THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

NOVEMBER 1996

041

BASIC MATHEMATICS

(For both School and Private Candidates)

TIME: 3 Hours.

INSTRUCTIONS

1. This paper consists of sections A and B.
2. Answer ALL questions in Section A and any FOUR (4) questions in Section B.
3. All necessary working and answers for each question from both sections A and B MUST be SHOWN CLEARLY.
4. All working must be done in the answer book(s) provided.
5. Unless otherwise stated, mathematical tables, squared (graph) papers may be used.
6. You are advised to spend not more than two (2) hours in Section A and not more than one (1) hour in Section B.

This paper consists of 5 printed pages.

SECTION A (60 Marks)

Answer all questions in this section. show CLEARLY, all your necessary STEPS and ANSWERS in your working for each question.

1. (a) Solve the inequality:

$$x^2 - 2x < 8$$

(b) Find the values of r and s if:

$$9x^2 - 12x + r = (3x - s)^2$$

2. Given the ratios:

$A : B = 2 : 3$

$B : C = 6 : 7$

Calculate the ratio of $A : C$.

3. The end of a 60 cm. pendulum describes an arc 5 cm. long. Find the angle, in degrees, through which the pendulum swings.

4. If the equation:

$(2p + 2)\ x^2 + px + p = 4(px + 2)$ has the sum of its roots equal to the product of the roots,

Find:

(a) the value of P

(b) the roots of the equation, using the value of P found in (a).

5. If $\tan^2 A + 2 \tan^2 B + 3 = 0$, show that $\cos^2 B + 2 \cos^2 A = 0$.

6. Find the values of θ between $0°$ and $360°$ which satisfy the equation:

$$\cos^2 \theta = 3\ (1 + \sin \theta\ ).$$

7. Two numbers are such that the first number plus three times the second number is 7, and the first number minus three times the second number gives 1. Find the two numbers.

8. Express the following recurring decimal number as a rational number:

$0.\dot{6}5\dot{7}$.

9. Find the y-intercept and the gradient of the line which passes through the points (7, 5) and (2, 3).

10. The height of a trapezium is 13 cm. If one of its parallel sides is 20 cm, and the area of the trapezium is 390 cm^2, find the length of the other parallel side.

11. Find without using tables, the value of $\tan\theta$, given that:

$$\tan(\theta - 45) = \frac{1}{3}.$$

12. If $\frac{k}{v} - \frac{1}{u} = \frac{k-1}{r}$, write k as the subject of the formula.

13. Find the value of $a^2 - b^2$ to three (3) significant figures when:

$b = 2 \times 10^8$ and $a - b = 12{,}600$.

14. (a) Factorise the expression:

$$\text{Cos}^4 x - \text{Sin}^4 x$$

(b) Simplify the expression:

$$\frac{\text{Sin}^4 x - \text{Cos}^4 x}{\text{Sin}^2 x - \text{Cos}^2 x}$$

15. Simplify the following:

$$\frac{1}{t^2 - 2t - 15} - \frac{1}{3t^2 + 10t + 3}$$

16. Solve by using factors:

(a) $\frac{k+6}{k-4} = \frac{1}{k}$

(b) $\log_b b^{2x^2 - x} = 1$

17. If sh. P is invested at r% compound interest, it amounts to sh. A after n years where:

$$A = P\left(1 + \frac{r}{100}\right)^n$$

Find A, if $P = 250$, $r = 4$, and $n = 12$.

18. Evaluate:

$$\log_3 9 \times \log_4 \frac{1}{64} \times \log_7 \frac{1}{7}$$

19. If y varies inversely as $\sqrt{x}$, and x is multiplied by n, what is the ratio of the first y to the second y?

20. A sphere of diameter 4cm. is beaten out into a circular sheet 0.03cm. thick. Find the radius of the sheet.

SECTION B (40 Marks)

Answer any FOUR (4) questions from this section. Show all your working and answers for each question you attempt, CLEARLY.

21. The fourth, fifth and sixth terms of the series are:

$(2x + 10)$, $(4x - 4)$, and $(8x + 40)$ respectively. Calculate the values of x and find the sum of the first ten terms when the series is

(i) an Arithmetric Progression

(ii) a Geometric Progression.

22. (a) Given that P, Q, and R are the points (8, 10), (6, 20), and (16, 16) respectively. Calculate the value of the dot product $\overrightarrow{PQ} \cdot \overrightarrow{PR}$, and calculate the size of the angle $Q\hat{P}R$.

(b) The resultant of two vectors $\underline{P} = (a, b)$, and $\underline{V} = (16, -8)$ is $\underline{R} = (12, -5)$. Find the magnitude and direction of vector $\underline{P}$.

23. (a) Find the matrix B in the equation AB = C, where

$$A = \begin{bmatrix} 7 & 5 \\ 4 & 3 \end{bmatrix} \quad \text{and} \quad C = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}.$$

(b) Given that $A = \begin{bmatrix} 0 & 2x \\ x & 0 \end{bmatrix}$, find the values for x if $|A| = -8$.

24. (a) Given $N = \{x : 1 \leq x \leq 20\}$. Find the following subsets of N.

(i) $A = \{x : x$ is a multiple of $3\}$

(ii) $B = \{x : x$ is a multiple of $4\}$

(iii) A' (iv) B' (v) $(A \cup B)'$ and (vi) $A' \cap B'$.

(b) If $D = \{x : 80 \leq x \leq 100\}$. Find the probability that the number selected from D is:

(i) divisible by 7

(ii) a prime number

(iii) an odd number.

25. (a) Sketch the graph of the function:

$$f(x) = -1 + |x|$$

and find:

(i) the domain,

(ii) the range, of $f(x)$.

(b) Given that $g(x) = 5 + \frac{x}{2}$, find the values of:

(i) $g^{-1}(6)$

(ii) $g^{-1}(0)$

(iii) $g^{-1}(-1)$

(iv) $g^{-1}(a)$.

26. (a) In a class of thirty pupils, one prize is awarded for English, another for Kiswahili, and a third for Mathematics. In how many ways can the winners be chosen?

(b) A girl has two jackets, four nice blouses, and three pairs of good shoes. How many different outfits, consisting of a jacket, blouse, and a pair of shoes, can she make out of these?

(c) A boy has five different flags. In how many ways can he fly them one above the other?