NAME: .... ADM.NO.......................

DATE:........................ CLASS:........ INDEX NO:...........................

121/2
MATHEMATICS
PAPER 2
JULY 2013
2½ HOURS

ALLIANCE HIGH SCHOOL TRIAL EXAMINATIONS
Kenya certificate of Secondary Education
MATHEMATICS
PAPER 2

Instructions to Candidates.

1. *Write your name and Index Number in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *This paper contains TWO Sections 1 and Section11.*
4. *Answer ALL the questions in Sections 1 and any five in Section 11.*
5. *Answers and working must be written on the question paper in the spaces provided below each question.*
6. *Show all the steps in your calculation, giving your answers at each stage in the spaces below each question.*
7. *Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.*
8. *This paper consists of 14 printed pages*
9. *Marks may be given for correct working even if the answer is wrong*
10. *Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.*

For Examiner's use only

Section 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section II

17	18	19	20	21	22	23	24	Total

Grand Total

SECTION I (50 Marks)

Answer all the questions in this section.

1. Given that $A = \begin{pmatrix} 2 & 3 \\ -5 & 4 \end{pmatrix}$ find A^{-1} and hence solve the equations

$2x + 3y + 4 = 0$
$-5x + 4y + 13 = 0$ (3 mks)

2. A curve has an equation which satisfies $\frac{dy}{dx} = kx(x-1)$ where K is a constant. Given that the gradient of the curve at the point (2,1) is 12, find the value of K. (3 mks)

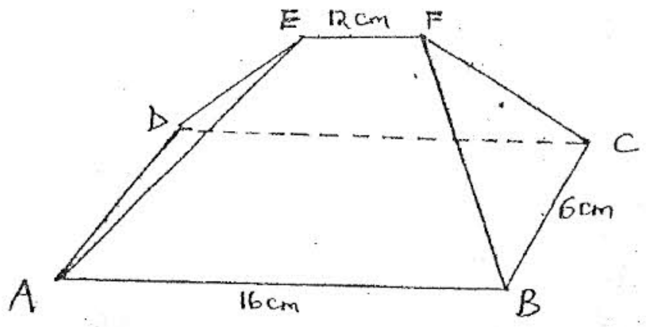
3. a) Express $4\cos 3\theta - \sin(90 - 3\theta)$ as a single trigonometric function. (1 mk)

b) Hence solve $4\cos 3\theta - \sin(90 - 3\theta) = 2$ in the interval $0 \leq \theta \leq 360°$ giving your answers to 3 significant figures. (3 mks)

4. The area of a rectangle is $\left(1+\sqrt{6}\right)m^2$. The length of one side is $\left(\sqrt{3}+\sqrt{2}\right)m$.

Find without using a calculator, the length of the other side in the form $\sqrt{a} - \sqrt{b}$, where **a** and **b** are integers. (3 mks)

5. A tent is erected as shown in the figure below. The base ABCD is rectangular and horizontal and the top edge EF is also horizontal. AE = BF=CF =DE = 5 cm. AB = CD = 16 cm AD = BC = 6 cm, and EF= 12 cm.



Calculate the angle between ADE and the base ABCD giving your answer to the nearest degree.

(3 mks)

6. A curve whose equation is

$y = \frac{a}{x} + c$, passes through the point (3, 9) with gradient 5. Find the values of the constants **a** and **c**. (3 mks)

7\. a) Expand and simplify the binomial expansion (2 mks)

$$\left(x^2 - \frac{1}{3x}\right)^6$$

b) Hence find the term which is independent of x. (1 mk)

8\. Solve the equation

$\log_{16}(3x-1) = \log_4(3x) + \log_4(0.5)$ (3 mks)

9\. F is directly proportional to the square root of **T** and inversely proportional to **L** and **D**. If T is increased by 50% and L is halved, find the percentage change in **F**. (3 mks)

10. Liquid X contains 80% laboratory spirit and liquid Y contains 55 % laboratory spirit. In what ratio must X and Y be mixed so that the mixture contains 70% spirit. (3 mks)

11. Calculate the distance between points A (30°N, 50°E) and B (30°N, 35°E) giving your answer to the nearest nautical mile. (3 mks)

12. Write down the amplitude, period and phase angle of the trigonometric equation.

$y = \frac{5}{4} \cos\left(\frac{5}{2}\theta + 90^\circ\right)$ (3 mks)

13. a) Use the equation $y\sqrt{\ }(10x - x^2)$ to complete the table below giving the values of y to 2 decimal places. (1 mks)

x	1	1.4	1.8	2.2	2.6	3
y	3	3.47	3.84		4.39	

b) Use trapezium rule with all the values of y from your table to find an approximation for the value of.

