

KCSE 2023 FINAL PREDICTION

MATHEMATICS

(KCSE PREDICTIONS 1-10)

*Confidential Analysis of Possible Expected sample KCSE Questions
most likely to be tested in the Forthcoming KNEC examinations
scheduled for November 2023.*

The following are Expected Questions in KCSE 2023 EXAM.

CONFIDENTIAL!

For Marking Schemes

Mr Isaboke 0746 222 000 / 0742 999 000

SUCCESS TO ALL CANDIDATES

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 1

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

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 (b) Sign and write the date of examination in the spaces provided.
 (c) This paper consists of two sections: **Section I** and **Section II**.
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 (e) Marks may be given for correct working even if the answer is wrong.
 (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

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SECTION I (50 MARKS)

1. Simplify $\frac{12x^2+ax-6a^2}{9x^2-4a^2}$ (3 marks)
2. Paul bought a refrigerator on hire purchase by paying monthly instalments of Ksh. 2000 per month for 40 months and a deposit of Ksh. 12,000. If this amounted to an increase of 25% of the original cost of the refrigerator, what was the cash price of the refrigerator? (3 marks)
3. Without using calculator, evaluate

$$\left(\frac{7}{3} \left[\frac{2}{5} \text{ of } 1\frac{2}{3} - \frac{1}{2} \left(\frac{1\frac{2}{3} - 2\frac{1}{2}}{\frac{1}{3} - \frac{19}{27}} \right)^{\frac{1}{2}} + \frac{2}{3} \right] \right)^{\frac{1}{2}}$$
 leaving the answer as a mixed fraction. (4 marks)

4. During a certain month, the exchange rates in a bank were as follows;

	Buying (Ksh.)	Selling (Ksh.)
1 US \$	91.65	91.80
1 Euro	103.75	103.93

A tourist left Kenya to the United States with Ksh.1 000,000. On the air port he exchanged all the money to dollars and spent 190 dollars on air ticket. While in US he spent 4500 dollars for upkeep and proceeded to Europe. While in Europe he spent a total of 2000 Euros. How many Euros did he remain with? (3marks)

5. A regular n -sided polygon has its interior angle equal to 4 times its exterior. Find n . (3 marks)
6. The ratio of the lengths of the corresponding sides of two similar rectangular petrol tanks is 3:5. The volume of the smaller tank is $8:1\text{m}^3$. Calculate the volume of the larger tank. (3 marks)
7. A man walks directly from point A towards the foot of a tall building 240m away. After covering 180m, he observes that the angle of elevation of the top of the building is 45° . Determine the angle of elevation of the top of the building from A. (3 marks)
8. The G.C.D. and L.C.M. of three numbers are 3 and 1008 respectively. If two of the numbers are 48 and 72, find the least possible value of the third number. (3 marks)
9. Solve for x in the equation below without introducing logarithms

$$5^{2x-1} = 60^{2x-1}$$
 (3 marks)

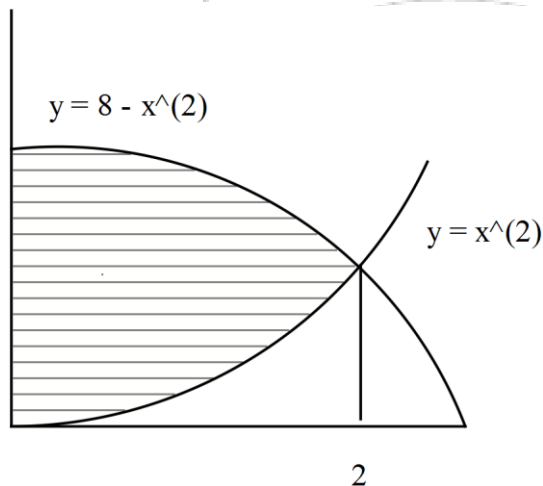
10. The table below shows masses of fifty students in a form one class.

Mass (kg)	Frequency
25-30	6
30-35	10
35-40	24
40-45	7
45-50	4

- a) State the modal class. (1mark)
- b) Calculate to 3 d.p the median mass. (2 marks)

11. Given that the position vectors of points P and Q are $\mathbf{p} = \begin{pmatrix} -4 \\ -2 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$. M is a point on PQ such that PM:MQ = 2:1. Find the coordinates of M. (3 marks)

12. Calculate the area of the shaded region. (3 marks)



13. Solve the simultaneous equations. (4 marks)

$$\frac{p}{q+1} = \frac{1}{4}, \frac{p-3}{p+q} = \frac{2}{3}$$

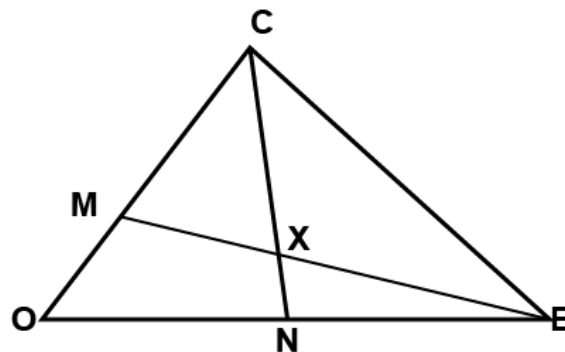
14. The ratio of boys to girls in a school is 4:5. One day $\frac{1}{3}$ of the boys and $\frac{1}{5}$ of the girls were absent. If 8 less pupils had been absent, $\frac{3}{4}$ of the school would have been present. Calculate the number of pupils in the school on that day. (3 marks)

15. Tap A can fill a tank in 10 minutes; tap B can fill the same tank in 20 minutes. Tap C can empty the tank in 30 minutes. The three taps are left open for 5 minutes, after which tap A is closed. How long does it take to fill the remaining part of the tank? **(3 marks)**
16. A solid in a shape of a right pyramid on a square base of side 8cm and height 15cm is cut at 6cm height from the base. Find the volume of the frustrum formed. **(3 marks)**

SECTION II (50 MARKS)

(Answer ANY FIVE questions in the spaces provided)

17. The points $A^1B^1C^1$ are the images of $A(4, 1)$, $B(0, 2)$ and $C(-2, 4)$ respectively under a transformation represented by the matrix $M = \begin{pmatrix} 1 & 1 \\ 1 & 3 \end{pmatrix}$.
- (a) Write down the coordinates of $A^1B^1C^1$ **(3 marks)**
- (b) $A^{II}B^{II}C^{II}$ are the images of $A^1B^1C^1$ under another transformation whose matrix is $N = \begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}$. Write down the co – ordinates of $A^{II}B^{II}C^{II}$ **(3 marks)**
- (c) Transformation M followed by N can be replaced by a single transformation P. determine the matrix for P. **(2 marks)**
- (d) Hence determine the inverse of matrix P. **(2 marks)**
18. The figure below shows a triangle OAB with O as the origin. $OA = \underline{a}$ $OB = \underline{b}$, $OM = \frac{2}{5}\underline{a}$ and $ON = \frac{2}{3}\underline{b}$.



- a) Express in terms of $\underline{a}$ and $\underline{b}$ the vectors
- (i) $\underline{BM}$ **(1 mark)**
- (ii) $\underline{AN}$ **(1 mark)**

b) Vector OX can be expressed in two ways: $OB + KBM$ or $OA + hAN$, where K and h are constants.

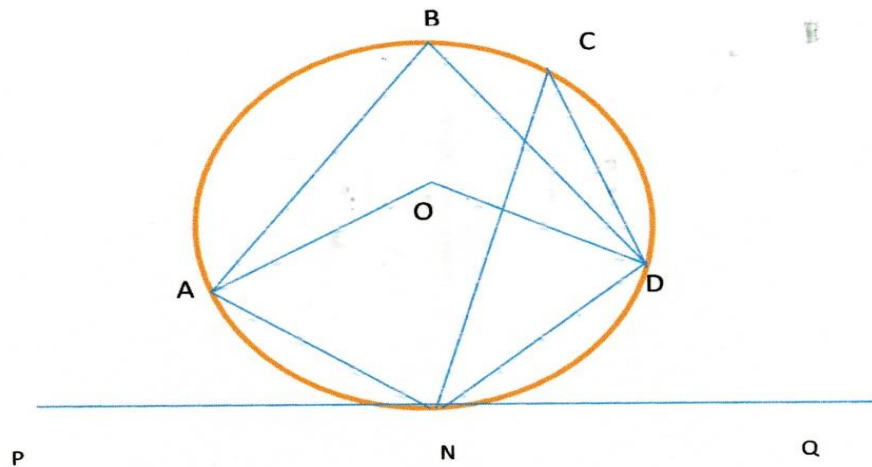
Express OX in terms of:

i. $\underline{a}$, $\underline{b}$ and k. (2 marks)

ii. $\underline{a}$, $\underline{b}$ and h. (2 marks)

c) Find the values of k and h. (4 marks)

19. In the figure below, O is the center of the circle. PQ is a tangent to the circle at N. Angle NCD is 10° and angle ANP is 30°



Giving reasons find;

a) Angle DON (2marks)

b) Angle DNQ (2marks)

c) Angle DBA (2marks)

d) Angle ONA (2marks)

e) Angle ODN. (2marks)

20. The displacement h metres of a particle moving along a straight line after t seconds is given by

$$h = -2t^3 + \frac{3}{2}t^2 + 3t.$$

a) Find its initial acceleration (3 marks)

b) Calculate;

i) The time when the object was momentarily at rest (3 marks)

ii) Its displacement by the time it comes to rest (2 marks)

c) Calculate the maximum speed attained (2 marks)

21. A metal R is an alloy of two metals X and Y. Metal X has a mass of 70g and a density of 16g/cm^3 . Metal Y has a mass of 19g and a density of 4g/cm^3 .

(a) Calculate the density of the metal R. **(4 marks)**

(b) If metal R is divided into two equal parts and each half reinforced by adding metal X to get to initial volume. Find the density of the new alloy. **(4 marks)**

(c) The two metals are mixed in a ratio of 4:1 respectively. What is the density of the alloy? **(2 marks)**

22. A trailer moving at a speed of 80km/h is being overtaken by a car moving at 100km/h in a clear section of a road. Given that the bus is 21m long and the car is 4m long.

a) How much time (in seconds) will elapse before the car can completely overtake the bus? **(3 marks)**

b) How much distance (in metres) will the car travel before it can completely overtake the bus? **(2 marks)**

c) Given that as soon as the car completed overtaking the trailer, a bus heading towards the trailer and the car and moving at a speed of 90km/h became visible to the car driver. It took exactly 18 seconds for the car and the bus to completely by pass each other from the moment they first saw each other.

i. How far was the tail of the bus from the tail of the car at the instance they first saw each other given that the bus is 12 metres long? **(3 marks)**

ii. How far a part was the trailer and the bus just immediately after the car and the bus had passed each other? **(2 marks)**

23. Every Sunday Alex drives a distance of 80km on a bearing of 074° to pick up his brother John to go to church. The church is 75km from John's house on a bearing of $S50^\circ E$. After church they drive a distance of 100km on a bearing of 260° to check on their father before Alex drives to John's home to drop him off then proceeds to his house.

