THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

142/1

ADVANCED MATHEMATICS 1
(For Both Private and School Candidates)

Duration: 3 Hours **Year: 2025**

Instructions

1. This paper consists of **ten (10)** questions.
2. Answer **all** the questions.
3. All necessary working and answers of each question done must be shown clearly.
4. Mathematical tables and non-programmable calculators may be used.
5. Communication devices and any unauthorised materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).

1. (a) Use a non-programmable calculator to evaluate the following expressions:

(i) $\dfrac{\tan 25^0 30' - \sqrt[5]{0.03e^{-3}}}{\ln 3.2 + 0.006e^{0.3}}$ correctly to six significant figures

(ii) $\displaystyle\sum_{n=4}^{7} \frac{2^{-n}(n!)}{\ln(0.3n)}$ correct to three decimal places.

(b) If $A_t = A_5 + A_0 e^{-kt}$, $k = -0.1386$, $A_5 = 20$ and $A_{20} = 40$, by using a non-programmable calculator, compute the value of A_{16} correct to 2 decimal places.

2. (a) Prove that $\dfrac{1+\tanh x}{1-\tanh x} = \cosh 2x + \sinh 2x$.

(b) Differentiate $\ln(\tanh x)$ with respect to x and simplify your answer.

(c) Find the area enclosed by the curve $y = \cosh x$, $x = \ln 2$, the x-axis and the y-axis, hence find the volume obtained when this area is rotated completely about the x-axis.

3. Rehema has 900 tonnes and 600 tonnes of bricks at Mtakuja and Tupendane villages respectively. She has planned to build new houses at sites A, B and C. She expects to use 500 tonnes of bricks at site A, 600 tonnes of bricks at site B and 400 tonnes of bricks at site C. The transport cost in Tsh. is proportional to the distance covered in kilometre as shown in the following table:

From/To	A	B	C
Mtakuja	600	300	400
Tupendane	400	200	600

If x and y are the number of bricks to be transported from Mtakuja to sites A and B respectively,

(a) formulate the inequalities and objective function to be satisfied by x and y.

(b) find the number of bricks to be transferred from Mtakuja and Tupendane villages to each site.

4. The following table shows the frequency distribution for the values of resistance in ohms of 48 resistors:

Resistors	20.5-20.9	21.0-21.4	21.5-21.9	22.0-22.4	22.5-22.9	23.0-23.4
Frequency	3	10	11	13	9	2

(a) Use this information to find the mode, median and 45^{th} percentile correct to 2 decimal places.

(b) Using the coding method, find the mean and standard deviation for the distribution correct to 4 significant figures.

5. (a) Given A= $\{x \in R : x \geq 1\}$ and B= $\{x \in R : -5 < x \leq 3\}$, display each of the following sets on a number line:

(i) $A \cap B$

(ii) $A \cup B'$.

(b) A survey on the type of cash crops grown in a certain village revealed that out of 230 families, 126 grow cotton, 85 grow sunflower only, 68 grow cotton and sunflower, 42 grow coffee and sunflower, and 34 grow cotton and coffee only. The number of families who grow cotton only is thrice the number growing coffee only and 9 grow none of these crops. Using the Venn diagram, determine the number of families growing:

(i) all three crops.

(ii) exactly one crop.

6. (a) Given the function $f(x) = x^3 + 3x^2 - 2x - 6$, draw the graph of $f(x)$ and hence, state its domain and range.

(b) Given that, $g(x) = \dfrac{x+1}{2x^2 + 5x - 3}$,

(i) find the vertical asymptotes

(ii) sketch the graph of $g(x)$ and determine the domain and range of $g(x)$.

7. (a) Derive the secant formula for approximating the roots of the equation $f(x) = 0$.

(b) Using the formula derived in part (a) and the interval (1.5, 2), perform two iterations to solve the equation $x^3 - 3 = 0$ correct to two decimal places.

(c) By using the Newton-Raphson method and $x_0 = 5$, perform two iterations to approximate the solution of the equation $x^3 - 4x^2 - x - 12 = 0$ correct to three significant figures.

8. (a) Calculate the perpendicular distance of a point $(3,-5)$ from the line $2x-y=1$.

(b) Obtain the equations to the bisectors of angles between the lines $3x+4y=12$ and $4x-3y=6$.

(c) Find the length of a tangent to the circle $x^2+y^2+2x+2y-7=0$ from the point $(2,3)$.

9. (a) Evaluate the definite integral $\int_1^2 \frac{4x^2+3x-2}{(x+1)(2x+3)}dx$ correct to four decimal places.

(b) Find the area enclosed between the curve $y=x(x-1)(x-2)$ and the x-axis.

(c) Find the volume of the solid formed by revolving the region enclosed by the curve $y=x^2-4$ and the x-axis about x-axis by $360°$.

10. (a) Differentiate $x^3y+y^3x=2y$ with respect to x at $(1,1)$.

(b) If a car starts from rest and moves a distance g cm in t seconds where $g=\frac{1}{8}t^4+\frac{1}{2}t^2$,

(i) find the velocity of the car after two seconds.

(ii) find the initial acceleration.

(c) Differentiate the following expressions with respect to x:

(i) $\frac{e^{x^3}(\sin x)^{\frac{1}{2}}}{3x+1}$.

(ii) $\cos^{-1}(\tan x)$.