$\int_1^3 \sqrt{(10x - x^2)}\, dx$ (2 mks)

14. The probability that three soccer players score penalties are $\frac{1}{6}, \frac{1}{4}$ *and* $\frac{1}{3}$ respectively. If each shoots once, find the probability that only one of them scores. (3 mks)

15. Given that $\log(p-q) = \log p - \log q$, express p in terms of q (3 mks)

16. A skip sails 6km from S to T on a bearing of 063° and then 9km from T to U on a bearing of 148°. Calculate.

i) The distance SU. (2mks)

ii) The bearing of U from S. (2 mks)

SECTION II (50 Marks)

Answer any five questions in this section

17. A car was purchased for Kshs.1800000 on 1st January 2010. On 1st January each following year the value of the car is 90% of its value on 1st January in the previous year.

a) Find the value of the car on 1st January 2013. (2 mks)

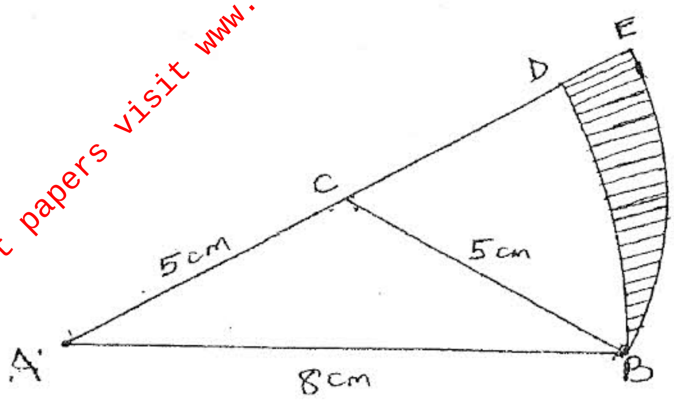
b) The value of the car falls to Ksh.1000000 for the first time in n years after it was purchased. Find the value of n, giving your answer to 2 decimal places. (3 mks)

c) A insurance company has a scheme to cover the maintenance of the car. The cost is Ksh. 20,000 for the first year and for every following year the cost increases by 12%.

i) Find the cost of the scheme for the 5th year giving your answer to the nearest shillings. (2 mks)

ii) Find the total cost of the insurance scheme for the first 15 years. (3 mks)

18. The diagram shows an isosceles triangle ABC in which AB = 8m, BC =CA = 5m. ABDA is a sector of the circle centre A. radius 8 m. CBEC is a sector of the circle centre C and radius 5m.



a) Find the size of angle BCE giving your answer correct to 3 decimal places. (2 mks)

b) Find the perimeter of the shaded region. (4 mks)

c) Find the area of the shaded region. (4 mks)

19\. a) Find how many terms of the AP $3 + 8 + 13 + ----$ should be taken in order that the total should exceed 200. (3 mks)

b) A company offers a ten – month contract to an employee. This gives a starting salary of Khs. 15,000 a month with a monthly increase of 8% of the previous month's salary.

i) How much does the employee expect to earn in the tenth month. (2 mks)

ii) Find the total amount of money the employee expects to earn over the ten months, giving your answer to the nearest shilling. (3mks)