(a) Using a scale of 1cm to represent 10km , show the relative positions of these places. **(4 marks)**

(b) Use your diagram to determine:

(i) the true bearing of Alex's home from their father's house. **(1 mark)**

(ii) the compass bearing of the father's home from John's home. **(1 mark)**

(iii) the distance between John's home and the father's home. **(2 marks)**

(iv) the total distance Alex travels every Sunday. **(2 marks)**

24. P and **Q** are two points on a geographical globe of diameter 50 cm. They both lie on a parallel latitude 50° North. **P** has longitude 90° West and **Q** has longitude 90° East. A string **AB** has one end at point **P** and another at point **Q** when it is stretched over the North pole. Taking $\pi = 3.142$;

(a) Calculate the length of the string. **(3 marks)**

(b) If instead the string is laid along the parallel of latitude 50° N with **A** at point **P**, calculate the longitude of point **B**. **(3 marks)**

(c) State the position of **B** if the string is stretched along a great circle of **P** towards the South pole if point **A** is static at **P**. **(4 marks)**

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 1

121/2

MATHEMATICS

PAPER 2

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SECTION II

17	18	19	20	21	22	23	24	Total

Grand Total

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SECTION I (50 MARKS)

Answer all questions in this section in the spaces provided

1. A piece of wire 10cm long is to be cut into two parts. If the parts are bent to form a square and a circle respectively, find the length each of the two parts, and hence find the radius of the circle formed, if the sum of their areas is minimum. **(4 marks)**
2. In 2022, the cost of processing a bag of wheat was Ksh 250, and this was divided between electricity costs and labour in the ratio 2:3. In the year 2023, the cost of electricity doubled, while the cost of labour increased by $x\%$. Calculate the value of x given that the cost of processing a bag of wheat in 2023 is 425. **(2 marks)**
3. A triangle PQR is such that the equation of line PQ is $3y - 2x - 11 = 0$, while that of line QR is $2y - 3 = -3x$. Find the coordinates of the point of intersection of the two lines. **(3 marks)**
4. Three quantities **b**, **n** and **m** are such that **b** varies directly as the product of **m** and **n**, and inversely as the square root of the difference of **n**² and **m**. Form an equation connecting **b**, **n** and **m**. Express **n** in terms of **b**, **m** and **k**, where **k** is the constant of proportionality. **(3 marks)**
5. The locus of points 3 cm away from a point (m,m) passes through the point (2,5). Find the value of **m**. **(3 marks)**
6. Using a ruler and pair of compasses only, construct triangle MNP in which MN = 5cm, NP = 4.4cm and angle PNM = 45° . Draw a circle passing through all the vertices of the triangle and measure its radius. **(3 marks)**
7. The deviations from the mean of a set of data are given as -4, -1, x^2 , 1, x , and -2. Find the value of x , hence find the standard deviation of the data, given that x is positive. **(3 marks)**
8. Two parallel chords of length 4.6cm and 6.8cm are on the same side of a circle of radius r cm. calculate the radius of the circle, correct to four significant figures, given that distance between the two chords is 2cm. **(3 marks)**
9. A piece of land is in the shape of a quadrilateral ABCD such that side AB=AD=50m, $\angle DAB = 100^\circ$, $\angle ABC = 87^\circ$ and $\angle ADC = 79^\circ$. Determine the length of barbed wire that would go around the land to the nearest metre. **(4 marks).**
10. OABC is parallelogram in which **OA** = **a** and **OC** = **c**. Y is the mid-point of **OC**, and **AY** meets **OB** at X. X divides line **OB** and **AY** in the ratio 3:4 and 1:2 respectively. Find **OB** in terms of **a** and **c**. **(3 marks)**
11. Simplify without using tables or calculators: **(3 marks)**

$$\frac{\sin 480^\circ - \cos 765^\circ}{\tan 225^\circ - \cos(-330^\circ)}$$
12. Use the first four terms of the expansion $(2a + b)^8$ to find the value of 2.05^8 correct to 4 significant figures. **(3 marks)**
13. Bazu owns a total more than 10 buses and matatus combined. There are four more matatus than buses, and the buses are not more than 8 in number. By taking x to represent the number of buses, write down all the inequalities for the information and hence state all possible solutions of x . **(3 marks)**

14. Two similar metallic cylinders have masses of 64g and 125g respectively. The smaller cylinder has a volume of 21.56cm^3 . The larger cylinder is molded into a sphere of radius r . Find the value of r correct to 3 decimal places. **(3marks)**
15. A ship is observed from the top of a cliff 200 m high in a direction $N18^\circ E$ at an angle of depression of 15° . Thirty minutes later, the same ship is observed in a direction $S72^\circ E$ at an angle of depression of 10° . Find the distance travelled in the 30 minutes assuming that the ship travelled along a straight line. **(4 marks)**
16. A right pyramid VABCD has its vertex at V and a rectangular base ABCD. $AB = 8\text{cm}$, $BC = 6\text{cm}$ and all the slant edges of the pyramid are 10cm. Find the angle between plane VBC and plane VAD correct to two decimal places. **(3 marks)**

SECTION B (50 MARKS)

Answer only FIVE questions in this section in the spaces provided

17. The table below shows the income tax rate for a certain year

Income in Ksh. p.m	Tax rate(%)
1 – 11180	10
11181 – 21714	15
21715 – 32248	20
32249 – 42781	25
42782 and above	30

In a certain month, Mr Zakayo paid a net tax of Ksh 26416. He was entitled to a monthly personal relief of Ksh 1648. He also paid insurance premiums amounting to 18200 and was entitled to an insurance relief at 15% of premiums paid, subject to a maximum of Ksh 2000 per month. He also lived in a company house for which he paid a nominal rent of 5200 per month. Other taxable allowances amounted to sh. 22400.

- a) Calculate Mr Zakayo's monthly gross tax **(2 marks)**
- b) Calculate Mr Zakayo's total taxable income in that month **(4 marks)**
- c) Calculate Mr Zakayo's net monthly income. **(4 marks)**

18. The equation of a curve is given as $y = \frac{x(x-2)}{(x-1)^{-1}}$.

- a) Sketch the curve. **(7 marks)**
- b) Determine the exact area bounded by the curve and the x-axis. **(3 marks)**

19. Water flows through a cylindrical pipe of diameter 2.8cm at a speed of 25m/min.

- a) Calculate the volume of water delivered by the pipe per minute in litres. **(3 marks)**
- b) A cylindrical storage tank of depth 2.5m is filled by water from this pipe and at the same rate of flow. Water begins flowing into the empty storage tank at 8:00am and is full at 2:00pm. Calculate the area of the cross section of this tank in m^2 . **(4 marks)**

- c) A family consumes the capacity of this tank in one month. The cost of water is sh. 150 per 1000 litres plus a fixed maintenance charge of sh. 200. Calculate this family's water bill for a month. **(3 marks)**
- 20.** The second, 4th and 7th terms of an AP form the first three consecutive terms of a GP.
- a) Find the common ratio of the G.P **(5 marks)**
- b) The first term of the GP if the common difference of the AP is 3 **(2 marks)**
- c) The seventh and the fifth terms of the G.P form the first two consecutive terms of an AP. Find the sum of the first 20 terms of the AP formed. **(3 marks)**
- 21.** Use a ruler and a pair of compasses only for all constructions in this question.
- (a) Construct parallelogram ABCD such that $\angle ABC = 67.5^\circ$, $BA = 7.8\text{cm}$ and $CB = 5.6\text{cm}$. **(3 marks)**
- (b) Construct a perpendicular from A to meet DC at E. Measure AE, hence find the area of the parallelogram. **(2 marks)**
- (c) On the same side of AB as C and D, construct the locus of points P such that $\angle APB = 45^\circ$ **(2 marks)**
- (d) Identify by shading the unwanted region, the locus of points R such that $AR > 2.8\text{ cm}$, $AR \leq RB$ and $\angle ARB \geq 45^\circ$. **(3 marks)**
- 22.** In a form 4 chemistry classes consisting of both boys and girls, $\frac{2}{5}$ of the students are girls. $\frac{2}{3}$ of the boys and $\frac{7}{10}$ of the girls are right handed. The probability that a right-handed student breaks a conical flask in any practical session is $\frac{3}{7}$ and the corresponding probability of a left-handed student is $\frac{4}{9}$, independent of the student's gender.
- a) Draw a tree diagram to represent the above information **(2 marks)**
- b) Determine the probability that a student chosen at random from the class is left handed and does not break a conical flask during a practical session in simplest form. **(3 marks)**
- c) Determine the probability that a conical flask is broken in any chemistry practical session in simplest form. **(3 marks)**
- d) Determine the probability that a conical flask is not broken by a right-handed student in the simplest form. **(2 marks)**
- 23.** A farmer wishes to grow two crops, maize and beans. He has 70 acres of land available for this purpose. He has 240 man-days of labour available to work out the land and he can spend up to sh. 180,000. The requirements of the crops are as follows:
- | | Maize | Beans |
|------------------------------------|--------|--------|
| Minimum number of acres to be sown | 10 | 20 |
| Man – day per acre | 2 | 4 |
| Cost per acre in sh. | 3,000 | 2,000 |
| Profit per acre in sh. | 15,000 | 10,000 |
- a) If x and y represent the number of acres to be used for maize and beans respectively, write down in their simplest form, all the inequalities which x and y must satisfy. **(2 marks)**

- b) Represent the inequalities on the grid provided (5 marks)
- c) Profit per acre of maize and beans is sh. 15,000 and 10,000 respectively. Draw a suitable search line on the graph and use it to find the number of acres to be used for maize and beans so as to give maximum profit. (2 marks)
- d) Find the maximum profit. (1 mark)

24. The table below gives values of P with corresponding values of G.

P	90.1	223.3	371.2	693.3	4450.1	11000
G	60	105	147	226	780	1500

- a) Using the data from the table above, draw a suitable straight line graph given that P and G are connected by the equation $\log P = n \log G + \log K$ (5 marks)
- b) Use the graph to determine:
- i) The values of k and n (3 marks)
- ii) The value of P when G is 113 (1 mark)
- iii) The value of G when P is 400 (1 mark)

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 2

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

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17	18	19	20	21	22	23	24	Total

Grand Total

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SECTION I (50 MARKS)

Answer all the questions in this section

1. Evaluate: (3mks)

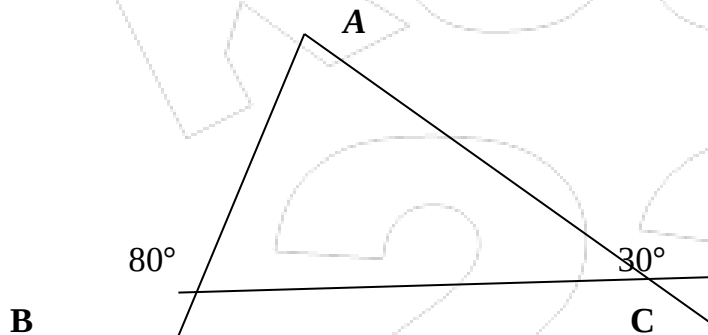
$$\frac{2\frac{1}{2} \text{ of } 1\frac{3}{4} - 5\frac{1}{4}}{1\frac{2}{5} + 2(1\frac{1}{4} - 2\frac{3}{4})}$$

2. Use logarithms to evaluate the following to 4 significant figures to: (4mks)

$$\left(\frac{95.75 \times 0.85}{4.524 + 1.234} \right)^{\frac{2}{3}}$$

3. An electrician made a loss of 30% by selling a multi plug at sh.1400.what percentage profit would he has made if he sold the multi plug at sh. 2300. (3mks)

4. In the triangle ABC below, BC=9cm, angle ABC=80°.and angle ACB=30°.



- Calculate, correct to 4 significant figures, the area of the triangle. (3mks)

- 5.) Given that the exterior angle of a regular hexagon is $2x$. Find the value of x . Hence find the size of each interior angle of the hexagon. (3mks)

