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MATHEMATICS
Oct./Nov. 2017
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN CARPENTRY AND JOINERY
CRAFT CERTIFICATE IN MASONRY
CRAFT CERTIFICATE IN PLUMBING
CRAFT CERTIFICATE IN ROAD CONSTRUCTION

MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
  Answer booklet;
  Mathematical tables/Scientific Calculator.
*Answer any **FIVE** of the following **EIGHT** questions in the answer booklet provided.*
All questions carry equal marks.
Maximum marks for each part of a question are as indicated.
Candidates should answer the questions in English.

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the
pages are printed as indicated and that no questions are missing.

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1.   (a)   Simplify

$$\frac{\left(\frac{a}{b^1}\right)^3-\left(\frac{b^2}{a}\right)^{-3}}{\left(\frac{a^2}{b}\right)^{-2}}$$

(5 marks)

(b)   Solve the equations:

(i) $\log_2(x^2+7)=1+\log_2 16$

(ii) $2(9^{2x})-9^x-1=0$

(10 marks)

(c)   Using the method of completing the square, solve the equation:

$15x^2+x-2=0$

(5 marks)

2.   (a)   Given the matrices

$$P=\begin{pmatrix} -4 & 3 \\ 1 & 2 \end{pmatrix},\ Q=\begin{pmatrix} -5 & 0 \\ 7 & 6 \end{pmatrix}\text{ and } R=\begin{pmatrix} 4 & 2 \\ 3 & 1 \end{pmatrix}$$

Evaluate $Q(PR)^{-1}$

(6 marks)

(b)   Two forces F1 and F2 in newtons acting on a structure satisfy the simultaneous equations:

$2F_1+5F_2=21$
$4F_1+3F_2=\ 7$

Use the inverse matrix method to solve the equations.

(7 marks)

(c)   Determine the values of a and b in the equation:

$$\begin{pmatrix} 4 & 2 \\ a-1 & 3 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix}=\begin{pmatrix} a+2 \\ \left(\frac{-73}{16}\right) \end{pmatrix}$$

(7 marks)

3.   (a)   (i)   Plot the graph $y=2x^2+x-1$, for integer values of x between $x=-4$ and $x=2$

(ii)   hence solve the equation

$2x^2+x-1=0$

(12 marks)

x	-4	-3	-2	-1	0	1	2
$2x^2$	-8	-6	-4	-2	0	2	4
-1	-1	-1	-1	-1	-1	-1	-1
y	-3	-10	-3	-4	-1	2	5

(b)   Make f the subject of the formula,

$$\frac{d}{D} = \sqrt{\left(\frac{1-f}{1+f}\right)}$$

(4 marks)

(c)   Q varies directly as x and inversely as y. If x is increased by 4%, determine the percentage change in Q.   (4 marks)

4.   (a)   Given the data 20, 19, 17, 28, 22, 24 and 32, determine the:

        (i)   mean;

        (ii)   standard deviation of the distribution.   (5 marks)

(b)   The marks scored by 100 students in mathematics paper were recorded as in **Table 1**.

Table 1

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of students	2	7	11	15	20	25	18	2

Calculate the:

    (i)   mean;

    (ii)   median;

    (iii)   interquartile range.   (10 marks)

(c)   A box contains seven functional and three faulty cutting tools. If two tools are picked at random from the box, determine the probability that:

    (i)   both are functional;

    (ii)   at least one is functional.   (5 marks)

5.   (a)   Given the vectors $a = 3i + 4j$, $b = 3i + 5j$ and $c = 2i - 3j$,

        (i)   evaluate $a + 2b - 3c$

        (ii)   solve the equation $k|a + b + c| = 18$ (8 marks)

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(b) A triangle has sides 7 cm, 13 cm and 19 cm. Calculate the size of the largest angle.
(4 marks)

(c) Solve the following equations for values of θ between 0° and 360° inclusive.

(i) $6 \sin^2\theta - 7 \sin + 2 = 0$

(ii) $4 \sin\theta - \sec\theta = 0$
(8 marks)

6. (a) A man earns a basic salary of Ksh 45,000 p.m., a house allowance of Ksh 24,000 p.m. and a travelling allowance of Ksh 8,000 p.m.

The rate of payable tax is as in **Table 2**.

Table 2

Income (K£ p.a.)	Rate (Ksh per £)
1 - 5,808	2
5809 - 11,280	3
11,281 - 16752	4
16,753 - 22,254	5
22,225 and above	6

(i) Calculate the amount he pays as PAYE per month, if he is entitled to a tax relief of Ksh 1,200 per month.

