SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI JUN 2017

DBM1013 : ENGINEERING MATHEMATICS 1

TARIKH : 25 OKTOBER 2017
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.
Bahagian A: Struktur (2 soalan)
Bahagian B: Struktur (4 soalan)
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A: 50 MARKS

BAHAGIAN A: 50 MARKAH

INSTRUCTION:

This section consists of **TWO (2)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1
C2

a) Express each of the following expressions in the simplest form:

Ungkapkan setiap ungkapan berikut dalam bentuk termudah :

i. $4x^2 + 3x(-9x + 6)$

[2 marks]

[*2 markah*]

ii. $5m^2n^3 - (6mn - 4m^2n^3 + 3) + 6$

[3 marks]

[*3 markah*]

iii. $\frac{x^2-x-6}{x-3} \times \frac{5}{3x+6}$

[3 marks]

[*3 markah*]

iv. $6(n - 2a) - 5(n + 3a)$

[2 marks]

[*2 markah*]

CLO1
C3

b) Evaluate the roots for the equations below by using the given method :
Nilaikan punca-punca bagi persamaan di bawah dengan menggunakan kaedah yang diberikan:

i. $n^2 - 8n + 12 = 0$
(Using Factorization Method)
(*Menggunakan Kaedah Pemfaktoran*)

[3 marks]
[*3 markah*]

ii. $2m(m - 2) = m - 2$
(Using Quadratic Formula)
(*Menggunakan Formula Kuadratik*)

[5 marks]
[*5 markah*]

iii. $f(f - 1) = 18$
(Using Completing the Square Method)
(*Menggunakan Kaedah Penyempurnaan Kuasa Dua*)

[7 marks]
[*7 markah*]

QUESTION 2

SOALAN 2

CLO1 C2

a) Determine the value of A and B for partial fraction below :

Tentukan nilai A dan B untuk pecahan separa di bawah :

$$\frac{x+7}{(x-3)(x+2)} = \frac{A}{(x-3)} + \frac{B}{(x+2)}$$

[4 marks]

[*4 markah*]

CLO1 C3

b) Solve the partial fraction decomposition for the following equation :

Selesaikan penguraian pecahan separa untuk persamaan berikut :

i. $\frac{-x+3}{x^2-9x+20}$

[6 marks]

[*6 markah*]

ii. $\frac{8x^2-12}{x(x^2+2x-6)}$

[7 marks]

[*7 markah*]

iii. $\frac{2x^3-x^2+x+5}{x^2+3x+2}$

[8 marks]

[*8 markah*]

SECTION B: 50 MARKS

BAHAGIAN B: 50 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **TWO (2)** questions only.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **DUA (2)** soalan sahaja.*

QUESTION 3

SOALAN 3

CLO2
C2

a) The diagram 3 below shows the position of vectors $\overrightarrow{JK}$ and $\overrightarrow{LM}$ in a Cartesian Plane.

Rajah 3 di bawah menunjukkan posisi bagi vektor $\overrightarrow{JK}$ dan $\overrightarrow{LM}$ di dalam Rajah Cartesian.

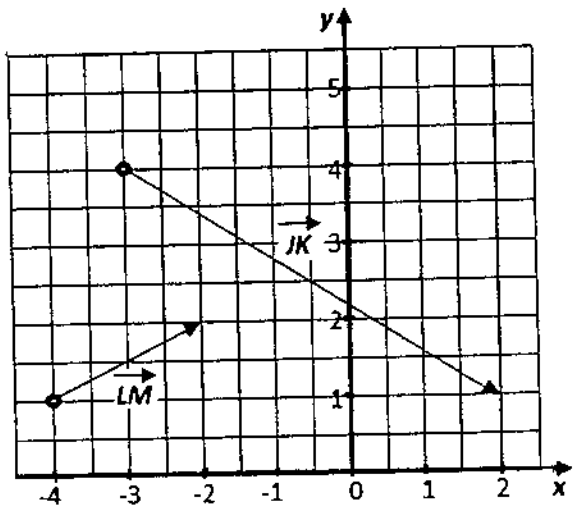


Diagram 3
Rajah 3

i. Express both vectors in matrix notation.

Ungkapkan kedua-dua vektor tersebut dalam bentuk matrix.

[2 marks]

[*2 markah*]

ii. Calculate the value of $\overrightarrow{LM} - \overrightarrow{JK}$.

Kirakan nilai bagi $\overrightarrow{LM} - \overrightarrow{JK}$

[3 marks]

[*3 markah*]

iii. Determine the unit vector of $\overrightarrow{JK}$

Tentukan vektor unit bagi $\overrightarrow{JK}$

[5 marks]

[*5 markah*]

_O2 C3

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

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

i. $\overrightarrow{PQ}$

[2 marks]

[*2 markah*]

ii. $|\overrightarrow{QR}|$

[4 marks]

[*4 markah*]

iii. $\overrightarrow{PQ} \times \overrightarrow{QR}$

[4 marks]

[*4 markah*]

iv. $\overrightarrow{PQ} \cdot (\overrightarrow{PQ} + \overrightarrow{QR})$

[5 marks]

[*5 markah*]

QUESTION 4

SOALAN 4

CLO2
C2

a) Refer to Diagram 4, given $xy = 20$ and $xz = 12$. Determine :

