



UNIVERSITI MALAYSIA TERENGGANU

**FINAL EXAMINATION
PEPERIKSAAN AKHIR**

**SEMESTER I SESSION 2024/2025 (STEM FOUNDATION PROGRAMME)
SEMESTER I SESI 2024/2025 (ASASI STEM)**

COURSE <i>KURSUS</i>	:	MATHEMATICS 1 <i>MATEMATIK 1</i>
COURSE CODE <i>KOD KURSUS</i>	:	AMM1114
DURATION <i>TEMPOH</i>	:	3 HOURS <i>3 JAM</i>

MATRIC NO. <i>NO. MATRIK</i>	:	_____
PROGRAMME <i>NAMA PROGRAM</i>	:	_____
SEAT NO. <i>NO. MEJA</i>	:	_____

INSTRUCTIONS TO CANDIDATES
ARAHAN KEPADA CALON

- Answer all questions.
Sila jawab semua soalan.
- All answers must be written in answer booklet provided.
Semua jawapan hendaklah ditulis dalam buku jawapan yang disediakan.

DO NOT OPEN THE QUESTION PAPER UNTIL INSTRUCTED
JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

THIS QUESTION PAPER CONSISTS OF EIGHTEEN (18) PRINTED PAGES
KERTAS SOALAN INI MENGANDUNGI LAPAN BELAS (18) MUKA SURAT BERCETAK

PART B/ BAHAGIAN B (60 Marks/ 60 Markah)

Please answer all questions.

Sila jawab semua soalan.

1. The complex number z is defined by $z = \sqrt{2} - \sqrt{6}i$. The complex conjugate of z is denoted by z^* . Compute the modulus and argument of z^* . (2 marks)
Nombor kompleks z ditakrifkan oleh $z = \sqrt{2} - \sqrt{6}i$. Konjugat kompleks z ditandakan dengan z^ . Kirakan modulus dan hujah bagi z^* . (2 markah)*

2. A system of linear equation is given as follows:
Satu sistem persamaan linear diberikan seperti berikut:

$$\begin{aligned}x + 3y + 4z &= 4 \\ -x + 3y + 2z &= 2 \\ 3x + 9y + 6z &= -6\end{aligned}$$

- a. Express the system of linear equations in the form of a matrix equation $AX = B$. (1 mark)
Ungkapkan sistem persamaan linear dalam bentuk persamaan matriks $AX = B$. (1 markah)
- b. From 2a., find $|A|$. (2 marks)
Daripada 2a., cari $|A|$. (2 markah)
- c. By using Cramer's Rule, compute the values of x, y and z . (5 marks)
Dengan menggunakan petua Cramer, kira nilai bagi x, y dan z . (5 markah)
3. The point A has coordinates $(1,0,5)$ and the point B has coordinates $(-1,2,9)$.
Titik A mempunyai koordinat $(1,0,5)$ dan titik B mempunyai koordinat $(-1,2,9)$.
- a. Find the vector $\overrightarrow{AB}$. (1 mark)
Cari vektor $\overrightarrow{AB}$. (1 markah)
- b. Find the vector equation of line AB . (1 mark)
Cari persamaan vektor bagi garis AB . (1 markah)
- c. Compute the intersection point of the lines AB and the line L with vector equation $r = \mathbf{i} + 3\mathbf{j} + 4\mathbf{k} + \mu(-\mathbf{i} - 2\mathbf{j} + 3\mathbf{k})$. (6 marks)
Kira titik persilangan bagi garis AB dan garis L dengan persamaan vektor $r = \mathbf{i} + 3\mathbf{j} + 4\mathbf{k} + \mu(-\mathbf{i} - 2\mathbf{j} + 3\mathbf{k})$. (6 markah)

4. The function f is defined by $f: x \rightarrow 2x^2 - 12x + 7$ for $x \in \mathbb{R}$.

Fungsi f ditakrifkan sebagai $f: x \rightarrow 2x^2 - 12x + 7$ bagi $x \in \mathbb{R}$.

