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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 : 2021**

Instructions

1. This paper consists of **ten (10)** questions. Each question carries **ten (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).

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Answer **all** questions.

1. Use a non-programmable scientific calculator to:

   (a) compute $\dfrac{\sqrt{\sqrt{19e^2}\ln 3}}{\sqrt{2}}$ correct to 5 significant figures.

   (b) evaluate $\int_0^1 \sqrt{1-x^2}\,dx$ correct to 5 significant figures.

   (c) find the mean and standard deviation of the following data correct to 4 decimal places.

Values	110	130	150	170	190
Frequency	10	31	24	2	2

2. (a) Given that $g(x) = -3x + 5$; Find the range of $g(x)$ for the domain $\{x : -2 \le x \le 3\}$.

   (b) Find the turning point of $h(x) = \frac{1}{2}x^2 - x$.

   (c) Find the inverse of $f(x) = 2x^2 - 5$.

3. (a) In a sequence, the sum of the third and fourth terms is -12, the sum of the third and fifth terms is 60 and the sum of the fourth and fifth terms is 24.

   (i) Show that the terms form geometrical sequence.

   (ii) Find the sum of the first ten terms of the sequence.

   (b) If the equation $(2k+3)x^2 + 2(k+3)x + (k+5) = 0$ has equal roots, find the numerical value(s) of x.

4. (a) (i) Find $\dfrac{dy}{dx}$ of $y = \sqrt{x^2+1}$.

   (ii) Given the equations $x = (t^2-1)^2$, $y = t^3$. Find $\dfrac{dy}{dx}$ in terms of t.

   (b) A metal wire whose length is 600 m is bent to make a rectangular fence. Calculate the dimensions of the fence that could give the maximum area.

5. (a) The first derivative of $f(t)$ is $f'(t) = 6t + 1$. Find $f(t)$ and the numerical value of $f(10)$ given that $f(0) = 2$.

   (b) Find the area enclosed between the curve $y = x(x-1)(x-2)$ and the x-axis.

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6. A biology teacher asked each of her 20 students to bring a grasshopper as a specimen for practical and the length of each grasshopper was recorded in centimeters as follows:

1	3	5	4	5	2	4	2	4	2
4	2	5	3	2	3	2	3	1	3

(a) Prepare frequency distribution table (do not group the data).

(b) Calculate median of the data.

(c) Use assumed mean $A = 3$ and coding method to calculate mean and standard deviation correct to 2 decimal places.

7. (a) A six sided die is thrown. Find the probability that an odd number will show up.

(b) Three coins are tossed at once.

(i) Use tree diagram to illustrate all possible outcomes.

(ii) Find the probability of getting at least two heads.

8. (a) If $\cos(x+\beta) = 2\sin(x-\beta)$, show that $\tan x = \dfrac{1+2\tan\beta}{2+\tan\beta}$.

(b) Solve the equation $2\sin\theta + \cos 2\theta = 1$ for $0^\circ \le \theta \le 180^\circ$.

(c) In a triangle XYZ, $\overline{XY} = 30\text{ m}$, $\overline{YZ} = 40\text{ m}$ and $\overline{ZX} = 60\text{ m}$. Calculate the angle formed by the sides $\overline{XY}$ and $\overline{YZ}$.

9. (a) If $f(x) = a^x$ where $x \in \mathbb{R}$;

(i) write down the condition(s) on a such that $f(x)$ is an exponential function.

(ii) show that $\dfrac{f(x+1)}{f(x)} = a$.

(b) Evaluate $\int_3^5 \dfrac{5}{(3x-8)}dx$ correct to 2 decimal places.

(c) Suppose Tsh 2000 is invested in an account which offers 7.125% compounded monthly.

(i) Express the amount A in the account as a function of the term of the investment t years.

(ii) How long will it take for the initial investment to double?

10. An engineer wants to make at least 6 steel tables and 9 wooden tables every day. He does not want to make more than 30 tables per day. A steel table requires 3 units and wooden table 2 units of workshop space and there are at least 54 units of workshop space available. The profit of making a steel table is Tsh 5800 and a wooden table is Tsh 3600.

(a) How many steel and wooden tables should be manufactured per day to realize maximum profit?

(b) What is the maximum profit?

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