(ii) If he is deducted the following items per month; NHIF Ksh 1,500, bank loan repayment ksh 15,000 determine his net monthly salary. (12 marks)

(b) A new car cost ksh 1,200,000. Each year the price of the same type of car increases by 5% p.a., while its resale value depreciates by 10% in the first year and by 4% p.a. in the subsequent years. A man bought a new car an sold it during the sixth year. If he used the money realized to purchase a new car of the same type, calculate the extra amount of money needed to the nearest thousands. (8 marks)
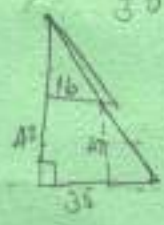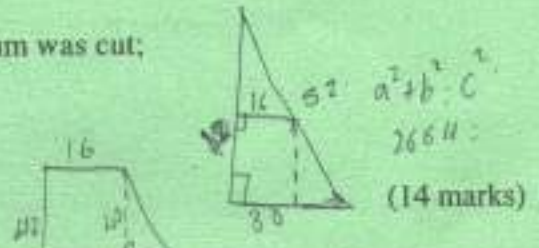
7. (a) A minor segment is enclosed between a chord of length 14 cm and a circle of diameter 20 cm. Determine the area of the segment. (6 marks)

(b) The frustum of a sold right cone has a height of 42 cm and its ends have radii of 16 cm and 30 cm. Determine the:

(i) height of the cone from which the frustum was cut;

(ii) volume of the frustum;
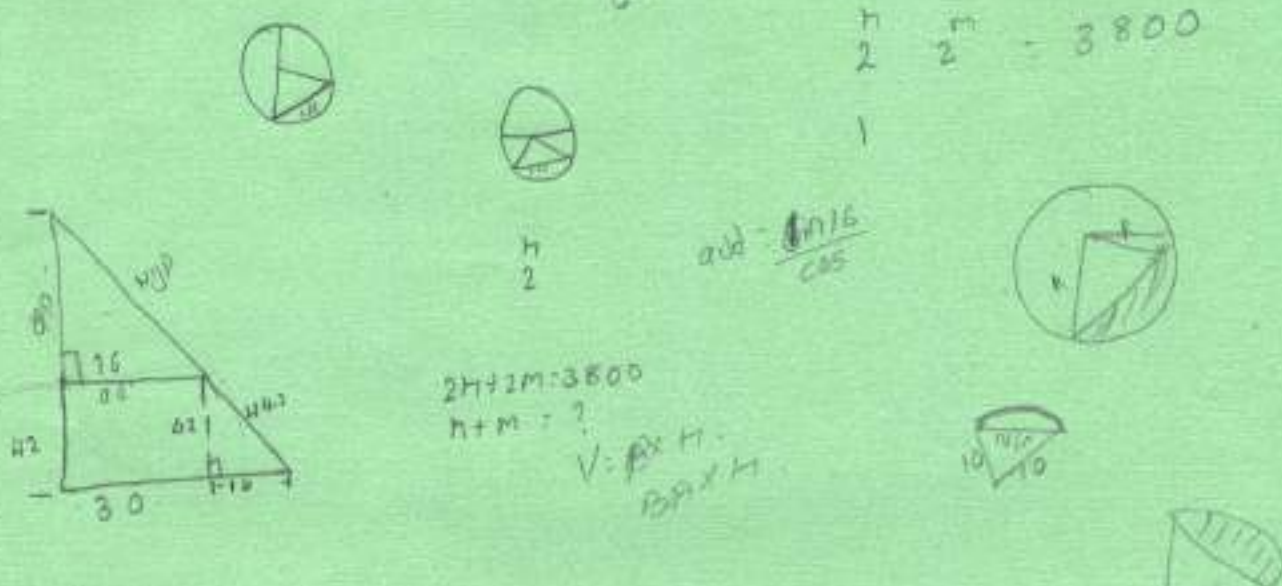
(iii) total surface area of the frustum. (14 marks)

8. (a) A piece of timber of length 380 cm was cut into three pieces in the ratio 5:6:8. Determine the length of each piece. (5 marks)

(b) The sum of the second and the fourth terms of an arithmetical progression is 48 and the sum of the first three terms is 57. Determine the:

(i) first term and common difference;

(ii) fifteenth term;

(iii) sum of the first ten terms. (9 marks)

(c) A man bought three hammers and two mallets at a total cost of Ksh 5,000. Another man bought five hammers and four mallets at a total cost of Kshs 8,800. Use the method of elimination to determine the cost of each tool. (6 marks)

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