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

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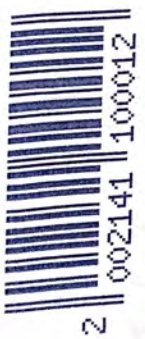
BASIC APPLIED MATHEMATICS

(For Both School and Private Candidates)

Time: 3 Hours **Year: 2020**

Instructions

1. This paper consists of **ten (10)** questions. Each question carries **10** marks.
2. Answer **all** questions.
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. Use a non-programmable scientific calculator to compute:

   (a) the value of $\dfrac{3+3(\sqrt[3]{0.65})}{3-3(\sqrt[3]{0.65})}$ correct to 4 significant figures.

   (b) the mean and standard deviation of 33, 28, 26, 35 and 38 correct to 2 decimal places.

   (c) the value of $\dfrac{{}^{5}C_{2}+{}^{9}P_{6}}{11!}$ correct to 4 decimal places.

2. (a) The function f is defined as $f(x)=\begin{cases}2x-1 & \text{if } -2<x\leq 1\\ x^2 & \text{if } 1<x\leq 2\\ 10-3x & \text{if } 2<x<3\end{cases}$

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

   (ii) State the domain and range of $f(x)$.

   (b) Given that $f(x)=3x+3$ and $g(x)=x+3$, find:

   (i) $(fog)(x)$.

   (ii) $(fog)^{-1}(x)$.

3. (a) Use the substitution method to solve the following system of equations:

$$\begin{cases} 3x-y=9 \\ x^2+xy+2=0 \end{cases}.$$

   (b) Find the value(s) of x satisfying the equation $4^x-6(2^x)-16=0$.

   (c) Find the sum of the first n terms of the series $1+3+5+\ldots$

4. (a) Find the first derivative of $f(x)=x^2$ from first principles.

   (b) Find the slope of the tangent to the curve $8x^3+xy^3-5y^2=0$ at $(1,-1)$.

   (c) Use second derivative test to classify the stationary point(s) of the curve $f(x)=2x^3+3x^2-12x-5$.

5. (a) Integrate $\sin^2 2x\cos 2x$ with respect to x.

   (b) Evaluate $\int_0^{\sqrt{a}} \dfrac{x}{x^2+a}\,dx$ (express your answer in the form $m\sqrt{n}$).

   (c) Find the area enclosed between the curves $y=x^2+2$ and $y=10-x^2$.

6. The following table shows litres of milk produced by 131 cows each day.

Litres of milk	5-10	11-16	17-22	23-28	29-34	35-40
Number of cows	15	28	37	26	18	7

   (a) Estimate the mode.

   (b) Draw the cumulative frequency curve and use it to estimate the median.

7. (a) A family has three children. Assuming equal chances for boys and g...

(i) use tree diagram to show all possible outcomes.

(ii) find the probability that two are girls and one is a boy.

(b) A bag contains 6 red and 4 blue beads. A bead is picked out and retained and then a second bead is picked out. Find the probability that:

(i) both beads are red.

(ii) the beads are of different colours.

(c) How many odd numbers greater than 2000 and less than 3000 can be formed using the digits 1, 2, 3, 4, 5 and 6 if each digit is not repeated?

8. (a) (i) Evaluate the value of $\tan 15^0$ from sine and cosine of 45^0 and 30^0.

(ii) Given that $\sin A = \frac{3}{5}$ and $\cos B = \frac{15}{17}$ where A and B are angles in the first and second quadrants respectively, find the exact value of $\sin(A+B)$.

(b) Prove that $\sin 2A = \frac{2\tan A}{1+\tan^2 A}$.

9. (a) Sketch the graphs of $f(x) = \ln|x|$ for $x \in \mathbb{R}$ and hence state its domain and range.

(b) The amount (A) of the radioactive isotope Carbon-14 at any time t is given by the formula $A(t) = A_0 e^{kt}$ where A_0 is the initial amount of the element. If the half-life of the radioactive isotope Carbon-14 is about 5730 years:

(i) express the amount of Carbon-14 left from an initial N milligrams as a function of time t in years.

(ii) what percentage of the original amount of Carbon-14 left after 20,000 years?

10. An aircraft has 600 m^2 of cabin space and can carry 5,000 kg of luggage. An economy class passenger gets 3 m^2 of space and is allowed to travel with 20 kg of luggage. The first class passenger gets 4 m^2 of space and is allowed to have 50 kg of luggage in the aircraft. In the aircraft, there is space for at least 50 economy class passengers. The profit per flight for the economy and first class passengers are 40,000/- and 100,000/- respectively.

(a) Write down all the constraints.

(b) Use graphical method to find the number of economy passengers and first class passengers which will give the maximum profit per flight.