MIRROR JET TWO JOINT EXAMINATION

Kenya Certificate of Secondary Education (K.C.S.E)

121/2 MATHEMATICS PAPER 2

Form 4 -ALT A-
TIME: 2 ½ Hours JUNE 2024

Name……Adm No……..……..Stream……

Index No……Signature……Date……School……..

INSTRUCTIONS TO CANDIDATES

- Write your name and Admission number in the spaces provided at the top of this page.
- This paper consists of two sections: Section I and Section II.
- Answer ***ALL*** questions from section I and ***ANY FIVE*** from section II
- All answers and workings must be written on the question paper in the spaces provided below each question.
- Show all the steps in your calculation, giving your answer at each stage in the spaces below each question.
- Non – Programmable silent electronic calculators and KNEC mathematical tables may be used, except where stated otherwise.

FOR EXAMINERS 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

SECTION I: ***Answer all questions from this section***

1. Given that $\sin 15^\circ = \frac{\sqrt{6}-\sqrt{2}}{4}$, simplify $\frac{1}{cos 75^\circ}$ (3mks)

2. Make N the subject of the formula in: (3mks)

$$w = \frac{m}{8\pi}\sqrt{\frac{G-hN}{N}}$$

3. The length of a rectangular sheet of paper is exactly 29.7cm while the width is given as 13.4 measured to the nearest millimetre. Calculate to four significant figures the relative error in the area of the paper. (3mks)

4. A quantity P varies partly as the square of Q and partly as R. When P=10, Q=6 and R=7 while when P= -4, Q=3 and R=5; find the equation connecting P, Q and R. (3mks)

5. Grade A rice is mixed with grade B rice in the ratio of 2:3. If grade A rice costs sh. 3500 per bag and grade B costs sh. 4000 per bag, at what price per kg should a shopkeeper sell the mixture in order to make a profit of 26% (3mks)

6. Solve the equation $\log(x+4) - log150x = -2$ (3mks)

7. (a) In the space provided below, draw a circle centre O, and radius 3.2 cm. (1mk)

(b) A point X is 9cm from the centre O, construct a tangent to the circle passing through X. (2mks)

8 (a) Expand $\left(2-\frac{1}{3}x\right)^6$ up to the term in x^3 (1mk)

(b) Use your expansion in (a) above to find the value of $(1.9)^6$ (2mks)

9 Given that the circle whose equation is $x^2 + y^2 - 4x + 10y + c = 0$ passes through a point (2, –1). Find;

(a) The value of c (1mk)

(b) Find the centre and radius of the circle (2mks)

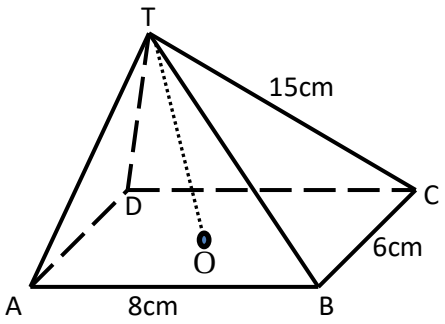
10 Find the amplitude, period and phase angle of the wave; $2y = 3\cos\left(\frac{9}{5}x + 20\right)$ (3mks)

11 The following table shows monthly income tax rates of a certain year.

Monthly income in kshs	Tax rate (%) in each shilling
0-24000	10
24001 - 32333	25
Above 32333	30

In that year, monthly relief of Ksh. 2400 was allowed. The net tax on Otweras' monthly income was ksh. 1500. Calculate Otwera's monthly income. (3mks)

12 The figure below is a right pyramid with a rectangular base ABCD and vertex T



O is the centre of the base and M is a point on OT such that O$M = \frac{1}{3}$OT. AB= $8cm, BC = 6cm, TA = TB = TD = TC = 15cm$. Find:

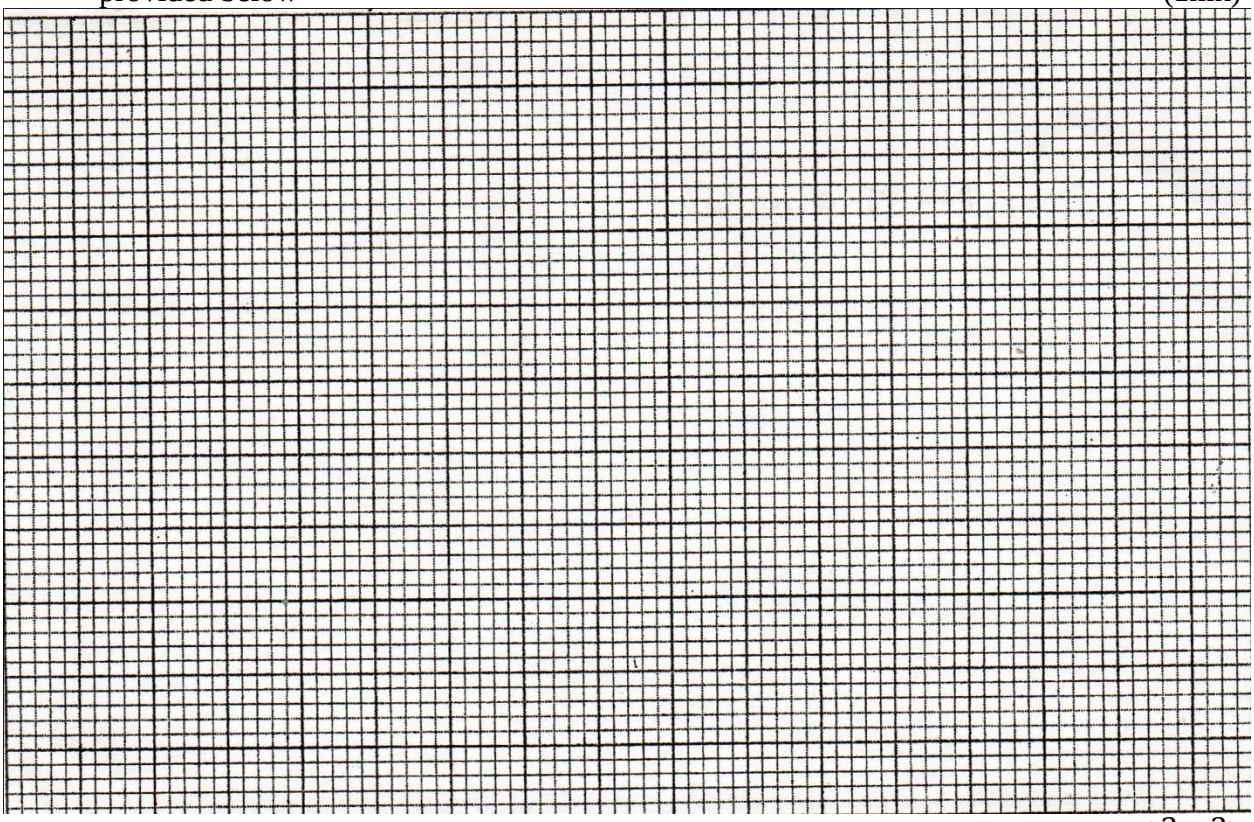
(i) The height OT of the pyramid (1mk)

(ii) The angle between the plane BMC and the base ABCD (3mks)

13 Given that **OP**= $2\boldsymbol{i} - 3\boldsymbol{j} + \boldsymbol{k}$, $OQ = 3\boldsymbol{i} - 4\boldsymbol{j} - 3\boldsymbol{k}$ and R divides **PQ** in the ratio $-3{:}2$, find the magnitude of QR to 2decimal places. (3mks)