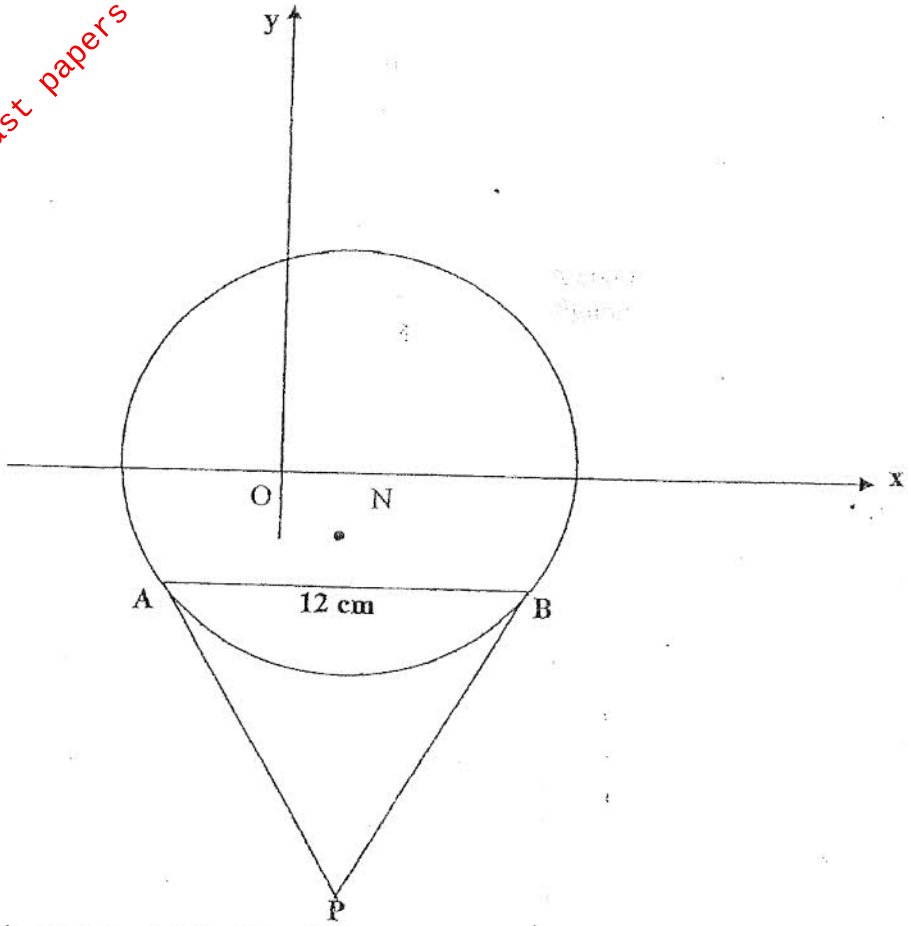
iv) After considering the offer the employee asks for a different scheme of payment. This has the same starting salary of Kshs.15000 but with a fixed monthly pay rise of Kshs.d. Find d if the total amount paid out over ten months is to be the same under the two schemes. (3 mks)

20. The figure below is a sketch of a circle with centre N and equation

$$(x-2)^2 + (y+1)^2 - \frac{169}{4} = 0$$

a) Write down the coordinates of N. (1 mk)

b) Find the radius of the circle (1 mk)



c) The chord AB of the circle is parallel to the x – axis, lies below the x – axis and is of length 12 units.

i) Find the coordinates of A and B. (4 mks)

ii) The tangents to the circle at points A and B meet at point P. Find the length AP giving your answer to 3 significant figures. (4 mk)

21. A taxi company has 'SUPER' taxis and 'MINI' taxis. One morning a group of 45 people needs taxis. For this group the taxi company uses X 'SUPER' taxis and y 'MINI' taxis. A 'SUPER' taxi can carry 5 passengers and a 'MINI' taxi can carry 3 passengers. The taxi company has 12 taxis. The taxi company always uses at least 4 'MINI' taxis.

a) Write down the inequalities in x and y that show the information above. (2 mks)

b) Draw the inequalities lines on a graph. Use the scale 1cm to represent 1 unit on each axis. (3 mks)

c) The cost to the taxi company of using a 'SUPER' taxi is shs.200 per km and 'MINI' taxi is sh.100 per km. The taxi company wants to find the cheapest way of providing 'SUPER' and 'MINI' taxis for this group of people. Use your graph to find two ways in which this can be done. (2 mks)

d) The taxi company decides to use 11 taxis for this group.

