UNIVERSITI KUALA LUMPUR

FINAL EXAMINATION
JULY 2023 SEMESTER

COURSE CODE	: WQD10103
COURSE NAME	: TECHNICAL MATHEMATICS 1
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: DIPLOMA OF ENGINEERING TECHNOLOGY
DATE	: 25 SEPTEMBER 2023
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.

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) Determine the value of the following trigonometric function by using the coterminal angle concept.

i. $\sin 875^\circ$.

(2 marks)

ii. $\cos\left(-1250^\circ\right)$.

(2 marks)

(b) Given point $W\left(-5, 12\right)$ is on the terminal side of θ which is a positive angle less than 360° in standard position. Determine the values of $\sin\theta$, $\cos\theta$, $\tan\theta$, $\csc\theta$, $\sec\theta$ and $\cot\theta$ of angle θ.

(6 marks)

Question 2

(a) Calculate the area of a circle if its circumference is 44 m.

(4 marks)

(b) Figure 1 shows a sector of a circle. Given the area of the sector is $8\ cm^2$.

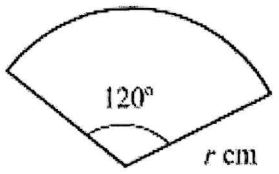

Figure 1

Calculate:

i. θ in radian

(1 mark)

ii. the arc of length of the sector, S.

(5 marks)

Question 3

(a) The shape *ABCD* is made from a rectangle *ANCD* and the right-angled triangle *NBC* as shown in Figure 2. Given the area of rectangle *ANCD* is 36 cm^2. Calculate the perimeter of shape *ABCD*.

(4 marks)

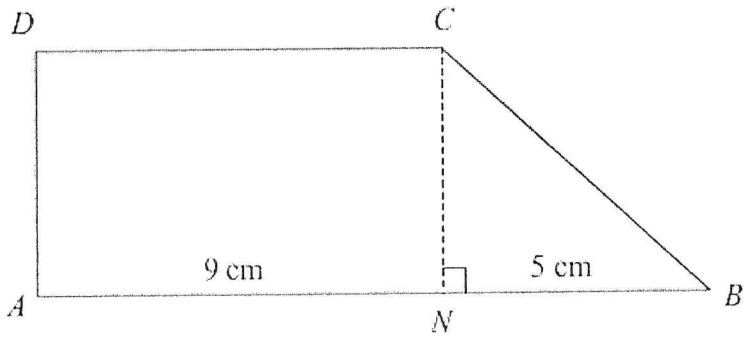

Figure 2

(b) Figure 3 shows the plan of a field *ABCDE*. Calculate the area of the field.

(6 marks)

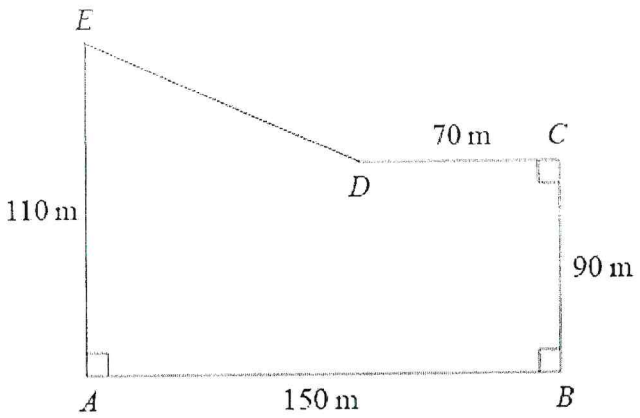

Figure 3

Question 4

Given $A = -3 + 8i$ and $B = 4 - 7i$. Determine:

(a) $\overline{A} - B$

(3 marks)

(b) $\overline{AB}$

(3 marks)

(c) $\dfrac{A}{\overline{B}}$

(4 marks)

Question 5

(a) Simplify each of the following expressions by using powers of i.

i. $2 - i^{17}$

(3 marks)

ii. $\left(\sqrt{-25}\right)^2 + i^{10}$

(3 marks)

(b) Determine the value of x and y for the following equation,

$$(2x + y) + (-x - y)i = 1 - 5i$$

(4 marks)

Question 6

Given $Z_1 = 4\left(\cos 120^\circ + i \sin 120^\circ\right)$ and $Z_2 = 28\left(\cos 285^\circ + i \sin 285^\circ\right)$. Determine:

(a) $Z_1 Z_2$ in polar form.

