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

141 BASIC APPLIED MATHEMATICS

(For Both School and Private Candidates)

Time: 3 Hours **Year: 2024**

Instructions

1. This paper consists of **ten (10)** questions.
2. Answe **all** the questions. Each question carries **ten (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. All writing must be in **blue** or **black** ink, **except** drawings which must be in pencil.
6. Communication devices and any unauthorised materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).

1. Use a non-prgrammable calculator to:

(a) compute the value of $1000\left(1+\frac{0.12}{8760}\right)^{4\times 8760}$ correct to 2 decimal places.

(b) compute the value of $\sum_{1}^{3}\left(\frac{\sin x}{x}\right)$ correct to five significant figures.

(c) evaluate $\int_0^2 e^{2x^2-3}dx$ correct to two decimal places.

2. (a) Given the function $g(x)=\frac{1}{x-3}+2$, find the vertical and horizontal asymptotes.

(b) Given that $f(x)=\begin{cases}1 & \text{if } x>0\\ 0 & \text{if } x=0\\ -1 & \text{if } x<0\end{cases}$

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

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

3. (a) Solve the following system of simultaneous equations:

$$\begin{cases} x+2y=4 \\ x^2+3xy=10 \end{cases}$$

(b) Evaluate $\sum_{1}^{4}16\left(-\frac{1}{2}\right)^n$.

(c) The time (t) to complete a project varies inversely to the number of employees (e). If 3 people complete the project in 10 days, how many days will 5 people take to complete the project?

4. (a) Use the first principles to find the first derivative of the function $f(x)=3x^2-2$.

(b) Given that $y^3+x^3-3xy=4$, find $\frac{dy}{dx}$.

(c) Find the slope of the curve $y^3=64x$ at $x=-1$.

5. (a) Evaluate $\int(2x-1)(4x^2-4x)^5\,dx$.

(b) Find the area enclosed between the curves of the functions $y=4-x^2$ and $y=x^2-2x$.

6. The following table shows the marks of 50 students obtained in Mathematics test:

Marks	1 – 5	6 – 10	11 – 15	16 – 20	21 – 25
Frequency	9	8	13	12	8

(a) Represent the data using histogram.

(b) Calculate the variance correct to 4 significant figures.

7. (a) A random experiment can result in one of the outcomes a, b, c and d whose probabilities are 0.1, 0.3, 0.5 and 0.1, respectively. If A denotes the event $\{a,b,d\}$ and B denotes the event $\{b,c,d\}$, determine the probability of the event $A \cap B$.

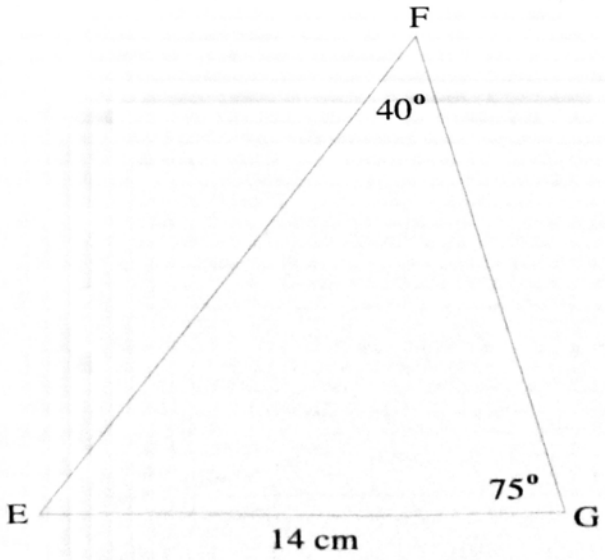
(b) A four-digit number is to be formed from the digits 1, 2, 3 and 5. If the repetition of a digit is not allowed, find the probability that the number formed is divisible by 5.

(c) The probability that a certain type of machine will break down in the first month of operation is 0.1. If a firm has two machines of such type installed at the same time, find the probability that, at the end of the first month, just one machine will be broken down.