14 Find the equation of the normal to the curve y= $(2x^2 + 1)(x - 3)$ at x= 1 (3mks)

15 (a) Plot the triangle A'B'C' with vertices at A'(1,1), B'(8,1) and C'(10, 7) on the grid provided below (1mk)

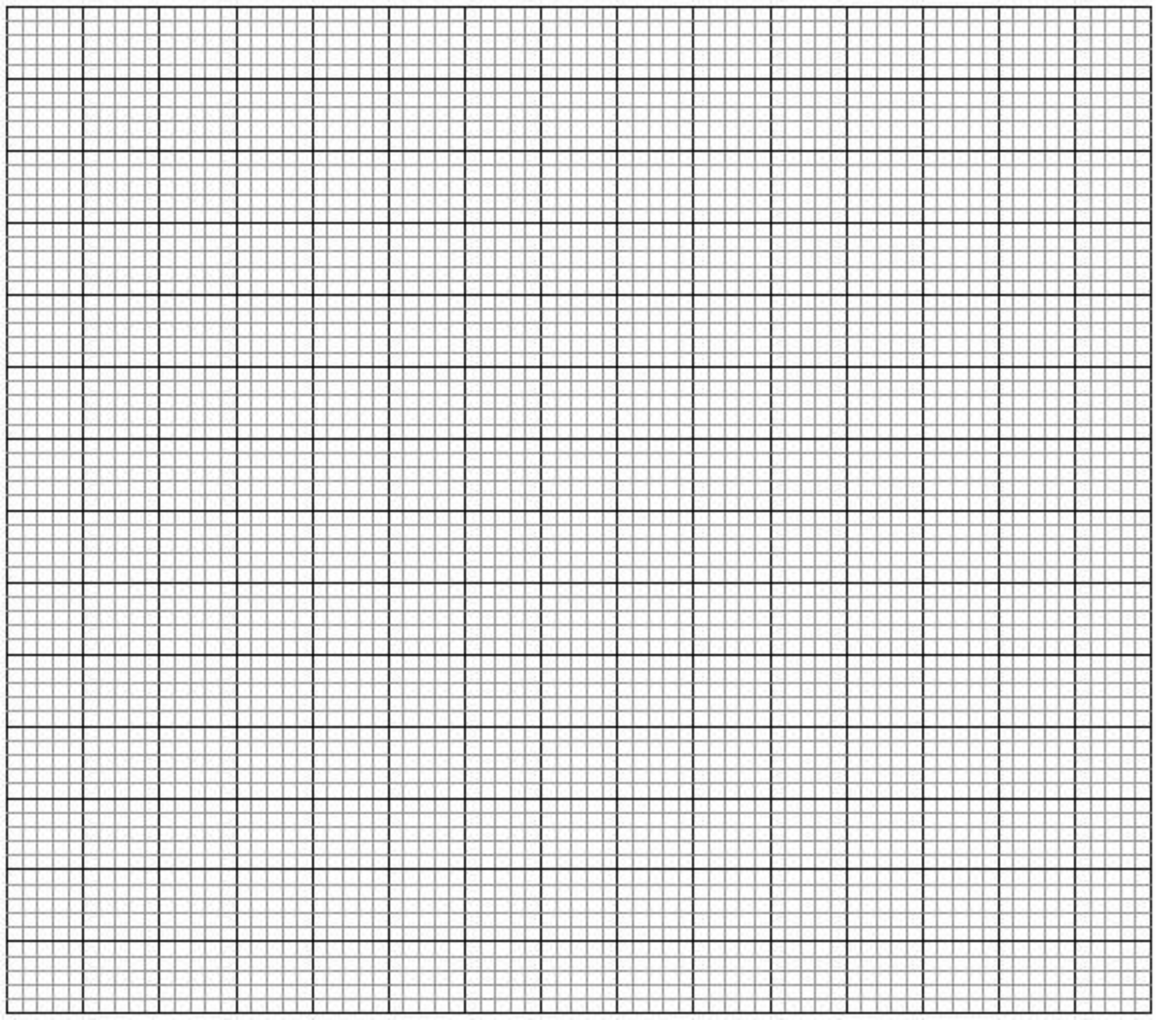


(b) A triangle A'B'C' is the image of triangle ABC under the transformation matrix $\begin{pmatrix} 2 & 3 \\ 5 & 4 \end{pmatrix}$, find the area of triangle ABC. (3mks)

