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 : 2022/2023

DBM10013: ENGINEERING MATHEMATICS 1

TARIKH   : 08 JUN 2023
MASA   : 8.30 PG – 10.30 PG (2 JAM)

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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)   Express the following expressions in the simplest form:

Ungkapkan setiap sebutan berikut dalam bentuk termudah:

i. $\dfrac{x^2 + 4x + 3}{4} \div \dfrac{x + 3}{8}$

[3 marks]

[*3 markah*]

ii. $\dfrac{x + 2}{5x} - \dfrac{2x - 1}{3x}$

[4 marks]

[*4 markah*]

CLO1

(b)   Solve the quadratic equation below by using Quadratic Formula.

Selesaikan persamaan kuadratik di bawah menggunakan Formula Kuadratik.

$$2x^2 = 9x + 6$$

[5 marks]

[*5 markah*]

CLO2 (c)   Construct the partial fraction for the following equations:

Bina pecahan separa bagi persamaan yang berikut:

i. $\dfrac{x+7}{x^2-7x+10}$

[5 marks]

[*5 markah*]

ii. $\dfrac{x^2+1}{x^2-3x+2}$

[8 marks]

[*8 markah*]

QUESTION 2

SOALAN 2

CLO1   (a)   Given $K = 3 + 8i$, $L = -2 + 6i$ and $M = -4 - 5i$. Calculate the following:

Diberi $K = 3 + 8i$, $L = -2 + 6i$ dan $M = -4 - 5i$. Kira yang berikut:

        i. $3K - L$

[3 marks]

[*3 markah*]

        ii. $\dfrac{L^2}{M}$

[5 marks]

[*5 markah*]

CLO1   (b)   Calculate modulus and argument for complex number $z = -3 - 9i$ and draw the Argand Diagram.

Kira modulus dan hujah bagi nombor komplek $z = -3 - 9i$ dan lukiskan Rajah Argand.

[7 marks]

[*7 markah*]

CLO2   (c)   Given that $z_1 = 8(\cos 35° + i \sin 35°)$, $z_2 = 40e^{1.3265i}$ and $z_3 = 4 + 3i$. Calculate the following in Polar form.

Diberi $z_1 = 8(\cos 35° + i \sin 35°)$, $z_2 = 40e^{1.3265i}$ and $z_3 = 4 + 3i$. Kira yang berikut dalam bentuk Kutub.

        i. $\dfrac{z_2}{z_1}$

[5 marks]

[*5 markah*]

        ii. $z_1 z_3$

[5 marks]

[*5 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Given matrix $Q = \begin{pmatrix} 5 & -1 \\ 2 & 9 \\ -3 & 5 \end{pmatrix}$, express:

Diberi matriks $Q = \begin{pmatrix} 5 & -1 \\ 2 & 9 \\ -3 & 5 \end{pmatrix}$, ungkapkan:

i. The order of matrix Q , the elements of Q_{31} and Q_{22}

Peringkat bagi matriks Q, unsur-unsur pada Q_{31} dan Q_{22}

[3 marks]

[*3 markah*]

ii. Q^T

Q^T

[1 mark]

[*1 markah*]

CLO1 (b) i. Calculate the value of a and b for the following matrix equation:

Kira nilai a dan b bagi persamaan matriks berikut:

$$\begin{pmatrix} \frac{1}{2}a & -1 & 3 \\ 1 & 2 & -3 \\ 9 & -5b & 4 \end{pmatrix} + \begin{pmatrix} \frac{3}{4}a & -1 & 4 \\ 1 & 7 & 3 \\ -5 & -2 & 2 \end{pmatrix} = \begin{pmatrix} 5 & -2 & 7 \\ 2 & 9 & 0 \\ 4 & 8 & 6 \end{pmatrix}$$

[6 marks]

[*6 markah*]

ii.   Given that $R = \begin{pmatrix} 1 & 5 \\ 8 & -2 \\ 5 & 0 \end{pmatrix}$ and $S = \begin{pmatrix} 2 & -3 & 6 \\ 5 & 4 & 1 \end{pmatrix}$. Calculate RS.

Diberi $R = \begin{pmatrix} 1 & 5 \\ 8 & -2 \\ 5 & 0 \end{pmatrix}$ dan $S = \begin{pmatrix} 2 & -3 & 6 \\ 5 & 4 & 1 \end{pmatrix}$. Kira RS.

[4 marks]

[*4 markah*]

CLO2   (c)   Solve the following equations using the Inverse Matrix Method.

Selesaikan persamaan berikut dengan menggunakan Kaedah Matriks Songsang.

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

[11 marks]

[*11 markah*]

QUESTION 4

SOALAN 4

CLO1 (a)   Given S and T are the coordinates for points (4,3,5) and (1,7,5) respectively. Calculate:

Diberi S dan T adalah koordinat bagi titik (4,3,5) dan (1,7,5) masing-masing. Kirakan:

   i.   Vector $\overrightarrow{ST}$

        Vektor $\overrightarrow{ST}$

[3 marks]

[*3 markah*]

   ii.   Magnitude $\overrightarrow{ST}$

        Magnitud $\overrightarrow{ST}$

[2 marks]

[*2 markah*]

   iii.   Unit vector for $\overrightarrow{ST}$

        Vektor unit bagi $\overrightarrow{ST}$

[2 marks]

[*2 markah*]

CLO1

(b)   i.   The Diagram 4(b)i shows that O, A and B are the points with coordinate (0,0), (-2,1) and (3,4) respectively. Calculate vector $\overrightarrow{AB}$ by using Triangle method.

