UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

JULY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LMB11703**
SUBJECT TITLE	:	**ENGINEERING MATHEMATICS 1**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF MARINE ENGINEERING TECHNOLOGY WITH HONOURS**
TIME / DURATION	:	**09.00 AM - 12.00 PM (3 HOURS)**
DATE	:	**20 DECEMBER 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)** parts; Part A and Part B.
4. Answer **ALL** questions in Part A and **THREE (3)** questions **ONLY** from Part 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 except for sketching, graphic and illustration.
8. Formulae sheet has been appended for your reference.

THERE ARE 6 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 Basic Numbers and Algebra Expression:

(a) Write these numbers in order, starting with the smallest.
Hint: ..... < ..... < ..... < ..... <.

$$\frac{6}{7} \qquad 8.6 \times 10^{-1} \qquad \frac{11}{13} \qquad 86.5\%$$

(2 marks)

(b) Express the result of the following operation as a single simplified fraction by manual calculation.

$$\frac{2}{5} - \frac{3}{4} + 4\frac{1}{3} \times 6\frac{3}{5}$$

(5 marks)

(c) In a mixture 60 litres, the ratio of milk and water 2 : 1. If this ratio is to be 1 : 2, show the quantity of water to be further added.

(5 marks)

(d) Write an algebraic expression for the following words problem:

i. The total surface area A, of an open rectangular box (without a top) with length l, width w and height h is calculated. This total surface area is then divided into three equal parts.

(3 marks)

ii. Using the total surface area A obtained in (i), express w as the new subject by considering the following equation:

$$\frac{C}{3} + c = -\sqrt{\left(\frac{B-A}{7}\right)}$$

(5 marks)

Question 2

With reference to Calculation with Linear Functions, Quadratic Function and Polynomial:

(a) Using the same graph paper,

i. draw the quadratic function, $f(x) = x^2 - 6x + 3$ and linear function, $g(x) = -2x + 3$.

(10 marks)

ii. from graph, determine the intersection point of $f(x)$ and $g(x)$.

(2 marks)

(b) The expression for the volume is given as $V1 = x^3 - 2x^2 - 9x + 18$.

i. Factorize $V1$ completely.

(6 marks)

ii. Given that $V2 = 5x^6 + 3x^5 - 4x^4 + 9x^2 - 4x + 6$, determine $V2 - V1$.

(2 marks)

PART B (Total: 60 marks)

INSTRUCTION: Answer THREE questions.
Please use the answer booklet provided.

Question 3

With reference to Calculations with Matrices:

Given the system of linear equations:

$$-5x + 6z - 3y = 9$$
$$2y + 4z - 5 = 5y$$
$$4y - 3x - 6z = 11$$

(a) Express the system into the matrix form.

(2 marks)

(b) Determine the determinants as follows:

i. D and D_x using diagonal multiplication.

(6 marks)

ii. D_y and D_z using cofactor expansion.

(6 marks)

(c) Hence, calculate the value of x, y and z.

(6 marks)

Question 4

With reference to Calculations with Trigonometry:

(a) Figure 1 below shows two triangles in one diagram.

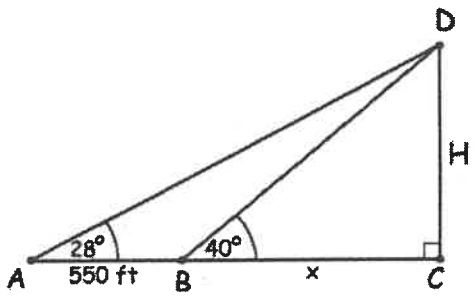

Figure 1

Calculate the:

i. value of H in ft.

(7 marks)

ii. area of *ABD*

(2 marks)

(b) The diagram in Figure 2 shows a triangular prism ABCDQP of length $7cm$. The cross section is the right triangle PAB with $PA = 4cm$, $AB = 5cm$ and angle $PAB = 90°$. Calculate the:

i. three main trigonometry functions of triangle PAB.

(5 marks)

ii. angle between the line PC and the base $ABCD$.