6. Two numbers t and s are such that $t^4x s^2= 5625$. Find t and s (3mks)

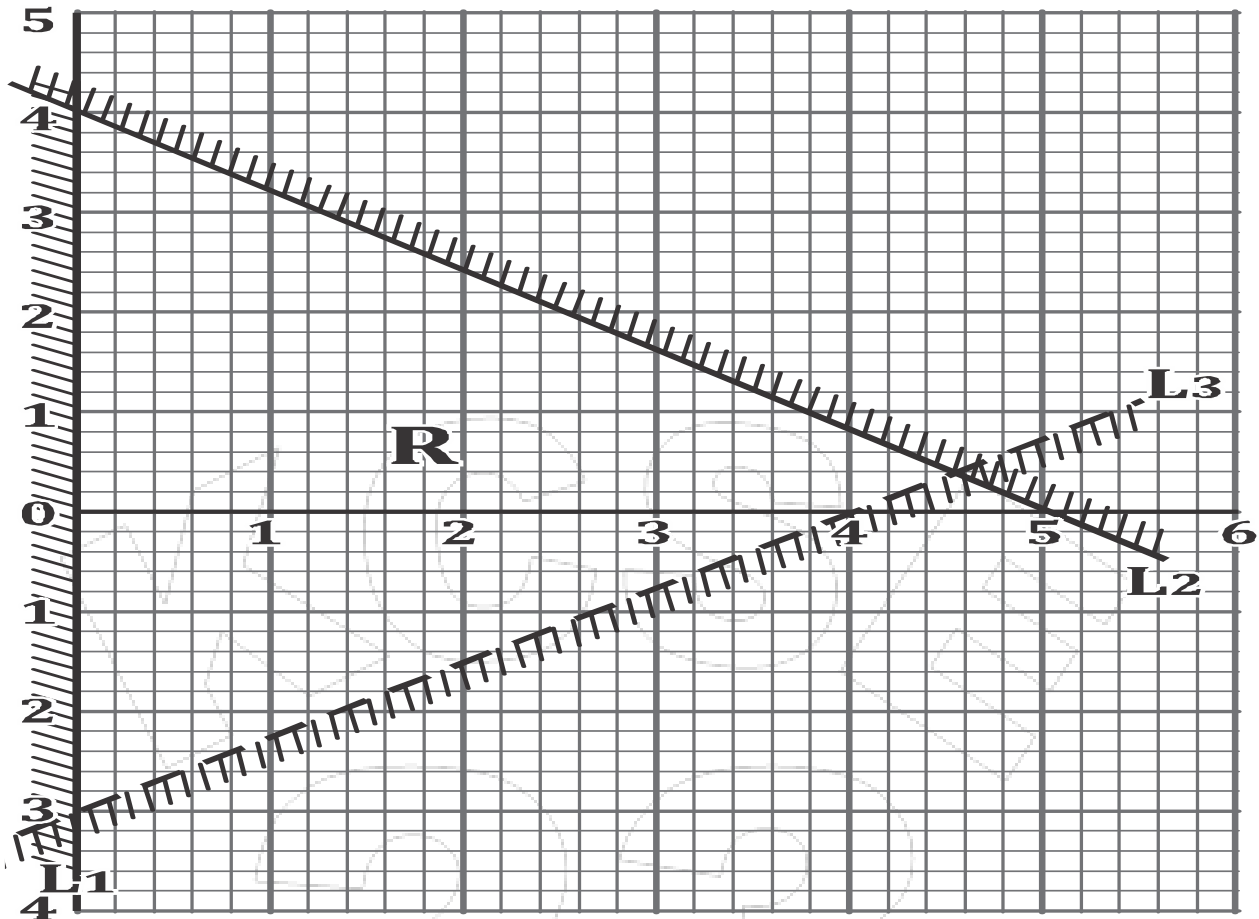
7. Find the obtuse angle the line with equation $2y+5x+2=0$ makes with the x -axis. (3mks)

8. Simplify the expression (3mks)

$$\frac{12x^2 + ax - 6a^2}{9x^2 - 4a^2}$$

9. A plot is in the shape of a right angled triangle. The length of the shorter side is 15m and the area is 456.8m^2 . Calculate the length of the longest side of the garden. (3mks)

- 10.) The diagram below shows a region R bounded by three lines L_1 , L_2 and L_3 . Form the three inequalities that satisfies the given region R (3mks)



11. A bus travelled at an average speed of 63km/h left the station at 9.15 am. A car later left the same station at 10.00am and caught up with bus at 11.45 am. Find the average speed of the car. (3mks)

12. A tourist came in Kenya and exchanged 1250 US dollars into Kenyan shillings at the rate shown below.

Buying (Kshs)	selling (Kshs)
1US dollar 105.5	110.8

- He spent Ksh. 85400 after which he converted the remaining balance to US dollars. How much US dollars did he get back to the nearest dollar. (3mks)

- 13.a) Complete the table below for $y = x^2 + 5$ (1mk)

X	0	1	2	3	4	5	6
$Y = x^2 + 5$	5						

b) Use the trapezoidal rule with 7 ordinates to estimate the area bounded by the curve $y=x^2+5$, x – axis, y -axis and $x=6$ (2mks)

14. Given that $\mathbf{a} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -2 \\ -4 \end{pmatrix}$ and $3\mathbf{a}-2\mathbf{b}+2\mathbf{c} = \begin{pmatrix} 32 \\ 20 \end{pmatrix}$, find $\mathbf{c}$ (3mks)

15). A triangle T with vertices A(2,4), B(6,2) and C(4,8) is mapped onto triangle T' with vertices A'(10,0), B'(8,-4) and C'(14,-2) by a rotation.

a) on the grid provided draw triangle T and its image T' (2mks)

b) Determine the centre and the angle of rotation that maps T onto T' (2mks)

16. A small cone of height 8cm is cut off from a bigger cone leaving a frustum of height 16cm. If the volume of the smaller cone is 160cm^3 , find the volume of the frustum. (3mks)

Section II (50MKS)

Answer any **five** questions in this section

17. Three businessmen, Hassan, Mutua and Wanyonyi decided to start a business. The initial capital which was needed was Ksh. 4,000,000 of which they were able to raise 30% by making contributions in the ratio 3:3:2 respectively. The rest of the amount was obtained from a bank and was to be paid back within one year with an interest of 25% in the same ratio 3:3:2. The three men were to share the profit of the business in the ratio of their contribution. During the year, the business realized a profit of Ksh. 4,800,000.

a) How much of the initial amount did Wanyonyi raise? (3mks)

b) How much did Hassan pay to the bank at the end of the year? (4mks)

c) After paying the bank at the end of the year, how much was Mutua left with? (3mks)

18. The marks scored by 50 students in a geography examination are as follows:

60	54	40	67	53	73	37	55	62	43
44	69	39	32	45	58	48	67	39	51
46	59	40	52	61	48	23	60	59	47
65	58	74	47	40	59	68	51	50	50
71	51	26	30	38	70	46	40	51	42

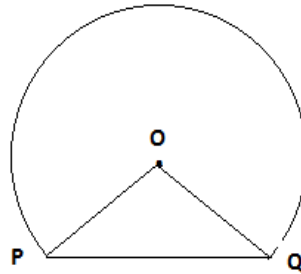
a) Prepare a frequency distribution table using a class interval of 10 starting from 21-30 (3mks)

b) Draw a histogram to represent the distribution (4mks)

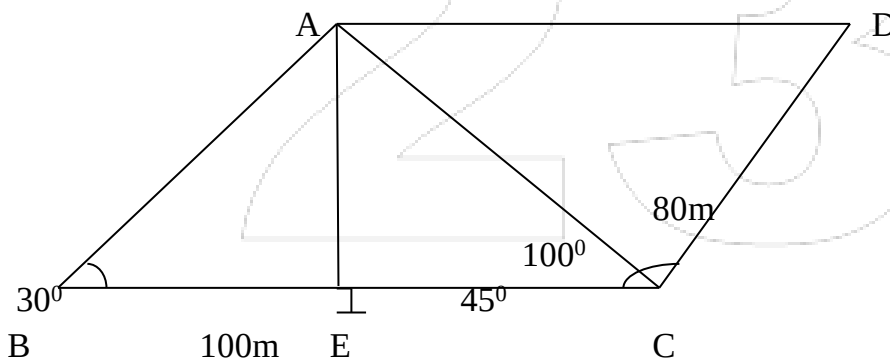
c) Use your histogram to estimate the modal class (1mk)

d) Using the histogram estimate the mean of the distribution of the data. (2mk)

19. A petrol tanker has a cross-section in the shape shown below. It is used to transport petrol. Its internal length is 7m while its internal radius is 3.5 m. Obtuse angle POQ = 144° . On one of its trips, it was filled to capacity. Taking $\pi = \frac{22}{7}$



- (a) Calculate the volume of petrol in the tanker in
- m^3 (2 marks)
 - litres (1 mark)
- (b) In the parking lot at night, a third of the petrol was stolen.
- How many litres of petrol was the owner left with? (2 marks)
 - What was the mass of the remaining petrol given that one cubic metre of petrol has a mass of 700kg? (3 marks)
 - At the weigh bridge, any vehicle carrying excess of 50,000 Kg was charged Sh. 12.50 for every extra kilogram. How much fine did the owner of the tanker pay? (2 marks)
20. The figure below represents a quadrilateral piece of land ABCD divided into three triangular plots. The lengths BE and CD are 100m and 80m respectively. Angle ABE = 30° , ACE = 45° and $\angle ACD = 100^\circ$.



- (a) Find to four significant figures:
- The length of AE. (2mks)
 - The length of AD. (2mks)
 - The perimeter of the piece of land. (3mks)
- (b) The plots are to be fenced with five strands of barbed wire leaving an entrance of 2.8m wide to each plot. The type of barbed wire to be used is sold in rolls of lengths 480m. Calculate the number of rolls of barbed wire that must be bought to complete the fencing of the plots. (3mks)

21. A straight line L_1 has a gradient $-\frac{1}{2}$ and passes through point **P** $(-1, 3)$. Another line L_2 passes through the points **Q** $(1, -3)$ and **R** $(4, 5)$.

Find:

- (a) The equation of L_1 (2 marks)
- (b) The equation of L_2 in the form $ax + by + c = 0$. (3 marks)
- (c) The equation of a line passing through a point **S** $(0, 5)$ and is perpendicular to L_2 . (3 marks)
- (d) The equation of a line through **R** parallel to L_1 . (2 marks)

22. a) A port B is on a bearing 080° from a port A and a distance of 95 km. A Submarine is stationed at a port D, which is on a bearing of 200° from A, and a distance of 124 km from B. A ship leaves B and moves directly Southwards to an Island P, which is on a bearing of 140° from A. The Submarine at D on realizing that the ship was heading to the Island P, decides to head straight for the Island to intercept the ship. Using a scale of 1 cm to represent 10 km, make a scale drawing showing the relative positions of A, B, D and P. (4 marks)

Hence find:

- b) The distance from A to D. (2 marks)
- c) The bearing of the Submarine from the ship when the ship was setting off from B. (1 mark)
- d) The bearing of the Island P from D. (1 mark)
- e) The distance the Submarine had to cover to reach the Island P. (2 marks)

23. (a) Find the inverse of the matrix: (1mk)

$$A = \begin{pmatrix} 4 & 3 \\ 3 & 2 \end{pmatrix}$$

- b) Amina bought 20 bags of oranges and 15 bags of mangoes for a total of sh. 9,500. Nafula bought 30 bags of oranges and 20 bags of mangoes for a total of sh. 13,500. If the price of a bag of oranges is X and that of mangoes is y:
 - a) Form two equations to represent the information above. (2mks)
 - ii) Hence use the matrix A^{-1} above to find the price of one bag of each item. (4mks)
 - (c) The price of each bag of oranges was increased by 10% and that of mangoes reduced by 10%. The businesswomen (Amina and Nafula) bought as many oranges and as many mangoes as they bought earlier. Find the total cost of oranges and mangoes that each businesswomen bought after the percentage change. (3mks)

24. The displacement, s metres, of a moving particle from a point O, after t seconds is given by, $s = t^3 - 5t^2 + 3t + 10$

- a) Find s when $t=2$ (2mks)
- b) Determine:
 - i) the velocity of the particle when $t=5$ seconds; (3mks)
 - ii) the value of t when the particle is momentarily at rest (3mks)
 - c) find the time, when the velocity of the particle is maximum (2mks)

KCSE 2023 FINAL PREDICTION**EXPECTED TRIAL 2**

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.**INSTRUCTIONS TO CANDIDATES**

- (a) Write your name and admission number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided.
- (c) This paper consists of two sections: **Section I** and **Section II**.
- (d) Answer all questions in **section I** and **only five** questions from **section II**.
- (e) Marks may be given for correct working even if the answer is wrong.
- (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

--

SECTION I (50 MARKS)Answer **all** the questions in this section

1. Use logarithms, correct to **4 decimal places**, to evaluate (4mks)

$$\sqrt[3]{\frac{83.46 \times 0.0054}{1.52^2}}$$

2. Given that the ratio of $x:y = 4:5$, find to the **simplest form** the ratio of $(7x-2y):(x+2y)$ (2mks)
 3. Ruto bought a plot of land for Ksh.280,000. After 4 years, the value of the plot was Ksh.495,000. Determine the rate of appreciation, per annum, **correct to one decimal place**. (3mks)

4. The height in centimeters, of 100 tree seedlings in a tree nursery are shown in the table below.

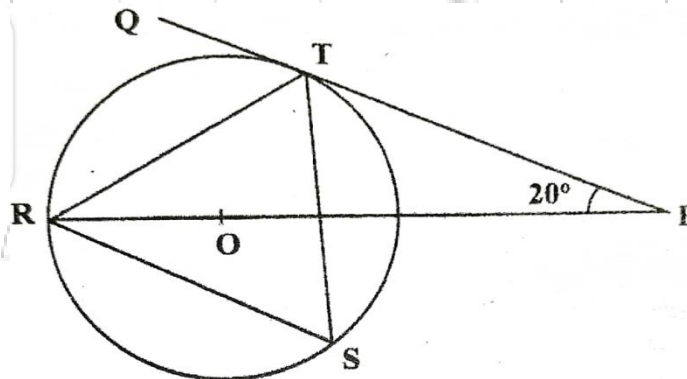
Height(cm)	10-19	20-29	30-39	40-49	50-59	60-69
Number of trees	9	16	19	26	20	10

Find the quartile deviations of the heights. (3mks)

5. The equation of a circle is given by $4x^2 - 12x + 4y^2 - 8y - 3 = 0$. Determine the coordinates of the centre of the circle and the radius of the circle. (4mks)

6. Simplify the expression $\frac{\sqrt{48}}{\sqrt{5} + \sqrt{3}}$, leaving the answer in the form $a\sqrt{b} + c$ where a, b and c are integers (3mks)

7. In the figure below R, T and S are points on a circle centre O. PQ is a tangent to the circle at T, POR is a straight line and $\angle QPR = 20^\circ$.

