# 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, 02nd May 2017 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).



AC17022

1. (a) Use a scientific calculator to find the values of each of the following expressions,

(i) $\dfrac{458.4^3 \times 0.00274 - 7560 \div 3567^3}{458.4^3 \times 0.00274 + 9681 \div 1516^2}$,

(ii) $\dfrac{547}{250}\left[\sum_{i=1}^{3} i(i+3)(i+4)\right]^{\frac{1}{2}}$.

(b) (i) Find $\log y$, if $y = \dfrac{-\sqrt[3]{3.14}}{\sin 45^\circ - \log 7}$ correct to six decimal places.

(ii) Determine the value of $q$ if $2.37q^3 + 0.625e^{\pi} = 314$.

2. (a) Given that $f(x) = 3x - 1$ and $g(x) = \sqrt{2x-1}$. Find,

(i) $f \circ g(25)$.

(ii) $g \circ f(14)$.

(b) (i) Verify that $x+4$ is not a factor of the polynomial function $f(x) = x^3 - 9x^2 + 10x - 24$.

(ii) Describe the nature of the stationary points of the function $f(x) = 2x^3 - 15x^2 + 24x$, hence show them on the graph.

3. (a) A series is given by $S_n = \sum_{r=1}^{n}(2r-3)$,

(i) Determine the value of $S_{50}$ in the series.

(ii) Find the value of $n$ such that $S_n = 624$.

(b) Determine the values of $x$ and $y$ in the following simultaneous equations,

$$\begin{cases} \log(x+y) = 1 \\ \log_2 x + 2\log_4 y = 4. \end{cases}$$

4. (a) Find $\frac{dy}{dx}$ in the following equations:

(i) $y = \frac{e^x \sqrt{\cos x}}{(2x+3)^2}$, when $x = 2\pi$.

(ii) $yx^2 - y^2x + 5y - 20x = 14$.

(b) Differentiate the function $f(x) = 4x^3 + 3x - 4$ from first principles.

(c) A 13 m long ladder leans against a wall. The bottom of the ladder is pulled away from the wall at the rate of 6m/s. How fast does the height on the wall decrease when the foot of the ladder is 5 m away from the base of the wall?

5. (a) Evaluate the following integrals:

$$\int_0^{0.5\pi} \cos^3 x dx,$$

(b) The slope of a curve at any point is defined by the equation $\frac{dy}{dx} = 3x - \frac{1}{x^2}$, where $x \neq 0$. Find the equation of the curve.

(c) The area bounded by the lines $y = mx$, $y = h$, $y = 0$ and $x = 0$ is rotated about $y-$axis. If $x = r$ when $y = h$. Find the volume of the figure generated in terms of $h$ and $r$.

6. (a) Define the following terms as they are used in statistics:
(i) Range,
(ii) Class size.

(b) The manager of Gold Mining Company recorded the number of absent workers in 52 working days as shown in the table below;

| Number of absent workers | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 |
|---|---|---|---|---|---|
| Frequency | 6 | 9 | 18 | 16 | 3 |

Use these data to construct the cumulative frequency curve.

(c) The following data shows time in seconds which was recorded by a teacher in a swimming competition of students from Precious Beach High School.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 31 | 27 | 30 | 29 | 27 | 25 | 29 | 26 | 26 | 32 |
| 32 | 25 | 31 | 31 | 27 | 24 | 26 | 26 | 32 | 33 | 28 |
| 26 | 33 | 24 | 28 | 32 | 29 | 32 | 24 | 31 | 27 | 30 |
| 31 | 25 | 29 | 25 | 27 | 30 | 26 | | | | |

(i) Prepare the frequency distribution using the class intervals of 0-4, 5-9 etc.
(ii) Determine the standard deviation.

7. (a) If $P(n,4)=42P(n,2)$

(i) Find $n$,

(ii) Evaluate $P(n,2)$ and $P(n,4)$.

(b) Events A, B and C are such that A and B are independent,while B and C are mutually exclusive. If $P(A)=\frac{1}{2}$, $P(B)=\frac{1}{4}$ and $P(C)=\frac{1}{3}$, find;

(i) $P(A\cap B)$,

(ii) $P(A\cup B)$,

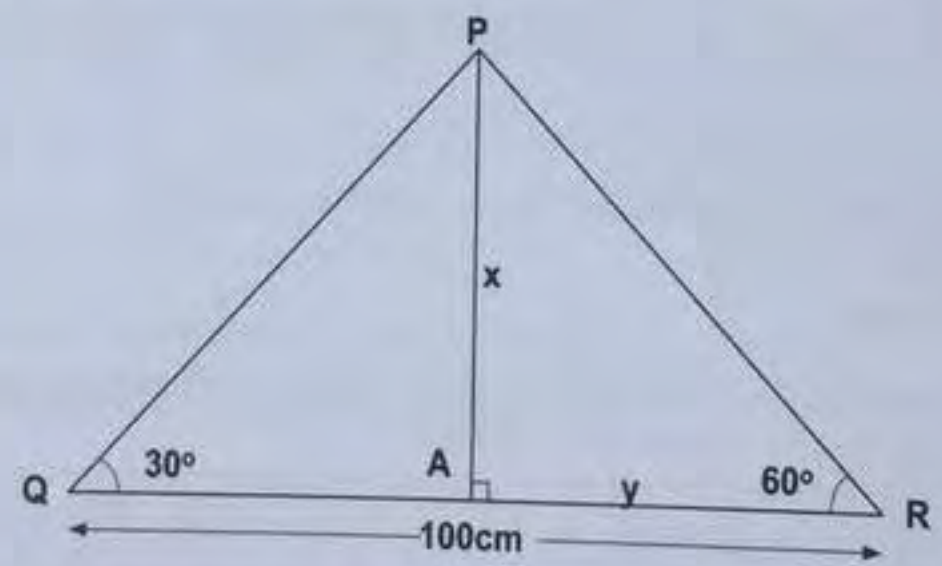
(iii) $P(A\cup C)$.

8. (a) (i) Express $\sin 3\theta$ in terms of $\sin\theta$.

(ii) Show that

$$\sqrt{\frac{(1-\cos\phi)}{1+\cos\phi}}=\cos ec\phi-\cot\phi.$$

(b) Given the figure below,




(i) Determine the values of $x$ and $y$,

(ii) Find $\sin\left(\hat{QPA}\right)$.

9. (a) (i) Find $a$ if $2^{2a+8}-32(2^a)+1=0$.

(ii) If $2\log_8 N = p$, $\log_2 2N = q$, and $q-p=4$, Find $N$.

(b) Given the system of linear equations below,

$x+y+z=7$

$x-y+2z=9$

$2x+y-z=1$

(i) Write the system of equations in matrix form.

(ii) Find the determinant and the inverse of the matrix.

(iii) Determine the values of $x$, $y$ and $z$.

10. (a) Define the following terms:

(i) Linear programming

(ii) Constraints.

(b) A trader has 15000, 9000 and 1920 units of ingredients X, Y and Z for production of cakes and loaves. The requirements of units of a loaf of bread and a cake are indicated in the table below.

| **Foodstuffs** | **Units** | | |
|---|---|---|---|
| | X | Y | Z |
| Bread | 25 | 10 | 30 |
| Cake | 15 | 18 | 30 |

A loaf of bread is sold at 4200/- shillings and a cake is sold at 2000/- shillings.

(i) Sketch the graph to illustrate this information.

(ii) What is the maximum amount of money obtained if both cakes and loaves of bread must be prepared?

(iii) How should the trader do to obtain that maximum profit?