(6 marks)

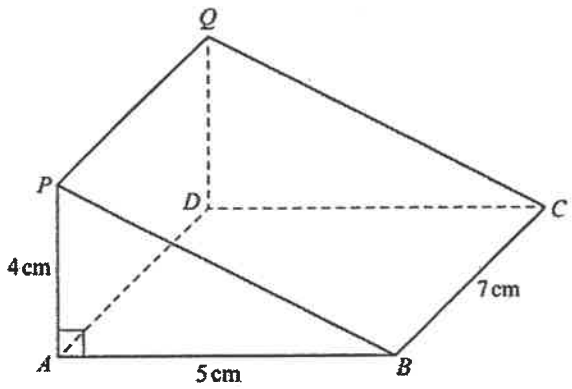

Figure 2

Question 5

With reference to Calculations with Mensuration:

(a) Figure 3 shows a cylinder containing water. There is a solid metal sphere touching the base of the cylinder. Half of the sphere is in the water. The radius of the cylinder is $12\ cm$ and the radius of the sphere is $3cm$. When the sphere is completely removed from the cylinder, the level of the water drops by $h\ cm$. Determine the value of h.

(8 marks)

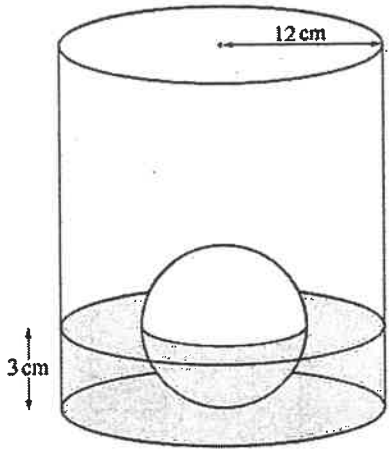

Figure 3

(b) Figure 4 shows a square *ABCD* with each side measuring $32\ cm$. *AEDF* is a semicircle with *E* as the midpoint of *AD*. Calculate the total shaded area of the figures.

(12 marks)

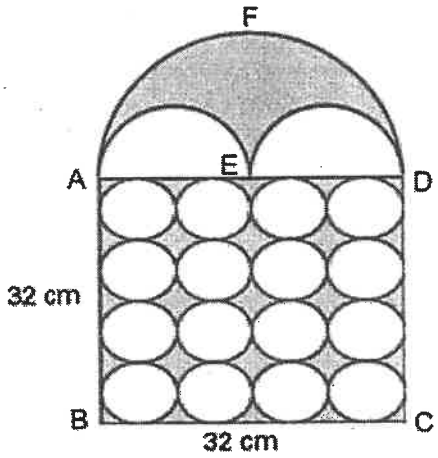

Figure 4

Question 6

With reference to Calculations with Mensuration and Trigonometry:

(a) An airplane pilot is following the direction of the highway at an altitude of 3000ft. The pilot sees two trucks on the highway ahead. The angle of depression to the farther truck is 20 degrees and the angle of depression to the closer truck is 35 degrees. Determine the distance between the trucks.

(10 marks)

(b) Find the total surface area of the open shape shown in Figure 5 below.

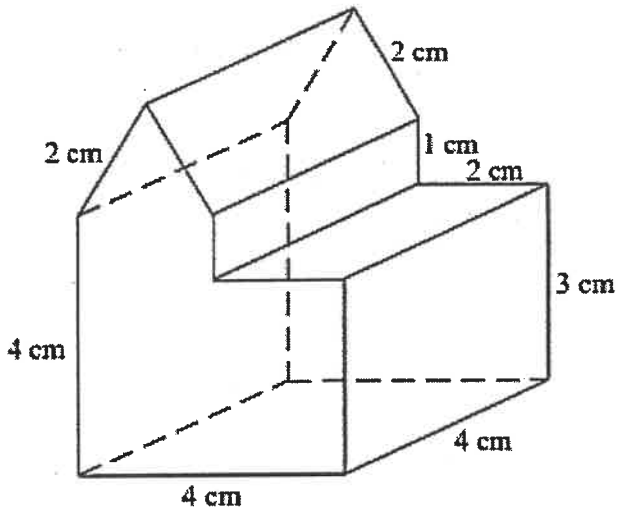

Figure 5

(10 marks)

END OF EXAMINATION PAPER

FORMULA SHEET

TRIGONOMETRY IDENTITIES

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

GEOMETRY AND MENSURATION

AREA	GENERAL FORM
TRAPEZIUM	$A = \frac{1}{2}(b_2 + b_1)h$
TRIANGLE	$A = \frac{1}{2}\, b\, h$
CIRCLE	$A = \pi r^2$
PARALLEOGRAM	$A = b\, h$

VOLUME	GENERAL FORM
CYLINDER	$V = \pi r^2 h$
PRISM	$V = A\, h$
SPHERE	$V = \frac{4}{3}\pi r^3$
CONE	$V = \frac{1}{3}\pi r^2 h$