



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE COMPUTER SCIENCE

SCO 110: MATHEMATICS FOUNDATION FOR COMPUTER SCIENCE

DATE: 22/7/2019

TIME: 2:00 – 4:00 PM

INSTRUCTION: Attempt question ONE and any other TWO questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Evaluate $\frac{\sqrt{7} - \sqrt{3}}{\sqrt{7} + \sqrt{3}}$ (3 marks)
- b) Define the following terms in relation to functions
- i) Injunctive function (2marks)
 - ii) Surjective function (2 marks)
 - iii) Bijective function (2 marks)
- c) Determine the inverse for the function $f : x \rightarrow \frac{4x+5}{7x-7}; x \neq \frac{6}{7}$ (4 marks)
- d) If $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f : x \rightarrow 2x+1$ and $g : x \rightarrow x-3$ respectively. Determine
- i) $f \circ g$ (2 marks)
 - ii) $f^{-1} \circ g^{-1}$ (4 marks)
- e) State the Remainder theorem (2 marks)
- f) State the Binomial theorem (2 marks)
- g) Find the value of $\sin 2\theta$ and $\cos 2\theta$ given that $\sin \theta = \frac{7}{25}$ and $\cos \theta = \frac{3}{5}$ where θ is an acute angle. (5 marks)
- h) Find the modulus of the complex number $z = 4i$ (2marks)

QUESTION TWO (20 MARKS)

- a) Prove that $\sqrt{3}$ is irrational (4 marks)
- b) State the D moivres theorem (2 marks)
- c) In how many ways can 4 boys and 2 girls be seated in a row if the girls must not be separated? (3 marks)
- d) Using the double angle formula, evaluate $\sin 120^\circ$ (3 marks)
- e) Express the following complex number $z = -4 + \sqrt{3}i$ in polar form (3 marks)
- f) A polynomial has a remainder 9 when divided by $x - 3$ and a remainder -5 when divided by $2x + 1$. Find the remainder when $f(x)$ is divided by $(x - 3)(2x + 1)$ (5 marks)

QUESTION THREE (20MARKS)

- a) Determine whether the following functions are odd, even or neither
 - i) $f(x) = x^5 + 1$
 - ii) $f : x \rightarrow 4x^2 - 3$
 - iii) $f(x) = \frac{1}{x}; x \in \mathbb{R}^+$ (6 marks)
- b) Given that $z = -2 + 5i$, represent it in a well labelled Argand diagram. (4 marks)
- c) State the Factor theorem and hence apply it to (6 marks)
- d) Determine the domain and range for the function
 - i) $f(x) = \frac{1}{x^2 + 2x + 1}$ (2 marks)
 - ii) $g(x) = \sqrt{x - 5}$ (2 marks)

QUESTION FOUR (20MARKS)

- a. Distinguish between monotone increasing and decreasing function (4 marks)
- b. Express the following in partial fraction $\frac{3x^2 - 8x - 63}{x^2 - 3x - 10}$ (5 marks)
- c. Express the complex number $z = x + iy$ in polar form (3 marks)
- d. State atleast 3 laws of logarithms. (3 marks)
- e. Apply the remainder theorem to determine the remainder in each case
 - i) $(5x^3 - 4x^2 - 3x + 6) \div (x - 2)$
 - ii) $(x^3 + 3x^2 - 13x - 10) \div (x + 5)$ (5 marks)

QUESTION FIVE (20MARKS)

- a. Prove that $\sin 2\theta = 2 \sin \theta \cos \theta$ (5 marks)
- b. Find the value of c and d if $cx^4 + dx^3 - 8x^2 + 6$ has a remainder $2x + 1$ when divided by $x^2 - 1$. (5 marks)
- c. Split the following in to partial fractions $f(x) = \frac{x+1}{x^2+2x+1}$ (5 marks)
- d. Verify the trigonometric identity $\sin \theta + \sin \phi = 2 \sin \frac{\theta + \phi}{2} \cos \frac{\theta - \phi}{2}$ (5 marks)