



MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT190: FOUNDATIONS OF MATHEMATICS FOR INFORMATION TECHNOLOGY

DATE: 2/3/2021

TIME: 2:00 – 4:00 PM

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 $\log_b \frac{M^{1/3} P^{1/4}}{\sqrt{(M^2 P^3)}}$

(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
 $3x^2 - 2x - 7 = 0$ (5 marks)
- c) How many ways can you pick 5 students from a group of 19 students. (5 marks)
- d) 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
 $2x^2 - 6x - 3 = 0$ (5 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 ϕ from 0^0 to 360^0 inclusive $3-3\cos \phi=2\sin^2 \phi$
(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)