



# MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)  
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST SEMESTER EXAMINATION FOR  
DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING  
DIPLOMA IN BUILDING AND CIVIL ENGINEERING  
DIPLOMA IN MECHANICAL ENGINEERING

GEOMETRY

DATE: 5/8/2016

TIME: 2:00 – 4:00 PM

---

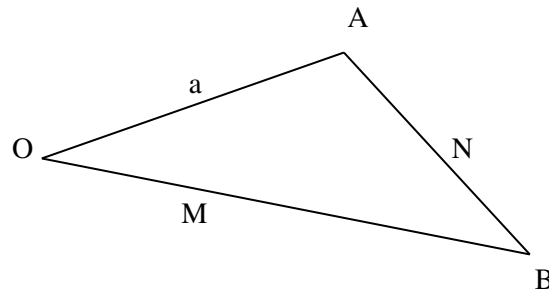
## INSTRUCTIONS:

Answer QUESTION ONE and Any other TWO Questions

Show all workings.

- 1 a) Solve for  $\theta$  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 labelled 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 as shown in the diagram.



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) (2, -6) and

ii) (-4, 5) in polar form (8 marks)

iii) (8, 225°) in Cartesian form (4 marks).

3. a) Given that angle  $\theta$  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  $25^\circ$ .

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  $41^\circ$ . 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) Vectors  $\vec{a} = 2\mathbf{i} - 3\mathbf{j} + \mathbf{k}$ ,  $\vec{b} = \mathbf{i} + 4\mathbf{j} - 2\mathbf{k}$  and  $\vec{c} = 3\mathbf{i} + \mathbf{j} + 2\mathbf{k}$ .

Determine

- i)  $\vec{a} \cdot \vec{b}$   
ii) angle between  $\vec{a}$  and  $\vec{b}$   
iii)  $\vec{a} \times \vec{b}$  (10 marks)
- b) Solve for  $\theta$  if  $0^\circ \leq \theta \leq 360^\circ$  in the equation  $2 \sec \theta = 3(2 - \tan \theta)$  (10 marks)