- a. Express $2x^2 - 12x + 7$ in the form of $2(x + a)^2 + b$ where a and b are constants. (2 marks)

Nyatakan $2x^2 - 12x + 7$ dalam bentuk $2(x + a)^2 + b$ yang mana a dan b adalah pemalar. (2 markah)

- b. Indicate the range of f . (1 mark)

Tunjukkan julat bagi f . (1 markah)

- c. The function g is defined by $g: x \rightarrow 2x^2 - 12x + 7$ for $x \leq k$. Present the largest value of k for which g has an inverse function. (1 mark)

Fungsi g ditakrifkan sebagai $g: x \rightarrow 2x^2 - 12x + 7$ untuk $x \leq k$. Persembahkan nilai terbesar bagi k yang mana g mempunyai fungsi songsang. (1 markah)

- d. Given that g has an inverse function, construct the expression for $g^{-1}(x)$. (3 marks)

Diberi bahawa g mempunyai fungsi songsang, bina ungkapan bagi $g^{-1}(x)$. (3 markah)

5. Given a function $f(x) = \cos \theta + \sqrt{2} \sin \theta$.

Diberi fungsi $f(x) = \cos \theta + \sqrt{2} \sin \theta$.

- a. Express $f(x)$ in the form of $R \sin(\theta + \alpha)$, where $R > 0$ and α is an acute angle. (4 marks)

Ungkapkan $f(x)$ dalam bentuk $R \sin(\theta + \alpha)$, yang mana $R > 0$ dan α ialah sudut tirus. (4 markah).

- b. Hence, solve the equation $\cos \theta + \sqrt{2} \sin \theta = \frac{\sqrt{3}}{2}$ for $0^\circ \leq \theta \leq 180^\circ$. (4 marks)

Maka, selesaikan persamaan $\cos \theta + \sqrt{2} \sin \theta = \frac{\sqrt{3}}{2}$ bagi $0^\circ \leq \theta \leq 180^\circ$. (4 markah)

6. a. Express $\frac{dy}{dx}$ for the implicit function $xy + \cos 2x = x^2y^2$. (5 marks)
Ungkapkan $\frac{dy}{dx}$ bagi fungsi tersirat $xy + \cos 2x = x^2y^2$. (5 markah)
- b. Then, compute the gradient of the curve at the point $\left(\frac{\pi}{4}, 0\right)$. (3 marks)
Kemudian, kira kecerunan lengkung tersebut pada titik $\left(\frac{\pi}{4}, 0\right)$. (3 markah)
7. A curve $y = f(x)$ has a stationary point at the point $(1, -9)$. It is given that $f'(x) = 3x^2 + px - 8$, where p is a constant.
Sebuah lengkung $y = f(x)$ mempunyai satu titik pegun $(1, -9)$. Diberikan bahawa $f'(x) = 3x^2 + px - 8$, yang mana p adalah pemalar.
- a. Find the value of p . (3 marks)
Cari nilai bagi p . (3 markah)
- b. Hence, give the x -coordinate of the other stationary point on the curve. (2 marks)
Seterusnya, berikan koordinat- x bagi titik pegun yang lain pada lengkung tersebut. (2 markah)
- c. Compute $f''(x)$ and determine the nature of each of the two stationary points on the curve $y = f(x)$. (3 marks)
Kira $f''(x)$ dan tentukan sifat masing-masing bagi kedua-dua titik pegun pada lengkung $y = f(x)$. (3 markah)
8. a. By using integration by parts, solve $\int (3x + 4) \sin\left(\frac{x}{5}\right) dx$. (7 marks)
Dengan menggunakan pengamiran bahagian demi bahagian, selesaikan $\int (3x + 4) \sin\left(\frac{x}{5}\right) dx$. (7 markah)
- b. Find the area of the region bounded by the curves $y = x^2 - 16$ and $y = -x^2 + 4x$, and the lines $x = -2$ and $x = 4$. (4 marks)
Cari luas kawasan yang dibatasi oleh lengkung $y = x^2 - 16$ dan $y = -x^2 + 4x$, dan garis $x = -2$ dan $x = 4$. (4 markah)

