CENTRAL KENYA NATIONAL SCHOOLS JOINT MOCK - 2016

121/2
**MATHEMATICS**
PAPER 2
JULY/AUGUST, 2016
TIME: 2½ HOURS

SECTION I: (50 MARKS)
Answer all the questions in this section in the spaces provided.

1. The length and breadth of a metal sheet are measured to the nearest centimetre and recorded as 25cm and 16cm respectively.
   (a) Find the maximum possible error in the area of the sheet. (1mk)
   (b) Calculate to one decimal place the percentage error in the area of the sheet. (2mks)

2. Given the column vectors

$$a = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}, \; b = \begin{pmatrix} 6 \\ -3 \\ 9 \end{pmatrix}, \; c = \begin{pmatrix} -3 \\ 2 \\ 3 \end{pmatrix} \text{ and that } P = 2a - \tfrac{1}{3}b + c$$

   express P as a column vector and hence calculate its magnitude to 3 significant figures. (3mks)

3. Solve for θ in the equation
   $6 \cos^2\theta - \sin\theta - 4 = 0$ in the range $0^\circ \le \theta \le 180^\circ$. (3mks)

4. Expand $(1 - 2\chi)^6$ upto the term containing χ^3. Hence use the expansion to estimate 0.98^6 to four decimal places. (3mks)

5. Solve the equation:
   $3 \log 4 - \log \chi = \log (\chi - 12)$ (4mks)

6. Make χ the subject of the formula.

$$\sqrt{\frac{(2\chi + r)^2}{4}} = \chi + r$$ (3mks)

7. Wambua invested Sh.6400 at 15% per annum compound interest for 3 years.
   Muinde invested twice that amount at 12½% per annum simple interest for the same period of time. Find whose investment earned more interest and by how much. (4mks)

8. Rationalize the denominator and leave your answer in surd form.

$$\frac{3}{2\sqrt{5} - \sqrt{2}}$$ (3mks)

9. A quantity P is partly constant and partly varies as the square of Q. When $Q = 2, P = 40$ and when $Q = 3, P = 65$, determine the value of P when $Q = 4$. (4mks)

10. Kamau sold a mixture of two types of coffee which were costing Sh.50 per kg and Sh.60 per kg at Sh.324 for 5kg of the mixture after making a profit of 20%. Find the ratio of the mixture. (3mks)

11. Evaluate: $\displaystyle\int_{1}^{2} (3\chi^2 - 2\chi + 3) \, d\chi$. (3mks)

12. The figure below is a right pyramid VPQRS. The base PQRS is a rectangle whose length is 24cm and width 7cm.
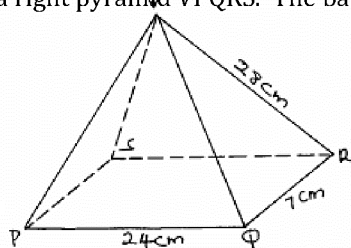
   Find the angle between VR and the base. (3mks)

13. The diameter AB of a circle passes through point (-4, 1) and B (2, 1) find the equation of the circle and the radius. Leave your answer in the form $\chi^2 + y^2 + a\chi + by = c$. (3mks)

14. A point C is on a line PQ where PQ = 9cm, C divides PQ such that PC = $^4/_7$ PQ.
   By construction locate C. (3mks)

15. A city P is (30ºN, 31ºE). Another city Q is located a distance of 4365 nautical miles east of P. Find the position of Q. (3mks)

16. In a transformation an object of area 64cm² is mapped onto image whose area is 32cm². Given that the matrix of

transformation is $\begin{pmatrix} \chi + 4 & \chi \\ 2 & 1 \end{pmatrix}$. Find the value of χ. (3mks)

SECTION II: (50 MARKS)
Answer only any FIVE questions in this section.

17. Mr. Omollo, a civil servant earns a basic salary of Sh.38,300 house allowance of Sh.12,000 and medical allowance of Sh.3,600 every month. He claims a family relief of Sh.1,172 and insurance relief of 3% of the premium paid. Using tax ratio   table below.

