



MACHAKOS UNIVERSITY

UNIVERSITY SUPPLEMENTARY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

SCO110: MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

DATE:

TIME :

INSTRUCTIONS: Answer QUESTION ONE and any other TWO QUESTIONS

QUESTION ONE 30 Marks (Compulsory)

a.) Verify the given trigonometric identity

$$\frac{\sin \theta}{1 + \cos \theta} + \frac{\cos \theta}{\sin \theta} = \operatorname{cosec} \theta \quad (3 \text{ marks})$$

b.) If $P(x) = 3x^3 - 5x^2 + 3x - 10$ then show that $P(2) = 0$ and use this fact to factorize $P(x)$.

(3 marks)

c.) Let $f : R \rightarrow R$ be defined by $f(x) = x^3 - x$. Show that f is not injective.

(4 marks)

d.) If $\log_b M = 3$ and $\log_b P = 4$, determine $\log_b \frac{M^{\frac{1}{3}} P^{\frac{1}{4}}}{\sqrt{(M^2 P^3)}}$ (5 marks)

e.) Use the remainder theorem to determine the remainder when $f(x) = 3x^2 + 5x - 8$ is divided by $(x - 2)$ (5 marks)

f.) Find the modulus and argument of the complex number $z = 1 - 2i$ (5 marks)

g.) Rationalize the denominator in $\frac{\sqrt[3]{3}}{\sqrt[3]{9} + \sqrt[3]{7}}$ (5 marks)

QUESTION TWO (20 MARKS)

a.) Find the quotient $\{(6 + 2i) + (1 + 3i)\} / -1 + i - 2$ (4 marks)

b.) Write down the sum and product of the roots of the equation

$$3x^2 - 2x - 7 = 0 \quad (5 \text{ marks})$$

c.) How many ways can you pick 5 students from a group of 19 students. (5 marks)

c.) Show that if $r = \sqrt{n+1} - \sqrt{n-1}$ for any integer $n > 1$, then r is irrational. (6 marks)

QUESTION THREE (20 MARKS)

a.) Show that $\binom{n}{r} + \binom{n}{r-1} = \binom{n+1}{r}$ (3 marks)

b.) If $x = \log_9 5$ and $y = \log_3 5$ find y in terms of x (5 marks)

c.) Find the amplitude, phase angle displacement and vertical displacement for the graph of $y = 4 + \frac{3}{2} \cos \frac{1}{2}(\theta - 90^\circ)$. (6 marks)

d.) Expand $(1 - 5x)^{\frac{1}{3}}$ 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 4 decimal places. (6 marks)

QUESTION FOUR (20 MARKS)

a.) Solve for x in the equation $\sin x + \sqrt{2} = -\sin x$ (2 marks)

b.) Find the exact value of $\sin 105^\circ$. (4 marks)

c.) Give the binomial expansion of $(a + b)^8$ (4 marks)

d.) solve the following quadratic equations using the method of completing the square

$$2x^2 - 6x - 3 = 0 \quad (5 \text{ marks})$$

e.) Find the cube roots of unity and hence factorize $z^3 - 1$ (5 marks)

QUESTION FIVE (20 MARKS)

a.) Solve the equation, giving values of θ from 0° to 360° inclusive $3 - 3\cos \theta = 2\sin^2 \theta$ (4 marks)

b.) 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)

c.) Write down the equation, the sum and product of whose roots are respectively 3 and -2
(5 marks)

d.) Find the values of the six trigonometric functions of θ if θ has its terminal ray in

Quadrant III and $\sin \theta = -\frac{2}{3}$. (6 marks)