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

SESI I : 2024/2025

BBM10013: MATHEMATICS FOR ENGINEERING TECHNOLOGY

TARIKH : 31 DISEMBER 2024
MASA : 9.00 PAGI – 12.00 TENGAH HARI

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf, Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 (a) Simplify $z = \sqrt{-36} + 5i^{86}$.

Permudahkan $z = \sqrt{-36} + 5i^{86}$.

[4 marks]

[*4 markah*]

CLO1 (b) Given that $Z_1 = -5 - 6i$ and $Z_2 = \frac{1}{2} + 3i$. Calculate each of the following:

Diberi $Z_1 = -5 - 6i$ *dan* $Z_2 = \frac{1}{2} + 3i$. *Kirakan setiap yang berikut:*

i. $\frac{2}{3}(Z_1 + Z_2)$

[4 marks]

[*4 markah*]

ii. $\frac{Z_1}{Z_2}$

[5 marks]

[*5 markah*]

CLO2 (c) Given that $X = 3\angle 35^\circ$, $Y = 8e^{0.425i}$ and $Z = 15(\cos 45^\circ + i \sin 45^\circ)$.

Diberi $X = 3\angle 35^\circ$, $Y = 8e^{0.425i}$ *dan* $Z = 15(\cos 45^\circ + i \sin 45^\circ)$.

i. Calculate the modulus and argument for XY with an aid of an Argand diagram.

Kirakan modulus dan hujahan bagi XY dengan bantuan lakaran gambarajah Argand.

[7 marks]

[*7 markah*]

ii. Solve $\frac{Y}{Z}$ and express the answer in trigonometry form and cartesian form.

Selesaikan $\frac{Y}{Z}$ *dan nyatakan jawapan dalam bentuk trigonometri dan bentuk kartesian.*

[5 marks]

[*5 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Given the determinant of matrix $P = \begin{pmatrix} 3 & -3 & 5 \\ 0 & x & 4 \\ -1 & 7 & 2 \end{pmatrix}$ is 16. Express the value of x.

Diberi penentu matrik $P = \begin{pmatrix} 3 & -3 & 5 \\ 0 & x & 4 \\ -1 & 7 & 2 \end{pmatrix}$ *adalah 16. Ungkapkan nilai* x.

[4 marks]

[*4 markah*]

CLO1 (b) Given matrix $A = \begin{pmatrix} -4 & -6 & 2 \\ 5 & -1 & 3 \\ -2 & 4 & -3 \end{pmatrix}$ and the minor of matrix A $= \begin{pmatrix} -9 & -9 & 18 \\ 10 & 16 & -28 \\ -16 & -22 & 34 \end{pmatrix}$. Calculate the inverse of matrix A.

Diberi matrik $A = \begin{pmatrix} -4 & -6 & 2 \\ 5 & -1 & 3 \\ -2 & 4 & -3 \end{pmatrix}$ *dan minor A*$= \begin{pmatrix} -9 & -9 & 18 \\ 10 & 16 & -28 \\ -16 & -22 & 34 \end{pmatrix}$.

Kirakan matrik songsangan bagi A.

[6 marks]

[*6 markah*]

CLO2 (c) Given linear equations below:

Diberi persamaan linear di bawah:

$$-2x + 3y - z = 1$$
$$x + 2y - z = 4$$
$$-2x + 3z = 8$$

i. Calculate the values of x, y and z by using Cramer's rule.

Kirakan nilai x, y *dan* z *menggunakan peraturan Cramer*.

[10 marks]

[*10 markah*]

ii. Calculate the value of LU by using Doolittle method.
Kirakan nilai LU menggunakan kaedah Doolittle.

[5 marks]
[*5 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Given $sin\, x = \frac{5}{13}$ where $90^o \leq x \leq 180^o$. Express the value of $\cos x$ and $\cot x$ without using a calculator.

Diberi $sin\, x = \frac{5}{13}$ *dimana* $90^o \leq x \leq 180^o$. *Ungkapkan nilai bagi* $\cos x$ *dan* $\cot x$ *tanpa menggunakan kalkulator.*

[5 marks]

[*5 markah*]

CLO1 (b) Solve the equation $6\, sec^2\theta - 8 = \tan\theta$ for the range $0^o \leq \theta \leq 360^\circ$.

Selesaikan persamaan $6\, sec^2\theta - 8 = \tan\theta$ *bagi julat* $0^o \leq \theta \leq 360^\circ$.

[7 marks]

[*7 markah*]

CLO1 (c) Based on Figure 3(c), calculate:

Berdasarkan Rajah 3(c), kirakan:

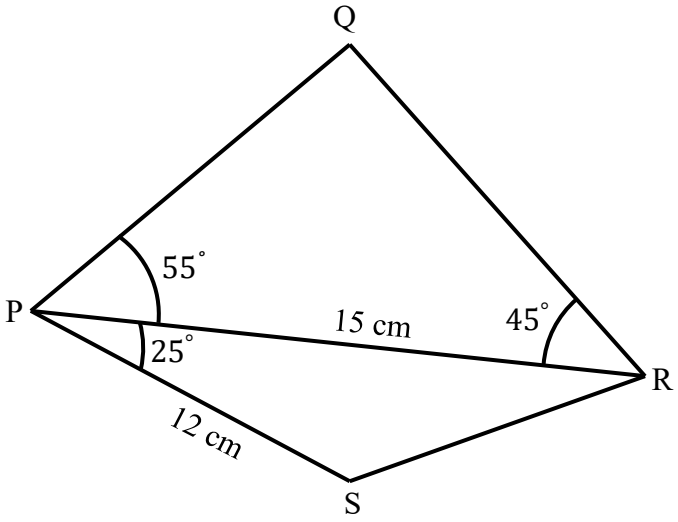


Figure 3(c)*/ Rajah 3(c)*

i. length of QR and length of RS.
panjang QR dan panjang RS.

