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 : 2021**

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 may be used.
6. Calculators, cellular phones 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) An object falls a vertical distance x which varies directly as the square of the time t. If it falls 900 cm in 20 seconds, write the variation equation expressing x in terms of t.

   (b) It is given that y is inversely proportional to x^2. If $y=4$ when $x=3$, find the value of y when x is 6.

2. The following table shows yields of gold in tones produced by 100 traders at a certain mine in one day.

Gold in tones	15-20	21-26	27-32	33-38	39-44	45-50
Frequency	10	22	32	21	13	2

   (a) Calculate the mean and mode if the assumed mean is 29.5 tones.

   (b) Draw the cumulative frequency curve and from it calculate the semi-interquartile range.

3. (a) If the points $P(2,4), Q(3,y)$ and $R(-3,4)$ are collinear, determine the value of y.

   (b) Determine the coordinates of the point dividing the line joining the point $(2,3)$ and $(4,6)$ in the ratio 1:3

   (i) internally.
   (ii) externally.

4. (a) Define "locus of a point'' as applied in mathematics.

   (b) The cartesian coordinates of the points A and B are (-3, 0) and (3, 0) respectively. If point P moves so that $AP = 2PB$, prove that its locus is the circle Z whose equation is $x^2 + y^2 - 10x + 9 = 0$.

5. (a) Make t the subject of the formula $A = \left(\frac{1+t}{1-t}\right)^{\frac{1}{2}}$.

   (b) By using the substitution method, solve the following pair of simultaneous equations:

$$\begin{cases} x^2 + y^2 = 18 \\ y - 2x = -3 \end{cases}$$

6. (a) A regular polygon is such that each interior angle is twice the exterior angle. What is the size of each interior angle and exterior angle?

(b) (i) Indicate all lines of symmetry on a diagram of a regular pentagon by using dotted lines.

(ii) State the order of rotational symmetry of the regular pentagon drawn in part b(i).

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

(b) Derive the trigonometric identity $\cos^2\theta+\sin^2\theta=1$.

8. (a) (i) What is the rule governing the divisibility of any number by 9.

(ii) Show whether 1091524 is divisible by 9.

(b) The following table shows the pattern of coefficients in the Pascal's triangle:

Power	Coefficients						
1	1	1					
2	1	2	1				
3	1	3	3	1			
4	1	4	6	4	1		
5	1	5	10	10	5	1	
6	1	6	15	20	15	6	1
7							

How can the entry 20 in the sixth line be obtained? Write the entries in the seventh line.

9. (a) Prepare the truth table for $[(\sim p\vee\sim q)\rightarrow\sim(p\wedge q)]\vee[(p\vee q)\rightarrow(\sim p\wedge\sim q)]$.

(b) By using the laws of algebra of propositions, show whether the statement $p\wedge q$ logically implies $p\leftrightarrow q$.

10. (a) Given the universal set $\mu=\{1,2,3,...,12\}$ and its subsets $A=\{1,3,5,7\}$, $B=\{2,3,4,5,6,8\}$ and $C=\{2,3,7,10,10\}$, find the elements of $(A\cap B)'\cup C$.

(b) If A, B and C are any three sets such that $n(A)=8$, $n(B)=12$, $n(C)=16$, $n(A\cap B)=5$, $n(A\cap C)=4$, $n(A\cup B\cup C)=20$ and $n(A\cap B\cap C)=2$, find $n(B\cap C)$.

SECTION B (40 Marks)

Answer **all** questions in this section.

11. (a) The roots of a quadratic equation $ax^2+bx+c=0$ are such that the first root is three times the second root. Show that $3b^2=16ac$.

(b) 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.

(c) Sketch the graph of $f(x)=\dfrac{x+2}{x^2-9}$.

12. (a) Use the quotient rule to differentiate $\left(\dfrac{1+x}{2+x}\right)^2$ with respect to x.

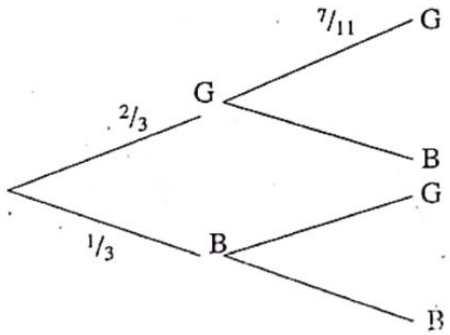
(b) Given the curve $y=2x^3-3x^2-36x+3$:

(i) find the minimum value of y.

(ii) determine the value of x at the point of inflexion.

(c) Compute the area enclosed by the curve $y=x^2-4$ and the $x-$axis.

13. (a) A bag contains 8 green discs (G) and 4 blue discs (B). A disc is drawn and not replaced. A second disc is drawn. Copy and complete the following tree diagram then answer the questions that follow:



Find the probability that;

(i) both discs are green,

(ii) both discs are blue,

(iii) one disc is green and one disc is blue.

(b) If A and B are dependent events whereby $P(A)=\dfrac{1}{5}$, $P(B)=\dfrac{3}{10}$ and $P\left(\dfrac{A}{B}\right)=\dfrac{1}{10}$, find $P(A\cup B)$ and $P(B\cap A')$.

(c) In how many ways can 11 people be seated on a bench if only 6 seats are available?

11. (a) Find the work done when a force given by $\underline{F} = 4\underline{i} - 3\underline{j} + 6\underline{k}$ displaces an object from $A(0,4,5)$ to $B(3,12,10)$.

(b) The position vectors of the points A and B are $\underline{a} = 5\underline{i} - \underline{j} - 3\underline{k}$ and $\underline{b} = \underline{i} + 3\underline{j} - 5\underline{k}$ respectively. Show that vector $\underline{a} + \underline{b}$ is perpendicular to vector $\underline{a} - \underline{b}$.

(c) Determine the image of $(3,-8)$ under a reflection in the line $x + y = 0$ followed by a rotation of -90^0 clockwise about the origin.