

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
SEMESTER II : 2023/2024**

FB20084: MATHEMATICS 2

**TARIKH : 29 MEI 2024
MASA : 11.30 PAGI – 1.30 PETANG (2 JAM)**

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

Struktur (5 soalan)

Dokumen sokongan yang disertakan : Kertas Graf, Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

INSTRUCTION:

This section consists of **FIVE (5)** structured questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi **LIMA (5)** soalan berstruktur. Jawab **SEMUA** soalan.

QUESTION 1**SOALAN 1**

- CLO1 (a) Express that the equation $x^3 + x - 4 = 0$ has roots between $x = 1.3$ and $x = 1.4$.
Tunjukkan bahawa persamaan $x^3 + x - 4 = 0$ mempunyai punca-punca antara $x = 1.3$ dan $x = 1.4$.

[3 marks]

[3 markah]

- CLO1 (b) By using the Newton-Raphson method, express the root of the equation $f(x) = e^x + x^2 - 5$ that lies between 1 and 2 correct to three decimal places.
Dengan menggunakan kaedah Newton-Raphson, tunjukkan punca bagi persamaan $f(x) = e^x + x^2 - 5$ yang terletak di antara 1 dan 2 betul kepada tiga tempat perpuluhan.

[5 marks]

[5 markah]

- CLO1 (c) State the order and degree of the following differential equation.
Nyatakan peringkat dan darjah bagi persamaan pembezaan yang berikut.

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

[2 marks]

[2 markah]

ii.
$$\frac{d^5 y}{dx^5} + 3\left(\frac{dy}{dx}\right)^2 - \sin x = 0$$

[2 marks]

[2 markah]

- CLO1 (d) Solve $x \frac{dy}{dx} - 2y = x + 1$ by using suitable method.

Selesaikan $x \frac{dy}{dx} - 2y = x + 1$ dengan menggunakan kaedah yang bersesuaian.

[8 marks]

[8 markah]

QUESTION 2

SOALAN 2

- CLO2 (a) Solve the integral for $\int \frac{-2}{\sqrt{4x+7}} dx$.

Selesaikan pengamiran bagi $\int \frac{-2}{\sqrt{4x+7}} dx$.

[3 marks]

[3 markah]

- CLO2 (b) Solve the following integral by using substitution method.

Selesaikan pengamiran berikut dengan menggunakan kaedah penggantian.

$$\int \cos^3 x \sin x dx$$

[5 marks]

[5 markah]

- CLO2 (c) Solve the following integral by using partial fraction method.

Selesaikan pengamiran berikut dengan menggunakan kaedah pecahan separa.

$$\int \frac{3x+7}{x^2+4x-5} dx$$

[6 marks]

[6 markah]

- CLO2 (d) Based on Diagram 1, calculate the volume when the shaded region is rotated through 360° around the y -axis.

Berdasarkan gambarajah 1, kira isipadu apabila kawasan berlorek diputar 360° pada paksi- y .

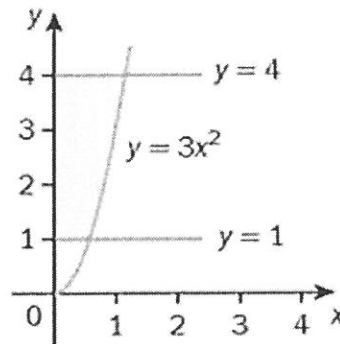


Diagram 1

Gambarajah 1

[6 marks]

[6 markah]

QUESTION 3

SOALAN 3

- CLO2 (a) The vertices of an ellipse are $(3\sqrt{3}, 0)$ and $(-3\sqrt{3}, 0)$ whereas its foci are $(4, 0)$ and $(-4, 0)$. Express the equation of the ellipse in standard equation.

Bucu-bucu elips adalah $(3\sqrt{3}, 0)$ dan $(-3\sqrt{3}, 0)$ dimana titik fokus adalah $(4, 0)$ dan $(-4, 0)$. Tunjukkan persamaan elips dalam persamaan piawai.

[4 marks]

[4 markah]

- CLO2 (b) Show the equation of the following ellipses $4x^2 + y^2 + 16x - 6y - 39 = 0$ in the standard form. Hence, find its centre, vertices and foci.

Tunjukkan persamaan elips berikut $4x^2 + y^2 + 16x - 6y - 39 = 0$ dalam bentuk am. Seterusnya tentukan titik pusat, bucu dan fokus.