(3 marks)

(b) $\frac{Z_2}{Z_1}$ in algebraic form, $a + bi$.

(3 marks)

(c) $\frac{Z_1}{Z_2}$ in exponential form.

(4 marks)

SECTION B (Total: 40 marks)

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

Question 1

(a) In oblique triangle ABC, given side $a = 23\,\text{km}$, $b = 29\,\text{km}$ and $c = 41\,\text{km}$. Calculate the values of angles A, B and C.

(10 marks)

(b) Determine the value of x and y for the following complex number equation,

$$x(1+i)^2 + y(2-i)^2 = 3 + 10i\,.$$

(10 marks)

Question 2

(a) Two small boats are $24\,\text{m}$ apart as shown in Figure 4. The angle of elevation of the boats to the top of a lighthouse are $20°$ and $34°$ respectively. Calculate the height, h of the lighthouse.

(10 marks)

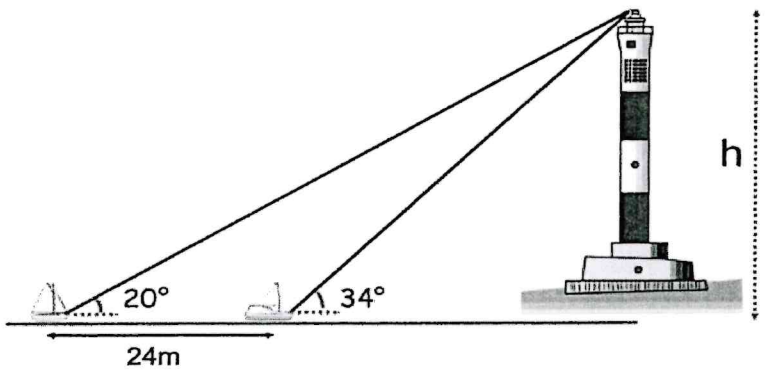

Figure 4

(b) Given $Z = -8 - 15i$. Express Z in trigonometric, polar and exponential form.

(10 marks)

Question 3

(a) A pole 5 m high is fixed on the top of a tower as shown in Figure 5. The angle of elevation of the top of the pole observed from point A on the ground is 60° and the angle of depression to point A from the top of the tower is 45°.

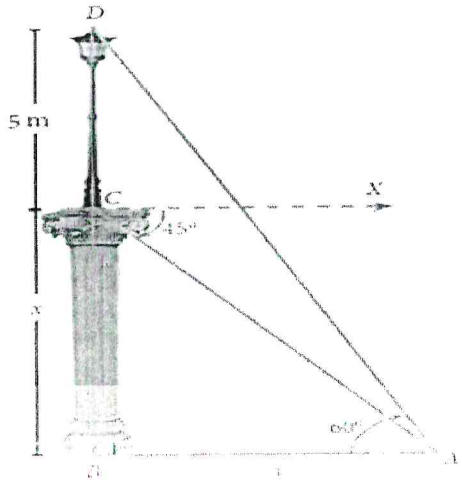

Figure 5

Calculate:

i. the height of the tower.

(8 marks)

ii. distance BA.

(2 marks)

(b) Given $Z = 3\angle 115^\circ$. Determine the indicated powers by using De Moivre's Theorem.

i. Z^4 in polar form.

(3 marks)

ii. Z^2 in algebraic form, $a + bi$.

(3 marks)

iii. Z^5 in exponential form.

(4 marks)

END OF EXAMINATION PAPER

FORMULA SHEET

ALGEBRA

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

TRIGONOMETRY 1

Arc of length, $S = r\theta$	Area of sector, $A = \dfrac{1}{2}r^2\theta$
LAW OF SINE	**LAW OF COSINE**
$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$	$a^2 = b^2 + c^2 - 2bcCosA$

COMPLEX NUMBER

POWER OF *i*
$i = \sqrt{-1}$ $i^2 = -1$ $i^3 = -i$ $i^4 = 1$
ALGEBRAIC FORM : $Z = a + bi$
TRIGONOMETRIC FORM : $Z = r(\cos\theta + i\sin\theta)$
POLAR FORM : $Z = r\angle\theta$
EXPONENTIAL FORM : $Z = re^{i\theta}$
DE MOIVRE'S THEOREM
$Z^n = r^n(\cos n\theta + i\sin n\theta)$ $Z^n = r^n\angle n\theta$ $Z^n = r^n e^{in\theta}$