# 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** **2006/10/09 a.m.**

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**Instructions**

1. This paper consists of sections A and B.
2. Answer all questions in section A and four (4) questions from section B.
3. All necessary working and answers for each question done must be shown clearly.
4. Mathematical tables or slide rules may be used unless otherwise stated.
5. Electronic calculators are not allowed in the examination room.
6. You are advised to spend not more than 2 hours on section A and the remaining time on section B.
7. Cellular phones are not allowed in the examination room.
8. Write your **Examination Number** on every page of your answer booklet(s).



This paper consists of 5 printed pages.

## SECTION A (60 marks)

Answer **all** questions in this section.

1. (a) By using logarithm tables evaluate: $\sqrt{\frac{86.21 \times 2.734}{5.218 \times 0.724}}$ **(2 marks)**

   (b) Two numbers, 60 and n, have the lowest common multiple (LCM) of 420. If n is a multiple of 6 less than 90, find the possible values of:

   (i) n.

   (ii) the greatest common factor (GCF) of the two numbers. **(4 marks)**

2. (a) In a certain school there are 50 pupils studying both Basic Mathematics and Additional Mathematics. School regulations require that an Additional Mathematics pupil must come from the Basic Mathematics class. In the school, 10 pupils do not study Basic Mathematics. If only 100 pupils study Basic Mathematics but not Additional Mathematics; how many pupils:

   (i) are in the school?

   (ii) study either Basic Mathematics or Additional Mathematics?

   (iii) do not study Additional Mathematics? **(3 marks)**

   Hint: (Use Venn diagram)

   (b) P and Q are finite sets such that n $(P \cap Q') = 15$, n $(P \cup Q) = 90$ and n $(P \cap Q) = 30$. Without using venn diagram, find n (Q). **(3 marks)**

3. (a) If $\underline{U} = 3\underline{i} - \underline{j}$, $\underline{V} = -2\underline{i} + 3\underline{j}$ and $\underline{W} = -2\underline{i}$, find the value of $|\underline{U} + \underline{V} - \underline{W}|$ **(3 marks)**

   (b) Given that $\text{Cos}(90° - \theta) = \frac{1}{2}\sqrt{3}$ where $\theta$ is acute angle, without using tables, find the value of Cos $\theta$. **(3 marks)**

4. (a) Find the value of the following expressions:

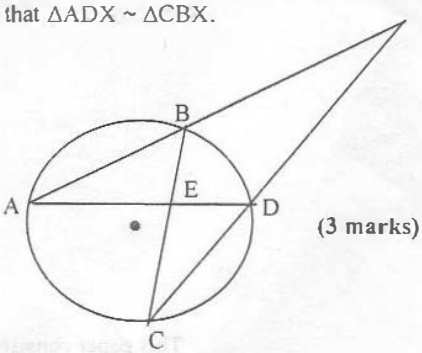
   (i) $2 \log 40 + \log \sqrt{81} - 2 \log 12$

   (ii) $\sqrt{50} - 2\sqrt{18} + \sqrt{8} + \sqrt{2}$ **(3 marks)**

   (b) (i) Express each of the irrational numbers $\frac{1}{3+\sqrt{5}}$ and $\frac{1}{3-\sqrt{5}}$ with a rational denominator. **(3 marks)**

   (ii) Show that the sum of numbers specified in b(i) above is a rational number.

5. (a) The figure below shows a circle in which the chords AD and BC intersect at E. Chords AB and CD produced meet at X. Show that $\Delta ADX \sim \Delta CBX$.




**(3 marks)**

(b) (i) Change 315° into radians (leave $\pi$ as $\pi$).

(ii) Show that the radius of a circle with an arc of length $\pi$m and central angle $\frac{\pi}{6}$ is 6 m. **(3 marks)**

6. (a) Three people share a property in the ratio 2:x:y. It is known that $y = x + 2$. If the largest shareholder had TSh. 39,100/= in monetary terms, find the value of this property. **(3 marks)**

(b) Mavuno wants to invest lump sum money so that its value after 4 years will be 812,000/=. How much should the investor invest at 4% per annum single interest? **(3 marks)**

7. (a) A line whose equation is $y = mx + c$ passes through (-1, 4). If x – intercept for this line is 3, determine the values of m and c. **(3 marks)**

(b) A straight line through (13.2) intersect perpendicularly the line $3x - 2y + 4 = 0$. Find the equation of this perpendicular line and write the equation in standard form. **(3 marks)**

8. (a) The total surface area of a solid cone is 440 $cm^2$. The length of the diameter of its circular region is 14 cm. Calculate the length of slant edge. **(3 marks)**

(b) Find the volume of the metal needed to make 1000 ball bearings of diameter 4 mm. **(3 marks)**

9. (a) Solve the following in equality and show its solution on the number line $4-x < x+8 < 5-2x$. **(3 marks)**

(b) Find the values of r and s in the following system of equations:
$3r + s = 17$
$27 - 3r - 6s = 0$ **(3 marks)**

10. A car with initial velocity of 20 m/s decelerates uniformly at a rate of 2 $m/s^2$ for 3 seconds. It then accelerates at a constant rate of 2.5 $m/s^2$ for 4 seconds. The car is finally brought to rest by applying the breaks for 2 seconds.

