UNIVERSITI KUALA LUMPUR
MATHEMATICS CENTRAL COMMITTEE

FINAL EXAMINATION
MARCH 2025 SEMESTER

COURSE CODE	:	**WQD10103**
COURSE NAME	:	**TECHNICAL MATHEMATICS 1**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DET IN NAVAL ARCHITECTURE SHIPBUILDING & DET IN SHIP CONSTRUCTION AND MAINTANENCE**
DATE	:	**24 JUNE 2025**
TIME	:	**09:00 AM – 11:30 AM**
DURATION	:	**2 HOURS AND 30 MINUTES**

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read 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) sections.

4. Answer ALL questions in Section A and TWO (2) questions in Section B.

5. Please write your answers on the answer booklet provided.

6. Answer all questions in English language ONLY.

7. Formula sheet is appended for your reference.

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THESE COVER PAGES.

SECTION A (Total: 60 marks)

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

Question 1

(a)   Solve the equation $2x - 3 = 13$.

(2 marks)

(b)   Solve the following quadratic equations:

   i. $x^2 - 5x = -6$.

(3 marks)

   ii. $(x + 3)(x - 5) = 20$.

(5 marks)

Question 2

(a)   Simplify the following expression:

   i. $\dfrac{x^3 x^4}{x^2}$.

(2 marks)

   ii. $\left(a^3\right)^4$.

(2 marks)

   iii. $\log_b b^3$.

(2 marks)

(b)   Convert the equation $2^x = 16$ to its logarithmic form. Without using calculator, determine the value of x.

(4 marks)

Question 3

(a)   A rectangle in Figure 1 has a length of 10 units and width of 6 units. Calculate the perimeter of the rectangle.
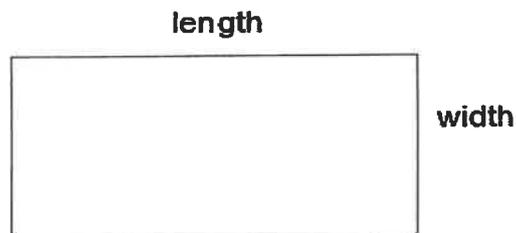
length

width

Figure 1

(2 marks)

(b)   A triangle in Figure 2 has a base of 24 cm and a side length of 13 cm. Calculate the area of the triangle.
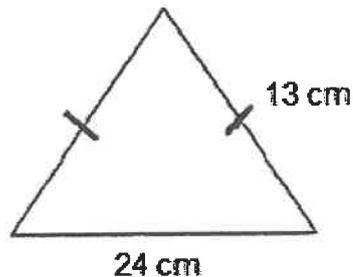
13 cm

24 cm

Figure 2

(3 marks)

(c)   A circular garden has an area of $50\,m^2$. If the radius of the new garden is doubled, determine the area of the new garden.

(5 marks)

Question 4

(a) In triangle $\triangle ABC$, angle B measures $30°$, angle C measures $45°$ and the length of side b is 10 units. Using the law of sines, determine the length of side c.

(4 marks)

(b) In a right triangle, the length of the hypotenuse is 10 cm and the angle opposite one of the sides is $45°$. Calculate the length of the side opposite this angle.

(3 marks)

(c) Figure 3 shows a ladder is leaning against a vertical wall. The bottom of the ladder is 3 meters away from the base of the wall, and the ladder makes an angle of $60°$ with the ground. Calculate the length of the ladder.
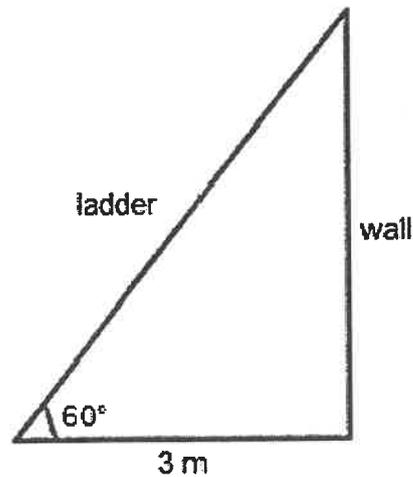

ladder   wall

$60°$

3 m

Figure 3

(3 marks)

Question 5

(a)   Plot the complex number $z = 3 + 4i$, on an Argand diagram.

(2 marks)

(b)   Given the complex numbers $a = 2 - 3i$ and $b = 1 + 5i$. Calculate $a + b$.

(3 marks)

(c)   The complex number w is represented by the point $(-2, 3)$ on an Argand diagram. Determine the modulus and the argument of w.

(5 marks)

Question 6

(a)   A complex number z has a modulus of 5 and an argument of $60°$. Express z in a polar, trigonometry and rectangular form.

(5 marks)

(b)   Given the complex numbers $p = 2 + 3i$ and $q = 1 - i$. Calculate $\overline{p \times q}$.