8. (a) Given that $\cos A = \frac{1}{2}$, evaluate $\cos\frac{A}{2}$. Express your answer in surd form.

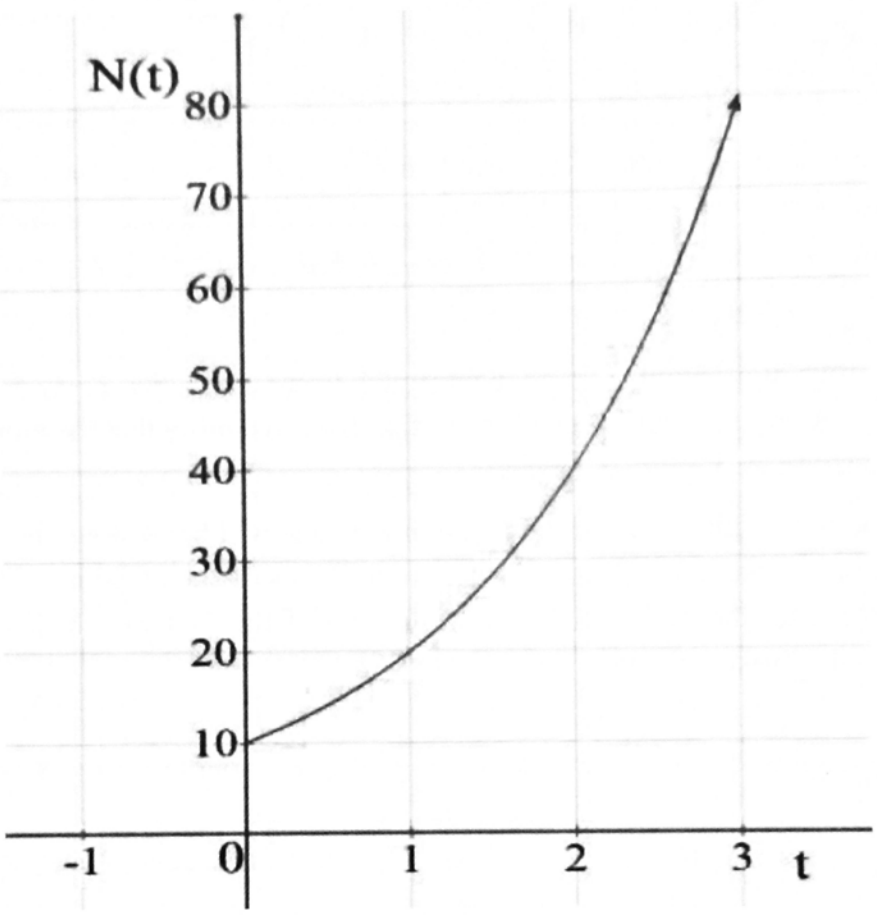
(b) Given that $\sin\theta - 2\sin\theta\cos\theta = 0$ and $0^\circ \le \theta \le 180^\circ$, determine the values of θ.

(c) Calculate the length of the side EF of the following diagram and write the answer correct to four significant figures.



9. (a) Evaluate $\int_0^1 \frac{4}{7x+2}dx$.

(b) The following gragh describes the population of bacteria $(N(t))$ after a particular period of time (t) in hours.



Formulate the equation that relates $N(t)$ and t.

10. (a) Given the matrices $A=\begin{pmatrix}3 & 1 & 2\\ 1 & 5 & 2\end{pmatrix}$ and $B=\begin{pmatrix}4 & -1 & 2\\ 3 & 1 & 3\end{pmatrix}$. Evaluate $3A-2B$.

(b) A manufacturer produces nuts and bolts for machines. It takes 1 hour of work on machine A and 3 hours on machine B to produce a package of nuts, while it takes 3 hours on machine A and 1 hour on machine B to produce a package of bolts. The manufacturer works for 12 hours a day and earns a profit of Tsh. 250,000 per package of nuts and Tsh. 100,000 per package of bolts. How many packages of nuts and bolts should be produced to realize a maximum profit?