

THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE,
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT
NJOMBE REGION



FORM SIX PRE – NATIONAL EXAMINATION

CODE: 131/1

BASIC APPLIED MATHEMATICS

(For Both School and Private Candidates)

TIME: 03: 00 HOURS

WEDNESDAY, 13TH March 2024 A.M

INSTRUCTIONS

- This paper consists of ten (10) questions.
- Answer ALL questions.
- Non-programmable calculator may be used.
- Communication devices and unauthorized materials are not allowed in the examination room.

1. Use non-programmable calculator to evaluate each of the following:

- (a) Find the value of y given that; $y = \ln \left(\frac{\ln \left(\frac{\ln 4 \times 10^2}{\pi} \right)}{\log_2 \sqrt{3}} \right)^{\frac{2}{3}}$ to three decimal places.
- (b) If $M^d = \frac{P}{\pi t} \left[\frac{4}{3} \ln \left(\frac{D}{d} \right) + \sqrt{\log P} \right]^{\frac{1}{3}}$ find the value of D to three decimal places, given that $P = 1.6 \times 10^3$, $t = 57 \times 10^{-2}$, $M = 57.01 \times 10^2$ and $d = M - 10000t$.
- (c) Compute the determinant and inverse of matrix A correct to one decimal place.

$$A = \begin{bmatrix} 0.1 & \sin 6^\circ & \frac{1}{8} \\ -1 & \frac{11}{4} & 7 \\ 9 & \frac{3}{4} & -11 \end{bmatrix}$$

2. (a) When divided by $x+1$, the polynomial function $ax^3 + bx^2 - 13x + 6$ leaves a remainder of 18, when divided by $2x-1$ it leaves the remainder of zero. Find the values of the constant a and b .
- (b) Use a long division method to find $\frac{P(x)}{Q(x)}$, given that $P(x) = x^3 - y^3$ and $Q(x) = x - y$.
- (c) Without using table of values draw the graph of $f(x) = x^3 - 4x$ and hence states the domain and range of $f(x)$.
3. (a) The roots of polynomial equation $Q(x) = x^3 - 7x^2 + Bx - 8$ form a Geometric progression. Find;
- The roots of polynomial equation $Q(x)$
 - The value of B .
 - The abscissa at the turning point on the curve.
- (b) Six people working 8 hours a day take ten days to finish a certain job. How long would it take for two people working 12 hours per day to finish the same job?
4. (a) Use the first principle of differentiation to find the derivative of $f(x) = -x^3 + 3$.
- (b) Given the equations $x = (t^2 - 1)^2$, $y = t^3$. Find $\frac{dy}{dx}$ in terms of t .
- (c) Water runs into a conical tank at the rate of $9m^3 \text{ min}^{-1}$. The tank slant point down and has a height of $10m$ and a base radius of $5m$. How fast is the water level rising when the water is $6m$ deep?
5. (a) Integrate $\int \log_6 x dx$
- (b) Find $f(x)$ at $(1,2)$ if $f'(x) = 5x^2 - 4x$.
- (c) Find the area enclosed between the curve $y = x(x-1)(x-2)$ and the x -axis.

6. A biology teacher asked each of her 20 students to bring a grasshopper as a specimen for practical and the length of each grasshopper was recorded in centimeters as follows;
- | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 5 | 4 | 5 | 2 | 4 | 2 | 4 | 2 |
| 4 | 2 | 5 | 3 | 2 | 3 | 2 | 3 | 1 | 3 |
- a) Prepare frequency distribution table (do not group the data).
 b) Calculate the median of the data.
 c) Use assumed mean $A = 3$ and coding method to calculate mean and standard deviation correct to 2 decimal places.
7. (a) All letters in the word **UNIVERSAL** are to be arranged without repetition such that 3 letters in the middle are vowels. How many ways can this be done?
 (b) Given that, for the dependent events A and B ;
 $n(A) = 32, n(B) = 28$ and $n(A \cap B) = 15$. Calculate
 i) $P(A/B)$
 ii) $P(B/A)$
 (c) The committee of seven members is to be formed from 9 boys and 4 girls. In how many ways can this be done if the committee consists of exactly 3 girls?
8. (a) If a triangle has three sides with length $0.06m$, $0.08m$ and $0.12m$, by how much does its largest angle differ from the small angle?
 (b) Prove that $\sec 2\theta + \tan 2\theta = \frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}$.
 (c) Solve the following equation $\cos 2\theta = \cos \theta$ for $0 \leq \theta \leq 2\pi$.
9. (a) Solve the equation $7^{2x+5} = 3^{4x}$
 (b) Sketch the graph of the following and states the domain and range $g(x) = \log_3 x$.
 (c) The current population of lizards in a certain Island is 1000. If they breed at a constant rate of 10% per year, what will be the population of the lizards in the Island after 7 years? Give the answer in four significant figures.
10. (a) Let $A = \begin{pmatrix} 1 & 2 & 4 \\ 6 & 1 & 0 \\ 4 & -1 & 3 \end{pmatrix}$, show that $AA^{-1} = I$ where I is the identity of 3×3 matrices.
 (b) A retail shop received orders from customers A and B for the following food packages. The packages A should contain 20kg of beans, 20kg of rice and 20kg of maize, while B contains only 10kg of beans and 30kg of rice. The stock has 340kg beans, 540kg of rice and 280kg of maize. If a unit of package A cost 1200/= Tsh and that of B costs 900/=Tsh. How many packages should be supplied by the retailer so as to realize maximum sale?