Merujuk kepada Rajah 4, diberi $xy = 20$ *dan* $xz = 12$. *Tentukan :*

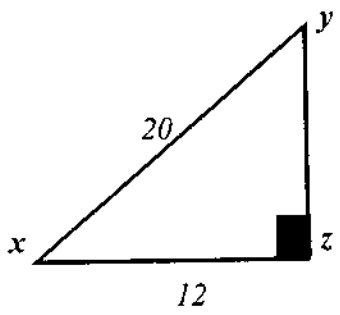


Diagram 4

Rajah 4

i. Length of yz

[2 marks]

[*2 markah*]

ii. $sin\, x$

[2 marks]

[*2 markah*]

iii. $cot\, y$

[3 marks]

[*3 markah*]

iv. $sec\, x + cosec\, x$

[3 marks]

[*3 markah*]

CLO2
C3

b) Calculate all the nearest degree in the interval $0° \leq \theta \leq 360°$ that satisfy the equation below :

Kirakan semua sudut terdekat yang terdapat di dalam sela $0° \leq \theta \leq 360°$ *yang memenuhi persamaan di bawah :*

i. $\sec \theta = 6.96$

[4 marks]
[*4 markah*]

ii. $3 \cos 2\theta + \sin \theta - 1 = 0$

[11 marks]
[*11 markah*]

QUESTION 5

SOALAN 5

CLO2
C2

a) Given equation $= 6 + i$, $w = -1 + 5i$ and $z = 4 - 8i$. Determine each of the following in the form of $a + bi$.

Diberi persamaan $= 6 + i$, $w = -1 + 5i$ *and* $z = 4 - 8i$. *tentukan setiap yang berikut dalam bentuk* $a + bi$.

i. $2x + 4z$

[3 marks]
[*3 markah*]

ii. $w \times z$

[3 marks]
[*3 markah*]

iii. $\frac{x}{w}$

[4 marks]
[*4 markah*]

CLO2
C3

b) Given $P = 6 - 8i$ and $Q = -4 + i$. Sketch the Argand's Diagram. Then, determine the modulus and the argument for the complex number below :

Diberi $P = 6 - 8i$ *dan* $Q = -4 + i$. *Lakarkan Gambarajah Argand. Seterusnya, tentukan modulus dan hujah bagi nombor kompleks di bawah :*

i. P

[6 marks]
[*6 markah*]

ii. $\frac{P}{Q}$

[9 marks]
[*9 markah*]

QUESTION 6

SOALAN 6

CLO2
C2

a) Referring to matrix $B = \begin{pmatrix} 3 & 5 & -3 \\ 0 & 8 & 4 \\ -1 & 7 & 2 \end{pmatrix}$, identify the element at:

Berdasarkan matriks $B = \begin{pmatrix} 3 & 5 & -3 \\ 0 & 8 & 4 \\ -1 & 7 & 2 \end{pmatrix}$, kenalpasti unsur pada:

i. B_{23}

[1 mark]
[*1 markah*]

ii. B_{21}

[1 mark]
[*1 markah*]

iii. B_{31}

[1 mark]
[*1 markah*]

iv. Calculate BI , where I is Identity Matrix
Kirakan BI , di mana I adalah matrix Identiti

[2 marks]
[*2 markah*]

v. Calculate B^T
Kirakan B^T

[2 marks]
[*2 markah*]

vi. Calculate $B^T + B$
Kirakan $B^T + B$

[3 marks]
[*3 markah*]

CLO2
C3

b)

i. Solve the following equations by using Inverse Method.
Selesaikan persamaan berikut dengan menggunakan Kaedah Songsangan.

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

[10 marks]
[*10 markah*]

ii. If $|A| = 2$, calculate the value of x, y and z in the following equations by using Cramer's Rule:
Jika $|A| = 2$, *kirakan nilai* x, y *dan* z *dalam persamaan berikut dengan menggunakan Petua Cramer.*

$$5x - y + 7z = 4$$
$$6x - 2y + 9z = 5$$
$$2x + 8y - 4z = 8$$

[5 marks]
[*5 markah*]

SOALAN TAMAT

FORMULA SHEET FOR DBM1013: ENGINEERING MATHEMATICS 1

QUADRATIC EQUATION

1. *Quadratic formula*, $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
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;* $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
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;* $A^{-1} = \frac{1}{|A|}Adj(A)$
4. *Cramer's Rule;*

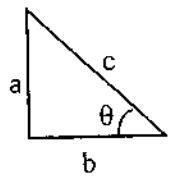
$$x = \frac{|A_1|}{|A|}, y = \frac{|A_2|}{|A|}, z = \frac{|A_3|}{|A|}$$

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;* $z = r(\cos\theta + \mathrm{i}\sin\theta)$

TRIGONOMETRY

Pythagoras' Theorem



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

Trigonometric Identities

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

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

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

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

VECTOR & SCALAR

1. *Unit Vector;* $\hat{u} = \frac{\vec{u}}{|u|}$
2. *Cos* $\boldsymbol{\theta}$ $= \frac{\vec{A}\bullet\vec{B}}{|A||B|}$
3. *Scalar Product;*

$$\vec{A}\bullet\vec{B} = a_1a_2 + b_1b_2 + c_1c_2$$

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 ABC;*

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

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