UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: FGE 1113
COURSE	: MATHEMATICS I
SEMESTER/SESSION	: 1 – 2023/2024 (JULY INTAKE)
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **FIVE** (**5**) questions in SECTION A, **THREE (3)** questions in SECTION B and **TWO (2)** questions in SECTION C. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

SECTION A (50 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

a) Simplify the following expressions.

i. $\sqrt{6}\sqrt{2}+\sqrt{8}$ (2 marks)

ii. $\dfrac{\left(3x^2y^3z\right)^4}{27x^3yz^2}$ (3 marks)

b) Solve the following inequalities.

i. $|3-5x|\geq 8$ (3 marks)

ii. $x+3\leq 8x-11\leq 2-5x$ (3 marks)

c) Solve $\left(\dfrac{1}{27}\right)^{4-x}=9^{2x}$. (3 marks)

QUESTION 2

a) If $(x-4)$ is a factor of $f(x)=x^4-x^3-12x^2+kx+8$, find the value of k.

(3 marks)

b) Find the quotient when $P(x)=5x^3-9x^2+24x-5$ is divided by $(5x-4)$ using long division method. (6 marks)

QUESTION 3

a) Given $A=\begin{pmatrix}13 & 5\\ -1 & -2\end{pmatrix}$, $B=\begin{pmatrix}2 & 5\\ 1 & 2\end{pmatrix}$ and $C=\begin{pmatrix}0 & 7\\ 3 & 0\end{pmatrix}$. Find:

i. $A-2B$ (2 marks)

ii. BC (3 marks)

b) Solve the following simultaneous equation using Cramer's rule.

$$\begin{aligned}2x-3y&=7\\ -x+6y&=10\end{aligned}$$ (5 marks)

QUESTION 4

Given that $\log_b 2=0.631$ and $\log_b 5=1.465$, find the following:

a) $\log_b \sqrt{10}$ (3 marks)

b) $\log_b\left(\frac{2}{25}\right)$ (3 marks)

QUESTION 5

a) Solve the following trigonometric equation for $0°\le\theta\le 360°$.

i. $2\tan\theta=1.44$ (3 marks)

ii. $\sin\theta=-\frac{\sqrt{3}}{2}$ (3 marks)

b) Given the geometric progression $-1, \frac{1}{2}, -\frac{1}{4}, \ldots$, find the 10^{th} term and calculate the sum of the first 8^{th} terms. (5 marks)

SECTION B (30 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

a) Express $\dfrac{7x+5}{(x+2)(x^2+2x+1)}$ as a partial fraction. (7 marks)

b) Solve the following logarithmic equation.

$$\log_3(x+25)+\log_3(x-1)=3$$ (6 marks)

QUESTION 2

Given two complex numbers, $z_1=3+4i$ and $z_2=5-12i$.

a) Find z_1z_2 and express in the form $a+bi$. (3 marks)

b) Express z_1z_2 in polar form. (5 marks)

QUESTION 3

Given two vectors, $\vec{u}=7\mathbf{i}-8\mathbf{j}$ and $\vec{v}=17\mathbf{i}+144\mathbf{j}$. Find:

a) the unit vector of $\vec{u}-2\vec{v}$ (4 marks)

b) the angle between $\vec{u}$ and $\vec{v}$. (5 marks)

SECTION C (20 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

a) A vendor sold 28 slices of vanilla cakes and 24 slices of chocolate cakes on the first day. On the second day, the vendor sold 16 slices of vanilla cakes and 12 slices chocolate cakes. The income on the first day and the second day is RM194 and RM104 respectively. Using matrix method, find the price, in RM, of a slice of vanilla cake and a slice of chocolate cake.

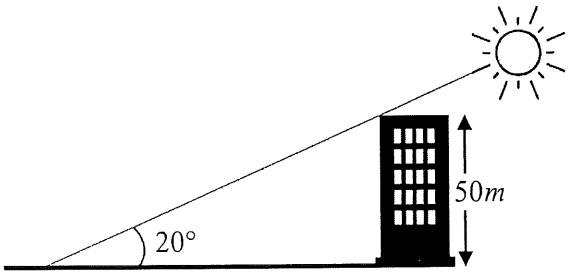
(6 marks)

b) A theater has 60 seats in the first row, 68 seats in the second row, 76 seats in third row, and so on, in the same increasing pattern. If the theater has 20 rows of seats, find the total number of seats in the theater.

(5 marks)

QUESTION 2

a) The following figure shows the sun is $20°$ above the horizon. Calculate the length of the shadow cast by a building 50 meter high.



(3 marks)

b) Calculate the area of a triangle *ABC* where $a = 512.3cm$, $B = 52.25°$ and $C = 63.76°$.

(6 marks)

---------- **END OF QUESTION** ----------

FORMULA

Rules of Indices

$a^m \times a^n = a^{m+n}$

$\frac{a^m}{a^n} = a^{m-n}$

$\left(a^m\right)^n = a^{mn}$

$\sqrt[n]{a^m} = a^{\frac{m}{n}}$

Rules of Surds

$a\sqrt{b} \pm c\sqrt{b} = (a \pm b)\sqrt{b}$

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$

$\sqrt{a} \times \sqrt{a} = a$

$\left(\sqrt{a} + \sqrt{b}\right)\left(\sqrt{a} - \sqrt{b}\right) = a - b$

Laws of Logarithms

$\log(a \times b) = \log a + \log b$

$\log\left(\frac{a}{b}\right) = \log a - \log b$

$\log\left(a^b\right) = b \log a$

$\log_a a = 1$

$\log_a c = \frac{\log_b c}{\log_b a}$

Absolute Inequalities

If $|x| < a$, then $-a < x < a$

If $|x| > a$, then $x > a$ or $x < -a$

Complex Number

$|z| = r = \sqrt{a^2 + b^2}$

$Arg(z) = \theta = \tan^{-1}\left|\frac{b}{a}\right|$

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

Matrix

$\det(A) = |A| = ad - bc$

$A^{-1} = \frac{1}{|A|}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$

Polynomial

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

$f(x) = d(x)q(x) + r(x)$

Trigonometry

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

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc\cos A$

$b^2 = a^2 + c^2 - 2ac\cos B$

$c^2 = a^2 + b^2 - 2ab\cos C$

$Area = \frac{1}{2}ab\sin C = \frac{1}{2}ac\sin B = \frac{1}{2}bc\sin A$

Vector

$|\vec{u}| = \sqrt{a^2 + b^2}$

$u = \frac{\vec{a}}{|\vec{a}|}$

$\vec{u} \cdot \vec{v} = u_1 v_1 + u_2 v_2$

$\theta = \cos^{-1}\left(\frac{\vec{u} \cdot \vec{v}}{|\vec{u}||\vec{v}|}\right)$

Sequence and Series

$T_n = a + (n-1)d$, $T_n = ar^{n-1}$

$S_n = \frac{n}{2}(a + l)$, $S_n = \frac{a(1 - r^n)}{1 - r}$

$S_n = \frac{n}{2}\left[2a + (n-1)d\right]$