16 The table below shows the vertices of t and the corresponding values of s for a given relation.

T	2	3	4	5	6	7
S	4	2.7	2	1.6	1.3	1.1

On the grid provided below, draw the graph to represent the information in the table hence calculate the rate of change of s at t= 4 (3mks)



SECTION II – 50 MARKS

Answer any FIVE questions from this section

17 The product of the first three terms of a geometric progression is 64. If the first term is a and the common ratio is r;

(a) Express r in terms of a. (3mks)

(b) Given that the sum of the first three terms is 14;

i) Find the value of a and r hence write down the two possible sequences each up to the third term. (5mks)

ii) Find the product of the fifth terms of the two sequences (2mks)

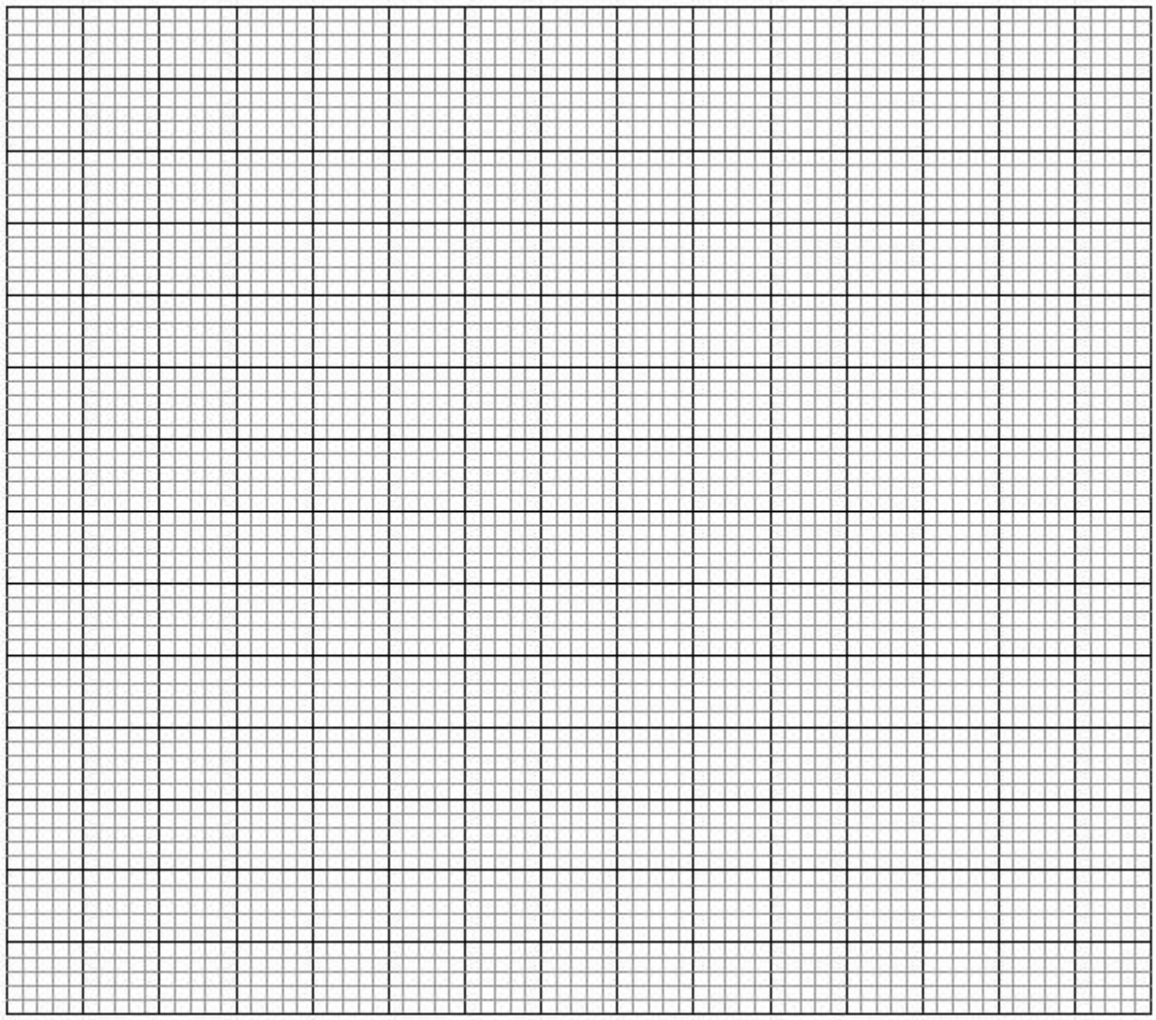
18 (a) The table below shows the values of x and some values of y for the curve $y = 14 + 10x - 8x^2 - 4x^3$. Complete the table. (2mks)