i) The taxi company charges sh. 300 for the use of each 'SUPER' taxi and sh.160 for the 'MINI' taxi. Find two possible total charges. (2 mks)

ii) Find the largest possible profit the company can make using 11 taxis. (1 mk)

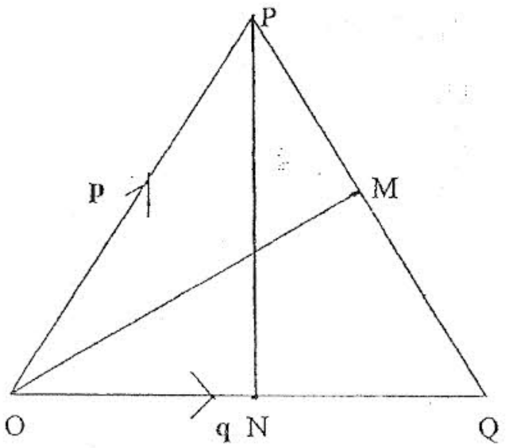
22. a) Given that $\mathbf{p} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$

i) Find as a single column vector. $\mathbf{p} + 2\mathbf{q}$ (1 mk)

ii) Calculate the value of $|\mathbf{p} + 2\mathbf{q}|$ (1 mk)

b) In the diagram **OP** = **p** , **OQ** = **q**

$\mathbf{PM} = \frac{1}{3}\mathbf{PQ}$ and $\mathbf{ON} = \frac{2}{5}\mathbf{OQ}$

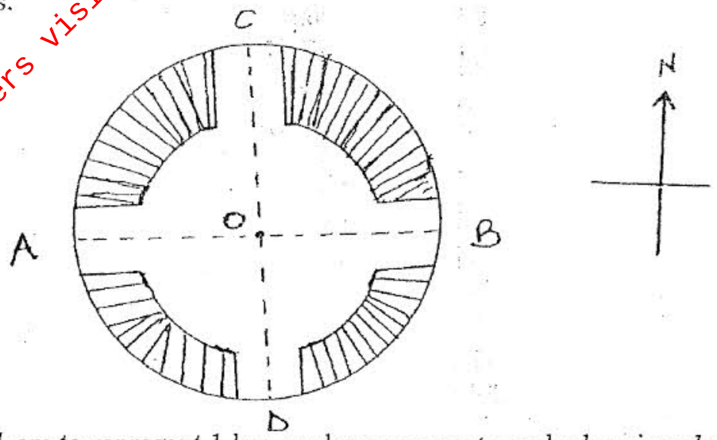


i) Given that **OX** = m**OM**, express **OX** in terms of m, **p**, and **q**. (2 mks)

ii) Given that **PX** = n**PN**, express **OX** in terms of n, **p** and **q**. (2 mks)

iii) Hence evaluate m and n. (4 mks)

23. The diagram shows a plan for the Konza technocity. It is to be built inside a circle of radius 5 km. The areas where homes can be built are shaded on the diagram. The homes must be at least 2 km from the centre of the city; O. The homes must also be at least 0.5km from two main roads CD. and AB; which are in North – south and West – East directions.



a) Using 1 cm to represent 1 km, make an accurate scale drawing showing the areas for the homes (you do not need to shade these areas) (3 mks)

b) The Technology Hall, T will be built so that is equidistant from the roads OA and OC. It will be 1 km from O and West of CD. On your scale drawing, using constructions mark and label the point T. (2 mks)

c) The police station, P, will be built so that it is equidistant from T and B. It will be 3 km from O and North of AB. Showing all your construction lines, find and label the point P. (3 mks)

d) What will be the actual straight line distance between the Technology hall and the police station. (2 mk)

24. A particle traveling in a straight line passes a fixed point O on the line with a velocity of 0.5m/s.
The acceleration a m/s^2 of the particle t seconds after passing O is given by
$a = 1.4 - 0.6t.m/s^2$

a) Find the time when the particle is instantaneously at rest. (4 mks)

b) Find the maximum velocity of the particle. (3 mks)

c) Find the total distance traveled by the particle between $t = 0$ and $t = 10$ seconds. (3 mks)