Giving reasons find the size of $\angle RST$ (2mks)

8. a) Expand the expression $\left(1 + \frac{1}{2}x\right)^5$ in ascending powers of x, leaving the coefficients as fraction in their simplest form. (2mks)
 b) Use the first three terms of the expansion in (a) above to estimate the value of $(1.05)^5$ correct to **4** significant figures (2mks)

9. Make t the subject of the formula in $s = \sqrt{\frac{3d(t-d)}{8}}$ (3mks)

10. A trader bought maize for Ksh 20 per kilogram and beans for Ksh 60 per kilogram. She mixed the maize and beans and sold the mixture at Ksh 48 per kilogram. If she made a 60% profit, determine the ratio of maize:beans per kilogram in the mixture. (3mks)
11. The cash price of a digital television is Ksh. 27,500. A customer decided to buy it on hire purchase terms by paying a deposit of Ksh 17,250. Determine the monthly rate of compound interest charged on the balance if the customer is required to repay by six equal monthly instalments of Ksh. 2,100 each. (3mks)
12. The first, the third and the seventh terms of an increasing arithmetic progression are three consecutive terms of a geometric progression. If the first term of the arithmetic progression is 10, find the common difference of the arithmetic progression. (4mks)
13. The lengths of two similar pieces of wood were given as 12.5 m and 9.23 m. Calculate the absolute error in calculating the difference in length between the two bars. (3mks)
14. Solve for x given that $\frac{1}{3} \log_2 8 + \log_2 (2x - 4) = 5$ (3mks)
15. In nomination for a committee, two people were to be selected at random from a group of 3 men and 5 women. Find the probability that a man and a woman were selected. (2mks)
16. Pipe A can fill an empty tank in 3 hours while, pipe B can fill the same tank in 6 hours. When the tank is full it can be emptied by pipe C in 8 hours. Pipe A and B are opened at the same time when the tank is empty. If one hour later, pipe C is opened, find the total time taken to fill the tank. (4mks)

SECTION II (50 marks)

Answer only **five** questions in this section

17. The table below shows the income tax rates for a certain year.

Monthly taxable income in Ksh	Tax rate (%) in each shilling
1-11,180	10
11,181-21,714	15
21,715-32,248	20
32,249-42,782	25
Over 42,782	30

- i. During the year, Njuguna's monthly income was as follows: Basic salary Ksh 40,000, House allowance Ksh 11,090 and Commuter allowance Ksh 7,000.
Calculate
 - a) Njuguna's total monthly taxable income. (1mk)
 - b) Total income tax charged on Njuguna's monthly income (4mks)
- ii. Njuguna's net monthly tax was Ksh. 10,750.80. Determine the monthly tax relief allowed. (1mk)
- iii. A proposal to expand the size of the first income tax band by 50% while retaining the size of the next three bands was made. The tax rates would remain as before in each band. Using the proposal, calculate:

- a) the tax Njuguna would pay in the first band. (2mk)
 b) the tax Njuguna would pay in the last tax band. (2mks)

18.a) Given that $A = \begin{bmatrix} 3 & x \\ x+1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix}$, find the values of x for which AB is a singular matrix. (3mks)

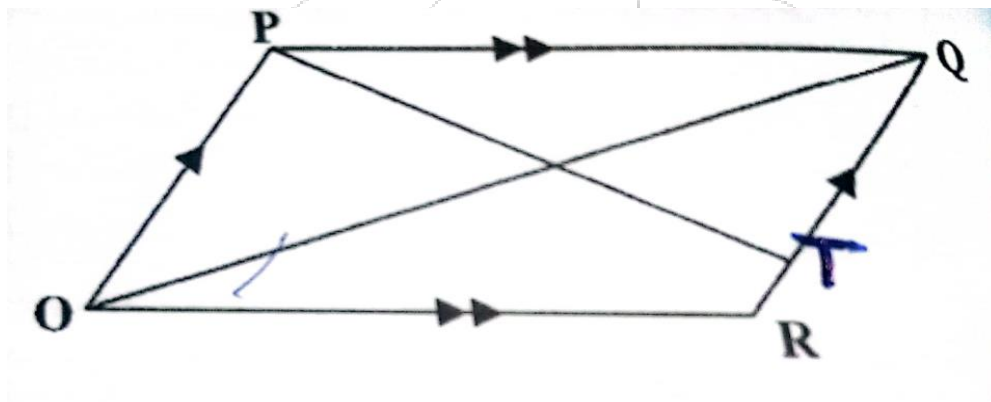
- b) Otieno bought 3 exercise books and 5 pens for a total of Ksh 165. If Otieno had bought 2 exercise books and 4 pens, he would have spent Ksh 45 less. Taking letter e to represent the price of an exercise book and letter p to represent the price of a pen
- i. Form two equations to represent the above information. (2mks)
 ii. Use matrix method to find the price of an exercise book and that of a pen. (3mks)

iii. The principal of Njabini boys decided to reward 36 students **each** with 2 exercise books and one pen. Calculate the total amount of money he paid. (2mks)

19. Three quantities X , Y and Z are such that X varies directly as the square root of Y and inversely as the fourth root of Z . When $X=64$, $Y=16$ and $Z=625$.

- i. Determine the equation connecting X , Y and Z . (4mks)
 ii. Find the value of Z when $Y=36$ and $X=160$ (2mks)
 iii. Find the percentage change in X when Y is increased by 44% and Z decreased by 19% correct to one decimal place. (4mks)

20. The figure below shows a parallelogram $OPQR$ with O as the origin, $OP = p$ and $OR = r$. Point T divides RQ in the ratio 1:4. PT meets OQ at S .



- a) Express in terms of p and r the vectors
- i. OQ (1mk)
 ii. OT (1mk)
- b) Vector OS can be expressed in two ways; i) $OS = mOQ$ ii) $OS = OT + nTP$, where m and n are constants. Express OS in terms of
- i. m , p and r (1mk)
 ii. n , p and r (1mk)

Hence find the

iii. value of n and m (5mks)

iv. ratio OS:SQ (1mk)

21. A quadrilateral ABCD has vertices at A(1,1), B(4,2), C(1,3), D(2,2).

a) Draw ABCD on the grid provided (1mk)

b) Give that $X = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$, $Y = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$, $V = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$. Find the coordinates of $A^1B^1C^1D^1$, $A^{11}B^{11}C^{11}D^{11}$ and $A^{111}B^{111}C^{111}D^{111}$ the images of ABCD under combined transformation VXY .

Show all your working of coordinates below;

i. Coordinates of $A^1B^1C^1D^1$ and draw it on the grid. (2mks)

ii. Coordinates of $A^{11}B^{11}C^{11}D^{11}$ and draw it on the grid. (2mks)

iii. Coordinates of $A^{111}B^{111}C^{111}D^{111}$ and draw it on the grid. (2mks)

c) Showing your working find a single matrix that will map ABCD onto $A^{111}B^{111}C^{111}D^{111}$. (3mks)

22.a) Complete the table below for $y = x^3 + 4x^2 - 5x - 5$ (2mks)

X	-5	-4	-3	-2	-1	0	1	2
$y = x^3 + 4x^2 - 5x - 5$			19			-5		

b) On the grid provided, draw the graph of $y = x^3 + 4x^2 - 5x - 5$ for $-5 \leq x \leq 2$ (3mks)

c) i) Use the graph to solve the equation $x^3 + 4x^2 - 5x - 5 = 0$ (2mks)

ii) By drawing a suitable straight line graph, solve the equation

$$x^3 + 4x^2 - x - 4 = 0 \quad (3mks)$$

23. A polytechnic planned to buy x lockers for a total cost of Ksh 16,200. The supplier agreed to offer a discount of Ksh 60 per locker. The polytechnic was then able to get three extra lockers for the same amount of money.

a) Write an expression in terms of x , for the:

i) Original price of each locker; (1mk)

ii) Price of each locker after the discount. (1mk)

- b) Form an equation in x and hence determine the number of lockers the polytechnic bought. (5mks)
- c) Calculate the discount offered to the polytechnic as a percentage (3mks)

- 24.** i) Using ruler and compasses only construct triangle ABC such that $AB=4$ cm, $BC= 5$ cm and $\angle ABC=120^\circ$. (3mks)
- ii) Measure AC (1mk)
- iii) On the same diagram draw a locus of points equidistant from point A and point C and label the locus as L_1 . (1mk)
- iv) Draw on the same diagram a locus of points L_2 equidistant from point C and point B and label the locus as L_2 (1mk)
- v) label the point where L_1 and L_2 meet as O. Using O as a centre draw a locus of points L_3 touching points A, B and C. Measure the length from point O to L_3 . (2mks)
- vi) Draw the locus of points L_4 equidistant from line AC and Line AB. Extend L_4 to meet line BC and label where they meet point D. Measure the length AD. (2mks)

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 3

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

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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

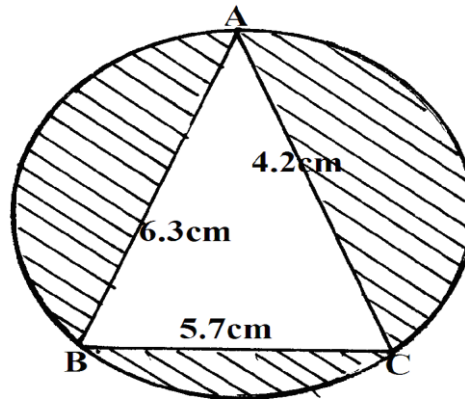
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SECTION I (50 MARKS)

Answer all questions in this section

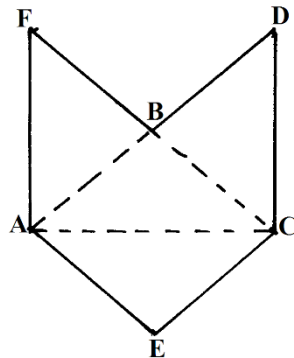
1. Without using tables or calculator, evaluate the following. (3mks)

$$\frac{-8 + (-13) \times 3 - (-5)}{-1 + (-6) \div 2 \times 2}$$
2. The straight line through the points D (6, 3) and E (3, -2) meets the y – axis at point F. Find the co-ordinates of F. (3 mks)
3. The circle below whose area is 18.05cm^2 circumscribes a triangle ABC where $AB = 6.3\text{cm}$, $BC = 5.7\text{cm}$ and $AC = 4.2\text{cm}$. Find the area of the shaded part to 2 dp. (3 mks)