x	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5
$y = 14 + 10x - 8x^2 - 4x^3$									

(b) On the grid provided, draw the graph of $y = 14 + 10x - 8x^2 - 4x^3$ for $-2.5 \leq x \leq 1.5$

Use the scale; 1cm rep 0.5 units on x-axis

2cm rep 5units on y-axis (3mks)



(i) Use your graph to solve the equation $14 + 10x - 8x^2 - 4x^3 = 0$ (1mk)

(ii) By drawing a suitable line on the same grid, solve the equation.

$4x^3 + 8x^2 - 5x - 4 = 0$ (4mks)

19 At a research centre, a new drug is being tried using a sample of eighty sick pigs. Sixty of these pigs are given drugs and the rest are not. A half of those given drugs are put on a high calorie diet while three quarters of those who are not given drugs were put on the same diet. For the ones who were treated and put on a high calorie diet the probability of dying is $\frac{1}{10}$ and $\frac{2}{10}$ if not put on a high calorie diet. For the ones who are not treated and put in a high calorie diet the probability of dying is $\frac{4}{10}$ and $\frac{6}{10}$ if not put on a high calorie diet.

(a) Draw a tree diagram to represent the above information. (2mks)

(b) Calculate the probability that a pig picked at random

(i) Is given drugs, put on a high calorie diet and will die (1mk)

(ii) Is given drugs and will die (2mks)

(iii) Will die (3mks)

(iv) Is not given drugs and will not die (2mks)

20 Use a ruler and a pair of compasses only for all constructions in this question

(a) Construct a square ABCD of side 8cm (3mks)

(b) On the diagram in (a) above, construct;

(i) The locus of a point P such that it is equidistant from the sides AD and BC (1mk)

(ii) The locus of a point Q such that angle AQB $= 60^{\circ}$ (2mks)

(iii) The locus of R such that it is equidistant from the sides AB and AD (1mk)

(c) Locate by shading the region T that satisfy the following conditions;

(i) T is nearer to BC than to AD (1mk)

