THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

NOVEMBER 1995

041

BASIC MATHEMATICS

(For Both School and Private Candidates)

TIME: 3:00 Hours

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1. This paper consists of sections A and B.
2. Answer ALL questions in section A and any FOUR (4) questions from section B in the answer book provided.
3. ALL WORKING for each question in both sections A and B must be shown clearly.
4. Unless otherwise stated, mathematical tables, squared papers and slide rules may be used.

This paper consists of 5 printed pages.

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SECTION A (60 marks)

Answer ALL questions in this section. Show clearly ALL WORKING for each question. You are advised to spend not more than 2 hours on this section.

1. If y is directly proportional to x, find the value of each of a, b and c in the table below.

y	8	12	b	32
x	2	a	6	c

2. If $\frac{a + 2b}{a - 2b} = \frac{1}{2}$, find the value of $\frac{a}{b}$

3. Simplify $\frac{\log x^4 - \log x}{\log x^3 - \log x}$

4. If $\underline{a} = 5\underline{i} + 4\underline{j}$, $\underline{b} = -3\underline{i} + 3\underline{j}$ and $\underline{c} = -2\underline{i} + 5\underline{j}$, find

   (a) $\underline{v} = 2\underline{a} + \underline{b} - 3\underline{c}$

   (b) the magnitude of $\underline{v}$

5. Make p the subject of the equation:

$$tp^{\frac{1}{2}} = q(p + r)^{\frac{1}{2}}$$

6. The circle $(x - 2)^2 + (y + 3)^2 = 4$ is rotated through an angle 90° about the origin (0,0). Find the equation of the image circle.

7. Given $x = 1.6 \times 10^8$ and $y = 5.6 \times 10^4$, find z in standard form if $xz = y$.

8. Given that $M * N = \frac{M - N}{2N} + \frac{M + N}{2M}$, find

   (a) $4 * 2$

   (b) a if $1 * a = 2$

9. (a) Construct triangle ABC, such that $\overline{AB} = 3cm$, $\overline{BC} = 4cm$ and $\overline{AC} = 6cm$.

   (b) Find the value of the largest angle in the triangle ABC (in (a) above by measuring.

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10. Solve the following simultaneous equations:

$$\begin{cases} \frac{x}{4} - \frac{y}{3} = 0 \\ \frac{x}{2} - \frac{y}{2} = 1 \end{cases}$$

11. Express $2.\dot{1}\dot{4}\dot{6}$ as a fraction.

12. If $\begin{pmatrix} 13 \\ 11 \end{pmatrix} = \begin{pmatrix} x & y \\ 2x & 3 \end{pmatrix}\begin{pmatrix} -2 \\ 5 \end{pmatrix}$, find the value of $x + y$.

13. Find the image of the vector $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$ under the transformation given by the matrix $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

14. If N is an acute angle and $\tan N = \frac{5}{13}$, without using tables, find the value of $\sin N + 5 \cos N$.

15. Find the inverse of the function $f(x) = \frac{1}{5}x + 2$.

16. (a) Without using tables, simplify: $\frac{\sin 30^\circ \cos 30^\circ}{\tan 30^\circ}$.

(b) Given the value of $\tan\theta = -1$, find the possible values of x in the interval $0^\circ \leq \theta \leq 360^\circ$.

17. What is the area of a regular 36 sided polygon inscribed in a circle of radius 10cm?

18. The four congruent faces of a tetrahedron are marked 1, 2, 3, and 4 respectively. What is the probability that when the tetrahedron is tossed it will show a prime number?

19. The second, fourth and eighth terms of an arithmetic progression form three consecutive terms of a geometric progression. If the sum of the third and fifth terms of the geometric progression is 20, find the sum of the first ten terms of the geometric progression.

20. (a) Factorise completely $pq + pr - rq - q^2$

(b) Find the value of the expression in (a) above, if

$p = 11{\cdot}1$, $q = 7.1$ and $r = 2.9$.

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SECTION B (40 marks)

Answer any FOUR (4) questions from this section. Show clearly ALL YOUR WORKING for each question you attempt. You are advised to spend not more than 1 hour on this section.

21. (a) A ship sails due north from latitude $20^{\circ}S$ for a distance of 1440 km. Find the latitude of the point it reaches.

(b) A second ship sails due west from a position 60° N 5° W for a distance of 1200km. Find its new position.

[Circumference of the Earth = 4×10^4km, $\pi = 3.14$]

22. (a) The position vector P is $\begin{pmatrix} 3 \\ 6 \end{pmatrix}$ and the position vector Q is $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$

Find the vector 2PQ and the position vector M which is the mid-point of PQ.

(b) Write the pair of simultaneous equations below as matrix equation.

$$x + 2y = 8 \quad \ldots\ldots\ldots\ldots (1)$$
$$15y + x = 47 \quad \ldots\ldots\ldots\ldots (2)$$

(c) Solve for x and y in (b) above by inverse matrix.

23. (a) How many four digit numbers can be formed from the digits 2, 3, 4, 5 and 6 if the digits may not be repeated in the same numeral?

(b) How many four digit numbers greater than 3000 can be formed from the digits 2, 3, 4, 5 and 6 if the digits may not be repeated in the same numeral?

(c) Find the probability of forming a four-digit number greater than 3000, if digits may not be repeated in the same numeral.

(d) Repeat (c) above if the digits may be repeated in the same numeral.

24. (a) Use logarithm tables to find the value of x to three significant figures in the following:

$$\frac{(17.9)^3 \times (0.004096)^2}{\sqrt{79.42}} = x$$

(b) Simplify $\log_2 32 - \log_3 9$.

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25. If $E = \{$ integers between 1 and 11 $\}$

$A = \{ x : 2 < x \leq 9 \}$

$B = \{ x : 1 \leq x < 10 \}$

(a) Draw a venn diagram to illustrate these sets.

(b) List the elements belonging to

(i) $A \cup B$

(ii) $A' \cap B$

(c) State $n(A \cap B')$

26. (a) The function f is defined by $f(x) = \begin{cases} x + 3 & \text{if } x < -1 \\ 2 & \text{if } -1 \leq x \leq 1 \\ x & \text{if } x > 1 \end{cases}$

(i) Sketch the graph of f.

(ii) Use your graph to determine the domain and range of f.

(iii) Find the value of: $f(-5)$, $f(0)$, $f(2)$.

(iv) State whether f is one to one.

(b) Given the rational function $g(x) = \dfrac{mx^2}{x^2-3x+2}$, determine its domain and range.

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