



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS
FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR

DIPLOMA IN DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING
DIPLOMA IN MECHANICAL ENGINEERING
DIPLOMA IN CIVIL ENGINEERING
ECU 0101: ENGINEERING MATHEMATICS II

DATE: 6/12/2017

TIME: 8.30-10.30 AM

INSTRUCTIONS

- i) Answer question ONE and any other TWO questions
 - ii) Show all workings.
1. a) Solve for θ if $0^\circ \leq \theta \leq 360^\circ$.
- i) $3 \cos \theta = 1.8 \cot \theta$ (6 marks)
 - ii) $6 \cos \theta = \frac{1 - \cos \theta}{\cos \theta}$ (8 marks)
- b) A plan of a triangular piece of land is labeled PQR. The lengths PQ= 75m, QR= 120m and PR=60m respectively.
Calculate the
- i) area of the piece of land
 - ii) largest angle (8 marks)
- c) A circle has a radius of 14cm. A chord of length 15cm is drawn inside the circle.
Calculate the area of the major segment. (8 marks)
2. a) Three vectors \vec{OA} , \vec{OB} , and \vec{AB} form a triangle.
N divides \vec{AB} in the ratio 1:1 while M divides \vec{OB} in the ratio 1:3. Express in terms of a and b

- i) \vec{ON}
- ii) \vec{AM} (8 marks)
- b) Write (i) and (ii) in polar form
- i) (2, -6)
- ii) (-4, 5) (8 marks)
- iii) (8, 225°) in Cartesian form (4 marks)
3. a) Given that angle θ is acute and that $\tan \theta = \frac{3}{4}$, determine without using trigonometric tables or calculators
- i) $\sin 2\theta$ (5 marks)
- ii) $\cos 2\theta$ (3 marks)
- iii) $\tan 2\theta$. (3 marks)
- b) Express $4\sin \theta + 9\cos \theta$ in the form $R\sin(\theta + \alpha)$ (9 marks)
4. a) Write the polar equation $r = 4a\cos \theta \csc \theta$ in Cartesian form (3 marks)
- b) The angle of elevation of a lighthouse from the observer at point A is 25°. The observer moves 27m along a straight level path towards the foot of the lighthouse and now sees the lighthouse at an angle of elevation of 41°. Calculate the height of the lighthouse (5 marks)
- c) The frustum of a solid right cone is 16.8 cm high. The top and bottom have radii of 22.4 cm and 56 cm respectively. Calculate the
- i) volume of the solid
- ii) total surface area of the solid (12 marks)
5. a) Solve for θ if $0^\circ \leq \theta \leq 360^\circ$ given the equation $4\tan \theta - 7\cot \theta = 3$ (10 marks)
- b) Vectors $\vec{a} = 2i - 3j + k$, $\vec{b} = i + 4j - 2k$ and $\vec{c} = 3i + j + 2k$. Determine
- i) $\vec{a} \cdot \vec{b}$
- ii) angle between \vec{a} and \vec{b}
- iii) $\vec{a} \times \vec{b}$ (10 marks)