[8 marks]

[8 markah]

- CLO2 (c) Calculate the vertex, focus and directrix of the following parabolas
 $(y-5)^2 = -12(x+3)$ and sketch its graph.
Kirakan bucu, fokus dan direktri bagi parabola berikut $(y-5)^2 = -12(x+3)$ dan lakarkan graf.
- [8 marks]
[8 markah]

QUESTION 4

SOALAN 4

- CLO2 (a) Express the magnitude of the following vectors:
Tunjukkan magnitud bagi vector-vektor di bawah:
- i. $|-6\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}|$
- [2 marks]
[2 markah]
- ii. $|9\mathbf{i} - 5\mathbf{j} - \mathbf{k}|$
- [2 marks]
[2 markah]
- CLO2 (b) Given that $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ and $\mathbf{b} = \mathbf{i} - 2\mathbf{j} + \mathbf{k}$. Compute $2\mathbf{a} + 3\mathbf{b}$ in terms of $\mathbf{i}$, $\mathbf{j}$ and $\mathbf{k}$.
Diberi bahawa $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ dan $\mathbf{b} = \mathbf{i} - 2\mathbf{j} + \mathbf{k}$. Kirakan $2\mathbf{a} + 3\mathbf{b}$ di dalam sebutan $\mathbf{i}$, $\mathbf{j}$ dan $\mathbf{k}$.
- [3 marks]
[3 markah]
- CLO2 (c) $A(3, 2, 5)$ and $B(-2, 4, 1)$ are two points. Calculate $\overline{AB}$ in the form $p\mathbf{i} + q\mathbf{j} + r\mathbf{k}$.
 $A(3, 2, 5)$ dan $B(-2, 4, 1)$ adalah 2 titik. Kirakan $\overline{AB}$ di dalam bentuk $p\mathbf{i} + q\mathbf{j} + r\mathbf{k}$.
- [4 marks]
[4 markah]

- CLO2 (d) Given that $\underline{a} = 5\underline{i} + 2\underline{j} - m\underline{k}$ and $\underline{b} = 2\underline{i} - 3\underline{j} + 6\underline{k}$ are perpendicular. Calculate the value of m .

Diberi $\underline{a} = 5\underline{i} + 2\underline{j} - m\underline{k}$ dan $\underline{b} = 2\underline{i} - 3\underline{j} + 6\underline{k}$ adalah berserenjang. Kirakan nilai m .

[4 marks]

[4 markah]

- CLO2 (e) Given $\overline{PQ} = 3\underline{i} + 2\underline{j} + 5\underline{k}$ and $\overline{PR} = \underline{i} - 6\underline{j} + 2\underline{k}$. Calculate the area of triangle PQR .

Diberi $\overline{PQ} = 3\underline{i} + 2\underline{j} + 5\underline{k}$ dan $\overline{PR} = \underline{i} - 6\underline{j} + 2\underline{k}$. Kirakan luas segitiga PQR .

[5 marks]

[5 markah]

QUESTION 5

SOALAN 5

- CLO1 (a) Express the mean, mode and median for the following set of numbers.
Tunjukkan min, mod dan median bagi set nombor berikut.

120, 135, 118, 120, 145, 142, 112, 129, 118, 121, 133, 118, 122, 118

[4 marks]

[4 markah]

- CLO1 (b) Express the quartiles for the following data.
Tunjukkan kuartil-kuartil bagi data berikut.

12.3, 13.5, 12.8, 16.9, 14.7, 11.2, 10.6, 12.1, 15.3, 19.5, 21.3, 10.8, 11.5

[4 marks]

[4 markah]

CLO1

- (c) Data shows time taken by 50 workers to arrive at their office from home.
Data menunjukkan masa yang diambil oleh 50 orang pekerja untuk sampai ke pejabat daripada rumah.

- i. In Table 1 below, express the value of x , fx and fx^2 .

Dalam Jadual 1 di bawah, tunjukkan nilai bagi x , fx dan fx^2 .

Table 1

Jadual 1

Time taken (minute)	No. of staff	x	fx	fx^2
1 - 10	8			
11 - 20	14			
21 - 30	12			
31 - 40	9			
41 - 50	7			

[5 marks]

[5 markah]

- ii. Based on result in Table 1, express mean, variance and standard deviation.
Berdasarkan keputusan dalam Jadual 1, tunjukkan min, varians dan sisihan piawai.

[7 marks]

[7 markah]

SOALAN TAMAT

FORMULA FB20084 - MATHEMATICS 2

NUMERICAL SOLUTIONS	
Newton Raphson Method	$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$
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. $\int k dx = kx + c, k \text{ is constant}$	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. $\int \frac{f'(x)}{f(x)} dx = \ln f(x) + c$	
13. $\int \sin(ax+b) dx = -\frac{1}{\frac{d}{dx}(ax+b)} \times \cos(ax+b) + c$	
14. $\int \cos(ax+b) dx = \frac{1}{\frac{d}{dx}(ax+b)} \times \sin(ax+b) + c$	
15. $\int \sec^2(ax+b) dx = \frac{1}{\frac{d}{dx}(ax+b)} \times \tan(ax+b) + c$	
INTEGRATION BY PARTS	
$\int u dv = uv - \int v du$	
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. $V_y = \pi \int_a^b x^2 dy$
FIRST ORDER DIFFERENTIAL EQUATIONS	
Logarithmic $a = e^{\ln a}$ $a^x = e^{x \ln a}$ $\int a^x dx = \frac{a^x}{\ln a} + c$	Separable variables $\frac{dy}{dx} = f(x)g(y)$