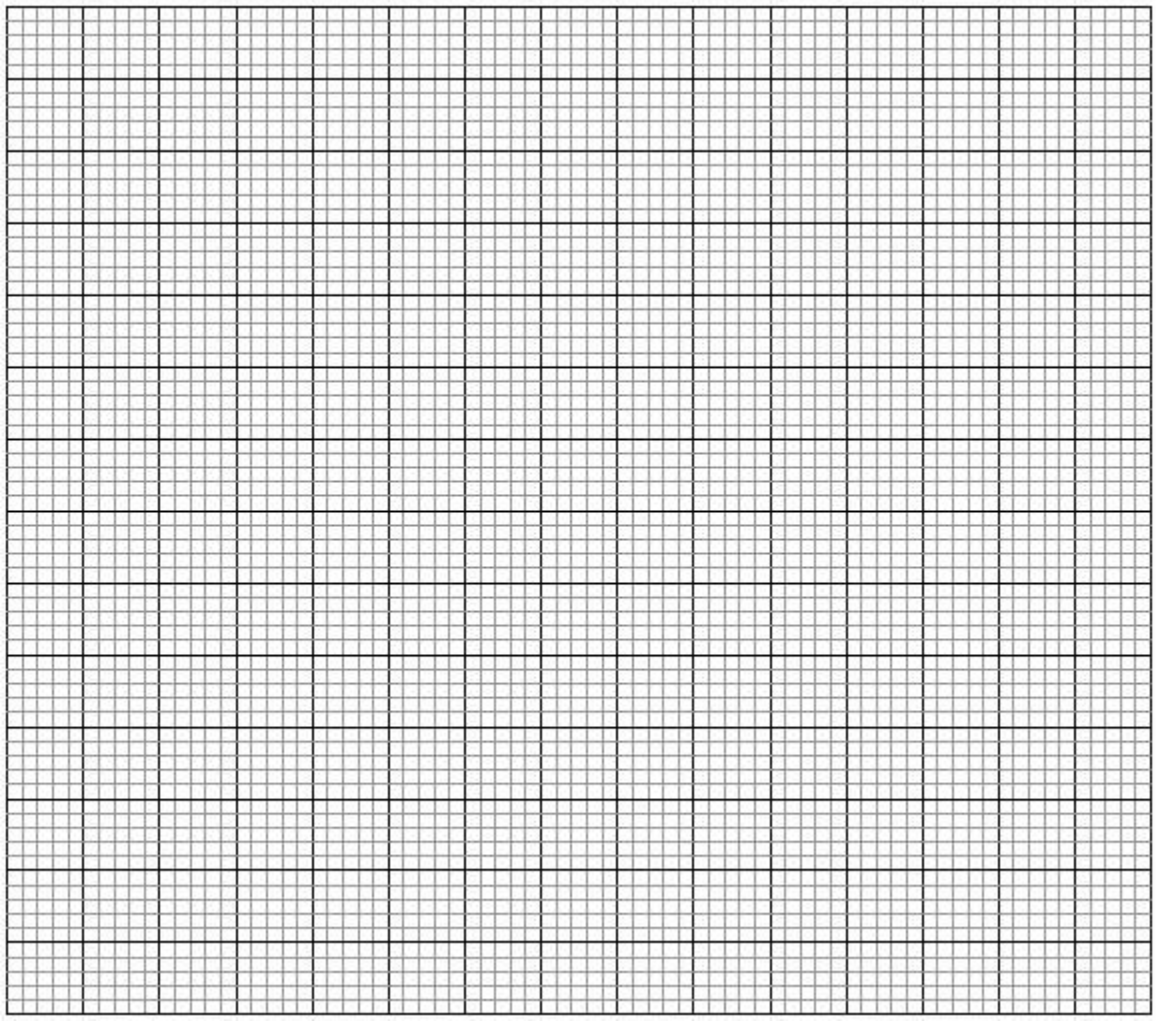
(ii) $< ATB \geq 60^{\circ}$ (1mk)

(iii) T is nearer to the side AD than to AB (1mk)

21 (a) Complete the table given below by filling in the blank spaces. (2mks)

x	0	15	30	45	60	75	90	105	120	135	150	165	180
y=4Cos2x	4.00		2.00	0.00			-4.00		-2.00	0.00	2.00		4.00
y=2sin(2x+30)	1.00	1.73	2.00	1.73		0.00		-1.00	-2.00	-1.73		0.00	1.00

