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

041 **BASIC MATHEMATICS**

(For Both School and Private Candidates)

Time: 3 Hours **Wednesday, 02nd November 2016 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. Each question in section A carries **6 marks** while each question in section B carries **ten (10) marks**.
3. **All** necessary working and answers for each question done must be shown clearly.
4. Mathematical tables may be used.
5. Calculators and cellular phones are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).

SECTION A (60 Marks)

Answer **all** questions in this section.

1. (a) From the set of numbers $\{1,\ 3,\ 4,\ 5,\ 6,\ 8,\ 10,\ 15,\ 17,\ 21,\ 27\}$; write down:
   (i) the prime numbers,
   (ii) the multiples of 3,
   (iii) the factors of 60.

   (b) Four wooden rods with lengths of 70 cm, 119 cm, 84 cm and 105 cm are cut into pieces of the same length. Find the greatest possible length for these pieces if no wood is left over.

2. (a) Solve for x in the equation $9^{(x-3)} \times 81^{(1-x)} = 27^{-x}$.

   (b) Show that $\frac{\log 16+\log 81}{\log 27+\log 8} = \frac{4}{3}$.

3. (a) By substituting $a = \frac{1}{x}$ and $b = \frac{1}{y}$ in the system of equations: $\begin{cases} \frac{4}{x} - \frac{6}{2y} = 1 \\ -\frac{1}{x} + \frac{3}{2y} = -1 \end{cases}$, find the solution set (x, y) .

   (b) Let U be a universal set and A and B be the subsets of U where:
   $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $A = \{$ odd numbers $\}$ and $B = \{$ prime numbers $\}$
   (i) Represent this information in a venn diagram.
   (ii) Find $A \cap B'$ and $(A \cup B)'$

4. (a) Given vectors $\underline{a} = 6\mathbf{i} + 12\mathbf{j}$, $\underline{b} = 17\mathbf{i} + 18\mathbf{j}$:
   (i) Find the vector $\underline{c} = 2\underline{a} - \underline{b}$ and its magnitude correctly to 3 significant figures.
   (ii) Represent vector $\underline{c}$ in part (a)(i) on the x - y plane.

   (b) Find the equation of the line passing passing through the midpoint of the points $A(-3, 2)$ and $B(1, -4)$ and which is perpendicular to line AB .

5. (a) In triangle ABC , X , Y and Z are the midpoints of sides $\overline{AB}$, $\overline{AC}$ and $\overline{BC}$ respectively. If $\overline{ZX} = \overline{ZY}$ and $Z\hat{X}B = Z\hat{Y}C = 90°$;
   (i) Represent this information diagrammatically,
   (ii) Show that $A\hat{B}Z = A\hat{C}Z$.

   (b) The areas of two similar polygons are 27 and 48 square metres. If the length of one side of the smaller polygon is 4.5 cm, find the length of the corresponding side of the larger polygon.

6. (a) The number of tablets given to a patient was found to be directly proportional to the weight of the patient. If a patient with 36 kg was given 9 tablets, find how many tablets would be given to a patient whose weight is 48 kg.

(b) Four people can eat 2 bags of rice each weighing 10 kg in 12 days. How many people can eat 6 bags of rice of the same weight in 18 days?

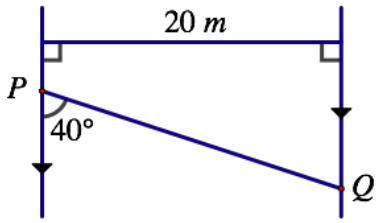
7. (a) Mariam, Selina and Moses contributed 800,000, 1,200,000 and 850,000 shillings respectively while starting their business.
   (i) Find the ratio of their contributions in simplest form.
   (ii) If the business made a profit of 1,900,000 shillings; find how much each got if the profit was shared in the same ratio as their contributions.

   (b) A dealer bought 10 books for 200,000. He sold $\frac{2}{5}$ of them at 30,000 shillings each and the remaining at 25,000 shillings each. What was his percentage profit?

8. (a) The 8^{th} term of an arithmetic progression is 9 greater than the 5^{th} term and the 10^{th} term is 10 times the 2^{nd} term. Find the common difference and the first term of the arithmetic progression.

   (b) The sum of the first two terms of a geometric progression is 18 whereas the sum of the second and third term is 54, find the first term and the common ratio.

9. (a) A river with parallel banks is 20 m wide. If P and Q are two points on either side of the river, as shown in the figure below, find the distance PQ.



   (b) In the triangle LMN, $LM = 5$ m, $LN = 6$ m and angle $MLN = 66°$. Find MN.