(a) Draw a velocity – time graph for the motion of the car. **(2 marks)**
(b) Calculate final retardation of the car. **(1 mark)**
(c) From the graph drawn in (a) above, determine the total distance travelled by this car. **(3 marks)**

## SECTION B (40 marks)

Answer four (4) questions from this section.

11. Two types of products namely A and B are manufactured on machines $M_1$ and $M_2$. The following table shows the requirements for the production of these products.

| Product | Processing time on $M_1$ | Processing time on $M_2$ | Unit profit |
|---|---|---|---|
| A | 1 minute | 2 minutes | 200/= |
| B | 1 minute | 1 minute | 200/= |
| Total machine hours available | 6 hours and 40 minutes | 10 hours | |

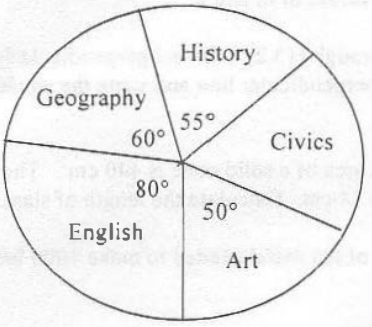
Formulate a linear programming mathematical model and use it to find the number of both products to be manufactured for maximum profit. **(10 marks)**

12. (a) A survey of 50 families showed the number of children per family as follows:

| Number of children | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Number of families | 19 | 18 | 9 | 3 | 1 |

(i) Write down the modal number of children per family.
(ii) Find the median number of children per family.
(iii) Calculate the mean number of children per family. **(5 marks)**

(b) The pie-chart below shows the number of students in one examination centre in different subjects sat for the national examinations.




Given that 220 candidates did History, find:

(i) The total number of candidates at this examination centre.

(ii) The number of students who sat for civics examination **(5 marks)**

13. (a) A speed boat travelling from Zanzibar (6°S, 45°E) to Mtwara (9°S, 45°E) using 30 knots left Zanzibar at 11:30 a.m. At what time did it reach Mtwara? **(4 marks)**

(b) Calculate the length of diameter (in kilometres) of the parallel of latitude 64° N. **(4 marks)**

(c) Define the following terms:

(i) Nautical mile
(ii) Knot. **(2 marks)**

14. (a) A quadrilateral has its vertices at ●(0,0), A(0,2), B(2,2,) and C(2,0). Given the transformation T defined by $\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$

Find the coordinates of the figure O'A'B'C' obtained by transforming the quadrilateral, OABC, hence draw ●ABC and its image on the same axes. **(7 marks)**

(b) If $A = \begin{pmatrix} 2 & -3 \\ 1 & -2 \end{pmatrix}$, $B = \begin{pmatrix} 3 & 4 \\ -3 & 1 \end{pmatrix}$ and $C = \begin{pmatrix} 1 & 7 \\ 2 & -3 \end{pmatrix}$, find the value of $4A - 3B + 2C$. **(3 marks)**

15. (a) The functions f and g are defined by:

$f(x) = |x|$ and $g(x) = 2 - 3x$

(i) Evaluate $f(-3)$.

(ii) Find $g^{-1}(x)$ and hence evaluate $g^{-1}(8)$.

(iii) Draw on the same axes the graphs of f and g. **(6 marks)**

(b) Without using a table of values, draw the graph of $y = -x^2 + 4x - 5$ and use it to solve the equation $-x^2 + 4x - 5 = -10$ **(4 marks)**

16. (a) Juma and Gadi are about to sit for CSEE. Juma says "I have 50 % chance of passing my examinations". Gadi says "Probability of failing my examinations is ¼". Find the probability that:

(i) Gadi will pass the examinations.

(ii) Either Juma will pass the examinations or Gadi will fail the examinations. **(6 marks)**

(b) The table below shows a distribution of students in each age group in a class.

| Age group | 16 | 17 | 18 | 19 |
|---|---|---|---|---|
| Number of students | 7 | 22 | 13 | 0 |

What is the probability that a student chosen from a class

(i) is 17 years old?

(ii) over 16 years old? **(4 marks)**