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

141

BASIC APPLIED MATHEMATICS

(For Both School and Private Candidates)

Time: 3 Hours **Tuesday 04 May 2004 a.m.**

Instructions

1. This paper consists of sections A and B.
2. Answer **all** questions in section A and **four** (4) questions from section B.
3. All work done in answering each question must be shown clearly.
4. Mathematical tables, mathematical formulae, slide rules and unprogrammable pocket calculators may be used.
5. Cellular phones are **not** allowed in the examination room.
6. Write your Examination Number on every page of your answer booklet(s).

This paper consists of 4 printed pages.

SECTION A (60 marks)

Answer **all** questions in this section showing all necessary steps and answers.

1. (a) Use common logarithms to find the value of the following.

$$\frac{(6.04)^2 \times 1.44}{(34.9)\cdot\sqrt{19}}$$ correct to 2 decimal places. **(4 marks)**

(b) Use the non programmable calculator to find the value of the following.

$$\sqrt{\frac{(\log 31.42)(\ln 31.42)}{(22)^{\frac{1}{5}}}}$$ correct to 6 decimal places. **(2 marks)**

2. (a) Three points have coordinates A (1,7), B (7,5) and C (0,-2). Find:

(i) The equation of a perpendicular bisector of $\overline{AB}$.

(ii) The point of intersection of this perpendicular bisector and $\overline{BC}$. **(4 marks)**

(b) Find the equation of a line passing through the point A (2,1) and is parallel to the line $2x - 4y - 5 = 0$. **(2 marks)**

$2x - 4y - 5 = 0$

3. Given the functions $f(x) = 3x - 4$ and $g(x) = \frac{1}{2x+3}$.

$\frac{2x-5}{4} = \frac{4y}{4}$

$\frac{2}{4} = \frac{y-1}{x-2}$

(a) State the domain of f and g. **(2 marks)**

$\frac{2x-5}{4} = y$

(b) Verify that fog (-2) $\neq$ [(f)(g)](- 2). **(4 marks)**

$(x-2) = 2(y-1)$

4. An arithmetic progression is such that the seventh term is three times the sum of the third and fourth terms. If the sum of the first six terms is 21:

$x-2 = 2y-2$

(a) Find the first term and common difference.

$x-2y-2+2=0$

(b) Compute the sum of the first 20 terms. **(6 marks)**

$x-2y-6=0$

5. (a) If $\sin A = \frac{1}{5}$, find the value of $\cos 2A - \sin^2 2A$ in its most simplified form. **(3 marks)**

(b) Solve for θ between 0° and 360° given the equation $\cos 2\theta + \sin^2\theta = 0$. **(3 marks)**

6. The value of a particular house in a certain city during the period 1988 to 1994 can be modelled by the equation $H = Ae^{-Pt}$, where A and P are constants. The value of the house in 1988 was £ 65,000 and its value in 1989 was £ 61,100.

State the value of A and calculate the value of P correct to 2 significant figures. **(6 marks)**

7. (a) Solve the following equation.

$\log_x 3 + \log_x 27 = 2$ **($2\frac{1}{2}$ marks)**

(b) Solve the following system of simultaneous equations.

$$\begin{cases} \log_{10}(x+y) = 1 \\ \log_2 x + 2\log_4 y = 4 \end{cases}$$ **($3\frac{1}{2}$ marks)**

8. (a) Differentiate the following with respect to x.

(i) $y = (2x^3 - 1)\sin x$

(ii) $y = \dfrac{\ln(5x)}{x^2}$. **(5 marks)**

(b) Find $\dfrac{dy}{dx}$ in part (a) above at the point where $x = 0$. **(1 mark)**

9. (a) Evaluate the integral below.

$$\int_0^1 x^2 \sqrt{x^3 \;\; x \;\; 1}\, dx.$$

(3 ½ marks)

(b) Find $\int \frac{1}{2x - 1}\, dx$. **(2 ½ marks)**

10. (a) The two roots of the quadratic equation $x^2 + 2x + 3 = 0$ are denoted by α, β. Without solving the equation, find the quadratic equation whose roots are

$$\alpha + \frac{1}{\beta},\ \beta + \frac{1}{\alpha}$$

($3\frac{1}{2}$ marks)

(b) Show that $\left(\dfrac{1 + x^2}{1 - x^2}\right)^2 - \left(\dfrac{2x}{1 - x^2}\right)^2$ has the same numerical value for all $x \neq \pm 1$ and determine this value. **($2\frac{1}{2}$ marks)**

SECTION B (40 marks)

Answer **four (4)** questions from this section showing all necessary steps and answers.

11. (a) Find the work done in moving an object along a straight line from point A (3, 2, -1) to point B (2, -1, 4) in a force field given by $\underline{F} = 4\underline{j} - 3\underline{j} + 2\underline{k}$. **(3 marks)**

(b) Given the vectors $\underline{a} = 2\underline{i} - \underline{j}$ and $\underline{b} = 3\underline{i} + 6\underline{j} - \underline{k}$

(i) Verify that the vectors are perpendicular to each other.

(ii) Find the unit vector perpendicular to both $\underline{a}$ and $\underline{b}$. **(7 marks)**

12. The marks for 30 students in a Mathematics terminal examination at Munjebwe Secondary School are tabulated as follows.

Marks	21 -30	31 - 40	41 - 50	51 - 60	61 - 70
Frequence	2	6	10	8	4

(a) Construct a histogram to represent the data. **(6 marks)**

(b) Compute:

(i) Mean

(ii) Median. **(4 marks)**

13. (a) If $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{4}{5}$ and $P(B') = \frac{2}{3}$.

Find:

(i) $P(B)$

(ii) $P(A \cap B)$

(iii) $P(A' \cap B')$ **(6 marks)**

(b) From a class of seventeen pupils of whom ten are boys and seven are girls, a committee of four pupils is to be selected to arrange a party. If the selection is made at random, what is the probability that the committee will contain three boys and one girl? **(4 marks)**

14. (a) Given the matrices $A = \begin{pmatrix} 2 & 3 \\ -1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 2 \\ 4 & -3 \end{pmatrix}$

(i) Write $2A + 3B^T$ as a single matrix.

(ii) Find the determinant of A^2B. **(6 marks)**

(b) Solve the following system of simultaneous equations using Cramer's rule:

$$\begin{cases} 3x - y = 5 \\ y - x = 1 \end{cases}$$

(4 marks)

15. A person requires 10, 12 and 12 Units of Chemicals A, B and C, respectively for his garden. A liquid product contains 5, 2, and 1 units of A, B and C, respectively, per jar and a dry product contains 1, 2 and 4 Units of A, B and C, respectively, per carton. If the liquid product sells for shs. 3,000 per jar and the dry product sells for shs. 2,000 per carton, how many of each should be purchased to minimize the costs and meet the requirements?

(10 marks)

16. (a) A particle moves following the path $S = 4 + 4t - 2t^2$. Find the values of t and s when the particle is at the maximum point. **(4 marks)**

(b) Evaluate the area under the curve

$$y = \frac{x}{1-x^2} \text{ from } x = 0 \text{ to } x = \frac{1}{2}.$$

(6 marks)