UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

MARCH 2025 SEMESTER SESSION

SUBJECT CODE	:	**LGB13503**
SUBJECT TITLE	:	**ENGINEERING MATHEMATICS 1**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BET IN (OFFSHORE) WITH HONOURS** **BET IN (NAVAL ARCHITECTURE AND SHIPBUILDING) WITH HONOURS**
TIME / DURATION	:	**09.00 AM - 12.00 PM (3 HOURS)**
DATE	:	**1 JULY 2025**

INSTRUCTIONS TO CANDIDATES

1. Please read **CAREFULLY** the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of **TWO (2)** section; Section A and Section B.
4. Answer **ALL** question Section A, and **THREE (3)** questions **ONLY** in Section B.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Answer should be written in blue or black ink except for sketching, graphic and illustration.
8. Formula is appended for your reference.

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE

PART A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

With reference to Calculations with Complex Numbers;

(a) Given $z = 1 + 2i$, express $\frac{z^2}{3-z}$ in the standard form $a + bi$.

(5 marks)

(b) Let $Z = 3 + 6i$ and $W = 5 - 3i$, sketch Z and W as two vectors on the same Argand Diagram.

(3 marks)

(c) Solve for x and y from the following complex equation:

$$(x - i2y) - (y - ix) = 2 + i.$$

(5 marks)

(d) Given $z = -3 + 4i$, then:

i. express z in polar form.

(3 marks)

ii. hence, determine z^4, give the answer in polar form.

(4 marks)

Question 2

With reference to Calculations with Quadratic, Simultaneous and Polynomial;

(a) A rectangular field is 15 meters longer than it is wide. The area of the field is 800-meter square. Find the length of the field. Give your answer to 1 decimal place.

(7 marks)

(b) A fruit vendor sells two types of fruits, which are apples and bananas. Each apple costs RM 2.50 and each banana costs RM 3.00. The total sales of apples and bananas were RM 0.75 less than three times the number of bananas sold. On the same day, the vendor also had a special promotion where apples were sold for Rm 1.60 each and bananas for Rm 1.20 each. Under the promotion, the vendor earned a total revenue of Rm 1.08. Determine apples and bananas did the vendor sell that day.

(8 marks)

(c) Given $P(x) = -2x^3 - 12x^2 - 16x$ and $P(x) = x + 4$. Divide $P(x)$

Find the quotient $Q(x)$, and the remainder $R(x)$, when $P(x)$ is divided by $x + 4$

(5 marks)

PART B (Total: 60 marks)

INSTRUCTION: Answer THREE questions.

Please use the answer booklet provided.

Question 3

With reference to Calculations with Hyperbolic and Trigonometry Functions;

(a) Show that $\cosh^2 x - \sinh^2 x = 1$

(5 marks)

(b) Solve the equation $2\sin^2\theta = \cos\theta + 2$ for $0° \leq \theta \leq 360°$

(7 marks)

(c) Prove that $\cot^2 x - \cot^2 x \cos^2 x = \cos^2 x$

(4 marks)

(d) Verify the $\tan^2 x + 1 = \sec^2 x$ by using Pythagorean Identity

(4 marks)

Question 4

With reference to Calculations with Arithmetic and Geometric Series.

(a) Find the sixth term of $\left(3a + \frac{b}{3}\right)^{13}$.

(6 marks)

(b) Find the value of *X* and *Y* from the following sequence:

$-3, 1, -\frac{1}{3}, \frac{1}{9}, \_\_\_\_, X, \_\_\_\_, Y\ldots$

(7 marks)

(c) Calculate the sum of all numbers between 1 and 255. The numbers are selected only for which are divisible by five.

(7 marks)

Question 5

With reference to Calculations with Logarithms and Indices;

(a) Solved the equation $\log_2 (x+3) + \log_2 (2-x) = \log_2 2^2 + \log_2 x$

(5 marks)

(b) Solve each of the following:

i. $3e^{2x} - 10e^x + 3 = 0$

(5 marks)

ii. $\log_3 x + \log_3 x = \log_3 3x$

(5 marks)

(c) Solve the equation $8^{x+5} = \frac{1}{\sqrt{4^{x-3}}}$. Show the answer in the base of 2.

(5 marks)

Question 6

With reference to Calculations with Linear Equation and Mensuration;

(a) Referring to Figure 1, the area of triangle Y is three times that of triangle X.

I. Calculate the area of triangle X.

II. Calculate the area of triangle Y.

III. Calculate the height of triangle Y.

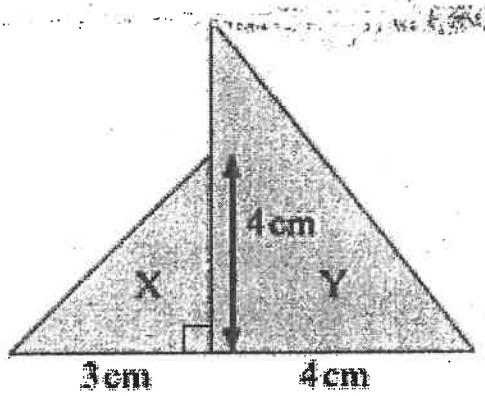

Figure 1

(7 marks)

(b) Given the information, solve each triangle ABC, $\angle A = 42^{o}$, $\angle B = 34^{o}$, b = 15mm.

