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 **Tuesday, 13th November 2018 a.m.**

Instructions

1. This paper consists of sections A and B with a total of **sixteen (16)** questions.
2. Answer **all** questions in section A and any **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, 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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SECTION A (60 Marks)

Answer **all** questions in this section.

1. (a) Write the next term in the series $\frac{1\times2}{-1}+\frac{3\times4}{-1}+\frac{9\times8}{1}+\frac{27\times16}{11}+\ldots$

   (b) Use the divisibility rules to show that 31752 is divisible by 7 and 9.

2. (a) Given three sets $A=\{1,2,3,4,5\}$, $B=\{2,4,6\}$ and $C=\{2,3,5\}$. Show the set $A\cup B\cup C$ in the Venn diagram by shading it.

   (b) If $A=\{4,5,7,8,10\}$, $B=\{4,5,9\}$ and $C=\{1,4,6,9\}$, show whether,

   (i) $A\cup(B\cap C)=(A\cup B)\cap(A\cup C)$.

   (ii) $A\cap(B\cup C)=(A\cap B)\cup(A\cap C)$.

3. (a) When the polynomial $P(x)=6x^2+x+7$ is divided by $x-a$ the remainder is the same as when it is divided by $x+2a$. Find the value of a.

   (b) If the roots of the equation $(x+2)^2-2Kx=0$ are α and β, find the equation whose roots are α^2 and β^2, leaving the answer in terms of K.

4. (a) Simplify $\frac{3a^2-4b^2}{a\sqrt{3}+2b}$.

   (b) Given that $\frac{1}{y}+y=2\sqrt{5}$, find $\frac{1}{y^2}+y^2$.

5. (a) A regular polygon has an exterior angle of 72°.

   (i) Find the size of an interior angle and the sum of all interior angles.

   (ii) How many sides does this polygon has?

   (b) Using the length of one side as 5cm, draw the regular polygon in (a) above.

6. (a) When an object is dropped from a position above the ground, it falls a vertical distance s, which varies directly as the square of the time t. In 10 seconds, the object falls 1,600cm. Write a formula relating height and time expressing in terms of t.

   (b) A woman invested an amount of money at the rate of 5% in a bank. She also invested twice as much in another bank at the rate of 7%. If her total year amount of simple interest from the two investments is 760 Tsh, how much was invested at each rate?

7. (a) Determine the first derivative in each of the following expressions:

(i) $y=\sqrt{x^2+3x^3}$.

(ii) $2xy\sin y+2x\cos y\frac{dy}{dx}+y\sin x-\cos x\frac{dy}{dx}=0$.

(b) Find

$$\int_4^9 \frac{2\sqrt{x}+3}{\sqrt{x}}dx.$$

8. (a) Prove whether $\frac{\sin\theta}{1+\cos\theta}-\frac{1+\cos\theta}{\sin\theta}=\frac{-2\cos\theta}{\sin\theta}$.

9. (a) Find the equation of the Locus of a point which is always equidistant from points A (1, 2) and B (-2, -1).

(b) Find the equation of a circle with points (0,1) and (2,3) as ends of its diameter.

10. Draw the plan, side and front elevations of a rectangular prism by using the third angle projection.

SECTION B (40 Marks)

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

11. (a) The points $P(x,0)$, $A(8,4)$ and $B(6,6)$ are corners of equilateral triangle, find x given that PA = PB.

(b) Find the equation of a circle which passes through points (1, 1) and (2, -1) if its centre lies on the line $y=3x-7$.

(c) Find the equation of a line through the point P (5, 11) and parallel to the x-axis.

12. The following table gives the distribution of marks of students in mathematics class test at a certain school.

Marks	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55
Frequency	1	3	8	16	40	26	5	2

(a) Use coding method with assumed mean A=37.5 to find mean and standard deviation (write the answer in two decimal places).

(b) Interpret the relationship between the obtained mean and standard deviation.

(c) Draw a cumulative frequency curve.

13. (a) By using the laws of algebra, show that $p \rightarrow q \wedge \sim q \rightarrow\!\!\!\!\!\sim\ p$ is a tautology.

(b) Construct the truth table of the proposition $[(p \rightarrow\!\!\!\!\!\sim\ q) \wedge (r \rightarrow q) \wedge r] \rightarrow\!\!\!\!\!\sim\ p$.

(c) Test the validity of the argument:
If I like algebra, then I will study Mathematics. Either I study Mathematics or I play dance music. Therefore I play dance music which implies that I do not like algebra.

14. (a) (i) In how many ways can the letters of the word BARAZA be arranged?

(ii) Find the number of ways of selecting a committee of 3 teachers and 2 students from 5 teachers and 15 students.

(b) A bag contains 5 red counters and 7 black counters. A counter is drawn from the bag, the color is noted and the counter is replaced. A second counter is then drawn. Find the probability that the first counter is red and the second counter is black.

(c) The probability that Husna and Ally will be selected for further studies are 0.4 and 0.7 respectively. Calculate the probability that one of them will be selected.

15. (a) Given the vectors $\underline{a} = x\underline{i} + y\underline{j}$ and $\underline{b} = 2\underline{i} + \underline{j}$. Find the relationship between x and y if $\underline{a}$ is perpendicular to $\underline{b}$.

(b) Find the vector $\frac{1}{2}\underline{a} \times \underline{b}$ if $\underline{a} = 4\underline{i} + 2\underline{j} + \underline{k}$ and $\underline{b} = 3\underline{i} + 4\underline{j} + 5\underline{k}$.

(c) Find the image of $3x + 4y + 6 = 0$ under reflection on the line $y = -x$.

16. (a) Find

(i) $\int (x+1)\sqrt{x+3}\,dx$.

(ii) $\int \tan^2 x \sec^2 x\,dx$ by using the substitution of $k = \tan x$.

(b) Determine the area of the region bounded by the curve $y = \frac{x^2}{2}$ and the line $y = x$.

(c) Find the volume of the solid of revolution formed by rotating the area enclosed by the curve $y = x + x^2$, the x-axis and the coordinates $x = 2$ and $x = 3$ through about x-axis.