



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:
**BACHELOR OF SCIENCE IN CIVIL/MECHANICAL/ELECTRICAL &
ELECTRONIC ENGINEERING**

SMA 2171: APPLIED GEOMETRY

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2012
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A & B**

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

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

- a) A surveyor measures the angle of elevation of the top of a perpendicular building as 10° . He moves from 170m nearer the building and finds the angle of elevation is now 57° . Determine the height of the building. **(4 marks)**

$$\frac{\tan x + \sec x}{\sec x \left(1 + \frac{\tan x}{\sec x}\right)} = 1$$

- b) Prove that (4 marks)
- c) Solve $6 \cos^2 \theta + 5 \cos \theta - 6 = 0$ for values of θ from 0° to 360° . (4 marks)
- d) Find the distance from the point $(3, -5)$ to the line $2x + y + 4 = 0$. (4 marks)
- e) Give the equation of the curve that is locus of all points equidistant from points $(5, 3)$ and $(2, 1)$. (5 marks)
- f) Determine the radius and the co-ordinates of the centre of the circle given by the equation $x^2 + y^2 + 8x - 2y + 8 = 0$. Sketch the circle. (4 marks)
- g) If $\sin A = \frac{3}{5}$ and $\cos B = \frac{15}{17}$, where A is obtuse and B is acute, find the exact value of $\sin(A + B)$. (5 marks)

Question Two

- a) Give the length of a, the length of the focal chord; and the equation of the parabola, which is the locus of all points equidistant from the point $(3, 0)$ and the line $x = -3$. Sketch the parabola. (5 marks)
- b) Find the equation of a circle that pass through the points $(1, 1)$, $(2, 2)$ and $(3, 3)$. Explain your results. (10 marks)
- c) Find C, B a and the area of the triangle $\triangle ABC$ given $A = 30^\circ$, $b = 4\text{cm}$ and $c = 5\text{cm}$. (5 marks)

Question Three

- a) If $\sin(x + 2) = \cos(x - \beta)$ and $\tan x = \frac{\cos \beta - \sin \alpha}{\cos \alpha - \sin \beta}$. Show that (5 marks)
- b) Reduce the equation $3x^2 + y^2 + 10x + 32 = 0$ to an ellipse in standard form. (7 marks)
- c) Find the Foci, directrices, eccentricity, latus rectum and equation of the asymptotes of the hyperbola $\frac{(x-0)^2}{3^2} - \frac{(y-0)^2}{4^2} = 1$ described by the equation. (8 marks)

Question Four

$$r = \sec \theta \tan \theta$$

a) Change the equation to an equation in rectangular coordinates. **(5 marks)**

$$r = 2 + 2 \cos \theta$$

b) Sketch the graph of the equation **(5 marks)**

$$3x - y - 2 = 0$$

c) Find to equation of a line parallel to and passing through the point (5, 2) **(5 marks)**

d) Find the equation of the tangent line, the equation of the normal line, and the lengths of the tangent

$$y^2 = \frac{4}{3}x$$

and the normal of: at (3, 2) **(5 marks)**

Question Five

a) Find the points of contact of the horizontal and vertical tangents to the curve represented by the parametric equation.

$$x = 3 - 4 \sin \theta$$

(i)

$$y = 4 + 3 \cos \theta$$

(ii)

(6 marks)

Plot the graph of the curve by taking θ from 0° to 360° in increment of 30° , given that

$$\frac{\Delta x}{\Delta \theta} = -4 \cos \theta \quad \text{and} \quad \frac{\Delta y}{\Delta \theta} = -3 \sin \theta$$

(10 marks)

b) Find the equation of every circle that passes through to point $P(1,1)$ and $Q(3,1)$ and its tangent to the

line $y = -3x$

(10 marks)