



**TECHNICAL UNIVERSITY OF MOMBASA**  
**Faculty of Applied & Health**  
**Sciences**

DEPARTMENT OF MATHEMATICS & PHYSISCS  
CERTIFICATE IN UPGRADING MATHEMATICS (UMTH 15J)

AMA 1002: GEOMETRY

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2015**

**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*
- *Mathematical Table*

This paper consist of **FIVE** questions

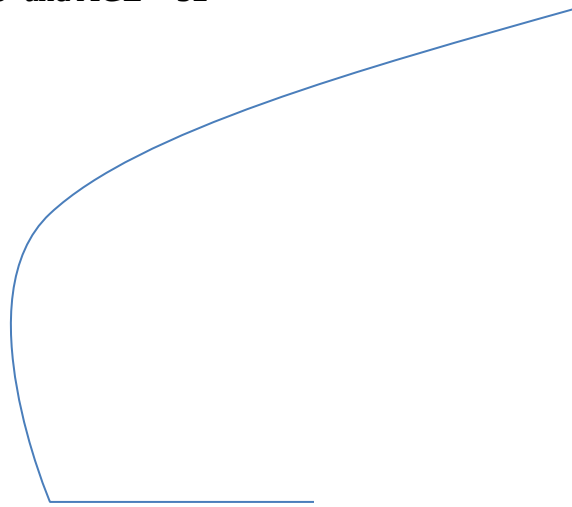
Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **FOUR** printed pages

**Question One (Compulsory)**

- a) Explain the following angles:  
 (i) Complementary angles  
 (ii) Reflex angles  
 (iii) Supplementary angles (3 marks)
- b) The figure below shows a circle ABCDE. The line FEG is a tangent to the circle at a point E. Line OE is parallel to CG,  $\angle DECE = 28^\circ$  and  $\angle AGE = 32^\circ$



Calculate  $\angle AEG$  and  $\angle ABC$  (4 marks)

- c) Calculate the height of a tree if a person 1.84m tall and is standing 16m away from the foot of the tree if the angle of elevation from his eye is  $20^\circ$  (3 marks)
- d) Calculate all the angles in a triangle whose lengths are 5.5cm, 4.2cm and 3.8cm (6 marks)

$$y = 3 \cos(2t + 30^\circ)$$

- e) Find the wavelength, amplitude and phase angle of (3 marks)
- f) When the angle of elevation of the sun is  $30^\circ$  a vertical pole casts a shadow of length 3m on a horizontal ground, calculate the height of the pole (4 marks)

- g) Two points A and B are in the same latitude  $\alpha^\circ N$  and on the longitudes  $30^\circ W$  and  $60^\circ E$  respectively. If the shortest distance along the circle of latitude between A and B is 5005km, calculate the value of  $\alpha$  (4 marks)

$$AB = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \quad BC = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

- h) Given that vectors  $AB = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$  and  $BC = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$  find:  
 (i)  $AB + BC$   
 (ii)  $-3AB$  (1 marks)

- (iii)  $AB - 2BC$  (1 marks)

### Question Two

- a) Solve for  $\theta$  such that  $0 \leq \theta \leq 360$  and  $2 \sin^2 2\theta + \sin 2\theta - 1 = 0$  (5 marks)
- b) For the following trigonometric equations, state the wavelength, amplitude and phase angle:
- (i)  $y = \sin(3x + 60^\circ)$  (2 marks)
- (ii)  $y = \sin\left(\frac{1}{2}x + 10^\circ\right)$  (2 marks)
- (iii)  $y = 3\cos(x + 40^\circ)$  (2 marks)
- c) A stool is made by shaping a stump into a conical frustum of vertical height 60cm. If the top radius is 12cm and the bottom one is 24cm. Calculate the surface area of the stool (9 marks)

### Question Three

- a) Construct  $\triangle ABC$  in which  $AB = 4.5\text{cm}$ ;  $BC = 6.5\text{cm}$  and  $AC = 7.5\text{cm}$  construct an escribed circle opposite to  $\angle ABC$ . Measure the radius of the circle. (7 marks)
- b) In the figure below,  $PQ = q$  and  $PR = r$   $QM:MR = 1:2$  or  $M$  divides  $QR$  in the ratio  $1:2$ . The points  $S$  is the midpoint of  $PQ$   $X$  is the intersection of  $PM$  and  $SR$   $SR = hSR$ ,  $PX = kPM$  where  $h$  and  $k$  are constant:

Figure 2

- (i)  $QR$  in terms of  $q$  and  $r$  (3 marks)
- (ii)  $PM$  in terms of  $q$  and  $r$  (3 marks)
- (iii)  $SR$  in terms of  $q$  and  $r$  (3 marks)
- c) A plane leaves a town  $T(20^\circ\text{S}, 35^\circ\text{E})$  and flies due north at a speed of 450 knots to a town  $U(10^\circ\text{N}, 35^\circ\text{W})$ . How long does the plane take to complete the journey (4 marks)

### Question Four

a) Let A (2, 8), B(3, 5), C(1, 3), D(0, 6) be coordinates of the quadrilateral ABCD. Suppose T is the

$$\begin{pmatrix} -1 \\ 2 \end{pmatrix}$$

translation with vectors  $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$ , R is the rotation center (0,0) 90° anticlockwise and L is the reflection on the line  $y = x$ . What is the image of ABCD after translation T followed by rotation R and the reflection L **(8 marks)**

b) In the figure below K, L, M and N are points on the circumference of a circle with center O the points K, O, M and P are on straight line PN is a tangent to the circle at N,  $\angle KOL = 130^\circ$  and  $\angle MKN = 40^\circ$

Find the values of the following angles:

- (i)  $\angle MLN$  **(2 marks)**
- (ii)  $\angle MNP$  **(2 marks)**
- (iii)  $\angle OLN$  **(2 marks)**
- (iv)  $\angle MPN$  **(2 marks)**

c) Three trees A, B and C are such that  $AC = 10\text{km}$   $\angle BAC = 40^\circ$  and  $\angle BCA = 30^\circ$  calculate:

- (i) AB **(2 marks)**
- (ii) BC **(2 marks)**

### Question Five

a) Convert the following angles into radians:

- (i)  $10^\circ$
- (ii)  $180^\circ$
- (iii)  $270^\circ$  **(3 marks)****

b) Calculate the values of x and y in the figure below QR is parallel to ST. **(4 marks)**

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c) Find the number of sides of:

- (i) A polygon having sum of interior angles  $1080^\circ$  **(3 marks)****
- (ii) A regular polygon if each exterior angle is  $24^\circ$  **(3 marks)****

d) Prove the following, trigonometric identities:

$$\frac{(\cos \theta + \sin \theta)^2}{\cos \theta} = \sec \theta + 2 \sin \theta$$

- (i) **(4 marks)****

(ii) 
$$\frac{(\operatorname{cosec} \theta + \cot \theta) \tan \theta}{\tan \theta + \sec \theta} = \frac{\cos \theta + 1}{\sin \theta + 1}$$

(3 marks)