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 **Monday, 11th November 2019 p.m**

Instructions

1. This paper consists of sections A and B with a total of **fourteen (14)** questions.
2. Answer **all** questions in sections A and 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 attempted must be shown clearly.
4. NECTA Mathematical tables may be used.
5. Calculators, cellular phones and any unauthorised materials 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) If $x \alpha yz^{\frac{1}{3}}$ and $y \alpha z^{-2}$, show that $x \alpha y^{\frac{5}{6}}$.

   (b) A quantity $(y-m)$ is directly proportional to the square of x. Express y in terms of x, k and m.

2. The masses of 50 apples in grams are as follows:

86	108	118	92	101	113	97	107	111	100
100	114	109	96	116	104	99	101	105	117
103	92	107	100	102	99	106	98	96	108
101	118	87	93	110	102	93	101	113	88
106	101	95	103	105	92	116	105	86	92

   (a) If the lower limit of the first class interval is 85 and the class width is 5, prepare a frequency distribution table.

   (b) Calculate the lower and upper quartiles in two decimal places.

3. (a) The straight line $y=x-6$ cuts the curve $y^2=8x$ at the points P and Q. Using the graphical method, determine the coordinates of P and Q and then calculate the length of PQ in the form $a\sqrt{b}$.

   (b) Find the acute angle between the lines $y=x+2$ and $3x-4y+4=0$.

4. The coordinates of points A and B are $(-5,n)$ and $(2,4)$ respectively. If $P(x,y)$ moves in such a way that $PA:PB=3:2$, the locus traced out by P is given by the equation $5x^2+5y^2-76x-48y+44=0$. Find the value of n.

5. (a) Solve the following pair of simultaneous equations by using the elimination method:

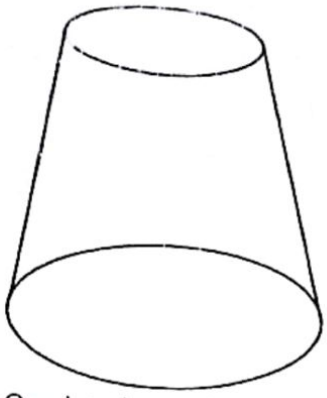
$$\frac{5}{x}-\frac{3}{y}=\frac{7}{2}$$

$$\frac{2}{x}+\frac{1}{y}=\frac{5}{2}$$

   (b) (i) If the algebraic expression $5x^2+hx+5$ is a perfect square, find the value of h.

   (ii) Using the results obtained in part (i) and the factorization method, solve the equation $5x^2+hx+5=0$.

6. (a) Draw the plan, front and side elevations of the following cone.



(b) One interior angle of an octagon is 100° and the remaining angles are of the same size. Find the value of each of the remaining interior angles.

7. (a) If $\sin(x-\alpha)=\cos(x+\beta)$, find $\tan x$ in terms of α and β.

(b) Solve the equation $3\cos 2\theta-\sin\theta+2=0$ for values of θ from 0° to 360° inclusive.

8. (a) Use the divisibility rule to show that 35120 is divisible by 5.

(b) The sum of the squares of the first n numbers is given by $\frac{n(n+1)(2n+1)}{6}$. Find the sum of the first three squares when n is a natural number.

9. (a) By using a truth table verify that $(p\rightarrow q)\wedge(q\rightarrow p)$ is equivalent to $p\leftrightarrow q$.

(b) Simplify $(p\vee q)\wedge\sim p$ by using the laws of algebra of propositions.

10. (a) By using the basic properties of set operations, simplify $(A\cap B')\cup(A\cup B)'$.

(b) If A and B are two sets such that $n(A)=42$, $n(B)=27$ and $n(A\cup B)=59$, find $n(A\cap B)'$ by using a Venn diagram.

SECTION B (40 Marks)

Answer all questions in this section.

11. (a) Sketch the graph of $g(x)=\frac{x+3}{2x-3}$.

(b) Use the graph in part (a) to determine the domain and range of $g(x)$.

(c) When the function $f(x)=2x^4+kx^3-11x^2+4x+12$ is divided by $x-3$, the remainder is 60. Use the remainder theorem to compute the value of k.

12. (a) Differentiate $f(x)=5$ from the first principles.

(b) Use the product rule to differentiate $y=\cos^2 x$ with respect to x.

(c) Find the area enclosed by the curve $y=x^2-3x+2$ and the x - axis.

13. (a) A bag contains 3 white balls, 4 red balls and 2 yellow balls. How many white balls must be added in the bag so that the probability of drawing a white ball is $\frac{1}{2}$?

(b) Find how many different numbers can be made by using four out of the six digits 0, 1, 2, 3, 4, 5.

(c) Two dice are thrown at the same time. Find the probability of obtaining a total which is less than 10.

14. (a) If $\underline{a}=-2\underline{i}+5\underline{j}-3\underline{k}$ and $\underline{b}=3\underline{i}-\underline{j}+2\underline{k}$, find $\underline{a}\times\underline{b}$ and $(\underline{a}\times\underline{b})\circ\underline{a}$.

(b) 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) Determine the matrix corresponding to the linear reflection of the point P(x, y) on the line $y-x=0$ and use it to find the point whose image under the reflection is (3, -2).