



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR

BACHELOR OF SCIENCE (MATHEMATICS AND COMPUTER SCIENCE)

BACHELOR OF SCIENCE (STATISTICS AND PROGRAMMING)

BACHELOR OF SCIENCE (INFORMATION AND TECHNOLOGY)

BACHELOR OF SCIENCE(MATHEMATICS)

BACHELOR OF EDUCATION

BACHELOR OF ARTS

SMA 103: ANALYTICAL GEOMETRY

DATE: 13/12/2017

TIME: 2.00-4.00 PM

INSTRUCTIONS: Answer question *one (compulsory)* and any other *two questions*.

QUESTION ONE (30 MARKS)

- a) A point $R(x, y)$ divides the line through the points $A(4, -9)$ and $B(-5, 25)$ externally in the ratio $3 : 2$. Calculate the coordinates of $R(x, y)$ (3 marks)
- b) Calculate the equation of the straight line which passes through the point of intersection of the lines $4x - 3y + 19 = 0$, $12x - 5y + 3 = 0$ and makes an intercept of $+2$ on the x -axis (5 marks)
- c) Prove that $\cos 4\theta = 8\cos^4 \theta - 8\cos^2 \theta + 1$ (4 marks)
- d) Determine the standard equation of a circle passing through the point $P(5, -8)$ and tangent to the line $5y - 12x + 149 = 0$ at the point $Q(12, 1)$, sketch the circle labelling the centre and radius. (5 marks)

- e) A parabola $y = ax^2 + bx + c$ passes through the points $(1,0)$, $(2,2)$, and $(3,10)$. Determine its equation. (5 marks)
- f) Work out the cartesian equation for the curve $r \cos \left(\theta - \frac{\pi}{3} \right) = 3$ (4 marks)
- g) Calculate the angle between the lines
 $y = 2x + 5$ and $y = 12x - 1$ (4 marks)

QUESTION TWO (20 MARKS)

- a) Determine the equation of a circle through the points $A(6,-1)$, $B(-2,5)$, $C(-6,-7)$, sketch the circle (6 marks)
- b) Calculate the equation of the circle which is tangent to the x-axis and concentric with the circle $2x^2 + 2y^2 - 11x + 6y - 8 = 0$ (6 marks)
- c) Determine the polar equation of the circle whose center has the cartesian coordinates $C(5,8)$ and radius $r = 10\text{cm}$ (5 marks)
- d) Calculate the distance from the point $(5,8)$ to the circle $x^2 + y^2 + 2x + 6y + 3 = 0$ (3 marks)

QUESTION THREE (20 MARKS)

- a) Solve for x in $\sin 3x + \sin x = 0$ (4 marks)
- b) Determine the of x for which $2 \cos x - 2\sqrt{3} \sin x = 3$ (5 marks)
- c) Show that
- i.) $\frac{\sin 4\theta + \sin 2\theta}{\cos 4\theta + \cos 2\theta} = \tan 3\theta$ (4 marks)
- ii.) $\sin 4\theta = 4 \cos^3 \theta \sin \theta - 4 \sin^3 \theta \cos \theta$ (3 marks)
- d) Given that $\cos 2x = \frac{1}{8}$, calculate the value of $\cos x$ (4 marks)

QUESTION FOUR (20 MARKS)

- a) Sketch the curve and label axes, foci and vertices described by the equation
 $\frac{x^2}{9} + \frac{y^2}{4} = 1$ (6 marks)
- b) Calculate the point on the parabola $y^2 - 12y - 14x + 162 = 0$ through which the tangents which meet at $Q(2,4)$ pass (6 marks)

- c) Determine the equation of the tangent to the parabola $x^2 - 22x + 24y + 169 = 0$ at the point whose focal distance is 11 *units* (8 marks)

QUESTION FIVE (20 MARKS)

- a) Determine the polar equation of the ellipse $x^2 + 9y^2 = 9$ (4 marks)
- b) Calculate the normal equation of the line with $\rho = 10$ *units* , $\omega = 60^\circ$ (4 marks)
- c) Sketch the curve and label axes, foci and vertices described by the equation

$$\frac{x^2}{25} - \frac{y^2}{16} = -1 \quad (12 \text{ marks})$$