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

042 **ADDITIONAL MATHEMATICS**

(For Both School and Private Candidates)

Time: 3 Hours **Monday, 14th November 2016 p.m.**

Instructions

1. This paper consists of sections A and B.
2. Answer **all** questions in section A and **four (4)** questions from section B. Each question in section A carries **six (6)** marks while each question in section B carries **ten (10)** marks.
3. **All** necessary working and answers for each question must be shown clearly.
4. Mathematical tables may be used.
5. Calculators and cellular phones are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).

SECTION A (60 Marks)

Answer **all** questions in this section.

1. (a) List the next two numbers in the series $\frac{1}{1\times 2}+\frac{1}{2\times 6}+\frac{1}{4\times 18}+\ldots$

   (b) (i) Define Divisibility of a number.

   (ii) Use the divisibility rule to show whether 24,679 is divisible by seven.

2. (a) Use the laws of algebra to simplify the set expression $(A\cup(A\cap B))'\cup A$.

   (b) A group of 150 workers visit Mikumi, Ruaha and Tarangire National Parks. Each worker visits at least one of the three National Parks. 105 workers visit Mikumi, 120 visit Ruaha and 86 visit Tarangire. 50 workers visit Mikumi and Ruaha, 40 visit Mikumi and Tarangire and 30 visit Ruaha and Tarangire. Find the number of workers who visit all the three National Parks.

3. (a) The polynomial $p(x)=x^3+kx^2+tx-\frac{1}{64}$ is a perfect cube. Find the values of k and t.

   (b) Sketch the graph of the function $f(x)=\frac{4}{x^2-6x+8}$.

4. (a) Determine the values of x if $(x-2)^2>16$.

   (b) The sum of areas of two squares is $100\,cm^2$. If the sum of their perimeters is $56cm$, find the length of the sides of the squares.

5. (a) Fill in the blanks in the following table:

Name of a Figure/Letter	Rotational Symmetry	Number of Lines of Symmetry
.....	4	4
H	2	.....
.....	5	5
.....	Infinity	Infinity

   (b) Prove that, in a rectangle the diagonals bisect each other.

6. The expression $\frac{y}{a}-4$ varies directly as the square of $\frac{1}{ax}$. If the constant of variation is 108 and when $x=3$, $y=16$, find the values of a.

7. (a) Find the derivative of the function $f(x)=(x^3+x)(x+4)$.

(b) Evaluate $\int_0^{\frac{\pi}{2}} \frac{4\cos x+2\sin 2x}{\cos x}\,dx$.

8. Show whether $\frac{\sin\theta+\sin 2\theta}{1+\cos\theta+\cos 2\theta}=\tan\theta$.

9. A goat is moving such that it is equidistant from point A (2, 3) and B (2, 7). Determine the locus of the goat.

10. Draw the plan, front and side elevations of a rectangular pyramid.

SECTION B (40 Marks)

Answer **four (4)** questions from this section.

11. (a) Calculate the shortest distance of point $(6,5)$ from the line $y=-\frac{5}{12}x-\frac{7}{6}$.

(b) A circle has a centre at the point $(2,3)$. If its radius is 5 units, find;

(i) the equation of the circle in expanded form.

(ii) the equation of tangent to the circle at the point (5, 7).

12. In an experiment, the candidates were asked to measure the mass of 50 potatoes in grams. The results were recorded as follows;

11	40	24	31	41	32	23	58	42	37	18	51	12
12	32	66	79	26	75	23	31	40	33	53	23	31
16	58	38	37	48	63	72	48	23	40	53	25	
18	11	41	29	16	38	32	57	28	64	44	27	

(a) Construct the frequency distribution table.

(b) Determine;

(i) The median.

(ii) The mean.

13. (a) Define tautology of a compound statement.

(b) Use truth table to determine the validity of the statement $(P \leftrightarrow Q) \wedge \sim P \wedge \sim (Q \rightarrow P)$.

(c) Famine does not exist if there is a plenty of food. If famine exists it means there was no rainfall in the previous year. But it rained much in the previous year and famine exists. Therefore there is no plenty of food this year. Write down the compound proposition in symbolic form and simplify it.

14. (a) How many six digit even numbers which are greater than 400,000 can be formed from the digits $1, 4, 3, 7, 5$ and 2 without repetitions?

(b) Given two events A and B, such that, $P(A \cap B) = \frac{1}{5}$, $P(A \mid B) = \frac{4}{9}$ and $P(A \mid B') = \frac{6}{11}$.

Find $P(B' / A')$.

15. (a) The two vectors $\underline{a} = 2p\underline{i} + 3\underline{j} + (p^2 + 1)\underline{k}$ and $\underline{b} = p\underline{i} + (p-3)\underline{j} - \underline{k}$ are perpendicular to each other.

(i) What are the possible values of p ?

(ii) Find $2\underline{a} + 3\underline{b}$ if $p > 0$.

(b) Point (4, 8) is reflected about the line $-\sqrt{3}x + 3y = 6$, anticlockwise. Find its image.

16. (a) Determine the intercepts and the stationary points of the function $p(x) = 1 - 3x + 3x^2 - x^3$, hence sketch its graph.

(b) Find the area which is between the curve $y = x^2 - 4x + 3$ and the x axis, from $x = 0$ to $x = 4$.