



# TECHNICAL UNIVERSITY OF MOMBASA

## Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING**  
**BACHELOR OF SCIENCE IN ELECTRICAL & ELECTRONIC ENGINEERING**  
**BACHELOR OF SCIENCE IN MECHANICAL & AUTOMOTIVE ENGINEERING**

AMA 4102: GEOMETRY

**END OF SEMESTER EXAMINATION**

SERIES: AUGUST 2014

**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

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 **TWO** printed pages

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**Question One (Compulsory)**

$$-180^\circ \leq x^\circ \leq 360^\circ$$

a) Solve within

$$\sec^2 \theta + \tan^2 \theta = 7$$

(i) (5 marks)

$$12 \sin x - 5 \cos x = 3.25$$

(ii) (5 marks)

b) Two interior angles of a triangle measure  $35^\circ$  and  $65^\circ$ . If the perimeter of the triangle is 20cm. Calculate the length of the longest side. (4 marks)

- c) P is the variable point  $(2at, at^2)$  on the parabola  $x^2 = 4ay$  and  $\theta$  is the foot of the perpendicular from point P to the x axis.
- (i) Sketch the curve (1 mark)
  - (ii) Find the locus of the midpoint of PQ (4 marks)
- $$\sin A + \sin B + \sin C = 4 \cos \frac{A}{2} \cos \frac{B}{2} \cos \frac{C}{2}$$
- d) Show that (5 marks)
- e) Ship Q is cruising in a straight line towards port R. At 1000h, R is 73 km away from Q while another port is 63km on a bearing  $162^\circ$  from R but on  $282$  from Q.
- (i) How far is P from Q (4 marks)
  - (ii) Which will be the shortest distance from P to the course R.? (2 marks)

### Question Two

$$\tan \frac{1}{2} A = \pm \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}, \quad S = \frac{a+b+c}{2}$$

- a) With the usual notation of a triangle ABC show that (10 marks)
- Hence or otherwise express  $\tan 15$  in surd form. (2 marks)
- b) A circle has its centre on the y-axis and passes through the points  $(-2, 1)$  and  $(2, 4)$ . Find its equation, center and radius. (8 marks)

### Question Three

- a) If  $L_1$  and  $L_2$  are non-perpendicular lines with slopes  $M_1$  and  $M_2$  respectively and  $\alpha$  be any angle from  $L_1$  to  $L_2$  prove that:
- $$\tan \alpha = \frac{M_2 - M_1}{1 + M_1 M_2}$$
- (3 marks)
- b) Find the slope of the line bisecting the angle from  $L_1$  to  $L_2$  with respective slopes 3 and -2 (4 marks)
- $$y^2 + 12x + 4y = 56$$
- c) The curve is given:
- (i) Sketch and name the curve, indicating its important features. (6 marks)
  - (ii) Show that the curve touches the line  $x + y = 6$  and find the point of contact P. (4 marks)
  - (iii) Calculate the distance of the focus from the tangent line in (ii) above. (3 marks)

### Question Four

$$\frac{1}{r} = \sqrt{2} - \cos \theta$$

Consider the curve

- a) Using  $Ox$  as the initial ray sketch the curve. (4 marks)

- b) Express the curve in rectangular co-ordinates and hence name the curve. **(6 marks)**
- c) Make a detailed sketch of the curve showing the centre, vertices, foci and directrices. **(10 marks)**

**Question Five**

$$x^2 - 9y^2 = 9$$

The curve is given

- a) Sketch and describe the curve fully **(5 marks)**
- b) Find the equation of the tangents to the curve that are drawn from the point (3, 2) and find the points of contact. **(13 marks)**
- c) Find the area of the triangle that these tangents form with their chords of contact. **(2 marks)**