NAME…….ADM.NO…….CLASS…….
Date ……

121/2
MATHEMATICS
Paper 2
2 ½ Hours

Instructions to candidates

1. *Write your **name, admission number** and **class** in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *The paper contains two sections: **Section I** and **Section II**.*
4. *Answer **All** the questions in **section I** and **strictly any five** questions **from Section II.***
5. *All answers and working must be written on the question paper in the spaces provided below each question.*
6. *Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.*
7. *Marks may be given for correct working even if the answer is wrong.*
8. *Non-programmable silent electronic calculators and **KNEC** mathematical tables may be used, unless stated otherwise.*

For Examiner's use only.

Section I

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

This paper consists of 16 printed pages .Candidates should check the question paper to Ensure that all the pages are printed as indicated and no question(s) are missing

SECTION A (50 MARKS)

Answer all the questions in this section

1. Use logarithm table to evaluate. 4 mks

$$\sqrt[3]{\frac{0.52 \times 0.312}{2.12^2}}$$

2. 200 cm^3 of acid is mixed with 300 cm^3 of alcohol. If the densities of acid and alcohol are 1.08g/cm^3 and 0.8 g/cm^3 respectively, calculate the density of the mixture.

3 mks

3. The coordinates of P and Q are P(5, 1) and Q(11, 4) point M divides line PQ in the ratio 2 : 1. Find the magnitude of vector OM. (3 marks)

4. The table below shows income tax rates in a certain year.

Monthly income in Ksh	Tax rate in each Ksh
1 – 9680	10%
9681 – 18800	15%
18801 – 27920	20%
27921 – 37040	25%
Over 37040	30%

In that year, a monthly personal tax relief of Ksh. 1056 was allowed. Calculate the monthly income tax paid by an employee who earned a monthly salary of Ksh 32500.
(4 mks)

5. Make w the subject of the formulae. 3mks

$$2x = \sqrt{\frac{2w + 8}{3w - 5}}$$

6. A line passes through points (2, 5) and has a gradient of 2.
   (a) Determine its equation in the form $y = mx + c$. 2mks

(b) Find the angle it makes with x-axis. 1mk

7. A quantity **P** is partly constant and partly varies as the cube of **Q**. When **Q**=1, **P**=23 and when **Q** =2, **P**= 44. Find the value of **P** when **Q** = 5. 3mks

8. The vertices of a triangle are A(1, 2) , B(3, 5) and C(4, 1). The co-ordinates of C' the image of C under a translation vector T are (6, -2).
   (a) Determine the translation vector T. 1mk

   (b) Find the co-ordinates of A' and B' under the translation vector T. 2mks

9. (a) Expand $(1 - x)^4$ using the binomial expansion. 1mk

Use the first three terms of the expansion in (a) above to find the value of $(0.98)^4$ correct to nearest hundredth. 2mks

10. Find the centre and radius of a circle with equation:
$\chi^2 + y^2 - 6\chi + 8y - 11 = 0$ (3mks)

11. Two grades of coffee one costing sh.42 per kilogram and the other costing sh.47 per kilogram are to be mixed in order to produce a blend worth sh.46 per kilogram in what proportion should they be mixed. (3mks)

12. Pipe A can fill an empty water tank in 3 hours while pipe B can fill the same tank in 5 hours. While the tank can be emptied by pipe C in 15 hours. Pipe A and B are opened at the same time when the tank is empty. If one hour later pipe C is also opened. Find the total time taken to fill the tank. 4 mks.

13. Simplify the expression: 3mks.

$$\frac{9t^2 - 25a^2}{6t^2 + 19at + 15a^2}$$

14. A business bought 300 kg of tomatoes at Ksh. 30 per kg. He lost 20% due to waste. If he has to make a profit 20%, at how much per kilogram should he sell the tomatoes.

3mks.

15. Evaluate without using a Mathematical table or a calculator.

$Log_6\ 216 + [Log\ 42 - Log\ 6] \div Log\ 49$ (2mks

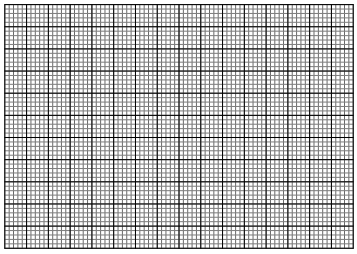
16. Given that the ratio $x: y = 2: 3$, find the ratio $(5x - 2y) : (x + y)$ (3 mk)

SECTION II (50mks)

Answer only *five* questions in this section in the spaces provide

17. Draw the graph of $y = x^3 + 2x^2 - 5x - 8$ for values of x in the range $-4 \leq x \leq 3$ 5mks

x	-4	-3	-2	-1	0	1	2	3
x^3	-64							27
$2x^2$								
$-5x$								
-8								
y	-20							



(a) By drawing suitable straight line on the same axis, solve the equations.

