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)

Time: 3 Hours **Year: 2020**

Instructions

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

2 002142 100011

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

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

(ii) $\sum_{n=4}^{7} \dfrac{2^{-n}(n!)}{\ln(0.3n)}$ correct to 3 decimal places.

(b) The population of Dar es Salaam city is modeled by the equation $P(t) = P_0 e^{\lambda t}$ where $\lambda = 0.034657$ per year. Use a non-programmable calculator to find the time t in years when the population in the city is three times the initial population P_0.

2. (a) Show that $(\cosh A - \cosh B)^2 - (\sinh A - \sinh B)^2 = -4\sinh^2\left(\dfrac{A-B}{2}\right)$.

(b) Use the second derivative test to identify the nature of the stationary point of the function $f(t) = \cos 2t - 4\sinh t$.

3. (a) A farm stocks two types of local brews called Kibuku and Lubisi, both of which are produced in cans of the same size. He wishes to order fresh supplies and finds that he has room for up to 1,500 cans. He know that Lubisi is more popular and so proposes to order at least thrice as many cans of Lubisi as Kibuku. He wishes, however, to have at least 120 cans of Kibuku and at most 950 cans of Lubisi. The profit on a can of Kibuku is sh. 3,000 and a can of Lubisi is sh. 4,000. Taking x to be the number of cans of Kibuku and y to be the number of cans of Lubisi which he orders, formulate this as a linear programming problem.

(b) A cooperative society has two storage depots for storing beans. The storage capacity at depot 1 and 2 is 200 and 300 tons of beans respectively. The tons of beans has to be sent to three marketing centres X, Y and Z. The demand of beans at X, Y and Z is 150, 150 and 200 tons respectively. The following table shows the cost of transport in Tshs. per ton from each depot to each marketing centre:

	To		
From	X	Y	Z
Depot 1	10,000	20,000	14,000
Depot 2	16,000	30,000	8,000

How many tons of beans should be sent from each depot to each of the marketing centre?

4. (a) Show that $\sum_{i=1}^{n}(x_i-\bar{x})^2=\sum_{i=1}^{n}x_i^2-n\bar{x}^2$.

(b) The following table shows the masses in gram of a sample of potatoes:

Mass (g)	10 – 19	20 – 29	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79	80 – 89	90 - 99
Frequency	2	14	21	73	42	13	9	4	2

(i) Using the coding method and the assumed mean A = 54.5, find the arithmetic mean.

(ii) Use the mean obtained in (b) (i) to find the variance and standard deviation correct to 2 decimal places.

(iii) Compute the 80 percentile correctly to three decimal places.

5. (a) Use the appropriate laws of set to simplify $(A\cup B)'\cap(A\cap B)'$.

(b) The Malya social Training College Cultural group consists of 36 villagers, 25 of them participate in dancing, 28 participate in singing, while 26 among them participate in drama, 19 villagers dance and sing; 18 villagers dance and play drama and 15 participate in all three activities. If each villager participate in at least one of the activities, use Venn diagram to find the number of villagers;

(i) who are either dancing or playing drama,

(ii) who participate in at most two activities and

(iii) who neither play drama nor sing.

6. (a) (i) If $f(x)=x^2+1$ and $g(x)=\sqrt{x-1}$, find fog,

(ii) Copy and complete the following table of values,

x	-3	-2	-1	0	1	2
fog						

(iii) Use the table of values in (ii) to sketch the graph fog.

(b) If $y=\dfrac{x^2-2x-3}{x^2-4}$;

(i) find the vertical and horizontal asymptotes,

(ii) sketch the graph of y.

7. (a) By using the trapezium rule with 5 ordinates, find an approximate value for $\int_0^4 x\sqrt{9+x^2}\,dx$ correct to three decimal places.

(b) Use Simpson's rule with 5 ordinates to find an approximation for $\int_0^4 x\sqrt{9+x^2}\,dx$ correct to three decimal places.

(c) Find the value of integral $\int_0^4 x\sqrt{9+x^2}\,dx$.

(d) Which of the two methods in (a) and (b) gives a better approximation of $\int_0^4 x\sqrt{9+x^2}\,dx$.

8. (a) If m and n are lengths of the perpendicular distance from the origin to the lines $x\cos\theta - y\sin\theta = p\cos 2\theta$ and $x\sec\theta + y\operatorname{cosec}\theta = p$ respectively, prove that $m^2 + 4n^2 = p^2$.

(b) Show that the bisector of the acute angle between $y = x + 1$ and the x-axis has the gradient of $-1+\sqrt{2}$.

(c) A point P lies on the circle of radius 2 whose centre is at the origin. If A is the point $(4,0)$, find the locus of a point which divides AP in the ratio $1:2$.

9. (a) Find the integral $\int \frac{\sin x}{1+\cos x}dx$.

(b) Evaluate the integral $\int_1^{e^2} \ln x\,dx$.

(c) Find the length of the arc of the curve given by the parametric equations $x = a(\cos\theta + \theta\sin\theta)$ and $y = a(\sin\theta - \theta\cos\theta)$ from $\theta = 0$ to $\theta = 2\pi$.

10. (a) Find the derivative of x^n from first principles.

(b) Use Taylor's theorem to expand $\cos\left(\frac{\pi}{6}+h\right)$ in ascending powers of h up to the term containing h^3.

(c) If $x + y = 10$, find the least possible value of $x^2 + y^2$.