

**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).



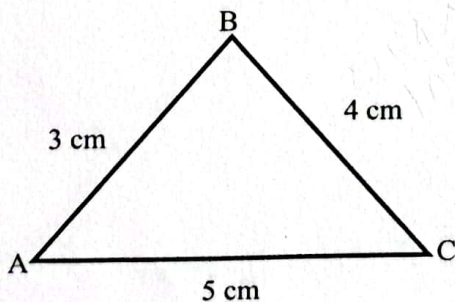
1. (a) Use a non-programmable calculator to;
- (i) compute $\frac{3254 \times 3.14 \sqrt{417}}{10^5 \times \log \sqrt[3]{278}}$ (write your answer correct to 2 decimal places).
- (ii) evaluate $\tan^{-1} \left[\frac{\ln \left(\frac{4 \times 10^2}{\pi} \right)}{\log \sqrt{2}} \right]$ correct to 2 significant 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 $f(x) = \frac{2x+5}{x^2-x-6}$.
- (ii) Write down the value(s) of x for which $f(x)$ does not exist.
- (b) Find the value of $\frac{f(2)f(1)}{f(-1)}$ given that $f(x) = \begin{cases} x & \text{for } -1 \leq x < 0 \\ x^2 & \text{for } 0 < x < 2 \\ x+2 & \text{for } 2 \leq x \end{cases}$.
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 8th and 15th terms of an arithmetic progression are 11 and 21 respectively. Find the n^{th} term.
4. (a) (i) Differentiate $y = \frac{1}{1+x}$ 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 $\angle ABC$ 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.