Taxable income £/p.a	Tax Ksh/£
1 – 8800	2
8801 – 16800	3
16801 – 24800	5
24801 – 36800	7
36801 – 48800	9
Over 48800	10

(a) Calculate Mr. Omollo's annual taxable income in Kenya pound per annum. (2mks)
(b) Tax due every month from Mr. Omollo. (4mks)
(b) If further deductions are made every month from his salary:
- WCPS of 2% of basic salary.
- Life insurance premium of Sh.4600.
- Sacco loan repayment of Sh.14,200
   Calculate
   (i) Total deductions. (2mks)
   (ii) His net pay for every month. (2mks)

18. Veterinary researchers were experimenting with a new drug on fowls in a research station. A sample of fowls which were known to have the disease was used. In this sample 30 fowls were treated with the drug and the remaining 18 fowls were not treated.
(a) Calculate the probability that a fowl selected at random from the sample as
   (i) treated with the drug. (1mk)
   (ii) not treated with the drug. (1mk)
(b) The probability that a fowl treated with the drug will die is $\frac{1}{10}$, while the probability that one which is not treated will

die is $\frac{7}{10}$.Calculate the probability that a fowl picked at random from the sample is

   (i) treated with the drug and will die. (2mks)
   (ii) not treated with the drug and will die. (2mks)
   (iii) treated with the drug and will not die. (2mks)
   (iv) not treated with the drug and will not die. (2mks)

19. Two variables A and B are connected by the equation.   A = kBn
   Where k and n are constants.
   The table below gives values of A and B.

A	1.5	1.95	2.51	3.20	4.50
B	1.59	2.51	3.98	6.31	11.5

(a) Find a linear equation connecting A and B. (2mks)
(b) On square paper draw a suitable line graph to represent the relation in (a) above (scale 1cm to represent 0.1 units on both axis). (5mks)
(c) Use your graph to estimate the values of k and n in to one decimal place. (3mks)

20. (a) Using a ruler and a pair of compasses only construct triangle ABC such that AB = BC = 5cm and angle BAC = 30º. (3mks)
(b) Construct the locus of point T above AC such that 2 ∠ATC ≥ ABC. (3mks)
(c) Find the area within the locus of T that is outside triangle ABC. (4mks)

21. A tailor uses 6hrs to make a shirt and 4 hours to make a dress. It takes the tailor at least 240 hours to make X shirts and Y dresses. The labour cost of making a shirt is Sh.60 and that of a dress is Sh.70. The total labour cost should not exceed Sh.4200. The tailor must make at least 20 shirts and more than 16 dresses.
(a) Write inequalities to represent the above information. (4mks)
(b) Represent the inequalities in part (a) above on the grid provided. (4mks)
(c) If the tailor makes a profit of Sh.140 per shirt and Sh.180 per dress, use the graph in part (b) above to determine the maximum profit that the tailor can make. (2mks)

22. In the figure below, circle ABDF has centre O. CE is a tangent to the circle at D and AF = 12cm is the diameter, AB = BD and angle DAF = 27º.
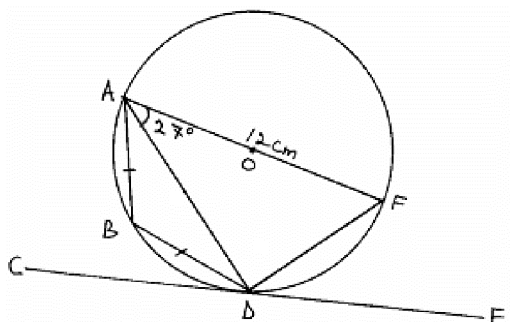
(a) Find the size of
   (i) Angle ADE. (2mks)
   (ii) Angle ADB. (2mks)
(b) Find the length of
   (i) AD. (2mks)
   (ii) BD. (4mks)

23. The sum of 21st and 65th terms of a arithmetic sequence is 368. Given that the seventh term of the sequence is 40, find;
(a) the common difference. (3mks)
(b) the first term. (2mks)
(c) the sum of the first 16 terms of the AP. (2mks)
(d) Given further that the 1st, 5th and 13th terms of the arithmetic sequence form the first 3 consecutive terms of a geometric progression, find;
(i) common ratio. (1mk)
(ii) the sum of the first 20 terms of the G.P. (2mks)

24. (a) Complete the table for the functions y = 3 Cos χ and y = 4 Sin (2χ - 10). (2mks)

χ	0	15	30	45	60	75	90	105	120	135	150	165	180
3 Cos χ	3.0		2.60		1.50		0	-0.75					-3.0
4 Sin (2χ - 10)	-0.69	1.37		3.94	3.76		0.69		-3.06		-3.76		-0.69

(b) (i) Taking 1cm rep 15º on χ-axis and 1cm rep 2 units on y-axis on the same grid draw the graphs of the functions y = 3 Cos χ and y = 4 Sin (2χ - 10º). (5mks)
(ii) Hence solve for 3 Cos χ = 4 Sin (2χ - 10). (1mk)
(iii) From the graphs determine the period of the two curves. (2mks)