

**FINAL
ALTERNATIVE ASSESSMENT**

(COVER PAGE)

Session : January 2022

Programme : Diploma in Electrical & Electronic Engineering (DEEI)
Diploma in Mechanical Engineering (DMEN)

Course : MAT1121/MAT1134: Engineering Mathematics 1

Date of Examination : 9 March 2022 (Wednesday)

Time : 12.00noon – 2.30pm Reading Time : Nil

Duration : 2 Hours 30 Minutes

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

Material permitted : Non-Programmable Scientific Calculator

Materials provided : Mathematics Formulae Booklet

Examiner(s) : Chong Mee Teng

Chief Moderator : Manickampraslad M Sambasivam

This paper consists of 5 printed pages, including the cover page

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING PROGRAMME (DEEI)
 DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
 MAT1121 / MAT1134: ENGINEERING MATHEMATICS 1
 FINAL ALTERNATIVE ASSESSMENT: JANUARY 2022 SESSION

Instruction: This paper consists of **FOUR (4)** questions. Answer **ALL** the questions. All questions carry equal marks.

Question 1

(a) Given that $\sin \alpha = \frac{4}{5}$ and $\cos \beta = -\frac{12}{13}$, with angle α in quadrant I and angle β in quadrant II. Compute the exact value of each of the following:

- (i) $\sin (\alpha + \beta)$ (3 marks)
- (ii) $\cos (\alpha + \beta)$ (3 marks)
- (iii) $\tan (\beta - \alpha)$ (3 marks)

(b) In **Figure Q1(b)**, you are on a fishing boat that leaves its pier and heads east. After travelling for 30 miles, there is a report warning of rough seas directly south. The captain turns the boat and follows a bearing of S45°W for 12 miles. Solve:

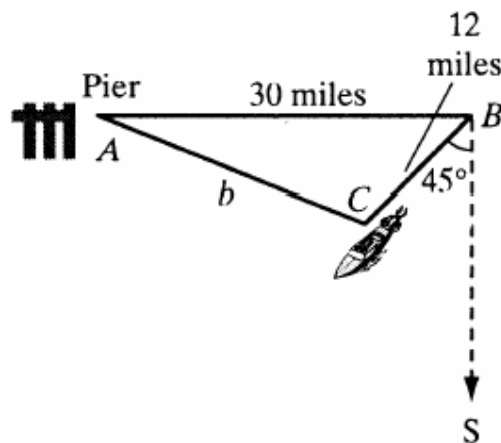


Figure Q1(b)

- (i) the distance between you from the boat's pier at this time, and (4 marks)
- (ii) the bearing could the boat have originally taken to arrive at this spot. (4 marks)

- (c) The depth of water at a boat dock varies with the tides. If y represents the depth of the water, in feet, x hours after midnight is modeled by $y = 2\sin(x + \frac{1}{2}\pi)$.
- (i) Compute the amplitude, period and phase shift of the water tidal cycle. (5 marks)
 - (ii) Sketch one cycle of the water tidal cycle. (3 marks)

Question 2

- (a) If $\tan \theta = -\frac{3}{4}$ and θ lies in quadrant II, compute the exact value of each of the following:
- (i) $\sin 2\theta$ (3 marks)
 - (ii) $\cos 2\theta$ (3 marks)
 - (iii) $\tan 2\theta$ (3 marks)
- (b) Solve $\tan \theta = 4 - 3 \cot \theta$ for $0^\circ \leq \theta \leq 360^\circ$. (6 marks)
- (c) Use trigonometry identity to prove: $\sec 2A + \tan 2A \equiv \frac{\cos A + \sin A}{\cos A - \sin A}$. (5 marks)
- (d) In **Figure Q2(d)**, a pole leans away from the sun at an angle of 7° to the vertical. When the angle of elevation of the sun is 51° , the pole casts a shadow 47 ft long on level ground. Solve the length of the pole. (5 marks)

