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 **Monday, 11th February 2013 a.m.**

Instructions

1. This paper consists of **ten (10) compulsory** questions. Each question carries **ten (10)** marks.
2. All work done in answering each question must be shown clearly.
3. Mathematical tables and non programmable calculators may be used.
4. Cellular phones are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. By using a non programmable calculator:

(a) Compute the value of $\sqrt[3]{\dfrac{3.141\times 2.751}{47\times 39.8}}$ and write your answer in 6 decimal places.

(b) Find the sum of the finite series $2\left[\dfrac{1}{1\cdot 2^1}+\dfrac{1}{3\cdot 2^3}+\dfrac{1}{5\cdot 2^5}+\dfrac{1}{7\cdot 2^7}+\dfrac{1}{9\cdot 2^9}\right]$ and write your answer in 4 decimal places.

(c) Find the mean length of 200 engine components that were measured and recorded as follows:

Length (mm)	198	199	200	201	202
Frequency	8	30	132	24	6

(d) Find the value of ${}^{15}P_6\times {}^{10}P_2$.

(e) Compute the value of ${}^{8}C_5\times {}^{11}C_2\times 9!$

2. (a) The functions f and g are defined by $f: x \mapsto \ln x$ and $g: x \mapsto e^x$.

(i) Sketch the graphs of f on $0\leq x\leq 3$ and g on $-3\leq x\leq 3$ on the same x and y plane.

(ii) State the domain and range of f and g.

(iii) Identify the asymptotes for f, g and describe briefly how f and g behave near the asymptotes.

(b) Given $f(a)=\dfrac{a-1}{a+1}$, show that $f(\frac{1}{a})=-f(a)$.

3. (a) The first four terms of the series A, B and C are given below. Among the series, one is an arithmetic series, one is a geometric series and the remaining is neither.

$A: 128+64+32+16+\ldots$

$B: 4+8+12+24\ldots$

$C: 38+35+32+29+\ldots$

(i) State the value of the common difference of the arithmetic series and calculate the 21st term of this series.

(ii) Find S_{10} of the geometric series.

(b) If the length of a paper in a roll of given dimensions varies inversely as the thickness of the paper, find the increase in length when the thickness of a paper in a 100 m roll is decreased from 0.25 mm to 0.20 mm.

4. (a) Differentiate with respect to x the functions:

(i) $f(x)=e^{\sin x}$,

(ii) $y=\dfrac{3}{x^3}-\dfrac{1}{\sqrt{x}}$,

(iii) $x^2+xy+y^3-2x+3y=0$.

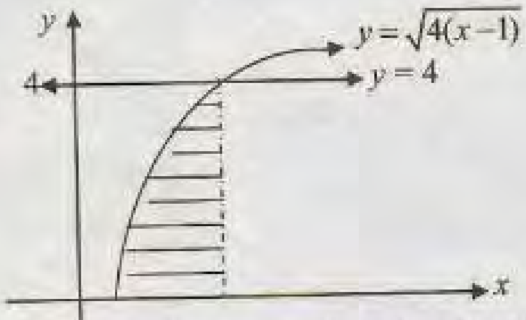
(b) Find the turning points of the polynomial function $y = x^3 - x^2$ and hence sketch the graph of this function.

5. (a) Evaluate the integrals:

(i) $\int \sin(4x+6)\,dx$,

(ii) $\int_0^1 (x^3+1)^2\,dx$.

(b) The graph of $y=\sqrt{4(x-1)}$ is shown in the sketch below together with the line $y = 4$.



Find the volume generated when the shaded area is rotated completely about the x-axis, leaving your answer in terms of π.

6. The scores of 40 students in a mathematics test are given below.

Scores	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81- 90
Number of students	3	6	10	8	6	4	3

(a) Represent the students' scores in a histogram and then use it to calculate the mode.

(b) Find;

(i) Variance of the scores,

(ii) The standard deviation of the scores.

7. (a) (i) Draw 2 possible venn diagrams representing two events A and B in a sample space S and then write down the formulae corresponding to $P(A \cup B)$.

(ii) Given that A and B are mutually exclusive events with probabilities $P(A)=\frac{1}{4}$ and $P(B)=\frac{2}{3}$, find $P(A\cup B)'$.

(b) Ntibagomba is going on holiday. He has 6 different shirts and has decided that he only needs to take 3 shirts. Find the number of different selections that he can make.

(c) Find the number of ways that six children Kauki, John, Tito, Ben, Kato and Sara can stand in a line outside the canteen waiting for lunch.

8. (a) If A is an acute angle such that $\tan A = \frac{3}{4}$, find without using tables or calculator, the values of (*i*) $\cos 2A$ and (*ii*) $\sin \frac{A}{2}$.

(b) Solve the equation $2\sin(x+60^\circ) = \cos(x-30^\circ)$ in the range $0^\circ \le x \le 360^\circ$ by expanding the sine and the cosine terms.

9. (a) Given that $A = \begin{pmatrix} 3 & 1 \\ 5 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} -4 & 3 \\ -5 & 2 \end{pmatrix}$, verify that $(AB)^T = B^T A^T$.

(b) Show whether the following system of equations has a common solution or not.

$$7x - 3y - 3z = 7$$
$$2x + 4y + z = 0$$
$$-2y - z = 2$$

(c) The results of three soccer teams Simba (S), Yanga (Y) and Mtibwa Sugar (M) are shown in matrix R and the points awarded for each team in matrix P.

$$R = \begin{matrix} & W & D & L \\ S & 6 & 2 & 4 \\ Y & 4 & 3 & 1 \\ M & 7 & 1 & 4 \end{matrix} \qquad P = \begin{matrix} & \text{Points} \\ W & 5 \\ D & 1 \\ L & 0 \end{matrix}$$

Multiply the matrices and hence state which team has many points.

10. The data for M & P Company, which manufactures tables and chairs, is given in the table below:

	Labour Hours per Item		Maximum Labour Hours Available
	Table	Chair	
Assembly Department	16	4	800
Finishing Department	4	2	240
Profit per Item	Shs. 10,000/=	Shs. 4000/=	

(a) How many tables and chairs that should be manufactured to realize a maximum profit?

(b) What is the maximum profit?