[7marks]
[*7 markah*]

ii. total area of the two triangles.
jumlah luas dua segitiga tersebut.

[6 marks]
[*6 markah*]

QUESTION 4

SOALAN 4

CLO2 (a) Given that the position vectors of point A and B are $\begin{pmatrix}-2\\3\\-4\end{pmatrix}$ and $\begin{pmatrix}-5\\-1\\8\end{pmatrix}$.

Calculate:

Diberi vektor kedudukan A dan B adalah $\begin{pmatrix}-2\\3\\-4\end{pmatrix}$ *dan* $\begin{pmatrix}-5\\-1\\8\end{pmatrix}$ *.Kirakan:*

i. the vector value of $\overrightarrow{AB}$ in the form of i, j and k.

nilai vektor $\overrightarrow{AB}$ *dalam bentuk i, j dan k.*

[4 marks]

[*4 markah*]

ii. unit of vector of $3(\overrightarrow{2B} + \vec{A})$.

vektor unit $3(\overrightarrow{2B} + \vec{A})$.

[6 marks]

[*6 markah*]

CLO2 (b) Given that the position vectors $\overrightarrow{OP} = 2i + j + 4k, \overrightarrow{OQ} = -i + 2j + 2k$ and $\overrightarrow{OR} = 3i - 3j + k$. Solve:

Diberi vektor kedudukan $\overrightarrow{OP} = 2i + j + 4k, \overrightarrow{OQ} = -i + 2j + 2k$ *dan* $\overrightarrow{OR} = 3i - 3j + k$. Selesaikan:

i. direction angle of the vector $\vec{R}$.

arah sudut bagi vektor $\vec{R}$.

[7 marks]

[*7 markah*]

ii. area of parallelogram PQR.
luas segi empat selari PQR.

[8 marks]
[*8 markah*]

SOALAN TAMAT

FORMULA SHEET FOR MATHEMATICS FOR ENGINEERING TECHNOLOGY (BBM10013)

REAL AND COMPLEX NUMBER SYSTEM

1. $Modulus\ of\ z = \sqrt{a^2 + b^2}$
2. $Argument\ of\ z = tan^{-1}\left(\frac{b}{a}\right)$
3. $Cartesian\ Form; z = a + bi$
4. $Polar\ Form; z = r\angle\theta$
5. $Exponential\ Form; z = re^{i\theta}$
6. $Trigonometric\ Form; z = r\ (\cos\theta + \mathrm{i}\sin\theta)$

MATRIX

1. *Cofactor;* $C = (-1)^{i+j}M_{ij}$
2. *Adjoin;* $Adj(A) = C^T$
3. *Inverse of Matrix;* $A^{-1} = \frac{1}{|A|}Adj(A)$
4. *Cramer's Rule;*

$$x = \frac{|A_1|}{|A|}, y = \frac{|A_2|}{|A|}, z = \frac{|A_3|}{|A|}$$

5. *Doolittle method;*

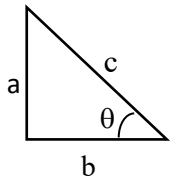
$$A = \begin{pmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{pmatrix} \times \begin{pmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{pmatrix}$$

6. *Crout method;*

$$A = \begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix} \times \begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$$

TRIGONOMETRY

Pythagoras' Theorem



$$c^2 = a^2 + b^2$$

Trigonometric Identities

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$cos^2\theta + sin^2\theta = 1$$

$$1 + tan^2\theta = sec^2\theta$$

$$1 + cot^2\theta = cosec^2\theta$$

Compound Angle

1. $sin(A \pm B) = \sin A\cos B \pm \cos A\sin B$
2. $cos(A \pm B) = \cos A\cos B \mp \sin A\sin B$
3. $tan(A \pm B) = \frac{tan\ A \pm tan\ B}{1 \mp \tan A\tan B}$

Double Angle

1. $\sin 2A = 2\sin A\cos A$
2. $\cos 2A = cos^2A - sin^2A$
   $= 1 - 2sin^2A$
   $= 2cos^2A - 1$
3. $\tan 2A = \frac{2\tan A}{1 - tan^2A}$

Formula of Triangle

1. *Sine Rules;* $\boldsymbol{\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}}$
2. *Cosine Rules;* $\boldsymbol{a^2 = b^2 + c^2 - 2bc\cos A}$
3. $\boldsymbol{Area\ of\ Triangle = \frac{1}{2}ab\sin C}$

VECTOR ALGEBRA

1. *Unit Vector;* $\hat{u} = \frac{\overline{u}}{|u|}$
2. $|u| = \sqrt{x^2 + y^2 + z^2}$
3. *Cos* $\theta = \frac{\overline{A} \bullet \overline{B}}{|A||B|}$
4. $\sin\theta = \frac{|\vec{A} \times \vec{B}|}{|A||B|}$
5. *Scalar Product;*
   $\vec{A} \bullet \vec{B} = a_1a_2 + b_1b_2 + c_1c_2$
6. *Vector Product;*

$$\vec{A} \times \vec{B} = \begin{vmatrix} i & j & k \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix}$$

7. *Direction of Cosine;*

$$\cos\alpha = \frac{V_x}{|V|}, \cos\beta = \frac{V_y}{|V|}, \cos\gamma = \frac{V_z}{|V|}$$

8. *Area of parallelogram ABC;*
   $|\overrightarrow{AB} \times \overrightarrow{BC}|$
9. *Area of triangle ABC;*
   $\frac{1}{2}|\overrightarrow{AB} \times \overrightarrow{BC}|$