(5 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 1

(a)   A lighthouse is situated on top of a cliff that is 40 meters high as shows in Figure 4. From a point on the beach, the angle of elevation to the top of the lighthouse is $32°$, and the angle of elevation to the top of the cliff is $28°$.
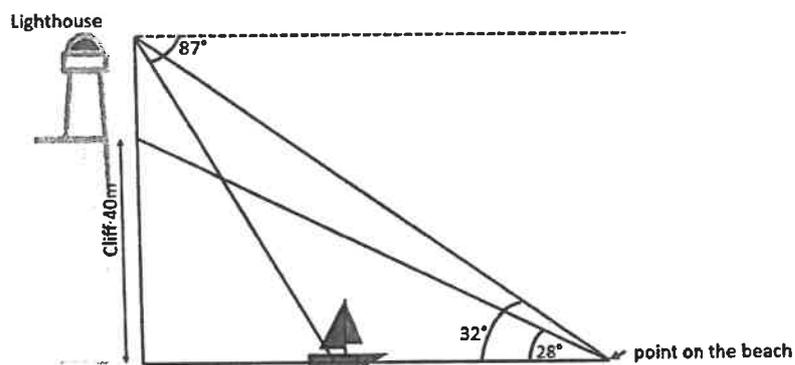

Figure 4

    i.   Calculate the distance from the point on the beach to the base of the cliff.

(2 marks)

    ii.   Calculate the height of the lighthouse above the cliff.

(5 marks)

    iii.   Determine the distance, L of the ship from the base of the cliff given a ship is approaching the lighthouse and sees its light at an angle of depression of $87°$ from the top of the lighthouse.

(3 marks)

(b)   Given a complex number $z = 3 + 4i$.

    i.   Calculate the modulus and argument of z.

(4 marks)

    ii.   Express z in a trigonometry, polar and exponential form.

(6 marks)

Question 2

(a) A surveyor needs to measure the width of a river. She sets up her equipment on one bank (point A) and observes a tree on the opposite bank (point B). She then walks 50 meters downstream to point C, which forms a right angle with AB. From point C, the angle between CA and CB is measured to be $35°$.

    i. Draw a diagram to illustrate this scenario, labeling all known angles and lengths.

        (2 marks)

    ii. Calculate the width of the river (length of AB) to the nearest meter.

        (4 marks)

    iii. Calculate the distance from point C to the tree (length of CB) to the nearest meter.

        (4 marks)

(b) Given the complex numbers $x = 3 + 2i$ and $y = 1 - 4i$.

    i. Determine $\bar{x}$ and $\bar{y}$.

        (2 marks)

    ii. Calculate $\overline{x - y}$.

        (4 marks)

    iii. Calculate $y \times x$.

        (4 marks)

Question 3

(a) An architect is designing a house with a slanted roof. The roof forms a right triangle with the following measurements:

- The horizontal distance from the edge of the roof to the centre ridge is 6 meters.
- The angle of elevation of the roof is $40°$.

    i.   Draw a diagram of the roof, labeling all known measurements.

(2 marks)

    ii.   Calculate the length of the slanted side of the roof to the nearest meter.

(4 marks)

    iii.   Calculate the height of the roof at its peak to the nearest meter.

(4 marks)

(b) Given the complex number $s = -3 - 4i$ and $t = 1 - 2i$.

    i.   Determine $u = \dfrac{s}{t}$.

(6 marks)

    ii.   Express u in a trigonometry form.

(4 marks)

END OF EXAMINATION PAPER

FORMULA SHEET

ALGEBRA

QUADRATIC FORMULA
$$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

TRIGONOMETRY 1

Area of Triangle $= \dfrac{1}{2}bh$	
Area of Trapezoidal $= \dfrac{1}{2}h(a+b)$	
θ in radian	
Arc of length, $S = r\theta$	Area of sector, $A = \dfrac{1}{2}r^2\theta$

LAW OF SINE	LAW OF COSINE
$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$	$a^2 = b^2 + c^2 - 2bc\cos A$
	$b^2 = a^2 + c^2 - 2ac\cos B$
	$c^2 = a^2 + b^2 - 2ab\cos C$

COMPLEX NUMBER

$$r = \sqrt{a^2 + b^2}$$	
$$\theta = \tan^{-1}\left|\dfrac{b}{a}\right|$$	
ALGEBRAIC FORM	$Z = a + bi$
TRIGONOMETRIC FORM	$Z = r(\cos\theta + i\sin\theta)$
POLAR FORM	$Z = r\angle\theta$
EXPONENTIAL FORM	$Z = re^{i\theta}$, θ in radian
DE MOIVRE'S THEOREM	$Z^n = r^n(\cos n\theta + i\sin n\theta)$ $Z^n = r^n\angle n\theta$ $Z^n = r^n e^{in\theta}$