



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN STATISTICS & COMPUTER SCIENCE

BACHELOR OF ENGINEERING IN ELECTRICAL & ELECTRONIC ENGINEERING

BACHELOR OF SCIENCE IN BUILDING & CIVIL ENGINEERING

SMA 2171: GEOMETRY

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: MARCH 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

Question One (Compulsory)

- a) ABCD is a rhombus. A is the point (2, -1) and C is the point (4, 9). Find the equation of the diagonal **(3 marks)**

$$-300^\circ \leq x^\circ \leq 400^\circ \quad \sin(x+20) + \sin(x+80) = 1.5$$

- b) Solve within **(4 marks)**

$$r = 4a \cot \theta \operatorname{cosec} \theta$$

- c) Find the Cartesian equation of the locus **(4 marks)** hence sketch the locus.
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$$\angle ABC = \cos^{-1} \frac{59}{62}$$

- d) In triangle ABC, AB = 24cm, AC = 11cm and $\angle ABC = \cos^{-1} \frac{59}{62}$. Find two possible values of BC. **(5 marks)**
- e) Find the equation of the circle whose centre is on the x-axis and which passes through the points (0, 3) and (4, 1) **(5 marks)**
- f) Sketch $y = \cos x$ and $y = \sin(x + 30)$ on the same set of axes and state the phase angle difference. Hence or otherwise express $y = \sin(x + 30)$ as a cosine function. **(4 marks)**

Question Two

The line $4x + 3y = 36$ and the circle $x^2 + y^2 - 4x - 2y - 20 = 0$ are given.

- a) Show that the line touches the circle **(5 marks)**
- b) Deduce the point of contact P and the equation of the normal to the circle through P **(3 marks)**
- c) Determine the centres of the two circles radii 6.5cm passing through the centre of the given circle and the point of contact P in (ii) above. **(10 marks)**
- d) Express the equation of the circle in (iii) above with its centre below the x-axis in the form $ax^2 + by^2 + cx + dy + e = 0$ where a, b, c, d, e are integers. **(2 marks)**

Question Three

- a) If A, B, C are the angles of a triangle, show that:
 $\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$

(7 marks)

- b) Given $t = \tan \frac{1}{2} \theta$, express $\sin \theta$ and $\cos \theta$ in terms of t and hence show that

$$\tan \theta = \frac{2t}{1-t^2}$$

(10 marks)

$$\frac{\cos B + \cos C}{\sin B - \sin C} = \cot \frac{B-C}{2}$$

- c) Prove that **(3 marks)**

Question Four

- a) The normal at a point $P(x_1, y_1)$ on an ellipse of eccentricity e meets the major axis at G. Prove that $GS = ePS$ where S is a focus. **(11 marks)**

- $xy = C^2$ $P\left(ct, \frac{c}{t}\right)$
- b) Find the equation of the tangent to the rectangular hyperbola at the point and show that if this tangent meets the axes at Q and R, then P is the mid-point of QR. **(9 marks)**

Question Five

- a) Solve within the domain given:
- (i) $4\cos^2 x + 9\sin x - 6 = 0$ $-200^\circ \leq x^\circ \leq 400^\circ$ **(6 marks)**
- (ii) $2\cos x - \sin x = 1$ $-360^\circ \leq x^\circ \leq 360^\circ$ **(7 marks)**

- b) Given the lines $4x + 3y + 3 = 0$ and $7x + 24y + 6 = 0$
- (i) Calculate the angle from the first line to the second line **(3 marks)**
- (ii) Determine the equations mediators of the angles between the two lines. **(4 marks)**