



(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER
SPECIAL/ SUPPLEMENTARY EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
MATHEMATICS

COURSE CODE : MAP 112

**TITLE: BASIC MATHEMATICS AND ANALYTIC
GEOMETRY**

DATE: 10/02/2021

TIME: 11 AM - 1 PM

INSTRUCTIONS TO CANDIDATES

Answer Question **One** in and **Any other TWO** Questions

TIME: 2 Hours

This Paper Consists of **3 Printed Pages**. Please Turn Over.

QUESTION ONE (30MARKS)

- a) State the factor and remainder theorems (4mks)
- b) Express $\cos 4x$ in terms of $\cos x$ (3mks)
- c) Find the equation of the normal to the curve $y^2 + x^2 + 2x + y + 3 = 0$ at the point $(2, 3)$ (5mks)
- d) Express the polar coordinate $(2, \frac{\pi}{2})$ in rectangular coordinates. (3mks)
- e) Sketch the curve of a parabola with the equation $(x - 2)^2 = 12(y + 1)$ (5mks)
- f) Find the shortest distance between two parallel lines with the equation $y = 2x + 3$ and $y = 2x - 4$ (3mks)
- g) Given that $\sinh x = 1$, find the value of x (4mks)
- h) Prove the trigonometric identity $\sin x + \frac{\cos^2 x}{\sin x} = \operatorname{cosec} x$. (3mks)

QUESTION TWO (20 MARKS)

- a) Find the equation of the normal to the curve $x^2 + y^2 + 4x + 3y - 10 = 0$ at the point $(4, 3)$ (6mks)
- b) Given a circle with the equation $(x - 2)^2 + (y + 1)^2 = 4$, show that the point $(10, 10)$ lies outside the circle and hence find the length of the tangent from the point to the circle. (7mks)
- c) Show that the general equation of a parabola with X - axis as the main axis is given by $y = 4Px$ (7mks)

QUESTION THREE (20 MARKS)

1. Prove the identities (6mks)
- i. $\frac{\cos x - \cos^3 x}{\sin x} = \sin x \cos x$
- ii. $\frac{\sin^2 x (\sec x + \operatorname{cosec} x)}{\cos x \tan x} = 1 + \tan x$
2. Express $\cos 4x$ in terms of $\cos x$ (2mks)
3. Given that $u = \tanh x$ use the definitions of $\sinh x$ and $\cosh x$ in terms of e^x and e^{-x} to show that $x = \frac{1}{2} \ln \left(\frac{1+u}{1-u} \right)$ (6mks)
4. In how many ways can 5 children be arranged in a line such that (6mks)
- i. Two particular children are always together
- ii. Two particular children are never together.

QUESTION FOUR (20 MARKS)

- a) State and prove remainder theorem (4mks)
- b) Use the remainder theorem to determine the remainder when
- $P(x) = x^3 - 10x + 6$ is divided by $(x + 4)$ (2mks)
 - Verify your answer using synthetic division (2mks)
- c) What is the value of C for a polynomial $P(x) = -2x^3 + Cx^2 - 5x + 2$ to have same remainder when it is divided by $(x - 2)$ and $(x + 1)$ (3mks)
- d) Solve the equation $4 \cos^3 \theta - 7 \cos \theta - 3 = 0$ for $0 \leq \theta \leq 180$ (9mks)

QUESTION FIVE (20 MARKS)

- a) An equation of a conic section is given by $4x^2 - 9y^2 - 16x - 18y - 29 = 0$.
- Write the equation in standard form (4mks)
 - Identify the center, vertices foci and asymptotes (5mks)
 - Sketch the curve (3mks)
- b) Another equation of a conic section is given by $4x^2 + 9y^2 - 8x - 36y + 4 = 0$. Find the foci, vertices, center and hence sketch it. (8mks)