End of Question Paper
Kertas Soalan Tamat

LIST OF FORMULAE
SENARAI FORMULA

Indices

1. $a^m \times a^n = a^{m+n}$
2. $a^m \div a^n = a^{m-n}$
3. $(a^m)^n = a^{mn}$
4. $(ab)^m = a^m b^m$
5. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$
6. $a^0 = 1 (a \neq 0)$
7. $a^{-n} = \frac{1}{a^n}$
8. $a^{\frac{1}{n}} = \sqrt[n]{a}$
9. $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$

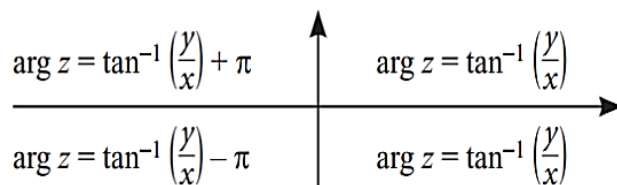
Logarithms

1. $N = a^x \Leftrightarrow \log_a N = x$
2. $\log_a a = 1$
3. $\log_a 1 = 0$
4. $a^{\log_a x} = x$
5. $\log_a MN = \log_a M + \log_a N$
6. $\log_a \frac{M}{N} = \log_a M - \log_a N$
7. $\log_a M = \frac{\log_b M}{\log_b a}$
8. $\log_a b = \frac{1}{\log_b a}$

Surds

1. $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$
2. $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$
3. $(\sqrt{a} - \sqrt{b})(\sqrt{a} + \sqrt{b}) = a - b$

Arguments



Matrices

1. Determinant of $A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$
2. Determinant of $A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} = a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13}$
3. Inverse of 2x2 matrix
$$A^{-1} = \frac{1}{|A|} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$$
4. Inverse of 3x3 matrix
$$A^{-1} = \frac{1}{|A|} \text{adj } A$$
5. Adjoint matrix,
$$\text{adj } A = \begin{pmatrix} C_{11} & C_{12} & C_{13} \\ C_{21} & C_{22} & C_{23} \\ C_{31} & C_{32} & C_{33} \end{pmatrix}^T = \begin{pmatrix} C_{11} & C_{21} & C_{31} \\ C_{12} & C_{22} & C_{32} \\ C_{13} & C_{23} & C_{33} \end{pmatrix}$$

Vectors

If $\mathbf{a} = a_1\mathbf{i} + a_2\mathbf{j} + a_3\mathbf{k}$ and $\mathbf{b} = b_1\mathbf{i} + b_2\mathbf{j} + b_3\mathbf{k}$ then

➤ $\mathbf{a} \cdot \mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3 = |\mathbf{a}||\mathbf{b}|\cos\theta$

➤ $\cos\theta = \frac{\mathbf{a} \cdot \mathbf{b}}{|\mathbf{a}||\mathbf{b}|}$

Algebra

For the quadratic equation $ax^2 + bx + c = 0$:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If $b^2 - 4ac > 0$, the equation has two real roots.

If $b^2 - 4ac = 0$, the equation has one real root.

If $b^2 - 4ac < 0$, the equation has no real roots.

Trigonometry

1. Trigonometric ratios

$$\tan \theta \equiv \frac{\sin \theta}{\cos \theta}, \quad \sec \theta = \frac{1}{\cos \theta}, \quad \operatorname{cosec} \theta = \frac{1}{\sin \theta}, \quad \cot \theta = \frac{1}{\tan \theta}$$

2. Special angles

$$\begin{array}{lll} \sin 30^\circ = \frac{1}{2} & \sin 45^\circ = \frac{1}{\sqrt{2}} & \sin 60^\circ = \frac{\sqrt{3}}{2} \\ \cos 30^\circ = \frac{\sqrt{3}}{2} & \cos 45^\circ = \frac{1}{\sqrt{2}} & \cos 60^\circ = \frac{1}{2} \\ \tan 30^\circ = \frac{1}{\sqrt{3}} & \tan 45^\circ = 1 & \tan 60^\circ = \sqrt{3} \end{array}$$

