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

042

ADDITIONAL MATHEMATICS

(For Both School and Private Candidates)

Time: 3 Hours **Year: 2023**

Instructions

1. This paper consists of sections A and B with a total of fourteen (14) questions.
2. Answer **all** questions.
3. Section A carries **sixty** (60) marks and section B carries **forty** (40) marks.
4. All necessary working and answers for each question attempted must be shown clearly.
5. NECTA Mathematical tables and non-programmable calculators may be used.
6. All 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).

SECTION A (60 Marks)

Answer all questions in this section.

1. (a) Briefly explain the term 'joint variation'? Give one example of the joint variation.

(b) Given that F varies directly as m and the square of v, and inversely as r;

(i) express this statement in the equation form.

(ii) use the equation in part (i) to find the values of a and b in the following table:

F	m	v	r
60	6	4	8
60	9	a	3
-25	b	-2	-4

2. The following frequency distribution table shows the age of 160 people who visited a certain public library.

Age (in years)	8 - 15	16 - 23	24 - 31	32- 39	40 - 47	48 -55	56 -63
Frequency	12	29	40	44	20	12	3

(a) By using the class mark of the median class as an assumed mean, calculate the mean correct to one decimal place.

(b) Find the standard deviation.

3. (a) Find the points where the lines $y+x-8=0$, $y=2x-1$ and $2y-x-1=0$ intersect.

(b) Determine the equation of a circle passing through the points obtained in part (a).

4. Find the equation of the locus of a point which is equidistant from the points $A(1,2)$ and $B(5,4)$.

5. (a) Factorize the expression $4x^2-4xy-3y^2$.

(b) (i) Solve the following simultaneous equations:

$$\begin{cases} y=3x-7 \\ y=x^2-3x+2. \end{cases}$$

(ii) Solve the equations $\log_x y=2$ and $xy=8$.

6. (a) Determine the sum of the interior angles of a six sided polygon.

(b) The interior and exterior angles of a regular polygon are x and $\frac{x-36^\circ}{3}$ respectively.

Determine:

(i) the value of x.

(ii) the size of each exterior angle.

7. (a) Show that $\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{3}\right)=\frac{\pi}{4}$.

(b) Solve the equation $3\cot^2 x = 2\cos x$ for x between -90° and 360° inclusive.

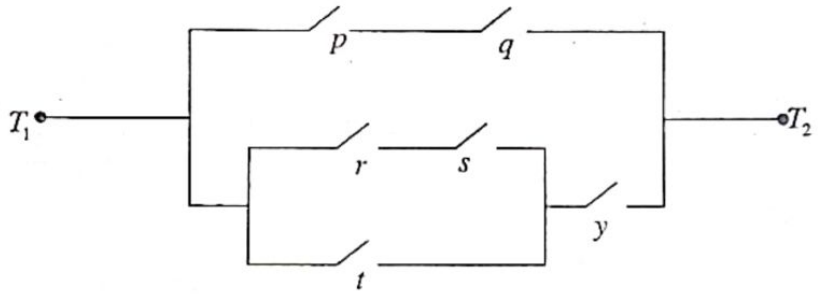
8. (a) Determine the rule governing the pattern of the numbers 0, 1, 1, 2, 3, ..., hence, write the seventh number for this sequence.

(b) Use the divisibility rules to show that 420672 is divisible by 6.

9. (a) (i) Construct a truth table for the compound statement $\sim(p\wedge q)\vee(\sim p\leftrightarrow q)$.

(ii) Test the validity of the argument "If I study hard, I will not fail Mathematics. If I am not a truant, then I will study Mathematics. I failed Mathematics. Therefore I was a truant."

(b) Find the compound statement which is represented by the following electrical network:



10. (a) Use the properties of sets operations to simplify $(A\cup B)'\cap(A\cap B)'$.

(b) A survey of 500 students pursuing at least one of the courses in Business, Mathematics and Economics in one academic year revealed that 83 study Business and Mathematics, 63 study Mathematics and Economics, 217 study Business and Economics. If 295, 186 and 329 students study Economics, Mathematics and Business respectively, represent this information on a Venn diagram and hence calculate the number of students pursuing Business or Economics but not Mathematics.

SECTION B (40 Marks)

Answer all questions in this section.

11. (a) If α and β are the roots of $4x^2+8x-1=0$, find the value of $(\alpha-\beta)^2$ without solving the equation.

(b) By using the remainder theorem, find the remainder when the polynomial $p(x)=4x^3-5x+4$ is divided by $2x-1$.

(c) Sketch the graph of $y=\frac{x+2}{x^2-9}$, and use it to determine its domain and range.

12. (a) The curve $y=(x-2)(x-3)(x-4)$ crosses the $x-$ axis at the points $P(2,0)$, $Q(3,0)$ and $R(4,0)$. Prove that the tangents at P and R are parallel.

(b) Find the equation of a normal to the curve $y=x^3-6x^2+12x+2$ at which the tangent to the curve is parallel to the line $y=3x$.

(c) Find the value of t such that $\int_0^2 tx(2-x^2)^2\,dx=1$.

13. (a) Using one example, explain the meaning of "independent events" as applied in probability.

(b) Two dice whose sides are labeled 1, 2, 3, 4, 5 and 6 each are thrown simultaneously at once. What is the probability that the sum of the sides of two dice is less than 10?

(c) Find the number of permutations in all letters of the word TERRITORY.

14. (a) Given that $\underline{a}=-2\underline{i}+5\underline{j}-3\underline{k}$ and $\underline{b}=3\underline{i}-\underline{j}+2\underline{k}$, find:

(i) $\underline{a}\times\underline{b}$.

(ii) $(\underline{a}\times\underline{b})\cdot\underline{a}$.

(b) (i) Find the value of t which satisfies the equation $\begin{vmatrix} t+3 & 5 & 6 \\ -1 & t-3 & -1 \\ 1 & 1 & t+4 \end{vmatrix}=0$.

(ii) Given that $A=\begin{pmatrix} 1 & 3 & 5 \\ 2 & -1 & 0 \\ 4 & 2 & 1 \end{pmatrix}$ and $B=\begin{pmatrix} 2 & 0 & 1 \\ 1 & -3 & 2 \\ 1 & 1 & 1 \end{pmatrix}$, show that

$\det(AB)=\det(A)\det(B)$.

(c) Find the matrix corresponding to the linear reflection of a point P(x, y) in the line $y-x=0$ and use it to find:

(i) the image of the line $x+2y=6$.

(ii) the point whose image under the reflection is (3, -2).