UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	MATHEMATICS 1
COURSE CODE	:	BBP 10603
PROGRAMME CODE	:	BBA / BBB / BBD / BBE / BBF / BBG
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.** 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) State whether the following statement is **TRUE** or **FALSE**.

(i) $\frac{\pi}{2}$ is a rational number (1 mark)

(ii) -3 + [- (-3)] = 0 is inverse of property of addition (1 mark)

(b) Simplify the following expressions:

(i) $\frac{1+5i}{-i}$ (2 marks)

(ii) $(5mn^2p)\left(\frac{2m^2n}{p^3}\right)^{-2}$ (2 marks)

(c) Solve the following expressions:

(i) $2\log 5 + \log 70 + \log\frac{45}{35} - \log\frac{45}{2}$ (3 marks)

(ii) $\frac{3\sqrt{40y}}{\sqrt{2y}}$ (2 marks)

(d) Given $z = 1 + i$

(i) Express $\frac{1}{z}+2z$ in the form $x + yi$ where x and y are real numbers (3 marks)

(ii) Find the modulus and argument of z (3 marks)

(iii) State the complex number in polar form (1 mark)

(iv) Sketch the complex number on an argand diagram. (2 marks)

Q2 (a) Solve $x^2 + 4x - 7 = 0$ by using completing the square method. Determine your answer in 3 decimal points (4 marks)

(b) Given a quadratic inequality $21 \geq 10y - y^2$

(i) Solve the above quadratic inequality (5 marks)

(ii) Then, sketch the graph of $f(y) = y^2 - 10y + 21$ (2 marks)

(c) A piece of wire is bent to form a rectangle with its length is 3 cm longer than the width. If the area of rectangle formed is 54 cm^2, evaluate the total length of the wire. (4 marks)

(d) Express the following fraction in partial fractions.

$$\frac{x}{(x+3)(x-2)}, x \neq -3, x \neq 2$$

(5 marks)

Q3 (a) Given matrices $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 \\ -1 & 2 \end{bmatrix}$, $C = \begin{bmatrix} 2 & 3 \\ -1 & 0 \end{bmatrix}$ and $D = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$.

(i) Verify A + D and justify. (1 mark)

(ii) Identify whether A (B – C) = AB – AC. (3 marks)

(b) Find the inverse matrix of $A = \begin{bmatrix} 3 & 1 \\ 4 & 2 \end{bmatrix}$

(3 marks)

(c) Three types of trawlers, A, B and C were used to catch three types of fish which are small, medium, and large. The capacity of each type pf trawler and the total weight of fish caught for each types on a certain day are shown in the table below.

Type of trawlers / Type of fish	A	B	C	Total weight of fish
Small	1	1	1	12
Medium	0	1	2	10
Large	2	1	1	16

Table Q3 (c)

(i) By using A, B and C to represent variables, write a system of linear equations to represent the given information in **Table Q3 (c)**

(3 marks)

(ii) Based on your answer in Q3(c)(i), examine the determinant, the cofactor, and the transpose of matrix.

(7 marks)

(iii) Hence, find the values of A, B and C.

(3 marks)

Q4 (a) Proof the following identities:

(i) $\cos\theta \tan\theta = \sin\theta$ (2 marks)

(ii) $\dfrac{1-\sin\alpha}{\cos\alpha} = \dfrac{\cos\alpha}{1+\sin\alpha}$ (4 marks)

(b) Given that $\sin\theta = \frac{3}{5}$, Calculate the values of

(i) $\tan\theta$ (2 marks)

(ii) $\text{cosec}\,\theta$ (2 marks)

(c) Given $\cos A = \frac{\sqrt{3}}{2}$. Find the value of $\cos 2A$. (4 marks)

(d) Solve $5\tan x - \cot 2x + 5 = 0$ for $0^{\circ} \leq x \leq 360^{\circ}$ (6 marks)

Q5 (a) Given $p = i - 2j + k$ and $q = i + 3k$, compute

(i) $p \cdot q$ (2 marks)

(ii) the angle between p and q (3 marks)

(b) Determine the vector normal to the plane containing vector $a = i - 2j + k$ and $b = -2i + 3j + 2k$. (3 marks)

(c) Given the vectors $a = i + 2j + 3k$, $b = i + j + 2k$ and $c = 2i - 4k$ verify that $a \times (b \times c) = (a \,.\, c)b - (a \,.\, b)c$ (9 marks)

(d) Determine a unit vector parallel to $\vec{a} = 2i + 2j + k$ (3 marks)

– END OF QUESTIONS –

FINAL EXAMINATION FORMULA

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Quadratic equation:

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

Trigonometry:

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

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

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

$$\sin 2\alpha = 2\sin\alpha\cos\alpha$$

$$\cos 2\alpha = \cos^2\alpha - \sin^2\alpha$$

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

$$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$$

$$\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$$

$$\tan(\alpha \pm \beta) = \frac{\tan\alpha \pm \tan\beta}{1 \mp \tan\alpha\tan\beta}$$

$$\tan 2\alpha = \frac{2\tan\alpha}{1 - \tan^2\alpha} \quad AA^{-1} = A^{-1}A = I$$

Solution of Systems of linear:

$$A_{ij} = (-1)^{i+j} M_{ij}$$

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

$$x_1 = \frac{|D_{x_1}|}{|D|},\ x_2 = \frac{|D_{x_2}|}{|D|},\ x_3 = \frac{|D_{x_3}|}{|D|}$$

Complex Numbers:

$$i^2 = -1$$

$$z = re^{i(\theta - 2k\pi)}$$

$$e^{i\theta} = \cos\theta + i\sin\theta$$

Vectors:

$$|v| = \sqrt{v_1^2 + v_2^2 + v_3^2}$$

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

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