4. A number n is such that when it is divided by 27, 30, or 45, the remainder is always 3. Find the smallest value of n . (3 mks)
5. The actual area of an estate is 3510 hectares. The estate is represented by a rectangle measuring 2.6cm by 1.5cm on the map whose scale is 1: n . Find the value of n . (give your answer in standard form) (3 mks)
6. Find the obtuse angle the line $y - 2x = 7$ makes with the x – axis (2 mks)
7. Given the column vector $\underset{\sim}{p} = \begin{pmatrix} -5 \\ 3 \end{pmatrix}$, $\underset{\sim}{q} = \begin{pmatrix} 4 \\ -8 \end{pmatrix}$ and $\underset{\sim}{r} = \begin{pmatrix} 6 \\ -9 \end{pmatrix}$ and $\underset{\sim}{t} = 2\underset{\sim}{p} - \frac{1}{2}\underset{\sim}{q} + \frac{1}{3}\underset{\sim}{r}$
 - (i) Express $\underset{\sim}{t}$ as a column vector (2mks)
 - (ii) Calculate the magnitude of vector $\underset{\sim}{t}$ in (i) above correct to two decimal places. (2mks)
8. Muthoni went to a shop and bought 50 packets of milk and 25 packets of salt all for Kshs.200.00. She sold the milk at a profit of 28% and the salt at a profit of 24% thereby making a net profit of Kshs.53.50. Find the cost price of a packet of milk and a packet of salt. (3 mks)
9. The angles of elevation from two points A and B to the top of a storey building are 48° and 57° respectively. If $AB = 50\text{m}$ and the point A and B are opposite each other; Calculate;
 - a) The distance of point A to the building (3 mks)
 - b) The height of the building (1 mks)
10. Find x if $3^{2x+3} + 1 = 28$ (2 mks)

11. Simplify as simple as possible $\frac{(4x+2y)^2 - (2y-4x)^2}{(2x+y)^2 - (y-2x)^2}$ (3 mks)
12. The cost of a camera outside Kenya is US\$1000. James intends to buy one camera through an agent who deals in Japanese Yen. The agent charges him a commission of 5% on the price of the camera and further 1260 Yen as importation tax. How much in Ksh. Will he need to send to the agent to obtain the camera, given that:- (3 mks)
- 1 US\$= 105.00 Yen. 1 US\$= Kshs.63.00
13. State all the integral values of x which satisfy the inequality $\frac{3x+2}{4} \leq \frac{2x+3}{5} \leq \frac{4x+15}{6}$ (3mks)
- 14 Without using a protractor, construct a triangle ABC such that angle ABC = 135° , AB = 4.6cm and BC =6.1cm. Measure AC and angle ACB (4 mks)
15. Without using mathematical tables or calculators, find the volume of a container whose base is a regular hexagon of side $\sqrt{3}$ cm and height $2\sqrt{3}$ cm (3 mks)
16. Below is a net of a model of a three dimensional figure. The lengths AB = BC = AC = 6.0cm and lengths AF = FB = BD = CD = CE = AE = 8.0cm.



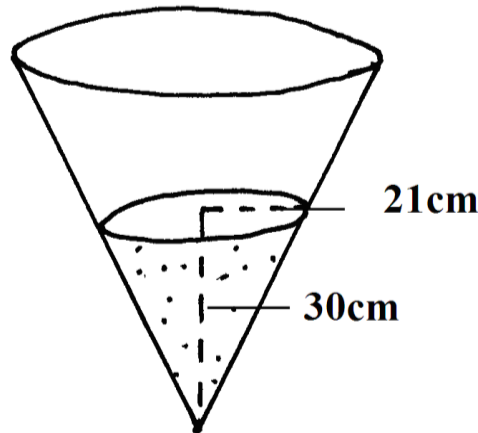
- a) Draw the solid when the net is folded by taking ABC as the base and the height 5cm. (3 mks)
- b) State the name of the figure drawn ;..... (1 mk)

SECTION II (50 Marks)

Answer only five questions in this section in the spaces provided.

17. The distance between towns A and B is 360km. A minibus left A at 8.15am and traveled towards B at an average speed of 90km/hr. A matatu left B two and a third hours later on the same day and traveled towards A at an average speed of 110km/hr.
- a) i) At what time did the two vehicles meet? (4mks)
- ii) How far from A did the vehicles meet? (2mks)
- b) A motorist started from his home which is between A and B at 10.30am on the same day and travelled at an average speed of 100km/hr. He arrived at B at the same time as the minibus. Calculate the distance from A to his house. (4 mks)

18. Consider the vessel below



- a) Calculate the volume of water in the vessel. (Take $\pi = 3.142$) (2mks)
- b) When a metallic hemisphere is completely submerged in the water, the level of the water rose by 6cm. Calculate:
 - i) the radius of the new water surface. (2mks)
 - ii) the volume of the metallic hemisphere (to 2 d.p.) (3mks)
 - iii) the diameter of the hemisphere(to 1 d.p) (3 mks)

19.The American government hired two planes to airlift football fans to Qatar for the World cup tournament. Each plane took $10\frac{1}{2}$ hours to reach the destination.

Boeing 747 has carrying capacity of 300 people and consumes fuel at 120 litres per minute. It makes 5 trips at full capacity. Boeing 740 has carrying capacity of 140 people and consumes fuel at 200 liters per minute. It makes 8 trips at full capacity. If the government sponsored the fans one way at a cost of 800 dollars per fan, and the fans pays for the return ticket. Calculate:

- (a) The total number of fans airlifted to Qatar. (1mk)
- (b) The total cost of fuel used if one litre costs 0.3 dollars. (5mks)
- (c) The total collection in dollars made by each plane. (2mks)
- (d) The net profit made by each plane. (2mks)

20.The following data shows the length of trees grown in Mau Forest measured to the nearest cm by a research team. Use the given data to answer the given questions.

230	240	250	253	260	253	274	238	263	260	231	284	257
260	275	271	257	267	255	265	241	256	256	257	260	262
234	259	263	244	254	248	281	240	247	236	256	282	242
246	277	238	250	279	252	269	284	271	249	273		

- (a) Arrange the data in a frequency distribution table with a class interval of five and starting with the class of 230 – 234,... (6mks)
- (b) Using the frequency distribution in (a) above and 257 as an assumed mean, find:-
 - (i) Mean of the data. (2mks)
 - (ii) The standard deviation of the data. (2mks)

21. Using a ruler and a pair of compasses only, draw a triangle ABC such that $AB = 5\text{cm}$, $BC = 8\text{cm}$ and $\angle ABC = 60^\circ$. Measure AC and $\angle ACB$. (5mks)
- a) Locate point O in triangle ABC such that $OA = OB = OC$. Using O as the center and radius OA draw a circle (3mks)
- b) Construct a perpendicular from A to BC to meet BC at D. Measure AD, hence find the area of triangle ABC. (2mks)
22. Three brick layers have to lay a total of 5400 bricks. The average number of bricks they can lay in an hour are in the ratio 5:6:9. If the slowest man lays 60 bricks in an hour. Calculate;
- (a) How many bricks each of the other two men lay in an hour. (4mks)
- (b) How many of the bricks each man will lay to complete the work if they are all employed for the same number of hours. (6mks)
23. Four towns P, Q, R and S are such that town Q is 120km due east of town P. Town R is 160km due North of town Q. Town S is on a bearing of 330° from P and on a bearing 300° from R. use a ruler and a pair of compasses only for all your constructions.
- a. Using a scale of 1cm to represent 50km, construct a scale drawing showing the positions P, Q, R and S. (6mks)
- . Use the scale to determine
- i. The distance from town S to town P. (1mk)
- ii. The distance from town S to town R. (1mk)
- iii. The bearing of town S from town Q. (2mks)
24. A carpenter constructed a closed wooden box with internal measurements 1.5m long 0.8m wide and 0.4m high. The wood used in constructing the box was 1.0cm thick and had a density of 0.6g/cm^3 .
- (a) Determine the:
- (i) Volume in cm^3 of the wood used in constructing the box. (4 mks)
- (ii) Mass of the box in kg correct to 1 d.p (2 mks)
- (b) Identical cylindrical tins of diameter 10cm height 20cm with a mass of 120g each were packed in the box. Calculate the:
- (i) Maximum number of tins that were packed (2 mks)
- (ii) Total mass of the box with the tins in kg. (to 1d.p) (2 mks)

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KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 3

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

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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

--

SECTION I (50 MARKS)**(Answer all questions in this section.)**

1. Simplify without using mathematical tables or calculator. (4mks)

$$\frac{2(\log_{10} 2.5 + \log_{10} 40)}{3 \log_{10} 0.05 + 2 \log_{10} 2 - \log_{10} 0.5}$$

2. Simplify $\frac{2}{2+\sqrt{5}} - \frac{2\sqrt{5}}{2-\sqrt{5}}$ and express your answer in the form $a+b\sqrt{c}$ where a, b and c are constants. (3mks)

3. A wedding committee did a budget for a wedding ceremony as follows:

Food: Ksh. 58,205

Chairs: Ksh. 11,950

Entertainment: 8,453

The sum of the budget was done by first rounding each figure to 3 significant figures.

- a) Determine the sum of the **budget** (2mks)

- b) Determine the percentage error in this sum of the budget (2mks)

4. Solve the equation $4\sin^2 x + 4\cos x = 5$ for $0^\circ \leq x \leq 360^\circ$ (3mks)

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

- b). Use the first three terms of the expansion in (a) above to find the value of $(0.998)^4$
Correct to the nearest hundredth (3mks)

6. Make w the subject of the **formula** (3mks)

$$P = \sqrt{\frac{vw^2}{v^2 - w^2}}$$

7. Given that $y = 3 \sin (\frac{1}{2} x + 60)^\circ$ find, amplitude, period and the phase angle of the function. (3mks)

8. A ship sails due North from latitude 20° S for a distance of 1440nm. Find the latitude of the point it **reaches** (2mks)

9. The equation of a circle is given by $3x^2 + 3y^2 + 3x + 42y + 30 = 0$. Determine the radius and the coordinates of the centre circle. (3mks)

- 10.a) i) Draw a straight line MN such that $MN = 7\text{cm}$ (1mk)

- ii) Construct the locus P such that $\angle MPN = 90^\circ$ (1mk)

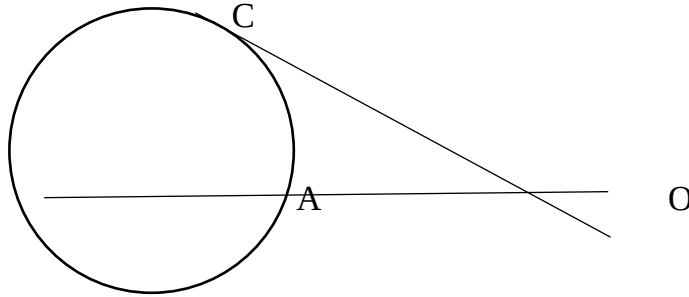
- b) On the locus of P in (a) above, mark point T such that T is equidistant from M and N. (2mks)

11. The table below shows tax table for monthly income

Monthly taxable income in Ksh.	Tax rate % in each shilling
0- 9680	10
9681- 18800	15
18801-27920	20

In a certain month, Kamau's tax was sh. 3336. Determine his income during that month. (3mks)

12. In the figure below OC is the tangent to the circle. If OE=8cm and OC=6cm, find EA.
(2mks)



13. Evaluate $\int_1^4 (3x^2 + 1)dx$ (3mks)

14. Liquid P contains 30% of water while liquid Q contains 48% of water. In what ratio should P and Q be mixed so that the mixture contains 42% of water? (3mks)

15. The probability that it is rainy in the morning is 0.6. The probability that John carries an umbrella while going to work is 0.4. Find the probability that
i) It is not rainy and John does not carry an umbrella. (2mks)

- ii) It is rainy and John carries an umbrella (1mk)

16. Solve the simultaneous equations
 $x-2y=1$, $x^2+y^2=29$ (3mks)

SECTION II (50 MARKS)

(Answer five questions in this section)

17. The first three consecutive terms of a geometric progression are 3^{2x+1} , 9^x and 81 respectively
a) Calculate the value of x (3mks)
b) Find the common ratio of the series (2mks)
c) Calculate the sum of the first ten terms of this series (2mks)
d) Given that the fifth and the seventh terms of this Geometrical Progression form the first two consecutive terms of an arithmetic sequence calculate the sum of the first 20 terms of the arithmetic sequence. (3mks)

18. In an experiment, the length of 100 rats were measured to the nearest 0.1cm and the frequency tabulated as follows:

Length in (cm)	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Frequency	1	4	x	20	25	26	7	1	1

- a) Find the value of x (2mks)
b) Calculate the mean length using assumed mean of 42 (4mks)
c) Calculate the standard deviation (4mks)

19. Complete the table below for the function

$$y = x^3 + 6x^2 + 8x$$

(2mks)

X	-5	-4	-3	-2	-1	0	1
x^3	-125	-64		-8	-1	0	1
$6x^2$		96	54		6	0	6
$8x$	-40		-24	-16		0	8
Y			3	0	-3	0	15

a) Draw the graph of the function $y = x^3 + 6x^2 + 8x$ for $-5 \leq x \leq 1$

(3mks)