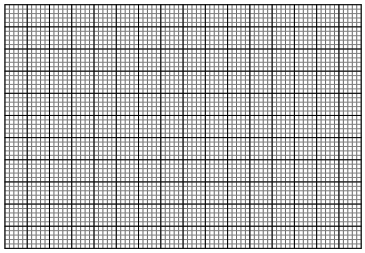
i) $x^3 + 2x^2 - 5x - 8 = 0$ 1mks

ii) $x^3 + 2x^2 - 5x - 7 = 0$ 2mks

iii) $3 + 3x - 2x^2 - x^3 = 0$ 2mks

18. A transformation represented by the matrix $\begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}$ maps the points A(0, 0), B(2, 0), C(2, 3) and D(0, 3) of the quad ABCD onto $A^1B^1C^1D^1$ respectively.

a) Draw the quadrilateral ABCD and its image $A^1B^1C^1D^1$. (3mks)



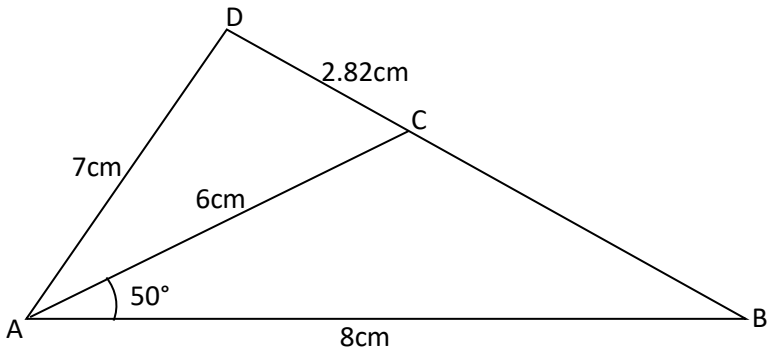
b) Hence or otherwise determine the area of $A^1B^1C^1D^1$. (2mks)

c) Another transformation $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ maps $A^1B^1C^1D^1$ onto $A^{11}B^{11}C^{11}D^{11}$.

Draw the image $A^{11}B^{11}C^{11}D^{11}$. (2mks)

d) Determine the single matrix which maps $A^{11}B^{11}C^{11}D^{11}$ back to ABCD. (3mks)

19. In the figure **below** (not drawn to scale) AB = 8cm, AC = 6cm, AD = 7cm, CD = 2.82cm and angle CAB = 50°.



Calculate (to 2d.p.)

(a) the length BC. (3 marks)

(b) the size of angle ABC. (3 marks)

(c) size of angle CAD. (3 marks)

(d) Calculate the area of triangle ACD. (2 marks)

20. Three variables P, Q and R are such that P varies directly as Q and inversely as the square of R.

a) When P = 18, Q = 24 and R = 4.
Find P when Q = 30 and R = 10. (3mks)

(b) Express P in terms of Q and R. (1mk)

(c) If Q is increased by 20% and R is decreased by 10% find:

(i) A simplified expression for the change in P in terms of Q and R. (3mks)

(ii) The percentage change in P. (3mks)

21. A surveyor recorded the following information in his field book after taking measurement in metres of a plot.

	To E	
	1000	
	880	320 to D
720 to F	640	
	480	600 to C
240 to G	400	
	200	400 to B
	From A	

(a) Sketch the layout of the plot. 4 mks.

(b) Calculate the area of the plot in hectares. 6mks

22. A line L passes through points (-2, 3) and (-1,6) and is perpendicular to a line P at (-1,6).

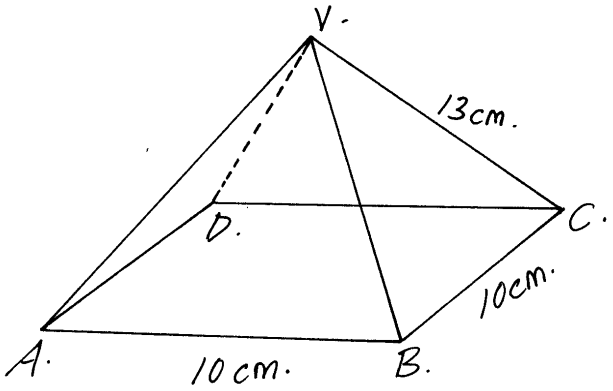
a) Find the equation of L. (2 mks)

b) Find the equation of P in the form ax + by = c, where a, b and c are constant. (2 mks)

c) Given that another line Q is parallel to L and passes through point (1,2) find the x and y intercepts of Q. (3 mks)

d) Find the point of intersection of lines P and Q. (3 mks)

23. The figure below shows a square ABCD point V is vertically above middle of the base ABCD. AB = 10cm and VC = 13cm.



Find;

(a) the length of diagonal AC (2mks)

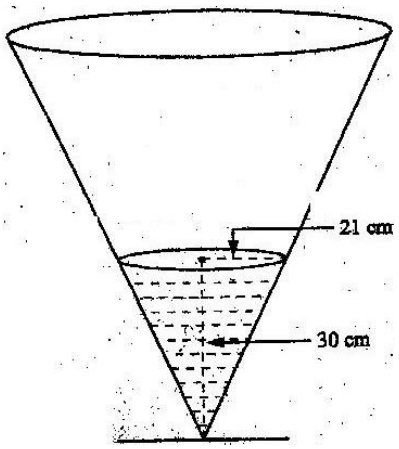
(b) the height of the pyramid (2mks)

(c) the acute angle between VB and base ABCD. (2mks)

d) the acute angle between BVA and ABCD. (2mks)

e) the angle between AVB and DVC. (2mks)

24. The diagram below represents a conical vessel which stands vertically. The which stands vertically,. The vessels contains water to a depth of 30cm. The radius of the surface in the vessel is 21cm. (Take $\pi=22/7$).



a) Calculate the volume of the water in the vessels in cm^3 3mks

b) When a metal sphere is completely submerged in the water, the level of the water in the vessels rises by 6cm.
Calculate:
(i) The radius of the new water surface in the vessel; (2mks)

(ii) The volume of the metal sphere in cm^3 (3mks)

(iii) The radius of the sphere. (3mks)