THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

041

BASIC MATHEMATICS
(For Both School and Private Candidates)

TIME: 3 Hours

2 November 1999 A.M.

INSTRUCTIONS

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 booklet provided.
3. All necessary working and answers for each question done must be shown clearly.
4. Mathematical tables and graph papers may be used unless otherwise stated.
5. You are advised to use not more than two (2) hours on Section A and not more than one (1) hour on Section B.

This paper consists of 4 printed pages

SECTION A: (60) marks).

Answer ALL questions in This Section

1. (a) Evaluate $\frac{0.008 \times 10^{5}}{6 \times 10^{-4}}$ expressing your answer in standard form correct to three significant figures (3.5 marks)

   (b) If $\left[3^{(x-2)}\right]\left[2^{(3y-3)}\right] = 72$, find the values of x and y (4 marks)

2. (a) (i) Determine the fractional notation for $0.6\dot{3}$.
   (ii) The operator * is defined as $a * b = b^2 - a$.
   Find the value $1*(3*2)$. (4.5 marks)

   (b) Find the value of $(64)^{-2/3} + \frac{(4)^{\circ}}{(16)^{1/2}}$ (3 marks).

3. (a). Simplify the expression:
   $\frac{9x^2 - 49}{2-(3x-5)}$ (3 marks)

   (b) (i) Rationalize the denominator of the expression, $\frac{6}{\sqrt{7}-2}$

   (ii) Find x if $\log_x 32 = 5$ (4.5 marks)

4. If f is a function such that:

$$f(x) = \begin{cases} -3 \text{ if } x \leq -1, \\ 1 \text{ if } -1 < x \leq 2, \\ 4 \text{ if } 2 < x, \end{cases}$$

   (a) determine the domain and range of f(x). (2 marks)

   (b) draw the graph of f(x). (5.5 marks)

5. (a) Find the values of x, y and z given that;
   $\frac{x}{3} = \frac{y}{4} = \frac{z}{2}$ and $2x + 3y - z = 16$. (4 marks)

   (b) Find the sum of all odd numbers less than 100 which are not multiples of 7. (3.5 marks)

6. (a) Determine the inverse of the matrix

$$A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$$

   (b) Solve the following simultaneous equations by using the inverse of the matrix obtained in (a) above.

$$\begin{cases} 4x + 2y = 40 \\ x = 35 - 3y \end{cases}$$ 4.5 marks)

7. (a) Find the image of point A(3, 4) after its reflection in the line $y + x = 0$ followed by another reflection in the line $y = 0$. (2.5 marks)

(b) By using the intercepts of a line $y = 2x + 5$, find the equation of the image of this line when it is reflected in the line $y - x = 0$. (5 marks).

8. (a) A fraction is written by selecting the numerator from the digits 1, 2, 3 and the denominator from the digits 6, 8.
Find the probability that the fraction written is less than ½. (3.5 marks).

(b) Box A contains 8 items of which 3 are defective and Box B contains 5 items of which 2 are defective. An item is drawn at random from each box. What is the probability that:

(i) both items are non-defective?
(ii) one item is defective and one item is not defective? (4 marks)

SECTION B (40 marks)

Answer any **FOUR (4)** questions from this section. Show **ALL** your necessary steps and answers clearly.

9. (a) The sum of the first two terms of a geometrical progression is 10 and the sum of the first four terms is 40. Given that all terms of the progression are positive, show that;

(i) the common ratio is $\sqrt{3}$.

(ii) the sum of the first n terms is $5(3^{n/2} - 1)$. (5 marks)

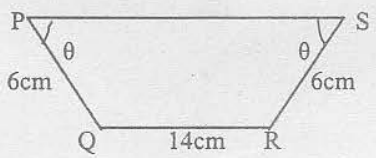
(b) In an arithmetical progression, the thirteenth term is 27, and the seventh term is three times the second term. Determine the sum of the first ten terms. (5 marks)

10. A car starts from rest and moves with a constant acceleration of $3m/s^2$ until it reaches a velocity of 24m/s. It maintains this velocity for 10 seconds and then breaks to rest with a retardation of $4m/s^2$
(a) Draw the velocity – time graph for this motion. (4 marks)

(b) Find the total distance travelled. (4 marks)

(c) Find the average velocity for the journey. (2 marks).

11. (a) A water-trough is to be constructed so that its cross-section is a trapezium PQRS in which PQ = RS = 6cm, QR = 14cm and $\angle SPQ = \angle PSR = \theta$, as shown in the diagram below.



Show that the area of PQRS is given by
$A = 84\sin\theta + 18\sin 2\theta$ given that $2\sin\theta\cos\theta = \sin 2\theta$ (6 marks).

(d) Change each of the following angles which are in radians into degrees.
(i) $\frac{7}{4}\pi$.
(ii) $\frac{5}{9}\pi$
(4 marks)

12. Carefully study the frequency distribution table for the scores of 68 students (in percentage) given here under.

Class Boundary (in percentage)	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Frequency	6	12	14	16	8	6	6

(a) Determine the mode of the scores. (4 marks)

(b) Calculate the median of the scores. (4 marks).

(c) A student is chosen at random from the frequency distribution table above. What is the probability that his score is below 60%? (2 marks).

13. (a) Determine the coordinates of the point P(x, y) on the y-axis such that the line joining it to the point (3, -1) forms a right angle with the line through the points (3, -1) and (-5,-5). (4 marks).

(b) Line L is perpendicular to the line joining the points (-3, 2) and (5,6). If it passes through the point of intersection of the lines $2x - y = 1$ and $3x + 3y - 6 = 0$; determine the equation of line L. (4 marks).

(c) Find the coordinates of the midpoint of the line joining the points (-2, 8) and (-4, -2). (2 marks)

14. (a) Find the values of a and b if the expression $x^3 + ax^2 + bx - 4$ is exactly divisible by $x^2 - 4$.

(5 marks).

(b) (i) Solve for x, given that $\log_3 x - \log_3(x - 8) = 2$.

(ii) Determine the values of x and y from the following expression:
$(\frac{1}{4})^x (3)^{y-2} = 432$. (5 marks).