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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, 02nd May 2016 a.m.**

Instructions

1. This paper consists of **ten (10) compulsory** questions. Each question carries **ten (10)** marks.
2. All necessary workings and answers for 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).

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1. (a) By using a scientific calculator evaluate,

(i) $\log_{0.75} 7.5 - \ln\left(5\sqrt{3}\right)$ correct to five significant figures.

(ii) $\left(\begin{vmatrix} 1 & 1 & 1 \\ 2 & -2 & -1 \\ 1 & 3 & -2 \end{vmatrix}\right)^{2.356}$ correct to four decimal places.

(b) The following data are the weight of 37 members in a National Boxing Club.

62	78	40	70	58	65	54	69	71	67	74	64
65	59	68	70	66	80	54	62	83	77	51	72
79	66	83	63	67	61	71	64	59	76	67	58
64											

With the aid of a scientific calculator,

(i) Compute the mean weight

(ii) Find the variance

(iii) Calculate the standard deviation of the data.

2. (a) A function is defined by the equation $f(x) = mx^2 + nx + k$. If $f(2) = 7$, $f(0) = -3$ and $f(-1) = 2$,

(i) Determine the values of m, n and k.

(ii) Find the domain and range of $f(x)$.

(b) (i) Sketch the graph of the rational function $g(x) = \dfrac{1}{4x-8}$.

(ii) What are the values of x and y for which $g(x)$ is defined?

3. (a) The roots of the polynomial equation $P(x) = x^3 - 7x^2 + Ax - 8$ form a geometric progression. Find,

(i) The roots of the polynomial equation

(ii) The value of A

(iii) The abscissa at the turning points on the curve.

(b) Solve the following simultaneous equations by substitution method,

$$\begin{cases} xy = 16 \\ x^2 + y^2 = 32. \end{cases}$$

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4. (a) Show that $\frac{d}{dx}\left(\sin^{-1}(x-1)\right)=\frac{1}{\sqrt{2x-x^2}}$.

(b) A relation is defined by the equation $y^2-4x^3-4=0$. Find

(i) The slope of the curve at a point where $x=2$

(ii) The equations of the tangent to the curve at a point where $x=2$.

(c) Find $\frac{dy}{dx}$ if $y=x^2\left(1-\frac{1}{\sqrt{x}}\right)e^{\tan x}$.

5. (a) If $f'(z)=ze^{z^2}$ and $f(0)=\frac{9}{2}$, find $f(z)$.

(b) (i) Calculate the area of the region bounded by the curve $y=x^2+3x-18$ and the line $y=0$.

(ii) The marginal cost of producing x units of a product is given by the equation $c'(x)=0.6x^2+4x$. If the fixed cost is 30000/-, find the cost function.

6. (a) The number of motorcycle accidents which were recorded in one region in Tanzania for seven weeks during November and December 2013 were 14, 2, 12, 4, 10, 6 and 8. Find,

(i) The mean number of accidents

(ii) The variance of the accidents.

(b) The table below shows the height of avocado trees in an Orchard,

Height $(\times 10^{-1}m)$	2-6	7-11	12-16	17-21	22-26	27-31
Frequency	12	14	18	15	4	8

(i) Use the data to draw the histogram

(ii) Estimate the mode from the histogram in b (i) above.

7. (a) A fair coin is tossed once and the results are recorded, then a fair die is tossed.

(i) Draw a tree diagram to show the possible outcomes.

(ii) Find the probability that, the outcome contains a head and an even number.

(b) Events X and Y are independent such that $P(X)=\frac{2}{3}$ and $P(X\cap Y)'=\frac{3}{4}$. Find,

(i) $P(X/Y)$

(ii) $P(X\cup Y)$.

8. (a) Define the following terms:

(i) Sine

(ii) Tangent.

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(b) Evaluate $\tan 15^\circ + \cot 75^\circ$. Give the answer in simplest surd form.

(c) Prove that $(1-\cos A)(1+\sec A) = \sin A \tan A$.

9. (a) If $f(m) = m^2 - 4m - k$, find $f(N)$ when $k = \begin{pmatrix} 11 & -5 \\ -4 & 12 \end{pmatrix}$ and $N = \begin{pmatrix} 2 & 5 \\ 3 & 1 \end{pmatrix}$.

(b) Use Cramer's rule to solve the following system of linear equations,

$5x - 7y + z = 11$

$6x - 8y - z = 15$

$3x + 2y - 6z = 7.$

10. (a) Given the linear inequalities: $2y \le 4x$, $x \le 6$, $y \ge 2$ and $2x + 3y \le 30$

(i) Draw the corresponding graph.

(ii) List the corner points of the feasible region.

(b) The daily profit obtained by Fruits Beverages Company in its business is given by the objective function $f(x, y) = 250x + 350y - 2200$ and the constraints;

$x + y \ge 5.5$

$4x + 2y \ge 16$

$x + 2.5y \ge 9$

(i) Represent the linear programming problem graphically.

(ii) Determine the minimum and maximum profit of the company.

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