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: 2020**

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) Given that y is proportional to x and $y = 4$ when $x = 2$:

   (i) Formulate an equation that relates x and y.

   (ii) Sketch a graph showing the relationship of x and y.

   (b) The electrical resistance (R) of a copper wire of a circular cross section area varies directly to the length (l) and inversely to the square of the radius (r). Two wires have equal resistance and one is four times as long as the other. Find the ratio of their radii.

2. The following frequency distribution table shows the amount of money spent by each person in a certain shop.

Amount of money spent (Shs)	0 - 500	500 - 1000	1000 - 1500	1500 - 2000	2000 - 2500	2500 - 3000
Frequency	6	16	27	18	9	2

   (a) Determine the lower and upper quartiles correct to two decimal places.

   (b) Find the variance and standard deviation correct to two decimal places.

3. (a) Determine the perpendicular distance of the point (2, -1) from the line $3x+4y-6=0$.

   (b) Find the equation of a circle whose diameter has the coordinates (1, 2) and (-1, 3) as its end points.

4. The point $P(x, y)$ moves in a plane in such a way that it is always 5 units from the fixed point $Q(2,3)$.

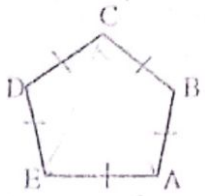
   (a) Sketch the locus of the point $P(x, y)$ in xy-plane.

   (b) Find the equation of the locus of the point $P(x, y)$ in the form $x^2 + y^2 - 2fx - 2gy + c = 0$.

5. (a) Given the formula $\frac{D}{d} = \sqrt{\frac{f+p}{f-p}}$, express p in terms of D, d and f and then find the value of p when $D = 2$; $f = 5$ and $d = 1$.

   (b) The perimeter of a rectangle is 46 cm. If one of the two adjacent sides is 7 cm longer than the other, find the dimensions of the rectangle.

6. (a) Use the following polygon to answer the given questions:



(i) Write the name of the polygon.
(ii) How many triangles does the polygon have?
(iii) Compute the sum of all interior angles of the polygon.
(iv) Find the size of each interior angle in the polygon.

(b) Use diagrams to find the number of axes of symmetry in each of the following:
(i) Cube
(ii) Rectangle
(iii) Sphere

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

(b) Without using mathematical tables or calculators, find the value of $\tan 105°$ in surd form.

8. (a) Applying rules for divisibility, show that 637 is divisible by 13.

(b) Find the sum of the first n terms of the series $1+3+5+...+(2n-1)$ and then show that; $1+3+5+...+(2n-1)+(2n+1)=(n+1)^2$.

9. (a) (i) Write the simplified compound statement for $S(p,q,r)$ having the following truth table:

p	q	r	S(p, q, r)
T	T	T	T
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	F
F	T	F	F
F	F	T	F
F	F	F	F

(ii) Draw a simple network for $S(p,q,r)$.

(b) By using the laws of algebra of proposition, simplify $p\vee(p\wedge q)$.

10. (a) Simplify $A\cap(A'\cap B)$ using the laws of set operations.

(b) In a meeting of 30 people, 15 are farmers, 20 are teachers and 8 are both teachers and farmers. By using a Venn diagram, find the number of people who are neither farmers nor teachers.

SECTION B (40 Marks)

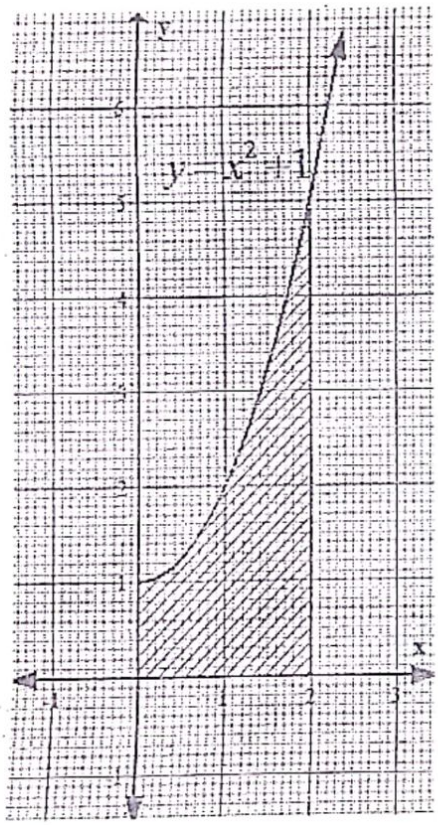
Answer all questions in this section.

11. (a) When the equation $ax^3-x^2+7x+c=0$ is divided by $x-1$ and $x+1$, the remainders are -4 and 6 respectively. Find the values of a and c.

(b) Given that $f(x)=\dfrac{x+1}{x^2+x-2}$, find the intercepts and asymptotes of $f(x)$.

(c) Sketch the graph of $f(x)$.

12. (a) Find the area of the shaded region in the following figure in the form $\dfrac{a}{b}$:



(b) Verify that $\int_0^{\frac{\pi}{3}}(\cos x-\sin x)\,dx=\dfrac{1}{2}\left(\sqrt{3}-1\right)$.

(c) Using the product rule, differentiate $y=x^2\sin 2x$ with respect to x.

13. (a) A bag contains 4 white balls and 6 black balls. Two balls were selected from the bag, one after the other without replacement. Draw a tree diagram showing all the probabilities and outcomes.

(b) Using the tree diagram in part (a), find the probability that:

(i) the first ball is white and the second ball is black.

(ii) one ball is white and the other is black.

(c) Find the first four terms of the expansion of $(1+x)^8$ in ascending powers of x.

14. (a) The linear transformation $T = \begin{pmatrix} 1 & 1 & 1 \\ 2 & -2 & -1 \\ 1 & 3 & -2 \end{pmatrix}$ takes the point $A(x, y, z)$ to the point $A'(3,0,15)$. By using the inverse matrix method, find the point $A(x,y,z)$.

(b) The vertices of a triangle are $P(1,1,1)$, $Q(0,1,2)$, and $R(3,2,1)$. Find the area of the triangle.

(c) Given that $\underline{a} = -3\underline{i} + 7\underline{j} + 5\underline{k}$, $\underline{b} = -3\underline{i} + 7\underline{j} - 3\underline{k}$ and $\underline{c} = 7\underline{i} - 5\underline{j} - 3\underline{k}$. Find $\underline{a} \bullet (\underline{b} \times \underline{c})$.