	Linear Factors (Integrating Factors) $\frac{dy}{dx} + P(x)y = Q(x)$ $y \bullet IF = \int Q \bullet IF \, dx$ Where $IF = e^{\int P(x)dx}$		
CONICS			
CIRCLES			
Standard equation of a circle: $(x - h)^2 + (y - k)^2 = r^2$ Centre (h, k) Radius, r			
General equation of a circle: $x^2 + y^2 + 2gx + 2fy + c = 0$ Centre $(-g, -f)$ Radius, $r = \sqrt{g^2 + f^2 - c}$			
ELLIPSE			
Equation of ellipse			
1. $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$		2. $\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$	
3. $c^2 = a^2 - b^2$			
Major Vertices, V :	$(h \pm a, k)$	Major Vertices, V :	$(h, k \pm b)$
Minor Vertices, V :	$(h, k \pm b)$	Minor Vertices, V :	$(h \pm a, k)$
Foci, F :	$(h \pm c, k)$	Foci, F :	$(h, k \pm c)$
Length of major axis	$2a$	Length of major axis	$2b$
PARABOLA			
Vertex	Equation of parabolas	Focus	Directrix
$V(h, k)$	$(y - k)^2 = 4p(x - h)$	$f(h + p, k)$	$x = h - p$
	$(y - k)^2 = -4p(x - h)$	$f(h - p, k)$	$x = h + p$
	$(x - h)^2 = 4p(y - k)$	$f(h, k + p)$	$x = k - p$
	$(x - h)^2 = -4p(y - k)$	$f(h, k - p)$	$x = k + p$
VECTOR AND SCALAR			
1. Unit vector, $\hat{u} = \frac{\vec{u}}{ u }$		2. $\cos \theta = \frac{\vec{A} \cdot \vec{B}}{ A B }$	
3. Scalar product; $\vec{A} \cdot \vec{B} = a_1a_2 + b_1b_2 + c_1c_2$		4. Vector product; $\vec{A} \times \vec{B} = \begin{vmatrix} i & j & k \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix}$	

5. Area of parallelogram $ \overrightarrow{AB} \times \overrightarrow{AC} $	6. Area of triangle $\frac{1}{2} \overrightarrow{AB} \times \overrightarrow{AC} $	
7. Vector Product Properties		
a) $\vec{a} \times \vec{a} = 0$ b) $\vec{a} \times \vec{b} = -\vec{b} \times \vec{a}$ c) $\vec{a} \times \lambda \vec{b} = \lambda \vec{a} \times \vec{b} = \lambda (\vec{a} \times \vec{b})$ d) $\vec{a} \times (\vec{b} + \vec{c}) = (\vec{a} \times \vec{b}) + (\vec{a} \times \vec{c})$ e) $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{c} \bullet \vec{a}) \vec{b} - (\vec{b} \bullet \vec{a}) \vec{c}$ f) $(\vec{a} \times \vec{b}) + (\vec{c} \times \vec{d}) = (\vec{a} \times \vec{c}) + (\vec{a} \times \vec{d}) + (\vec{b} \times \vec{c}) + (\vec{b} \times \vec{d})$		
DATA DESCRIPTION		
Mean	$\bar{x} = \frac{\sum x}{n}$	$\bar{x} = \frac{\sum (fx)}{f}$
Median	$Median = L_m + \left(\frac{\frac{N}{2} - F}{f_m} \right) C$	
Mode	$Mode = L_{Mo} + \left(\frac{d_1}{d_1 + d_2} \right) C$	
Quartile	$Q_k = L_{QK} + \left(\frac{\frac{kN}{4} - F}{f_{QK}} \right) C; k = 1, 2, 3$	
Percentile	$P_k = L_{PK} + \left(\frac{\frac{kN}{100} - F}{f_{PK}} \right) C; k = 1, 2, 3, \dots, 99$	
Variance	Ungrouped data	Grouped data
	$s^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N - 1}$	$s^2 = \frac{\sum fx^2 - \frac{(\sum fx)^2}{\sum f}}{\sum f - 1}$
Standard deviation	$s = \sqrt{\text{variance}}$	
Pearson's Coefficient of Skewness	$S_k = \frac{3(\text{mean} - \text{median})}{\text{Standard deviation}} \quad \text{or} \quad S_k = \frac{\text{mean} - \text{mode}}{\text{Standard deviation}}$	

