markah*]

CLO 2 **QUESTION 2**

SOALAN 2

CLO 2 (a) Based on the following linear equations:

Berdasarkan persamaan linear di bawah:

$$x + 3y + 3z = -1$$
$$2x + 4y = 2 - 3z$$
$$3x + 5y + 4z = 3$$

i. construct Matrix L and Matrix U using the Doolittle Method.

bina Matriks L dan Matriks U menggunakan Kaedah Doolitle.

[10 marks]

[*10 markah*]

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

kira nilai x, y dan z.

[8 marks]

[*8 markah*]

CLO 1 (b) Use the Fixed-Point Iteration Method to find the root of the equation $f(x) = x^3 - 7x + 2$ given that $x_0 = 2.5$. Give your answer to 3 decimal places.

Gunakan Kaedah Fixed-Point Iteration untuk mencari punca bagi persamaan $f(x) = x^3 - 7x + 2$ *apabila* $x_0 = 2.5$. *Berikan jawapan anda kepada 3 tempat perpuluhan.*

TERBUKA

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO 2 (a) Solve the following differential equations using the methods stated:

Selesaikan persamaan berikut dengan menggunakan kaedah yang dinyatakan:

i. $\frac{dy}{dx} = e^{8x+5}$; Direct Integration

; *Pengamiran Langsung*

[5 marks]

[*5 markah*]

ii. $\frac{dy}{dx} = (x-1)(2+y)$; Separating Variables

; *Memisahkan Pembolehubah*

[5 marks]

[*5 markah*]

iii. $\frac{dy}{dx} + 6y = e^{2x}$; Integrating Factors

; *Factor Pengamiran*

[5 marks]

[*5 markah*]

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

Selesaikan persamaan pembezaan peringkat kedua di bawah:

i. $y'' + 4y' = 21y$

[4 marks]

[*4 markah*]

ii. $3y'' + 4y' + 2y = 0$

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[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO1

(a) Solve the linear programming problem below using the Graphical Method
Selesaikan Pengaturcaraan Linear di bawah menggunakan Kaedah Graf

Maximum value of objective function, $Z = 2x + 3y$
Maksimum fungsi objektif, $Z = 2x + 3y$

Constraints, $x + y \leq 30$
Kekangan, $x \leq 20; y \leq 12$
$x \geq 0; y \geq 0$

i. Draw and shade the feasible region which fulfills the given constraints
Lukis dan lorek rantau tersaur yang memenuhi had yang diberikan.

[7 marks]
[*7 markah*]

ii. Based on the graph in (a) i, calculate the value of x and y to obtain the maximum value of objective function, Z.
Berdasarkan graf (a) i, kirakan nilai x dan y untuk memperoleh nilai maximum bagi fungsi objektif Z.

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[3 marks]
[*3 markah*]

CLO2

(b) Given the linear programming problem where maximum value, $P = 7x + 8y - 10z$ with the constraint below:

Diberi permasalahan pengaturcaraan linear bernilai maksimum $P = 7x + 8y + 10z$ *dengan ketaksamaan berikut:*

$$2x + 2y + 2z \leq 100$$
$$x + y + 2z \leq 80$$
$$x \geq 0; y \geq 0$$

i. write the objective function and the corresponding constraints equation above in the Standard Simplex Form.
tuliskan nilai maksimum dan ketaksamaan di atas dalam bentuk Simplex Piawai.

[3 marks]
[*3 markah*]

ii. based on answer in (b)i, convert the standard form into the Initial Simplex Tableau.
Berdasarkan jawapan di (b)i, tukarkan persamaan bentuk Simpleks Piawai tersebut kepada Jadual Simplex Permulaan.

[4 marks]
[*4 markah*]

iii. then, solve the Initial Simplex Tableau to get the optimal solution.
Kemudian, selesaikan Jadual Simplex Permulaan untuk mendapatkan penyelesaian optimum.

[8 marks]
[*8 markah*]

TERBUKA

SOALAN TAMAT

FORMULA DBM30183 - ENGINEERING MATHEMATICS 3

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

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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. Complex roots	$y = e^{\alpha x}(A\cos \beta x + B\sin \beta x)$

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

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