

THE UNITED REPUBLIC OF TANZANIA



PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT
FORM SIX PRE- MOCK EXAMINATION - RUVUMA REGION

142/2

ADVANCED MATHEMATICS 2

Time: 3 Hours

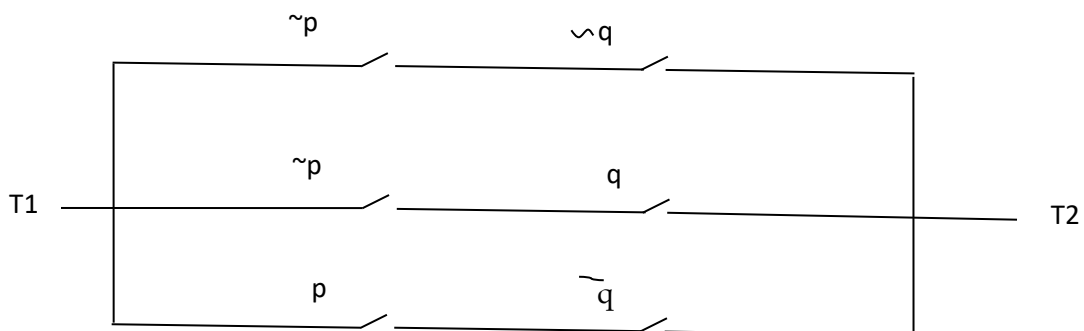
Monday, 19th August, 2024 a.m

Instructions

1. This paper consists of sections A and B with a total of **eight (8)** questions.
2. Answer **all** questions in section A and two **(2)** questions in section B.
3. All necessary working and answer of each question done must be shown clearly.
4. NECTA's mathematical tables and non – programmable calculators may be used.
5. All writing must be in blue ink or black ink except drawing which must be in pencil
6. Cellular phones and unauthorized materials are not allowed in the examination room.
7. Write your **Examination Number** on every page of your answer sheet(s) provided

SECTION A (60 Marks)

1. (a) Three countries each has teams of six or more drivers in a car racing tournament. In how many ways can the first six positions be taken by the three country?
- (b) Events A and B are such that $P(A) = 0.3$, $P(B) = 0.4$ and $P(A \cap B) = 0.1$. Find the value of
 - i. $P(A \cap B')$
 - ii. $P(A' \cap B')$
- (c) The probability density function (p.d) of a discrete random variable y is given by $p(Y = y) = cy^2$ for $y = 0, 1, 2, 3, 4$ and $p(Y = y) = 0$ else where. Find the value of the constant c
2. (a) Use the laws of algebra of propositions to show that $\sim(p \vee (\sim p \wedge q))$ and $\sim p \wedge \sim q$ are logically equivalent
- (b) Test the validity of the following arguments.
 “ If I read my text book, I will understand how to do my homework. I did not understand how to do my homework. Therefore, I did not read my text book”.
- (c) Draw a simplified electric network using the following circuit



3. (a) (i) . Find the projection of vector $i + 3j + 7k$ on the vector $7i - j + 8k$
- (ii) The vector $\underline{a} = 5i + 7j + k$ and $\underline{b} = 5i + 5j + 5k$ respectively. Find a unit vector perpendicular to $\underline{a} + \underline{b}$ and $\underline{a} - \underline{b}$
- (b) The area of the parallelogram whose adjacent sides is $2i - 4j + \lambda k$ and $i - 2j - 3k$ is $\sqrt{605}$ square units. Find the possible value of λ .

(c) Find the work done by $F = 2i + j + 3k$ acting on a particle, if a particle is displaced from a point with position vector $2i + 2j + 3k$ to the point with position vector $3i + 4j + 5k$

4. (a) (i) Find the solution of the equation $x^2 + 2x + 2 = 0$
 (ii) Plot the complex numbers $z = 1 + 2i$ and $w = 1 - 2i$ on the same argand diagram.
 (b) Find the modulus and Argument of the complex number $z = 2 + 3i$
 (c) (i) Express $z = \frac{7-i}{3-4i}$ into polar form

(ii) Determine the locus defined by $\arg \left[\frac{z-1}{z+1} \right] = \frac{\pi}{4}$

SECTION B (40 Marks)

Answer any two (2) questions

5. (a) Eliminate θ from the following parametric equations

$$\begin{cases} x = 2 + 4 \cos \theta \\ y = 3 + 5 \sin \theta \end{cases}$$

 (b) Prove that $\cos(x+y)\cos(x-y) = \cos^2 x - \sin^2 y$
 (c) Solve the equation $2 \sin x = \cos(x + 60^\circ)$ for values of x between 0° and 360°
 6. (a) Use the principle of Mathematical Induction to prove that $9^n - 1$ is divisible by 8 for all positive integers n

(b) Find the determinant and inverse of the matrix $B = \begin{bmatrix} 2 & -1 & 3 \\ 1 & 1 & 1 \\ 1 & -1 & 1 \end{bmatrix}$ hence solve

the following system of simultaneous equations
$$\begin{cases} 2x - y + 3z = 9 \\ x + y + z = 6 \\ x - y + z = 2 \end{cases}$$

(c) Express $\frac{8x^2 - x - 1}{(x-1)^2}$ in partial fractions

(d) Solve: $x^2 + x - 6 > 0$ algebraically

7. (a) Form the differential equation

i. $y = Ae^x + Be^{-2x}$

ii. $y = A \sin x + B \cos x$

(b) Solve the differential equation $\frac{dy}{dx} = \frac{x-5}{y^2}$, for $y(0) = 3$, expressing y in terms of x

(c) If a radioactive substance had an initial mass of $200g$, what would be its mass after 30 days if it is known that after 8 days its mass was half of its initial mass?

8. (a) Formulate the equation of a parabola whose focus is at the point $(4,0)$ and its directrix is $x = -4$

(b) Given the ellipse $25x^2 + 9y^2 - 18y - 100x - 116 = 0$. Find each of the following;

- i. Centre
- ii. Foci
- iii. Vertices
- iv. Directrices

(c) Change the polar equation $1 = \frac{\cos \theta}{r^2} + \frac{\sin \theta}{r}$ into Cartesian form