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

041 **BASIC MATHEMATICS**
(For School Candidates Only)

Time: 3 Hours **Tuesday, 9h October 2012 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 10 marks.
3. **All** necessary working and answers for each question attempted must be shown clearly.
4. Mathematical tables may be used.
5. Calculators and cellular phones are **not** allowed in the examination room.
6. You are advised to spend not more than **two (2)** hours on section A and the remaining time on section B.
7. Write your **Examination Number** on every page of your answer booklet(s).
8. The following constants may be used:
   (a) The radius of the earth $R = 6370km$
   (b) $\pi = \frac{22}{7}$

SECTION A (60 Marks)

Answer **all** questions in this section.

1. (a) By using mathematical tables, evaluate $\frac{\sqrt[3]{0.0072}\times(81.3)^2}{\sqrt{23140}}$ to three significant figures.

   (b) Rationalize $\frac{2+\sqrt{3}}{1-\sqrt{3}}$

2. (a) Find the value of x for which $2^x \cdot 16 = \frac{1}{8^x}$

   (b) Solve $\log_a(x^2+3) - \log_a x = 2\log_a 2$

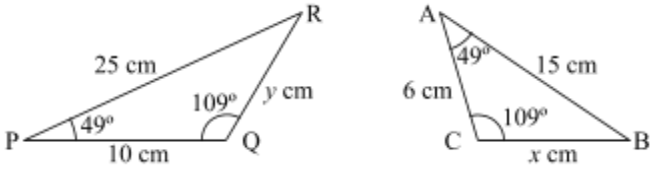
3. (a) Mr. Bean lived a quarter of his life as a child, a fifth as a teenager and a third as an adult. He then spent 13 years in his old age. How old was he when he died?

   (b) A and B are subsets of the universal set U. Find $n(A \cap B)$ given that $n(A) = 39$, $n(A' \cap B') = 4$, $n(B') = 24$ and $n(U) = 65$.

4. Given that $\underline{a} = (3, 4)$, $\underline{b} = (1, -4)$ and $\underline{c} = (5,2)$ determine:
   (a) $\underline{d} = \underline{a} + 4\underline{b} - 2\underline{c}$;
   (b) magnitude of vector $\underline{d}$, leaving your answer in the form $m\sqrt{n}$;
   (c) the direction cosines of $\underline{d}$ and hence show that the sum of the squares of these direction cosines is one.

5. (a) If polygons X and Y are similar and their areas are $16cm^2$ and $49cm^2$ respectively, what is the length of a side of polygon Y if the corresponding side of polygon X is $28cm$?

   (b) (i) Show whether triangles PQR and ABC are similar or not



   (ii) Find the relationship between y and x in the triangles given above.

6. (a) The power (P) used in an electric circuit is directly proportional to the square of the current (I). When the current is 8 Ampere (A), the power used is 640 Watts (W).
   (i) write down the equation relating the power (P) and the current (I).
   (ii) calculate the current (I) when the circuit uses 360 Watts.

   (b) If $x * y$ is defined as $\frac{1}{2}(x+y)$, find $(5 * -2) * (3 * -4)$.

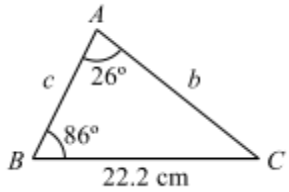
7. (a) By selling an article at shs. 22,500/= a shopkeeper makes a loss of 10%. At what price must the shopkeeper sell the article in order to get a profit of 10% ?

   (b) An alloy consists of three metals A, B and C in the proportion $A : B = 3 : 5$ and $B : C = 7 : 6$ Calculate the proportion $A : C$.

8. (a) If the 5^{th} term of an arithmetic progression is 23 and the 12^{th} term is 37, find the first term and the common difference.

   (b) Find the sum of the first four terms of a geometric progression which has a first term of 1 and a common ratio of $\frac{1}{4}$.

9. (a) Find the length AC from the figure below:



   (b) A ladder reaches the top of a wall $18m$ high when the other end on the ground is $8m$ from the wall. Find the length of the ladder.

10. (a) Solve for x if $\frac{6}{x-4} = 1 + \frac{4}{x}$

    (b) If the sum of two numbers is 3 and the sum of their squares is 29, find the numbers.

SECTION B (40 Marks)

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

11. Anna and Mary are tailors. They make x blouses and y skirts each week. Anna does all the cutting and Mary does all the sewing. To make a blouse it takes 5 hours of cutting and 4 hours of sewing. To make a skirt it takes 6 hours of cutting and 10 hours of sewing. Neither tailor works for more than 60 hours a week.
    (a) For sewing show that $2x + 5y \leq 30$
    (b) Write down another inequality in x and y for the cutting.
    (c) If they make at least 8 blouses each week, write down another inequality.
    (d) Using $1cm$ to represent 1 unit on each axis, show the information in parts (a), (b) and (c) graphically. Shade only the required region.
    (e) If the profit on a blouse is shs. 3,000/= and on a skirt is shs. 10,000/=, calculate the maximum profit that Anna and Mary can make in a week.

12. In a survey of the number of children in 12 houses, the following data resulted: 1, 2, 3, 4, 2, 2, 1, 3, 4, 3, 5, 3
    (a) Show this data in a frequency distribution table.
    (b) Draw a histogram and a frequency polygon to represent this data.
    (c) Calculate the mean and mode number of children per house.

13. (a) An open rectangular box measures externally $32cm$ long, $27cm$ wide and $15cm$ deep. If the box is made of wood $1cm$ thick, find the volume of wood used.

    (b) Find the distance (in km) between towns $P(12.4°S,\ 30.5°E)$ and $Q(12.4°S,\ 39.8°E)$ along a line of latitude, correctly to 4 decimal places.

14. (a) The following balances were extracted from the ledgers of Mr. and Mrs. Mkomo business on 31st January. Prepare a trial balance.

Capital	30,000/=	Insurance	3,000/=
Furniture	25,000/=	Cash	18,000/=
Motor vehicle	45,000/=	Discount received	7,000/=
Sales	68,000/=	Discount allowed	4,000/=
Purchases	54,000/=	Drawing	12,000/=
Creditors	76,000/=	Electricity	5,000/=
Debtors	15,000/=		

    (b) Determine the gross profit and the net profit from the information given below.

Sales	38,000/=
Opening stock	8,000/=
Purchases	25,000/=
Electricity	4,000/=
Discount allowed	2,000/=
Closing stock	5,000/=

15. (a) Find the value of k such that the matrix $\begin{pmatrix} 2k+2 & k \\ 4k-3 & k+3 \end{pmatrix}$ is singular.

    (b) The vertices of ABC are $A(1,2)$, $B(3,1)$ and $C(-2,1)$. If triangle ABC is reflected on the x-axis, find the coordinates of the vertices of its image.

    (c) Solve the following simultaneous equations by matrix method.
    $$\begin{cases} 2x+3y-2=0 \\ -9y+8x-1=0 \end{cases}$$

16. A box contains 7 red balls and 14 black balls. Two balls are drawn at random without replacement.
    (a) Draw a tree diagram to show the results of the drawing.
    (b) Find the probability that both are black.
    (c) Find the probability that they are of the same colour.
    (d) Find the probability that the first is black and the second is red.

(e) Verify the probability rule $P(A) + P(A') = 1$ by using the results in part (b).