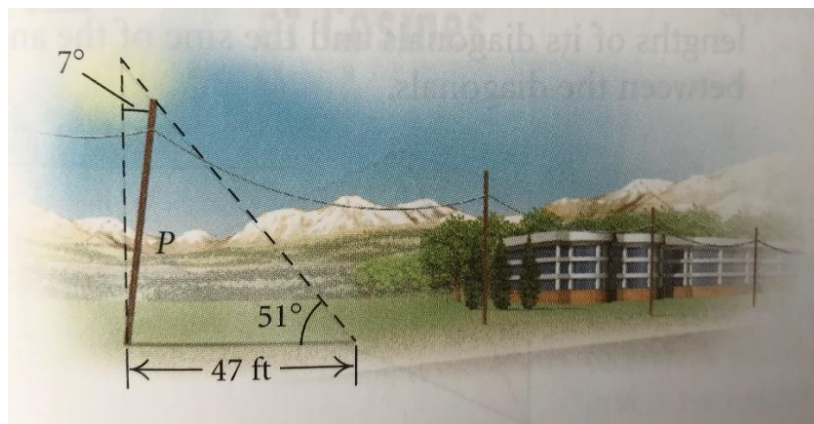


Figure Q2(d)

Question 3

- (a) A flagpole is situated on top of a building. The angle of elevation from a point on level ground 330 feet from the building to the top of the flagpole is 63° . The angle of elevation from the same point to the bottom of the flagpole is 53° . Solve the height of the flagpole to the nearest tenth of a foot.

(5 marks)

- (b) Solve the 4th term of $(2x - 3y)^6$.

(4 marks)

- (c) Compute the first three terms in the expansion of $(1 + 2x)^{12}$ in the ascending powers of x . Hence solve the coefficient of x^2 in the expansion of $(2 + 3x + 4x^2)(1 + 2x)^{12}$.

(6 marks)

- (d) Solve the following hyperbolic equations:

(i) $\sinh 2x = 3 \cosh x$, and

(5 marks)

(ii) $2 \sinh^2 x - 3 \cosh x = 7$.

(5 marks)

Question 4

- (a) (i) Compute the point in polar coordinates to Cartesian coordinates: $(3, \frac{\pi}{6})$

(3 marks)

- (ii) Compute the point in Cartesian coordinates to polar coordinates: $(-4\sqrt{3}, 4)$

(3 marks)

- (b) Solve the polar equation into rectangular form: $r = a \cos \theta \sin 2\theta$.

(5 marks)

- (c) Replace the following polar equations by equivalent Cartesian equations and describe their graphs.

(i) $r = \pm 5$

(3 marks)

(ii) $r = \frac{-4}{\sin \theta - 2 \cos \theta}$

(4 marks)

- (d) In **Figure Q4(d)**, a ranger in fire tower A spots a fire at a direction of 295° . A ranger in fire tower B, located 45 miles at a direction of 45° from tower A, spots the same fire at a direction of 255° . Solve:

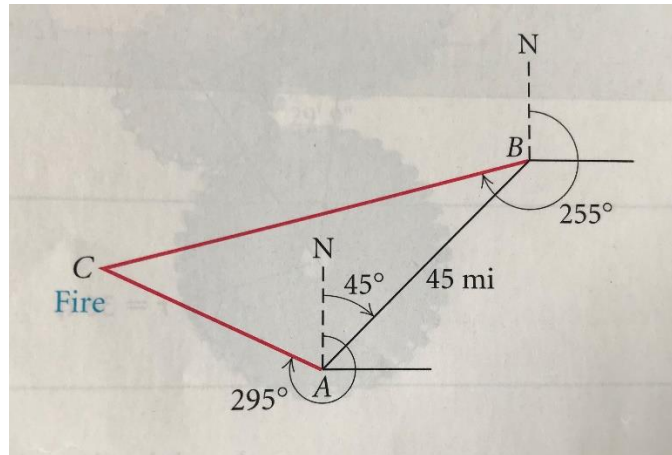


Figure Q4(d)

- (i) the distance the fire from tower A, (5 marks)
- (ii) the distance the fire from tower B. (2 marks)

~THE END~