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 **Tuesday, 08th May 2018 a.m.**

Instructions

1. This paper consists of **ten (10) compulsory** questions. Each question carries **ten (10)** marks.
2. Answer **all** questions.
3. **All** necessary working and answers for each question done must be shown clearly.
4. 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).

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1. Use a non-programmable calculator to:

(a) Compute the value of $\sqrt[3]{\dfrac{\log 122 \times \ln 315}{e^{0.9} + \cos^{-1} 0.5487}}$ to 6 significant figures.

(b) Find mean and standard deviation of the following data correct to 4 decimal places:

Length (cm)	110	130	150	170	190
Frequency	12	35	24	5	3

(c) Find the determinant of the matrix A, where $A = \begin{pmatrix} -1 & 3 & 1 \\ 2 & 4 & 0 \\ 0 & 5 & -3 \end{pmatrix}$.

(d) Solve the quadratic equation $t^2 - 5t + 3.31414 = 0$ giving the answer into 3 decimal places.

2. (a) A step function f is defined on the set of real numbers such that $f(x) = \begin{cases} 12x + 5 \text{ if } x > 1 \\ x - 4 \text{ if } x \le 1 \end{cases}$. Find; $f\left(-\frac{1}{8}\right)$, $f(2)$ and $f(-3)$.

(b) Sketch the graph of $f(x) = \dfrac{1}{2 - x}$ and hence state its domain and range.

(c) The line that passes through point $A(-4, 6)$ has a slope of -1. Draw the graph of this line in the interval $-4 \le x \le 4$.

3. (a) Solve the simultaneous equations $\begin{cases} x^2 - 2y = 7 \\ x + y = 4 \end{cases}$ by substitution method.

(b) Calculate the sum of the series $\sum_{r=3}^{5} (-1)^{r+1} r^{-1}$.

(c) The second and fifth terms of an A.P are $x - y$ and $x + y$ respectively, find the third term.

4. (a) If $f(x) = x$, find $\dfrac{dy}{dx}$ from first principles.

(b) Given the curve $f(x) = (x + 1)(x - 1)(2 - x)$,

(i) Find x and y intercepts.

(ii) Determine the maximum and minimum points of $f(x)$.

(iii) Sketch the graph of $f(x)$.

5. (a) Integrate $\int 2x\sqrt{x^2+3}\,dx$.

(b) Find the area of the region enclosed by the curve $y = x^2$ and the line $y = x$.

(c) Find the volume of revolution which is obtained when the area bounded by the line $y=2x$, $x-$axis, $x=1$ and $x=h$ is rotated about the x-axis.

6. The masses of 50 apples measured to the nearest grams are as follows:

86	101	114	118	87	92	93	116	105	102	97	93	101
111	96	117	100	106	118	101	107	96	101	102	104	92
99	107	109	105	113	100	103	108	92	98	95	100	103
110	113	99	106	116	101	105	86	88	108	92		

From these data;

(a) Construct a frequency distribution table using equal class intervals of width 5 grams taking the lower class boundary of the first interval as 84.5.

(b) Draw the histogram to illustrate the data.

(c) Calculate the mode by using the appropriate formula.

7. (a) Verify that ${}^8C_3 + {}^8C_2 = {}^9C_3$.

(b) Two events A and B are such that $P(A)=\frac{1}{3}$ and $P(B)=\frac{2}{7}$.

(i) Find $P(A\cup B)$ when A and B are mutually exclusive events.

(ii) $P(A\cap B)$ when A and B are independent events.

(c) Two students are chosen at random from a class containing 20 girls and 15 boys to form a student welfare committee. If replacement is allowed, find the probability that:

(i) both are girls.

(ii) one is a girl and the other is a boy.

8. (a) (i) Without using a calculator, find the value of $\cos 15^0$.

(ii) Prove that $\sin(A+B)\sin(A-B) = \sin^2 A - \sin^2 B$.

(iii) Sketch the graph of $f(x) = \sin x$, where $-2\pi \leq x \leq 2\pi$.

(b) Solve the equation $\cos 2x + \sin^2 x = 0$, where $0^0 \leq x \leq 360^0$.

9. (a) Three entrepreneurs R_1, R_2 and R_3 sell seedlings of two species A and B. If the sales in one month and prices paid (in Tsh) for each type are $S = \begin{matrix} \\ R_1 \\ R_2 \\ R_3 \end{matrix}\begin{matrix} \begin{matrix} A & B \end{matrix} \\ \begin{bmatrix} 12 & 13 \\ 8 & 5 \\ 16 & 9 \end{bmatrix} \end{matrix}$ and $P = \begin{matrix} A \\ B \end{matrix}\begin{bmatrix} 2500 \\ 3500 \end{bmatrix}$ respectively, find the total sales for each of the three entrepreneurs.

(b) Given matrix $A = \begin{bmatrix} 3 & -5 \\ 7 & -11 \end{bmatrix}$. Verify that $A^{-1}A = I$, where I is an identity matrix.

(c) Use Cramer's rule to solve $\begin{cases} x + y + z = 6 \\ 2x + y - z = 1 \\ x - y + z = 2 \end{cases}$.

10. (a) Mention any four applications of linear programming.

(b) Define the following terms in linear programming:

(i) Objective function

(ii) Constraints

(iii) Feasible region

(c) A special take away fast lunch of food and drinks contains 2 units of vitamin B and 5 units of iron. In each glass of drinks there are 4 units of vitamin B and 2 units of iron. A minimum of 8 units of vitamin B and 60 units of iron are served each day. If each serving of food cost 2000 Tshs and that of drinks cost 1600 Tshs; How much of the food and drinks are needed to be consumed in order to meet daily needs at a minimum cost?