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

141 **BASIC APPLIED MATHEMATICS**
(For Both School and Private Candidates)

Time: 3 Hours **Year: 2023**

Instructions

1. This paper consists of **ten (10)** questions.
2. Answer **all** the questions. Each question carries **10** marks.
3. All work done in answering each question must be shown clearly.
4. Non-programmable calculators and NECTA mathematical tables may be used.
5. All writing must be in **blue** or **black** ink **except** drawing which must be in pencil.
6. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).

1. Use a non-programmable scientific calculator to:

(a) compute the value of $\dfrac{67.9\sqrt[3]{68.53}}{\sqrt[4]{e^3 \ln 2}}$ correct to 5 significant figures.

(b) evaluate $\int_0^1 e^{x^2} dx$ correct to 4 decimal places.

(c) approximate the value(s) of x (correct to 3 decimal places) which satisfy the equation $x^3 + 5x^2 + 3x - 7 = 0$.

2. The function f is defined as $f(x) = \dfrac{a}{x} + b$ such that $f(2) = 2$ and $f(-1) = -1$.

(a) Find the values of a and b.

(b) Sketch the graph of f.

(c) State the domain and range of f.

3. (a) The sum of the first three terms of an arithmetic progression is 3 and the sum of the first five terms is 20. Find the first term and the common difference.

(b) The volume of a cone varies jointly as its height and the square of its radius. The cone with a radius of 6 cm and a height of 10 cm has a volume of 120π cm^3. Find the volume of the cone having a radius of 15 cm and a height of 7 cm.

4. (a) Find the first derivative for each of the following functions:

(i) $f(x) = \cos(2x+1)$.

(ii) $g(x) = \dfrac{x}{1+x^2}$.

(iii) $h(x) = 3^x$.

(b) The temperature (T) in $^\circ C$ of meat in a freezer after t hours is given by $T = 70 - 12t + \dfrac{4}{t+1}$.

(i) What is the temperature of the meat after 3 hours?

(ii) How fast is the temperature of the meat falling after 3 hours?

5. (a) Given that $\int_1^5 h(x)\,dx = 4$,

(i) evaluate $\int_1^5 \big(h(x)+3\big)\,dx$.

(ii) find the value of k if $\int_1^5 \big(h(x)+kx\big)\,dx = 28$.

(b) Find $\int t(1+5t)^7\,dt$.

6. Consider the following data;

28	46	62	8	30	21	60	40	10	13	31	47	45
31	25	15	55	18	34	46	20	30	18	9	38	42
32	52	32	67	9	70	31	29	50	25	18	25	63
42	48	47	30	21	35	54	45	8	39	54	61	63
12	50	38	24	45	11	20	47	55	43	46	53	25

(a) Construct a frequency distribution table using the intervals 0 - 9, 10 - 19, …, ...

(b) Draw a histogram and use it to estimate the mode correct to 2 decimal places.

(c) Calculate:

(i) the median (correct to 3 decimal places).

(ii) the 70th percentile (correct to 3 decimal places).

7. (a) A certain family consists of mother, father and their ten children. The family is invited to send a group of four representatives to a wedding. In how many ways can the group be formed if it must include both parents?

(b) A fair coin is tossed three times. Using tree diagram, find the probability of obtaining exactly two heads.

