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, 04th May 2015 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. Evaluate the following expressions with the help of a calculator (write your answers correct to 2 decimal places).

(a) $\cos^{-1}\left(\frac{2}{3}\right)+\sin^{-1}\left(\frac{3}{4}\right)$.

(b) $\sqrt[3]{8\sin 25^{\circ}\cos 55^{\circ}}$.

(c) $\log_{8}17-\ln\left(\frac{5}{12}\right)$.

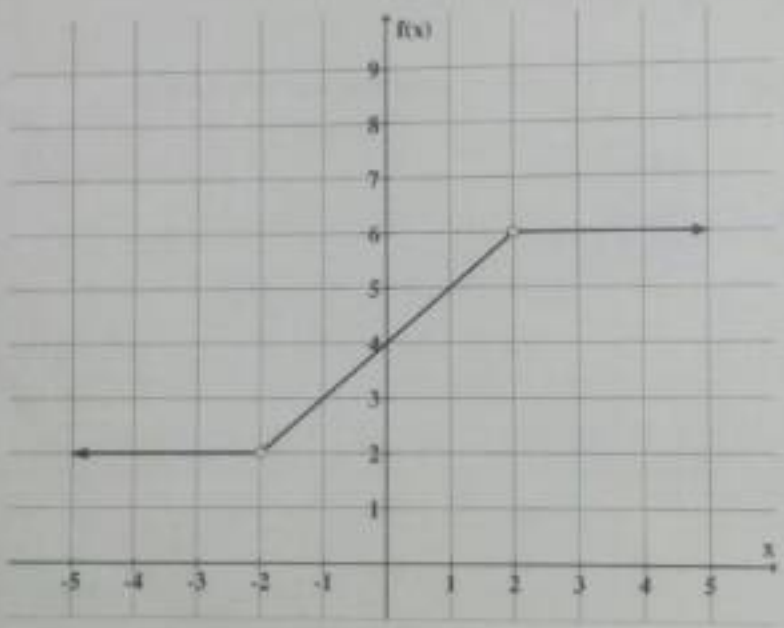
(d) $T(t)=280+920e^{-0.0910t}$ at $t=10$ given that $e\cong 2.72$.

(e) The number of ways for 20 people to be seated on a bench if only 5 seats are available.

(f) The value of the function $f(x)=\left(1+\frac{1}{x}\right)^{x}$ when $x=10, 100, 1000, 10{,}000$ and hence comment on the value of $f(x)$ when x gets very large.

2. (a) Find the coordinates of the points where the line $y-2x+5=0$ meets the curve $3x^{2}-4y^{2}=10+xy$.

(b) The graph of a function $f(x)$ is given below.



Use the graph to determine:

(i) The function $f(x)$.

(ii) The domain and range of $f(x)$.

(c) Find the asymptotes and the intercepts of the function $f(x)=\frac{3x-7}{x+2}$ and then sketch its graph.

3. (a) Given the series $-1+1+3,...$

   (i) Express it in the form $S_n = \sum_{r=1}^{n} f(r)$.

   (ii) Give one reason as to whether the series is an arithmetic or a geometric progression.

   (iii) Determine the value of n for which $S_n = 575$.

   (b) If in a geometric progression, the second term exceeds the first term by 20 and the fourth term exceeds the second term by 15, find the possible values of the first term.

4. (a) Find $\frac{dy}{dx}$ from first principle given $y = 2x^2$.

   (b) If $x = 2t+9$ and $y = (t+1)^4$, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ in terms of x.

   (c) Given $f(x) = x^3 - 2x^2 + x - 7$:

   (i) Find the stationary values of the function.

   (ii) Find the equation of the tangent line to the curve at the point (0, -7).

   (iii) Draw the graph of this function for $-2 \le x \le 3$ and indicate on the graph the stationary points and the equation of the tangent line obtained in part (c) (ii).

5. (a) Evaluate the following integrals:

   (i) $\int x(x+9)^{1/2}dx$,

   (ii) $\int x\cos(5x+9)dx$.

   (b) Given that $\int_{2}^{4}\left(3x^2 - ax - \frac{16}{x^2}\right)dx = 40$, find the value of the constant a.

   (c) Sketch the graph of the curve $y = x^3 - 3x^2 + 2x$ and hence find the area bounded by the curve and the x-axis.

6. The following were the scores obtained by 22 students from Sarawak Secondary School in a mathematics classroom test:
49, 64, 38, 60, 46, 64, 68, 42, 38, 68, 57, 63, 76, 51, 54, 66, 62, 63, 58, 59, 47, 55.

   (a) Summarize the scores in a frequency table with equal class intervals of size 5. Take the lowest limit to be 35.

   (b) Find the mean score by using the data in part (a).

   (c) Find the interquartile range.

   (d) How many students scored above the mean score?

7. (a) If A and B are two events such that $P(A)=\frac{1}{4}$, $P(B)=\frac{1}{2}$ and $P(A\cap B)=\frac{1}{8}$, find $P(A\cup B)$ and $P(A'\cap B')$.

(b) A fair die was rolled and the events A and B were recorded as follows: $A=\{1,3,5\}$ and $B=\{2,3,4,5\}$. Find $P(A/B)$.

(c) In Section B of CSEE Basic Mathematics Examination each candidate has to choose and answer four out of six questions. How many choices are there for each candidate?

(d) A box contains 4 ripe mangoes and 9 none ripen mangoes. If two mangoes are randomly chosen from the box, find the probability that both will be ripe mangoes.

8. (a) Without using a mathematical table or a calculator, evaluate:

(i) $\cos(165^\circ)$.

(ii) $\tan(A+B)$ given that A and B are acute angles having $\sin(A)=\frac{7}{25}$ and $\cos(B)=\frac{5}{13}$.

(b) (i) Find the values of x that satisfy the equation $\sin 2x+\cos x=0$ for $0^\circ\leq x\leq 360^\circ$.

(ii) Verify that the solution of the equation in part (b) (i) can be obtained graphically by plotting the graph of $y=\sin 2x+\cos x$ for $0^\circ\leq x\leq 360^\circ$.

9. (a) Given:

$$A=\begin{pmatrix}1 & 2\\ 3 & 4\\ -1 & 5\end{pmatrix},\quad B=\begin{pmatrix}-2 & 3 & 4\\ 3 & 2 & 1\end{pmatrix}\text{ and } C=\begin{pmatrix}3 & 5\\ 1 & 2\end{pmatrix}$$

(i) State with one reason as to whether the matrix operations AB, BA and BC are defined or not.

(ii) Find $2A+3B^T$.

(b) Verify that $\begin{vmatrix}1 & 1 & 1\\ a & b & c\\ a^2 & b^2 & c^2\end{vmatrix}=(a-b)(b-c)(c-a)$.

(c) If $D=\begin{pmatrix}a & -4 & -6\\ -8 & 5 & 7\\ -5 & 3 & 4\end{pmatrix}$ is the inverse of matrix $E=\begin{pmatrix}1 & 2 & -2\\ 3 & b & 1\\ -1 & 1 & -3\end{pmatrix}$, find the values of a and b.

10. Mr. Taramise owns 480 acres of land on which he grows either maize or beans during the farming period. He normally expects a profit of Tshs 40,000/= per acre on maize and Tshs 30,000/= per acre on beans and he has 800 hours of labour available. If maize requires 2 hours per acre to raise and beans require 1 hour per acre to raise, find how many acres of maize and beans he should plant to get maximum profit.