(Use a scale of 2 big squares to represent 1 unit on the x-axis and 1 big square to represent 2 units on the y-axis)

b) Use your graph to estimate the roots of the equations

i. $x^3 + 6x^2 + 8x = 0$

(1mk)

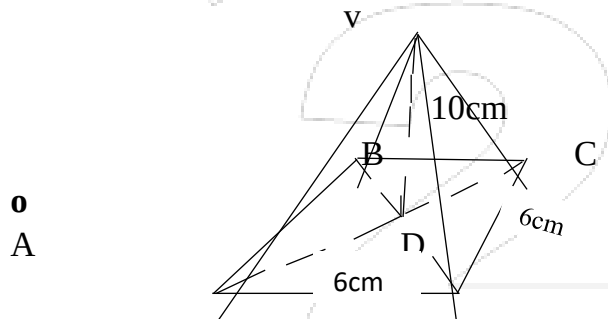
ii. $x^3 + 5x^2 + 4x = -x^2 - 3x - 1$

(2mks)

c) Find the values of x which will satisfy the inequality $x^3 + 6x^2 + 8x > 1$

(2mks)

20. The figure below is a square based pyramid ABCDV with AD=DC=6cm. VO=10cm



a) State the projection of VA on the base ABCD

(1mk)

b) Find:

i. The length of VA

(3mks)

ii. The angle between the planes VA and ABCD

(2mks)

iii. The angle between the planes VDC and ABCD

(2mks)

iv. The volume of the pyramid

(2mks)

21. The points A (0,0), B (-3,1), C (1,3) and (4,2) are the vertices of a parallelogram ABCD.

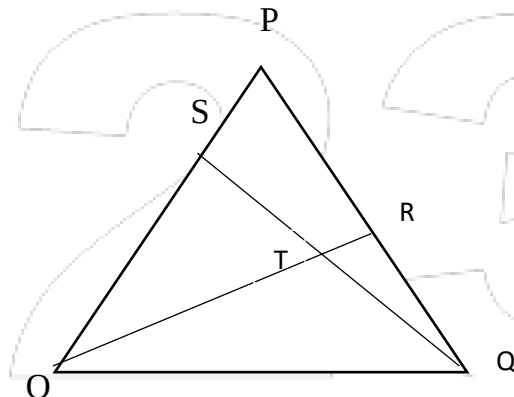
a) $A'B'C'D'$ is the image of ABCD under the matrix of transformation $\begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}$

Draw ABCD and $A'B'C'D'$ on the grid. Write down the coordinates of $A'B'C'D'$

(3mks)

- b) The points $A''(0,0)$ $B''(-6,2)$ $C''(2,6)$ and $D''(8,4)$ are the vertices of $A''B''C''D''$ the image of ABCD under a certain transformation. Draw $A''B''C''D''$ on the same grid as ABCD. Describe this transformation fully. (3mks)
- c) A single transformation T maps $A'B'C'D'$ on to $A''B''C''D''$. Determine the matrix of T (4mks)
22. A sum of money is deposited in a bank that pays simple interest at a rate r . After 3 years the total amount of money in the account is Ksh. 358,400. The interest earned each year is Ksh. 12,800.
- a) Calculate: i) The amount of money which was deposited. (2mks)
 ii) The rate of interest r . (2mks)
- b) A computer whose marked price is Ksh. 40,000 is sold at ksh. 56,000 on hire purchase terms.
- i) James bought the computer on hire purchase terms. He paid a deposit of 25% of the hire purchase price and cleared the balance by equal monthly instalments of ksh. 2625. Calculate the number of instalments. (3mks)
- ii) Had James bought the computer on cash price he would have been allowed a discount of 12.5% on the marked price. Calculate the difference between the cash price and the hire purchase price and express it as a percentage of the cash price. (3mks)

23. In the figure below OPQ is a triangle in which $OS = \frac{3}{4}OP$ and $PR:RQ = 2:1$. Lines OR and SQ meet at T.



- a) Given that $\vec{OP} = \mathbf{p}$ and $\vec{OQ} = \mathbf{q}$. Express the following vectors in terms of $\mathbf{p}$ and $\mathbf{q}$:
- i. $\vec{PQ}$ (1mk)
- ii. $\vec{OR}$ (2mks)
- iii. $\vec{SQ}$ (2mks)
- b) Given that $\vec{ST} = m\vec{SQ}$ and $\vec{OT} = n\vec{OR}$ where m and n are consonants, determine the values of m and n (4mks)
- c) Find the ratio of $ST:TQ$ (1mk)

24. During installation of electricity bulbs in street lighting a dealer is required to supply two types of bulbs A and B. The total number of bulbs should not be more than 400. He must supply more of type A than of type B and type A should not be more than 300 and type B should not be less than 80.
- a) By letting the number of type A bulbs to be x and the number of type B bulbs to be y , write all the inequalities representing the above information. **(3mks)**
- b) On the grid provided draw all the inequalities **(4mks)**
- c) If type A bulbs cost sh.450 per piece and type B cost sh.350 per piece and that the higher the cost the higher the profit:
- i. Use your graph to determine the number in each type of bulb that he should supply to maximize the profit. **(1mk)**
- ii. Calculate the maximum cost of lighting the street **(2mks)**

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 4

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and admission number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided.
- (c) This paper consists of two sections: **Section I** and **Section II**.
- (d) Answer all questions in **section I** and **only five** questions from **section II**.
- (e) Marks may be given for correct working even if the answer is wrong.
- (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

--

SECTION I (50 MARKS)

Answer all the questions in this section

1. Without using a calculator evaluate.

(3marks)

$$\frac{2\frac{1}{3} - 1\frac{1}{5} \text{ of } 4}{\frac{1}{4} - \left(-\frac{1}{3}\right)^2}$$

2. A piece of rectangular plot measuring 27m by 16m is to be divided into smaller rectangular units leaving no remainder. Calculate the highest number of smaller units whose dimensions are each greater than 1m that can be obtained from the plot.

(3marks)

3. Given that $x=1.\dot{3}1\dot{3}$, find the **exact** value of .

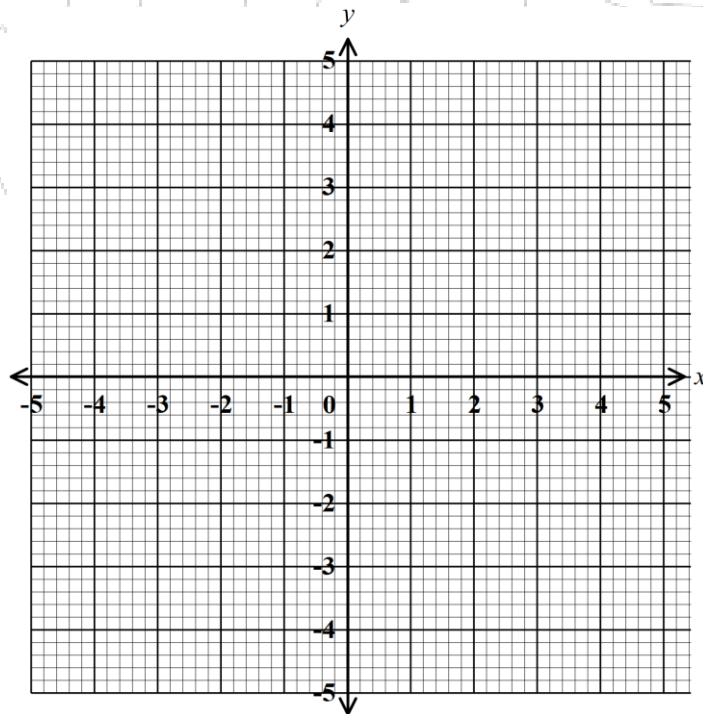
(3 marks)

4. Using the grid provided below, solve the simultaneous equation

(3 marks)

$$3x - 4y = 10$$

$$5x + 7y = 3$$



5. Write the following ratios in ascending order 2:3, 15:16, 7:6, 13:15(3 marks)

6. Under an enlargement, the image of the points A(3,1) and B(1,2) are A'(3,7) and B'(7,5).

Find the centre and scale factor of enlargement.

(4 marks)

7. A Kenyan businessman intended to buy goods worth US dollar 20,000 from South Africa.

Calculate the value of the goods to the nearest south Africa (S.A) Rand given that 1 US dollar = Ksh 101.9378 and 1 S.A Rand = Ksh 7.6326.

(3marks)

8. Solve for x in the following equation.

(3marks)

$$4^x (8^{x-1}) = \frac{\sin 45^\circ}{\cos 45^\circ}$$

9. From a viewing tower 40 metres above the ground, the angle of depression of an object on the ground is 36° and the angle of elevation of an aircraft vertically above the object is 48° .

Calculate the height of the aircraft above the object on the ground. (3marks)

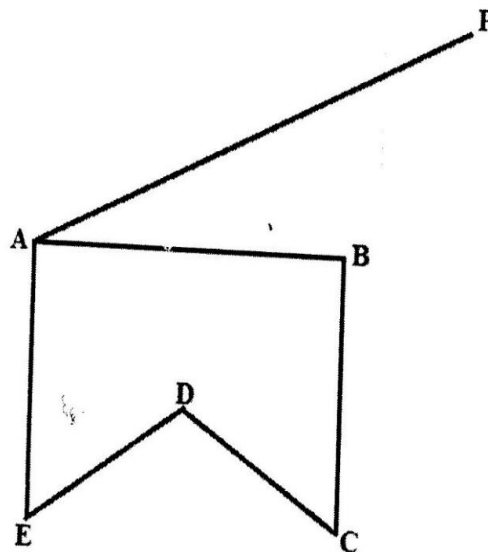
10. Solve the equation $2x^2 + 3x = 5$ by completing the square method. (3marks)

11. The mean of five numbers is 20. The mean of the first three numbers is 16. The fifth number is greater than the fourth by 8. Find the fifth number. (3marks)

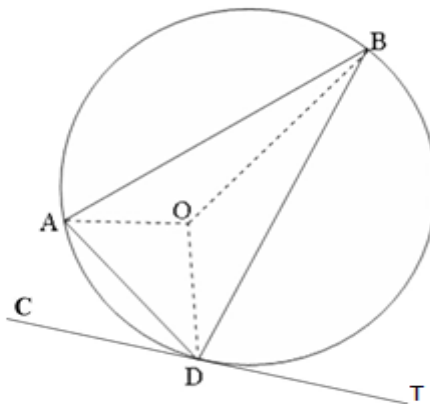
12. Simplify: (3 marks)

$$\left[\frac{x^3 - xy^2}{x^4 - y^4} \right]^{-1}$$

13. The figure below ABCDE is a cross-section of a solid ABCDEPDRST. The solid has a uniform cross-section. Given that AP is an edge of the solid, complete the sketch showing the hidden edges with a broken line. (3 marks)



14. In the circle below, O is the centre, angle DAB = 87° and acute angle AOD = 62° . CD is a tangent to the circle at D.



Calculate the size of;

- i) Angle ABD. (2marks)
- (ii) Angle ADC (1mark)
- (iii) Angle ADB (1mark)

15. Given that $\log a = 0.30$ and $\log b = 0.48$ find the value of $\log \frac{b^2}{a}$. (3marks)

16. The area of a rhombus is 60cm^2 . Given that one of its diagonal is 15cm long. Calculate the perimeter of the rhombus. (3marks)

SECTION II (50marks)

Answer 5 questions only in this section

17. Three business partners Abila, Bwire and Chirchir contributed Ksh120,000, Ksh 180,000 and Ksh 240,000 respectively to boost their business. They agreed to put 20% of the profit accrued back into the business and to use 35% of the profits for running the business. The remainder was to be shared among the business partners in the ratio of their contribution. At the end of the year, a gross profit of Ksh225,000 was realised.