3. Identities

$$\cos^2 \theta + \sin^2 \theta \equiv 1, \quad 1 + \tan^2 \theta \equiv \sec^2 \theta, \quad \cot^2 \theta + 1 \equiv \operatorname{cosec}^2 \theta$$

$$\sin(A+B) \equiv \sin A \cos B + \cos A \sin B$$

$$\sin(A-B) \equiv \sin A \cos B - \cos A \sin B$$

$$\cos(A+B) \equiv \cos A \cos B - \sin A \sin B$$

$$\cos(A-B) \equiv \cos A \cos B + \sin A \sin B$$

$$\tan(A+B) \equiv \frac{\tan A + \tan B}{1 - \tan A \tan B}, \quad \tan(A-B) \equiv \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

$$\sin 2A \equiv 2 \sin A \cos A$$

$$\cos 2A \equiv \cos^2 A - \sin^2 A \equiv 2 \cos^2 A - 1 \equiv 1 - 2 \sin^2 A$$

$$\tan 2A \equiv \frac{2 \tan A}{1 - \tan^2 A}, \quad \sin^2 A = \frac{1}{2}(1 - \cos 2A), \quad \cos^2 A = \frac{1}{2}(1 + \cos 2A)$$

$$a \sin \theta + b \cos \theta = r \sin(\theta + \alpha)$$

$$a \sin \theta - b \cos \theta = r \sin(\theta - \alpha)$$

$$a \cos \theta + b \sin \theta = r \cos(\theta - \alpha)$$

$$a \cos \theta - b \sin \theta = r \cos(\theta + \alpha)$$

$$\text{where } r = \sqrt{a^2 + b^2}, \quad \cos \alpha = \frac{a}{r}, \quad \sin \alpha = \frac{b}{r}$$

4. Principal values:

$$-\frac{1}{2}\pi \leq \sin^{-1} x \leq \frac{1}{2}\pi,$$

$$0 \leq \cos^{-1} x \leq \pi,$$

$$-\frac{1}{2}\pi < \tan^{-1} x < \frac{1}{2}\pi,$$

Differentiation

$y = f(x)$	$\frac{dy}{dx}$
x^n	nx^{n-1}
$\ln x$	$\frac{1}{x}$
e^x	e^x
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$

$y = f(x)$	$\frac{dy}{dx}$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\tan^{-1} x$	$\frac{1}{1+x^2}$

If $x = f(u)$ and $y = g(u)$ then $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$

Product Rule: $\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$

Quotient Rule: $\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$

Integration

(Arbitrary constants are omitted; a denotes a positive constant.)

$y = f(x)$	$\int f(x)dx$
x^n	$\frac{x^{n+1}}{n+1}, (n \neq -1)$
$\frac{1}{x}$	$\ln x $
e^x	e^x
e^{ax+b}	$\frac{1}{a}e^{ax+b}$
$\sin(ax+b)$	$-\frac{1}{a}\cos(ax+b)$
$\cos(ax+b)$	$\frac{1}{a}\sin(ax+b)$

$y = f(x)$	$\int f(x)dx$
$\sec^2(ax+b)$	$\frac{1}{a}\tan(ax+b)$
$\frac{1}{x^2+a^2}$	$\frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right)$
$\frac{1}{x^2-a^2}$	$\frac{1}{2a}\ln\left \frac{x-a}{x+a}\right $ ($x > a$)
$\frac{1}{a^2-x^2}$	$\frac{1}{2a}\ln\left \frac{x+a}{x-a}\right $ ($ x < a$)

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$$

$$\int \frac{f^{-1}(x)}{f(x)} dx = \ln |f(x)| + c$$

$$\int \frac{1}{x^2+k^2} dx = \frac{1}{k} \tan^{-1}\left(\frac{x}{k}\right) + c \quad \text{and} \quad \int \frac{k}{x^2+k^2} dx = \tan^{-1}\left(\frac{x}{k}\right) + c$$

➤ Area,

On the x-axis: $A = \int_a^b y dx$

On the y-axis: $A = \int_a^b x dy$

➤ Volume of revolution

About the x-axis: $V = \int_a^b \pi y^2 dx$

About the y-axis: $V = \int_a^b \pi x^2 dy$