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: 2022**

Instructions

1. This paper consists of **ten (10)** questions.
2. Answer **all** 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. 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).

1. (a) Use a non-programmable calculator to;

(i) compute $\dfrac{3254\times 3.14\sqrt{417}}{10^5\times\log\sqrt[3]{278}}$ (write your answer correct to 2 decimal places).

(ii) evaluate $\tan^{-1}\left[\dfrac{\ln\left(\dfrac{4\times 10^2}{\pi}\right)}{\log\sqrt{2}}\right]$ correct to 2 significant figures.

(iii) find the value of $\sum_{x=1}^{4} e^x\sqrt{1+x^2}$ correct to 4 decimal places.

(b) Given that $P(x=r)=\binom{n}{r}P^r(1-P)^{n-r}$ where $n=10$ and $P=0.45$, find the numerical value of $P(x=1)$ correct to 4 significant figures.

2. (a) (i) Sketch the graph of $f(x)=\dfrac{2x+5}{x^2-x-6}$.

(ii) Write down the value(s) of x for which $f(x)$ does not exist.

(b) Find the value of $\dfrac{f(2)f(1)}{f(-1)}$ given that $f(x)=\begin{cases} x \text{ for } -1\le x<0 \\ x^2 \text{ for } 0<x<2 \\ x+2 \text{ for } 2\le x \end{cases}$.

3. (a) The total number of pencils and pens in a box is 47 and the product of the number of the pencils and the number of pens is 370. Find the number of pencils present in the box.

(b) The 8^{th} and 15^{th} terms of an arithmetic progression are 11 and 21 respectively. Find the n^{th} term.

4. (a) (i) Differentiate $y=\dfrac{1}{1+x}$ from the first principles.

(ii) Find the first derivative of $g(x)=\sqrt{x^2+2x}$.

(b) The total length of the diameter and height of a cylinder is 3 metres. Show that the cylinder has the maximum volume when both height and radius measure 1 metre.

5. (a) Evaluate $\int_{\frac{1}{2}}^{1} x\sqrt{(1-x^2)}dx$ correct to 4 decimal places.

(b) Find the area bounded by the curve $y=2\cos x$, the lines $x=0$, $x=2\pi$ and the $x-$axis.

6. (a) The mean and variance of 7 observations are 8 and 16 respectively. Amongst, the five observations are 2, 4, 10, 12 and 14. Find the other two observations.

(b) The following table shows heights of 40 trees measured to the nearest meters:

Heights	4 – 8	9 – 13	14 – 18	19 – 23	24 – 28	29 - 33
Number of trees	2	4	7	14	8	5

Find the median.

7. (a) Show that ${}^{n+1}P_2 = n(n+1)$.

(b) A and B are mutually exclusive events with $P(A)=\frac{1}{2}$ and $P(B)=\frac{1}{4}$. Find $P(A\cap B')$.

(c) Two balls are drawn randomly without replacement from a bag containing 3 black balls and 2 white balls.

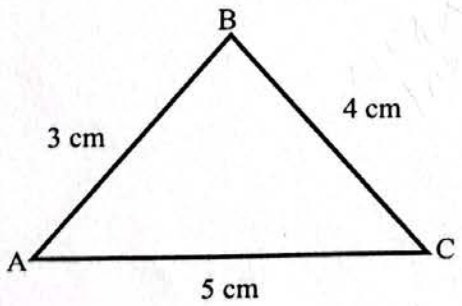
(i) Use tree diagram to analyze the probability of each drawing.

(ii) Find the probability that both balls are white.

8. (a) Write $\cos 2B$ in terms of $\tan B$.

(b) If $\tan A=\frac{m}{m-1}$ and $\tan B=\frac{1}{2m-1}$, show that $A-B=\frac{\pi}{4}$.

(c) Find the degree measure of ABC in the following figure:



9. (a) Draw the graphs of $f(x)=2^{x-5}$ and $g(x)=\log_2(2x+3)$ on the same xy plane.

(b) Use the graphs drawn in 9 (a) to determine the domain and range of:

(i) $f(x)$.

(ii) $g(x)$.

10. (a) Given the matrices $D=\begin{pmatrix} a & -4 & -6 \\ -8 & 5 & 7 \\ -5 & 3 & 4 \end{pmatrix}$ and $E=\begin{pmatrix} 1 & 2 & -2 \\ 3 & b & 1 \\ -1 & 1 & -3 \end{pmatrix}$; If D is the inverse of E, determine the value(s) of a and b.

(b) A firm manufactures two products, A and B. The firm sells product A at a profit of 5 shillings per unit and product B at a profit of 3 shillings per unit. Each product is processed on two machines, M_1 and M_2. One unit of product A requires one minute of processing on M_1 and two minutes of processing on M_2 per day. One unit of product B requires two minutes of processing on M_1 and one minute of processing on M_2 per day. Machine M_1 works for 5 minutes per day while machine M_2 works for 6 minutes per day. Represent this information by using a graph and indicate the feasible region.