- a. Calculate the amount.
 - (i) Put back into the business. (2marks)
 - (ii) Used for official operations. (1mar
- b. Calculate the amount of profit each partner got. (4marks)
- c. If the amount put back into the business was added to individual's shares proportionately of their initial contributions, find the amount of Chirchir's new shares. (3marks)

18. One day Mr. Makori bought some oranges worth Ksh 45, on another day of the same week his wife Mrs.Makori spent the same amount of Money but bought the oranges at a discount of 75 cents per orange

- a) If Mr.Makori bought an orange at Kshs x, write down and simplify an expression for the total number of oranges bought by the two in the week. (3marks)
- b) If Mrs.Makori bought 2 oranges more than her husband, find how much each spent on an orange. (5 marks)
- c) Find the number of oranges bought by the two. (2 marks)

19. Two lines $L_1: 2y - 3x - 6 = 0$ and $L_2 = 3y + x - 20 = 0$ intersect at a point A.

- a) Find the coordinates of A (3 marks)
- b) A third line L_4 is perpendicular to L_2 at point A. Find the equation of L_3 in the form $y = mx + c$, where m and c are constants. (3 marks)
- c) Another line L_4 is parallel to L_1 and passes through $(-2, 3)$. Find the x and y intercepts of L_4 (4 marks)

20. The masses to the nearest kilogram of some student were recorded in table below

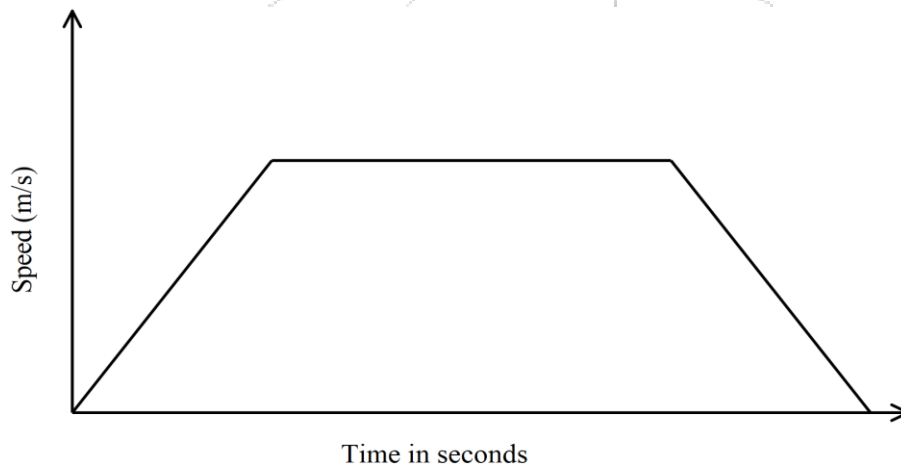
Mass (kg)	41-50	51-55	56-65	66-70	71-85
Frequency	8	12	16	10	6
Height of rectangle					0.2

- Complete the table above to 1 decimal (2 marks)
- On the grid provided below, draw a histogram to represent the above information (3 marks)
- Use the histogram to
 - State the class in which the median mark lies. (1 mark)
 - Estimate the median mark (2 marks)
 - The percentage number of students with masses of at least 74kg. (2marks)

21. Use a ruler and compass only for all the constructions in this question.

- Construct a triangle XYZ in which $XY = 6\text{cm}$, $YZ = 5\text{cm}$ and angle $XYZ = 120^\circ$. (2marks)
- Measure XZ and angle YXZ. (2 marks)
- Construct the perpendicular bisector of XZ and let it meet XZ at M. (1 mark)
- Locate a point W on the opposite of XZ as Y and that $XW = ZW$ and $YW = 9\text{cm}$ and hence complete triangle XZW. (2 marks)
- Measure WM and hence calculate the area of triangle XZW. (3 marks)

22. The diagram below shows the speed time graph for a bus travelling between two stations, the bus starts from rest and accelerates uniformly for 75 seconds. It then travels at constant speed for 150 seconds and finally decelerates uniformly for 100 seconds.



- Given that the distance between the two stations is 5225 m. Calculate
 - maximum speed in km/h attained by the bus. (3 marks)
 - the acceleration of the bus (2 marks)

(b) A van left Nairobi at 8.00 a.m and travelled towards Mombasa at an average speed of 80 km/h. At 8.30 am a car left Nairobi and travelled along the same road at an average speed of 120km/h.

(i) Calculate the distance covered by the car to catch up with the van. **(4 marks)**

(ii) Find the time of the day when the car caught up with van. **(1 mark)**

23. While designing the water circulation system, planners of an estate used assumption that each housing unit in the estate will require at least 0.32m^3 of water per day. To satisfy this need, they are to use a water pipe of radius 8cm to distribute the water. The water will be flowing in the pipe for only 14 hours a day at the rate of 24cm/s.

a) Determine the amount of water to the nearest litres, supplied in one hour. **(3marks)**

b) What is the maximum number of housing units that can be supported by the water circulation system? (Assume that a housing unit requires at most 0.32m^3 of water per day). **(2marks)**

c) Each housing unit will pay a flat rate of sh. 280 per month for the supply of water. If the number of housing units in the estate is to be maximum and all end up being occupied, calculate the amount of money that will be collected in a month. **(2 marks)**

d) The maximum number of housing units were constructed and all got occupied. The estate ended up using on average 0.35m^3 of water per housing unit per day. How much longer was the water pumped per day to satisfy the estate's water demand? **(3marks)**

24. The equation of the curve is $y = x^3 - 2x^2 - 1$

(a) Determine

(i) the stationary points **(4marks)**

(ii) the nature of the stationary points in (a) (i) **above** **(2 marks)**

(b) Determine

(i) the equation of the tangent to the curve at $x = 1$ **(2marks)**

of the normal to the curve at $x = 1$ **(2marks)**

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 4

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and admission number in the spaces provided above.
 (b) Sign and write the date of examination in the spaces provided.
 (c) This paper consists of two sections: **Section I** and **Section II**.
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 (e) Marks may be given for correct working even if the answer is wrong.
 (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

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SECTION I (50 MARKS)

ANSWER ALL QUESTIONS IN THIS SECTION

1. Solve for x in the equation

$$2\sin^2 x - 1 = \cos^2 x + \sin x \text{ for } 0 \leq x \leq 360$$

(3 Marks)

2. (a) Expand $\left(1 + \frac{3}{x}\right)^5$ upto the fifth term

(2 Marks)

(b) Hence use your expansion to evaluate the value of $(2.5)^5$ to 3 d.p.

2 Marks)

3. Make p the subject of the formula

(3 Marks)

$$E + m = m + \sqrt{\frac{p - 3u}{y - 3mp}}$$

4. A object A of area 10cm^2 is mapped onto its image B of area 60cm^2 by a transformation whose matrix is given by

$$P = \begin{pmatrix} x & 4 \\ 3 & x+3 \end{pmatrix}. \text{ Find the possible value of}$$

(3 Marks)

5. A variable Z varies directly as the square of X and inversely as the square root of Y. Find the percentage change in Z if X increased by 20% and Y decreased by 19%

(3 Marks)

6. A circle whose equation is $(x - 1)^2 + (y - k)^2 = 10$ passes through point (2,5). Find the coordinates of the two possible centres of the circle.

(3marks)

7. Juma deposited Sh. 45 000 in a bank which paid interest at 12% p.a compounded monthly. Calculate the amount of interest after 3 years

(3 Marks)

8. (a) Find the inverse of the matrix $\begin{pmatrix} 4 & 3 \\ 3 & 5 \end{pmatrix}$

(1 Mark)

(b) Hence solve the simultaneous equation below using matrix method

(3 Marks)

$$4x + 3y = 6$$

$$5y + 3x - 5 = 0$$

9. Given that $P=4+\sqrt{2}$ and $Q=2+\sqrt{2}$ and that $\frac{P}{Q}=a+b\sqrt{c}$, where a, b and c are constants, find the values of a, b and c.

(3 marks)

10. Find the value of x that satisfies the equation:

$$\log_3(x + 24) - 2 = \log_3(9 - 2x)$$

(3 marks)

11. Under a shear with x-axis invariant the point (3,2) is mapped onto (-2,2). Find the image of point (4,4) under the same transformation.

(3marks)

12. The data below shows the marks obtained by ten students in a test.

71, 55, 69, 45, 65, 57, 71, 82, 55, 50

Find the quartile deviations.

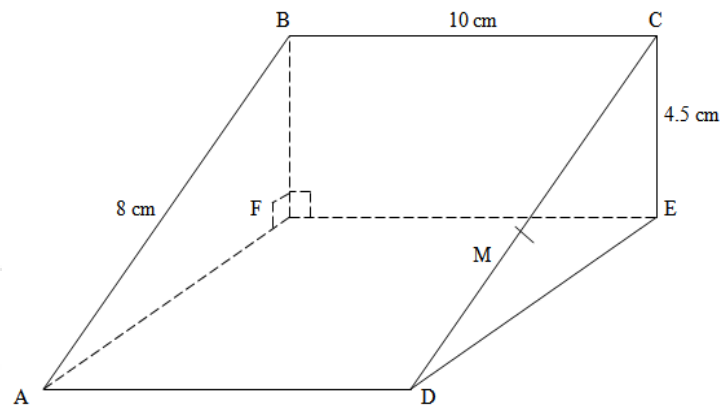
(3 marks)

13. A bag contains 4 green, 9 purple and 18 blue balls. The balls are identical except for the colour. Two balls are picked at random, one at a time without replacement, find the probability that, a blue ball and a green ball are picked.

(3 marks)

14. Find the equation of the tangent to the curve $y = x^2 + 2x + 3$ at the point where the gradient is equal to 4. (3 marks)
15. The radius of a spherical ball is 2.5cm correct to one decimal place. Calculate the percentage error in calculating the surface area of the ball (3 marks)

16.

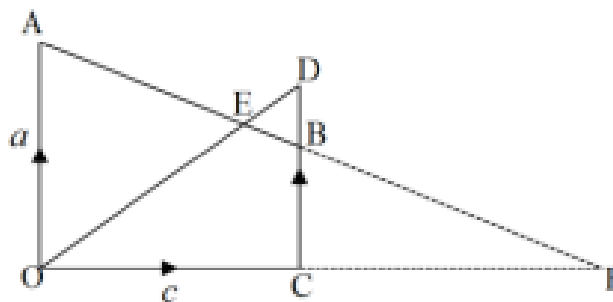


The above diagram represents a wooden prism. ABCD is a rectangle. Points E and F are directly below C and B respectively. M is the mid-point of CD. AB = 8 cm, BC = 10 cm and CE = 4.5 cm. Calculate the Angle CAE makes with the plane ADEF (3marks)

SECTION II: 50 MARKS

ANSWER ANY 5 QUESTIONS IN THIS SECTION

17. In the figure below, $\vec{OA} = \vec{a}$ and $\vec{OC} = \vec{c}$. $\vec{CB} = \frac{2}{3}\vec{OA}$ and B divides CD in the ratio 3: 1



- (a) Express the following vectors in terms of $\vec{a}$ and $\vec{c}$ only:
- (i) $\vec{AB}$ (1 mark)
- (ii) $\vec{OD}$ (2 marks)
- (b) Given that $\vec{OE} = h\vec{OD}$ and $\vec{AE} = k\vec{AB}$ where h and k are scalars express OE in two different ways hence find the scalars h and k. (5 marks)
- (c) If OC produced meets AB produced at F, find $\vec{OF}$. (3 marks)

18.(a) The 5th term of an AP is 82 and the 12th term is 103. find:

(i) the first term and common difference.

(3marks)

(ii) the sum of the 21 terms.

(2 marks)

(b) A stair case was built such that each subsequent stair has a uniform difference in height. The height of the 6th stair from the horizontal floor was 85 cm and the height of the 10th stair was 145. Calculate the height of the 1st stair and the uniform difference in height of the stairs.

(3 marks)

(c) During the construction of the staircase, each step was supported by a vertical piece of timber.

If the staircase has 11 stairs, calculate the total length of timber used.

(2 marks)

19.(a) Complete the table below given that $y = -x^2 + x + 12$ for $-4 \leq x \leq 5$

(2 marks)

X	-4	-3	-2	-1	0	1	2	3	4	5
Y	8				12	12				

(b) On the grid provided below, draw the graph of $y = -x^2 + x + 12$ for $-4 \leq x \leq 5$
Scale: 1 cm represents 1 unit on the x – axis and 1 cm represents 2 units on the y – axis.

