



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRSTYEAR SPECIAL /SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

SCO 110: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

DATE: 20/1/2021

TIME: 8.30-10.30 AM

INSTRUCTIONS TO CANDIDATES

Answer questions ONE and ANY TWO Questions

QUESTION ONE (30 MARKS) (COMPULSORY)

- a) Four men and their wives sit on the bench. In how many ways can they be arranged if
- i) There is no restriction (2 marks)
 - ii) Each man must sit next to his wife. (3 marks)
- b) Determine $\log_2(8 \times 32)$ (3 marks)
- c) Simplify $\frac{16!}{9!7!} + \frac{16!}{10!6!} + \frac{16!}{11!5!}$ (3 marks)
- d) Use binomial theorem to determine $(9.9)^9$ to the nearest whole number (3 marks)
- e) Find without using tables, calculator, exact values of $\sin 60^\circ$, $\cos 60^\circ$, $\sin 30^\circ$ and $\cos 30^\circ$. (4 marks)
- f) Rationalize the denominator in $\frac{\sqrt[3]{3}}{\sqrt[3]{9} + \sqrt[3]{7}}$ (4 marks)
- g) If $z_1 = [2, 45^\circ]$ by $z_2 = [3, 15^\circ]$. Find the product $z_1 z_2$ (4 marks)
- h) Sketch the graph of $y = 4 + 3\sin 2(x - \pi/4)$ (4 marks)

QUESTION TWO (20 MARKS)

- a) Find the modulus of the complex number $z = 4i$ (2 marks)
- b) Let $p(x) = 3x^3 - 5x^2 + 3x - 10$
- i. Find $p(-2)$ (3 marks)
- ii. Divide $p(x)$ by $x + 2$ (5 marks)
- c) Expand $(1 - 5x)^{1/3}$ in ascending powers of x up to and including the term in x^4 . State the range of values of x for which the expansion is valid. Use the expansion to obtain $\sqrt[3]{0.95}$ correct to 4dp. (5 marks)
- d) A polynomial has a remainder 9 when divided by $x - 3$ and a remainder -5 when divided by $2x + 1$. Find the remainder when $p(x)$ is divided by $(x - 3)(2x + 1)$ (5 marks)

QUESTION THREE (20 MARKS)

- a) Determine the number of ways in which the letters of the word STATISTICS can be arranged in a row. (3 marks)
- b) Express the following complex number $z = -4 + \sqrt{3}i$ in polar form (4 marks)
- c) If the quadratic equation $x^2 - px + q = 0$ has roots α and β , form the equation whose roots are $\frac{\alpha}{\beta^2}$ and $\frac{\beta}{\alpha^2}$ (6 marks)
- d) Solve for all x in the equation $\sin x + \sqrt{2} = -\sin x$ (7 marks)

QUESTION FOUR (20 MARKS)

- a) Divide the complex number $5 + 2i$ by $4 - 2i$ (3 marks)
- b) In how many ways can four students be chosen from eight students and in how many of those ways will a particular student be included? (3 marks)
- c) Prove that the square of an even integer is even and the square of an odd integer is odd. (4 marks)
- d) 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. (4 marks)
- e) By using DeMoivre's theorem show that $\tan \theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$ (6 marks)

QUESTION FIVE (20 MARKS)

- a) If one root of equation $ax^2 + bx + c = 0$ is three times the other, $3b^2 = 16ac$ (4 marks)
- b) Prove that $\sin 2\theta = 2 \sin \theta \cos \theta$ (4 marks)
- c) Determine whether $x + 2$ is a factor of the polynomial $p(x) = x^4 - 7x^2 - 6x$. if so, find the other factors by long division. (5 marks)
- d) Find z if $z^3 = \left[8, \frac{2}{3}\pi \right]$ (7 marks)