10. (a) If one of the roots of the quadratic equation $x^2 + bx + 24 = 0$ is $1\frac{1}{2}$, find the value of b.

   (b) Two numbers differ by 3. If the sum of their reciprocals is $\frac{7}{10}$, find the numbers.

SECTION B (40 Marks)

Answer **four (4)** questions from this section.

11. A shopkeeper sells refrigerators and washing machines. Each refrigerator takes up 1.8 m^2 of space and costs 300,000 shillings; whereas each washing machine takes up 1.5 m^2 of space and costs 500,000 shillings. The owner of the shop has 6,000,000 shillings to spend and has 27 m^2 of space.

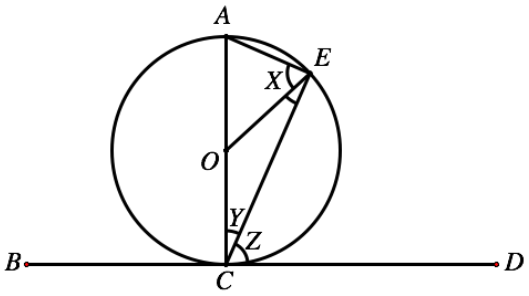
   (a) Write down all the inequalities which represent the given information.

(b) If he makes a profit of 30,000 shillings on each refrigerator and 40,000 shillings on each washing machine, find how many refrigerators and washing machines he should sell for maximum profit.

12. The following were the scores of 35 students in a mathematics mock examination:
07, 19, 78, 53, 43, 67, 12, 54, 27, 22, 33, 80, 25, 58, 50, 36, 65, 33, 16, 19, 34, 20, 55, 27, 37, 41, 04, 32, 48, 28, 70, 31, 61, 08, 35

(a) Prepare the frequency distribution table using the class intervals: 0–9, 10–19, 20–29, etc.
(b) Which class interval has more students?
(c) Represent the information in a histogram and a frequency polygon and then find the mode.
(d) Calculate the median mark.

13. (a) In the figure below, BD is a tangent to the circle having the centre O.



Given that angle $OEC = 28°$, find the values of angles marked X, Y and Z.

(b) Calculate the distance from Chagwe (5°S, 39°E) to Minga (12°S, 39°E) in kilometres. Use $\pi = 3.14$, the radius of the earth $R = 6370$ km and write the answer correct to 1 decimal place.

(c) If a bus leaves Chagwe at 8:00 am on Monday and travels at 40 km/hour, at what time will it reach Minga?

14. (a) Given:

Opening stock 01-01-2012	34,430/=
Closing stock 31-12-2012	26,720/=
Net purchases during 2012	212,290/=
Expenses for the year	45,880/=

Gross Profit is 50% of cost of goods sold
Find: (i) Cost of goods sold (ii) The gross profit

(b) On 1st June, 2013 Mrs. Lemisha started business with capital of 100,000/= and mad ehte following transactions

June	2	bought furniture	40,000/=
	7	bought goods	70,000/=
	11	sold goods	65,000/=
	16	paid Sundry expenses	30,000/=
	19	cash sales	80,000/=

	24	paid wages	50,000/=
	26	withdraw cash	30,000/=

(i) Prepare the cash account

(ii) Prepare the balance sheet as at 30/06/2013

(iii) Explain the importance of the balance sheet you have prepared in part (b)(ii) above.

15. (a) Given matrices $A = \begin{pmatrix} 3 & 5 \\ 4 & -2 \end{pmatrix}$, $B = \begin{pmatrix} 3 & -1 \\ -3 & 2 \end{pmatrix}$ and $C = \begin{pmatrix} k & -4 \\ 3 & -2 \end{pmatrix}$:

(i) Find $A^2 + 2A$

(ii) Find t and y such that $B^2 = tB + yI$ where I is an identity matrix.

(iii) Find the value of k if the determinant of C is 5.

(b) A linear translation Q carried point (x, y) into (x', y') such that $x' = 5x - 3y$ and $y' = -2x + 4y$

(i) Determine the transformation matrix Q.

(ii) Find $Q(3, 3)$

(iii) Find the image of the point obtained in part (b)(ii) under Q.

16. (a) The function f is defined as follows:

$$f(x) = \begin{cases} 1 & \text{if} \quad x \leq 0 \\ x^2 + 1 & \text{if} \quad 0 < x \leq 2 \\ 5 & \text{if} \quad x \geq 2 \end{cases}$$

(i) Sketch the graph of $f(x)$,

(ii) Use the graph to determine the domain and range of $f(x)$.

(b) (i) Two numbers are chosen at random from 1, 2 and 3. What is the probability that their sum is an odd number if repetition is not allowed?

(ii) 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 $P(A \cup B)'$.