(6 marks)

(c) In triangle base on Figure 2 below, find the length of PQ and PR

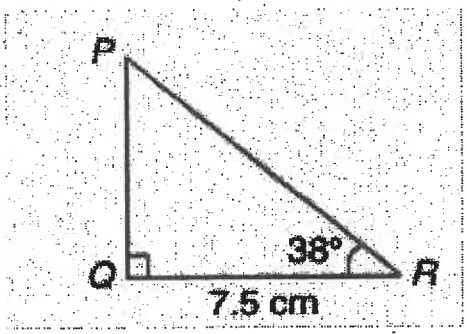

Figure 2

(7 marks)

END OF EXAMINATION PAPER

ENGINEERING MATHEMATICS 1

QUADRATIC FORMULA

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

COMPLEX FORMULA

De Moivre's Theorem $Z^n = r^n(\cos nx + i \sin nx)$

VOLUME AND SURFACE AREA

Volume	Surface area
Prism $v = l \times b \times h$ $l = length,\ b = base,\ h = height$	**Prism** $Surface\ area = 2(bh + hl + lb)$
Cylinder $v = \pi r^2 h$ $r = radius,\ h = height$	**Cylinder** $Surface\ area = 2\pi rh$
Sphere $v = \frac{4}{3}\pi r^3$	**Sphere** $Surface\ area = 4\pi r^2$
Cone $v = \frac{1}{3}\pi r^2 h$ $r = radius,\ h = height,\ l = length,$	**Cone** $Surface\ area = \pi rl + \pi r^2$

HYPERBOLIC FUNCTION

$\cosh x = \frac{e^x + e^{-x}}{2}$	$\sinh x = \frac{e^x - e^{-x}}{2}$	$\tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}}$

HYPERBOLIC IDENTITIES

$$cosh^2(x) - sinh^2(x) = 1$$

ADDITION AND SUBTRACTION FORMULAS

$$\sinh(A \pm B) = \sinh A \cosh B \pm \cosh A \sinh B$$
$$\cosh(A \pm B) = \cosh A \cosh B \pm \sinh A \sinh B$$

DOUBLE-ANGLE FORMULAS

$$\sinh(2x) = 2\sinh(x)\cosh(x)$$
$$\cosh(2x) = cosh^2(x) + sinh^2(x)$$
$$sinh^2(x) = \frac{\cosh 2x - 1}{2}$$
$$cosh^2(x) = \frac{\cosh 2x + 1}{2}$$

Pythagorean Identities		
$\sin^2\theta + \cos^2\theta = 1$	$1 + \cot^2\theta = \csc^2\theta$	$1 + \tan^2\theta = \sec^2\theta$

TRIGONOMETRIC FUNCTION

FUNDAMENTAL IDENTITIES	FORMULAS FOR NEGATIVES
$\csc\theta = \frac{1}{\sin\theta}$	$\sin(-\theta) = -\sin\theta$
$\sec\theta = \frac{1}{\cos\theta}$	$\cos(-\theta) = \cos\theta$
$\cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$	$\tan(-\theta) = -\tan\theta$
$\cos^2\theta = \frac{1}{2}(1+\cos 2\theta)$	$\csc(-\theta) = -\csc\theta$
$\sin^2\theta + \cos^2\theta = 1$	$\sec(-\theta) = \sec\theta$
$1+\tan^2\theta = \sec^2\theta$	$\cot(-\theta) = -\cot\theta$
$1+\cot^2\theta = \csc^2\theta$	$\sin^2\theta = \frac{1}{2}(1-\cos 2\theta)$

ADDITION FORMULAS	SUBTRACTION FORMULAS
$\sin(A+B) = \sin A\cos B + \cos A\sin B$	$\sin(A-B) = \sin A\cos B - \cos A\sin B$
$\cos(A+B) = \cos A\cos B - \sin A\sin B$	$\cos(A-B) = \cos A\cos B + \sin A\sin B$
$\tan(A+B) = \frac{\tan A + \tan B}{1-\tan A\tan B}$	$\tan(A-B) = \frac{\tan A - \tan B}{1+\tan A\tan B}$

HALF-ANGLE FORMULAS	DOUBLE-ANGLE FORMULAS
$\sin\frac{\theta}{2} = \pm\sqrt{\frac{1-\cos\theta}{2}}$	$\sin 2\theta = 2\sin\theta\cos\theta$
$\cos\frac{\theta}{2} = \pm\sqrt{\frac{1+\cos\theta}{2}}$	$\cos 2\theta = \cos^2\theta - \sin^2\theta$ $\ldots\ldots = 1-2\sin^2\theta$ $\ldots\ldots = 2\cos^2\theta - 1$
$\tan\frac{\theta}{2} = \frac{1-\cos\theta}{\sin\theta} = \frac{\sin\theta}{1+\cos\theta}$	$\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta}$

PRODUCT-TO-SUM FORMULAS	SUM-TO-PRODUCT FORMULAS
$\sin\alpha\cos\beta = \frac{1}{2}[\sin(\alpha+\beta)+\sin(\alpha-\beta)]$	$\sin\alpha+\sin\beta = 2\sin\frac{\alpha+\beta}{2}\cos\frac{\alpha-\beta}{2}$
$\cos\alpha\sin\beta = \frac{1}{2}[\sin(\alpha+\beta)-\sin(\alpha-\beta)]$	$\sin\alpha-\sin\beta = 2\cos\frac{\alpha+\beta}{2}\sin\frac{\alpha-\beta}{2}$
$\cos\alpha\cos\beta = \frac{1}{2}[\cos(\alpha+\beta)+\cos(\alpha-\beta)]$	$\cos\alpha+\cos\beta = 2\cos\frac{\alpha+\beta}{2}\cos\frac{\alpha-\beta}{2}$

EXPONENTIAL FUNCTION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}e^x = e^x$	$\frac{d}{dx}e^{f(x)} = f'(x)e^{f(x)}$

LOGARITHMIC FUNCTION

STANDARD FORM	GENERAL FORM
$\frac{d}{dx}\ln x = \frac{1}{x}$	$\frac{d}{dx}\ln f(x) = \frac{f'(x)}{f(x)}$