Rajah 4(b)i menunjukkan bahawa O, A dan B ialah titik dengan koordinat (0,0), (-2,1) dan (3,4) masing-masing. Kira vektor $\overrightarrow{AB}$ dengan menggunakan kaedah Segitiga.
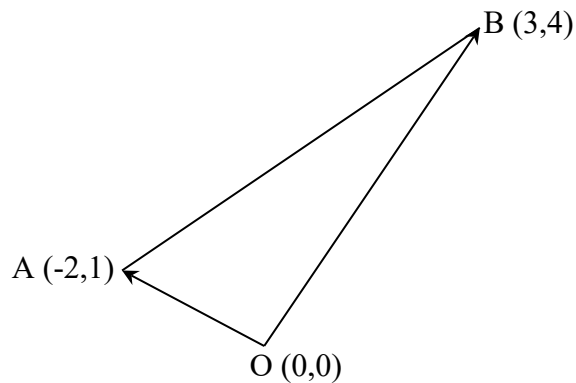
B (3,4)

A (-2,1)

O (0,0)

Diagram 4(b)i / *Rajah 4(b)i*

[4 marks]

[*4 markah*]

ii.   The Diagram 4(b)ii shows that PQRS is a parallelogram with $\overrightarrow{PQ} = 2i + 2j$ and $\overrightarrow{QR} = 3i + 4j$. Calculate $\overrightarrow{QS}$.

Rajah 4(b)ii menunjukkan bahawa PQRS ialah Segiempat Selari dengan $\overrightarrow{PQ} = 2i + 2j$ dan $\overrightarrow{QR} = 3i + 4j$. Kirakan $\overrightarrow{QS}$.
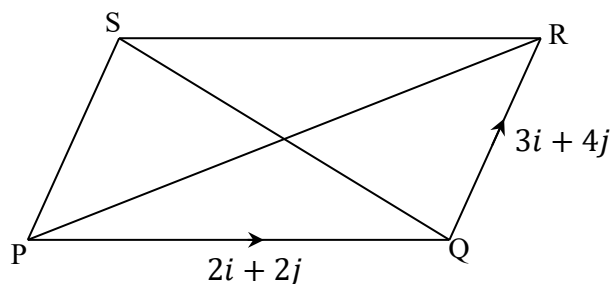
S   R

$3i + 4j$

P   Q
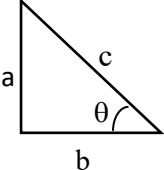
$2i + 2j$

Diagram 4(b)ii / *Rajah 4(b)ii*

[4 marks]

[*4 markah*]

CLO2 (c)　A, B and C is a triangle with points $(0,1,3), (4,-1,2)$ and $(1,3,-5)$ respectively. Given $\overrightarrow{AB} = 4i - 2j - k$, calculate:

A, B dan C merupakan sebuah segitiga dengan titik $(0,1,3), (4,-1,2)$ dan $(1,3,-5)$ masing-masing. Diberi $\overrightarrow{AB} = 4i - 2j - k$, kirakan:

　i.　　$\overrightarrow{AB} \bullet \overrightarrow{BC}$

[5 marks]
[*5 markah*]

　ii.　　$\overrightarrow{AB} \times \overrightarrow{BC}$

[3 marks]
[*3 markah*]

　iii.　　Area of triangle ABC
　　　　Luas segitiga ABC

[2 marks]
[*2 markah*]

SOALAN TAMAT

FORMULA SHEET FOR ENGINEERING MATHEMATICS 1 (DBM10013)

QUADRATIC EQUATION

1. **Quadratic formula**, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

2. **Completing the square**,

$$\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c = 0$$

FORMULA OF TRIANGLE

1. **Sine Rules;** $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

2. **Cosine Rules;** $\mathbf{a^2 = b^2 + c^2 - 2bc \cos A}$

3. **Area of Triangle** $= \frac{1}{2} ab \sin C$

MATRIX

1. **Cofactor;** $C = (-1)^{i+j} M_{ij}$

2. **Adjoin;** $Adj(A) = C^T$

3. **Inverse of Matrix;** $A^{-1} = \dfrac{1}{|A|} Adj(A)$

4. **Cramer's Rule;**

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

COMPLEX NUMBER

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;** $z = r\,(\cos\theta + i\sin\theta)$

TRIGONOMETRY

Pythagoras' Theorem

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

Trigonometric Identities

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

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

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

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

VECTOR & SCALAR

1. **Unit Vector;** $\hat{u} = \dfrac{\bar{u}}{|u|}$

2. **Cos** $\boldsymbol{\theta}$ = $\dfrac{\bar{A}\cdot\bar{B}}{|A||B|}$

3. **Scalar Product;**

$$\vec{A} \cdot \vec{B} = a_1 a_2 + b_1 b_2 + c_1 c_2$$

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 ABC;**

$$\left|\overrightarrow{AB} \times \overrightarrow{BC}\right|$$

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. $\tan(A \pm B) = \dfrac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

DOUBLE-ANGLE

1. $\sin 2A = 2\sin A \cos A$

2. $\cos 2A = \cos^2 A - \sin^2 A$

$$= 1 - 2\sin^2 A$$

$$= 2\cos^2 A - 1$$

3. $\tan 2A = \dfrac{2\tan A}{1 - \tan^2 A}$