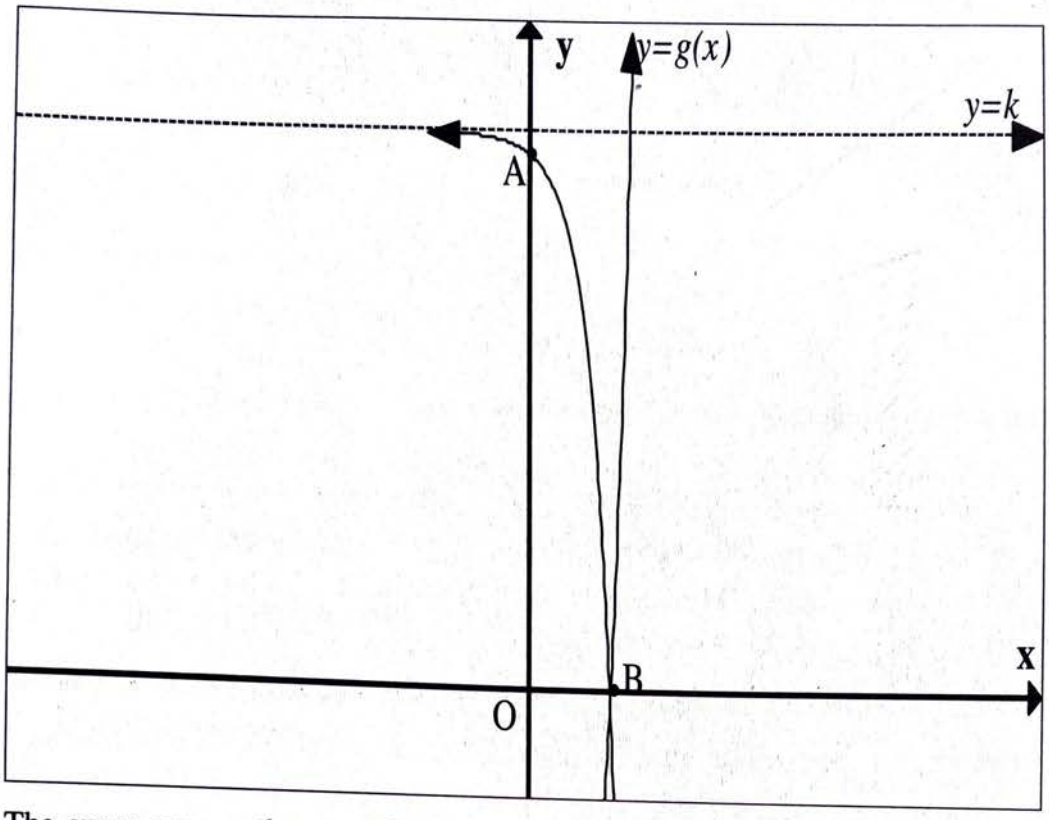
8. (a) If $x = \sin(A+B)$ and $y = \sin(A-B)$, prove that $xy = \sin^2 A - \sin^2 B$.

(b) Solve the following equations for $0^\circ \le \theta \le 360^\circ$:

(i) $2\sin^2\theta - 3\cos\theta = 3$.

(ii) $\sqrt{2}\cos\theta - \sin 2\theta = 0$.

9. The following figure shows part of the curve of the function $y = g(x)$, where $g(x) = \left|4e^{2x} - 25\right|$, $x \in \mathbb{R}$.



The curve crosses the y - axis at point A and meets x - axis at point B. The curve has an asymptote $y=k$, where k is a constant. Giving your answer in the simplest form, find:

(a) the y - coordinate of point A.

(b) the x - coordinate of point B.

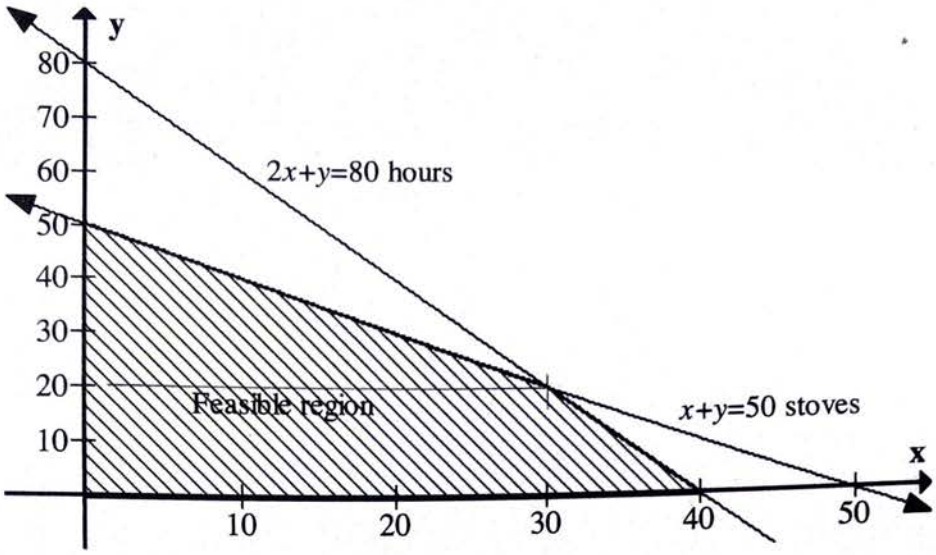
(c) the value of k.

10. (a) (i) Write down all possible orders for a matrix with 6 elements.

(ii) Suppose $A=\left[a_{ij}\right]$ is a 2×2 matrix whose elements are given by $a_{ij}=\frac{j-i}{2}$.

Determine the elements of matrix A.

(b) The following graph represents business optimization possibilities for a company which sales two types of stoves, S_1 and S_2. The variable x represents the number of S_1 type while y represents the number of S_2 type. The time available for the company to make both S_1 type and S_2 type is 80 hours and the space available can hold not more than 50 stoves.



Use the graph to answer the following questions:

(i) How many hours are used to make one stove of each type?

(ii) If one stove of S_1 type is sold at a price of Tshs. 300 and one stove of S_2 type is sold at a price of Tshs. 200, how many stoves of each type could be sold in order to maximize revenue?