(b)On the grid provided, draw on the same axes the graph of y=4Cos2x and y=2sin(2x+30) for $0^{\circ} \leq x \leq 180^{\circ}$. Take the scale 1cm for 15° on the x-axis and 1cm for 1 unit on the y-axis. (5mks)



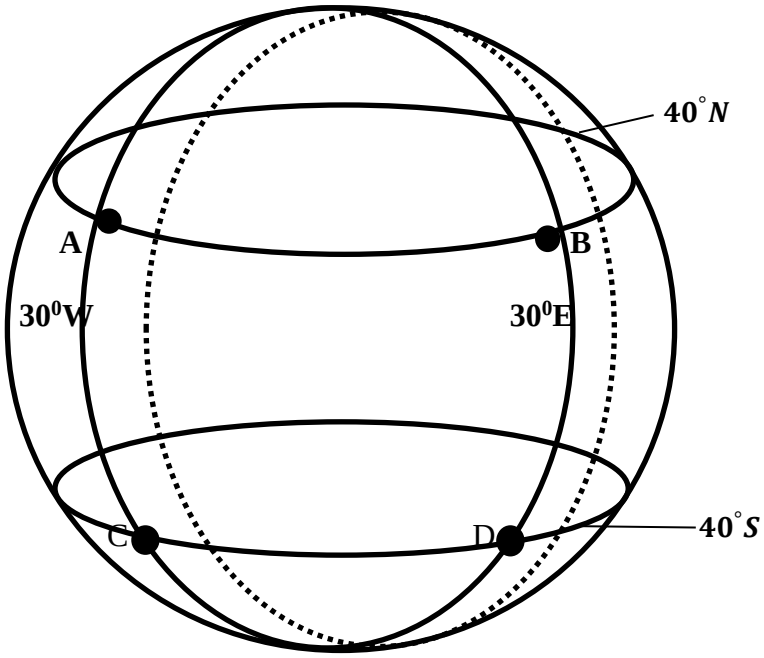
(c)From the graph;

(i) state the period of y=2sin(2x+30) (1mk)

(ii) state the range for which $4\text{Cos}2x \leq 0$ (1mk)

(iii) use the graph to solve the equation $4\text{Cos}2x - 2\sin(2x+30) = 0$ (1mk)

22 The figure below shows points on the earths' surface.



(a) State the positions of points A, B,C and D in coordinates form. (2mks)

(b) An aircraft flies from A to B along latitude 40°N, B to C along longitude $30^{\circ}E$ and C to D along latitude $40^{\circ}S$. Calculate to 4 s.f the total distance it covered in km. $\left(\text{Take radius of the earth } = 6370\text{km and } \pi = \frac{22}{7}\right)$ (5mks)

(c) If the aircraft leaves A at 8:00a.m at a speed of 720km/h to B. At what local time is it expected at B. (3mks)

23 The following are marks scored by form four students in mathematics test

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
frequency	2	6	10	16	24	20	12	8	2

Using the assumed mean of 54.5, calculate;

(a) The mean mark (3mks)

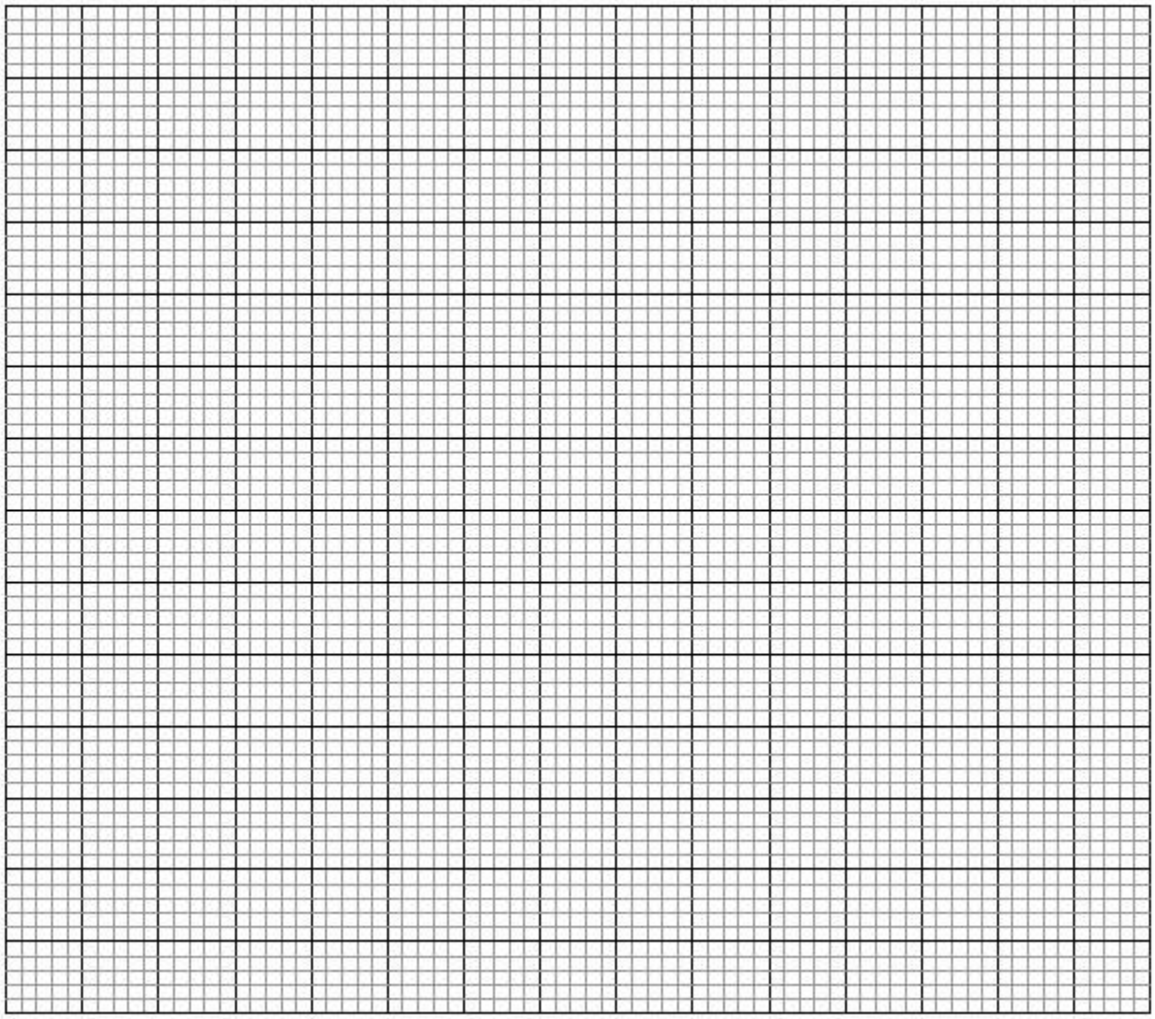
(b) The quartile deviation (4mks)

(c) The standard deviation (3mks)

24 A company has up to 40 acres of land available for planting wheat and maize. The labour costs of planting maize is ksh.900 per acre while for wheat it is ksh.1500 per acre. Maize takes 3 labourers per acre while wheat takes 6 laborers per acre. Atleast 72 labourers are to be hired and ksh. 4500 is available to cater for labour cost. The company hopes to make a profit of ksh. 3500 per acre of maize and khs. 4000 per acre of wheat. By letting the number of acres of maize be x and the number of acres of wheat to be y

(a) Write the inequalities representing the above information. (4mks)

(b) On the grid provided below, graph the inequalities in (a) above shading the unwanted regions (4mks)



(c) Determine the maximum profit that could be made by the company. (2mks)