(4 marks)

(c) Using your graph, to Solve the equation $x^2 - 3x - 10 = 0$

(2 marks)

ii. State the range of values of x for which $-x^2 + x + 12 \geq 0$

(1 mark)

(d) Estimate the coordinates of the turning point of the curve $y = -x^2 + x + 12$

(1 mark)

20. An aircraft leaves town $P(30^\circ S, 17^\circ E)$ and moves directly to town $Q(60^\circ N, 17^\circ E)$. It then moved at an average speed of 300 knots for 8 hours westwards to town R. Determine;

(a) The distance PQ in nautical miles.

(3 marks)

(b) The position of town R.

(3 marks)

(c) The local time at R if the local time at Q is 3:15 p.m

(2 marks)

(d) The total distance moved from P to R in km. Take 1nm=1.853 km

(2 marks)

21. Using a ruler and compasses only.

(i) Construct a parallelogram ABCD such that AB = 10cm, BC = 7cm and angle ABC = 105° .

(3 marks)

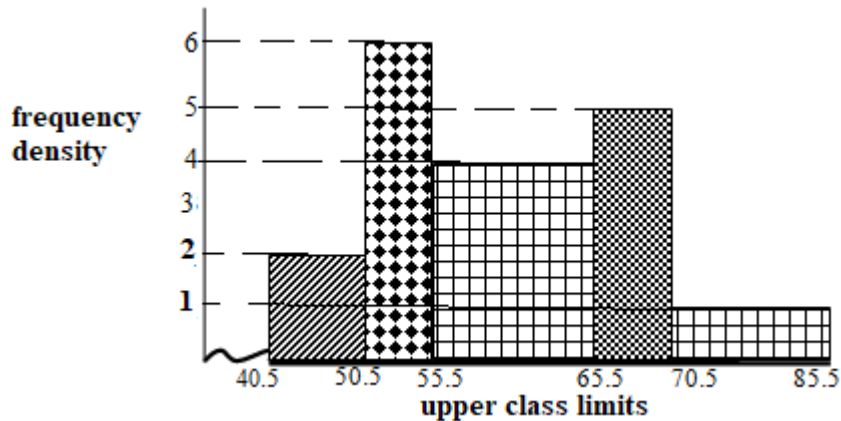
(ii) Construct the loci of P and Q within the parallelogram such that $AP \leq 4cm$ and $BQ \leq 6cm$

(3 marks)

(iii) Calculate the area within the parallelogram but outside regions bounded by the loci of P and Q.

(4 marks)

22. Below is the histogram representing marks obtained in Mathematics test



- (a) Develop a frequency distribution table for the data (3 Marks)
- (b) Using an assumed mean of 60.5 find the mean. (3 marks)
- (c) Calculate Standard deviation. (4marks)

23. (a) Use the mid ordinate rule with 5 strips to estimate the area bounded by the curve $y = x^2 - 3x - 4$, $x = -2$, $x = 3$ and x - axis (3 marks)
- (b) Calculate the exact area above (5 marks)
- (c) Find the percentage error involve in using the mid-ordinate role. (2 marks)

24. Eldoret Airport is planning to build a fire fighting plant on a space of 250m^2 . Two types of machines are to be installed, machine x which occupies a space of 5m^2 and machine Y which occupies 10m^2 . The airport can have a maximum of 40 machines at a time. At most 15 machines of type Y are used at any given time.

- a) Write down three inequalities other than $x > 0$, and $y > 0$. (3marks)
- b) On the grid below, show the region satisfying the given conditions. (4marks)
- c) The profit from a type x machine is Ksh 1000 and that of type y is Ksh 4000. Use the graph to obtain the number of machines of each type that should be installed to obtain maximum profit. Calculate the maximum profit. (3marks)

KCSE 2023 FINAL PREDICTION**EXPECTED TRIAL 5**

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.**INSTRUCTIONS TO CANDIDATES**

- (a) Write your name and admission number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided.
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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

--

SECTION I (50 MARKS)

Attempt all questions

1. An irregular 6 sided polygon has two of its interior angles equal to $2x$ each, three angles equal to x each and one side equal to 20°
Calculate the value of x (3marks)
2. The diagonals of a parallelogram are 20cm and 28.8cm. The acute angle between the diagonals is 62° . Calculate the area of the parallelogram. (3marks)
3. A mobile phone seller gets a commission of shs 250 on every mobile phone that he sells. In a given month he got 33,000 shillings.
 - a. How many phones did he sell that month (1mark)
 - b. If this commission is 2% what is the sale price of each mobile phone. (2marks)
4. Given that $\sin x = \frac{3}{4}$, without using tables or calculators, find.
 - a. $\cos x^\circ$ (2marks)
 - b. $\tan (90-x)^\circ$ (1mark)
5. Solve the simultaneous equation
 $2\log y = \log 2 + \log t$
 $2^y = 4^t$ (4marks)
6. Evaluate without using tables or a calculator
 $100^{-1.5} \times 32^{0.2}$ (3marks)
7. The angle subtended by the major arc at the center of the circle O is twice the angle subtended by the minor arc at the center. If the radius of the circle is 3.5cm. Find the length of the minor arc. (3marks)
8. Two trains T_1 and T_2 travelling in the opposite directions on a parallel tracks are just beginning to pass one another. Train T_1 is 72m long and is travelling at 108km/hr. Train T_2 is 78m long and is travelling at 72km/hr. Find the time in seconds the two trains take to completely pass one another (3marks)
9. The angle of depression of a chick from the hawk on top of a vertical tree 8m tall is 28° . On seeing the hawk, the chick moves directly towards the base of the tree to a point P such that the angle of elevation of the hawk from P is 32° . Calculate the distance moved by the chick. (4marks)
10. Find a 2×2 matrix m such that (3marks)

$$\begin{pmatrix} 1 & 3 \\ 2 & -1 \end{pmatrix} m + \begin{pmatrix} 4 & -6 \\ 2 & 0 \end{pmatrix} = \begin{pmatrix} 1 & 7 \\ 3 & -2 \end{pmatrix}$$
11. Given that $a=1.2$, $b=0.02$ and $c=0.2$ Express $ac + b$ in the form $\frac{m}{n}$ where m and n are integers (3mark)
12. line passing through the point $P(-1,3w)$ and $Q(w,3)$ is parallel to another line whose equation is $2y - 3x = 9$.
Write down the co-ordinates of P and Q (3marks)

13. A certain volume of solution has a mass of 2.2kg with density of 0.8g/cm^3 . Calculate the volume of the solution in liters (3marks)
14. The graph below shows frequency densities for the masses of same 200 students selected from a class. Use it to answer the questions that follows.



- (a) Complete the frequency distribution table below. (2 marks)

Mass in kg					
frequency					

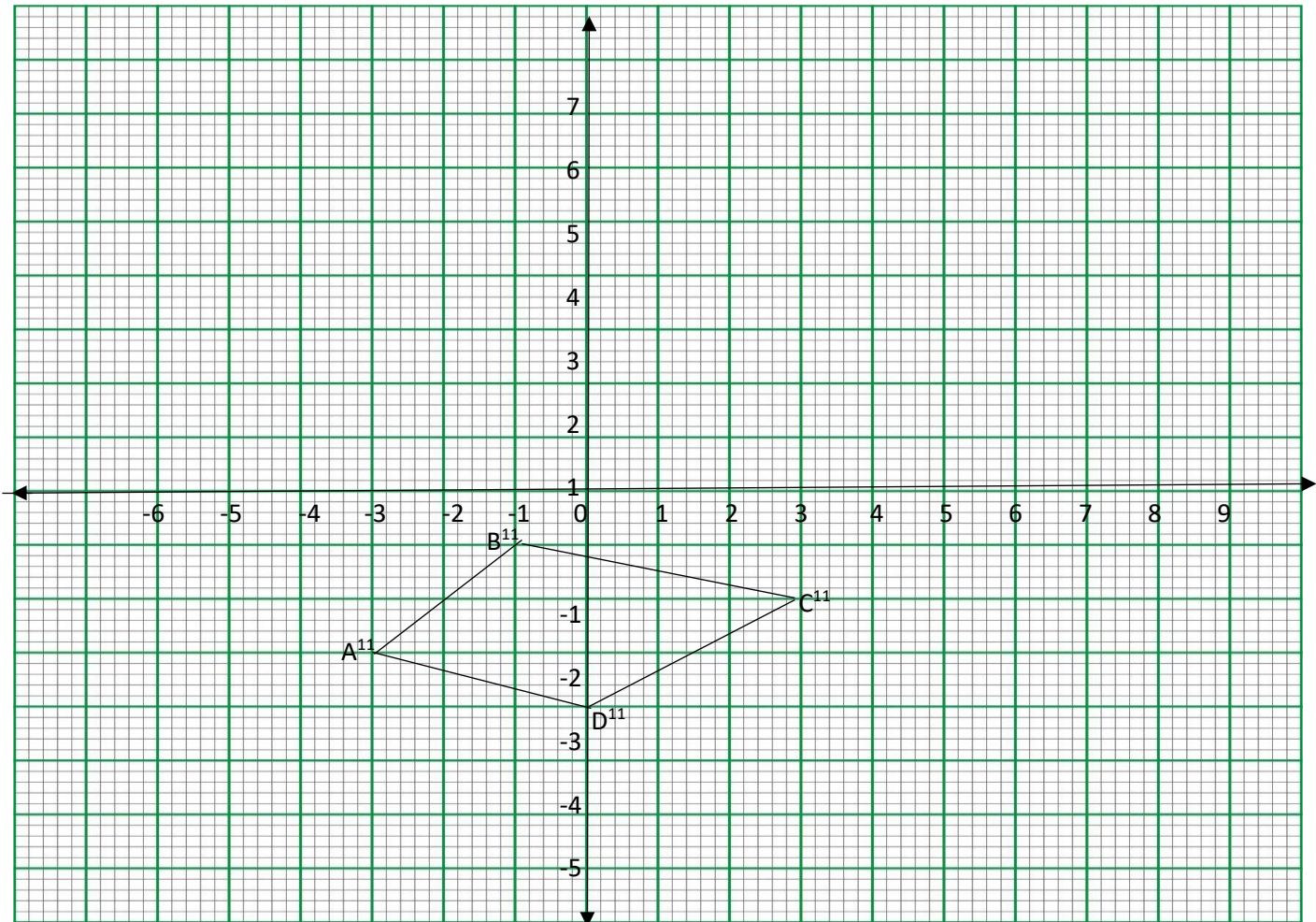
- (b) State the modal frequency (1mark)

15. Calculate the area bounded by the curve $y=x^2$, the line $y=-1$ and the lines $x=0$ and $x=3$ using trapezoidal rule with 7 ordinates (correct to 3 d p) (3marks)
16. Mutai imports rice from United States at the initial cost of 500 US dollars per tonnes. He then pays 20% of this amount as shopping costs and 10% of the same amount as custom duty. When the rice reaches Mombasa he has to pay 6% of the initial cost to transport it to Nairobi. Given that on the day of this transaction the exchange rate was 1 us dollar =kshs 76.60. calculate the total cost of importing one tonne of rice up to Nairobi in Kenya shillings. (3mks)

SECTION II (50 MARKS)

Answer only 5 questions from this section.

17. (a) On the Cartesian plane given below, draw the quadrilateral ABCD with vertices A(6,6), B(2,2) C(4,-6) and D(8,0).



(1mrk)

- Draw the image $A^1B^1C^1D^1$ of ABCD under an enlargement scale factor $\frac{1}{2}$, center origin. State the coordinates of $A^1B^1C^1D^1$ **(3mrks)**
 - Describe the transformation that maps $A^1B^1C^1D^1$ onto the given image $A^{11}B^{11}C^{11}D^{11}$ **(2mark)**
 - Rotate $A^{11}B^{11}C^{11}D^{11}$ about center $(-2,-1)$ through a positive quarter turn to get $A^{111}B^{111}C^{111}D^{111}$. State the co-ordinates of $A^{111}B^{111}C^{111}D^{111}$ **(3marks)**
 - State a pair of quadrilaterals that are oppositely congruent. **(1mark)**
18. On a certain day, Mwema bought plates worth Kshs 1200. On another day, Mrs. Mwema spent the same amount of money but bought the plates at a discount of 20% per plate.
- If Mwema bought a plate at Kshs x , write down a simplified expression for the total number of plates bought by the two people **(3marks)**

- b. If Mrs. Mwema bought 6 plates more than her husband, find how much each spent on a plate. **(5marks)**
- c. Find the total number of plates bought by the family **(2marks)**

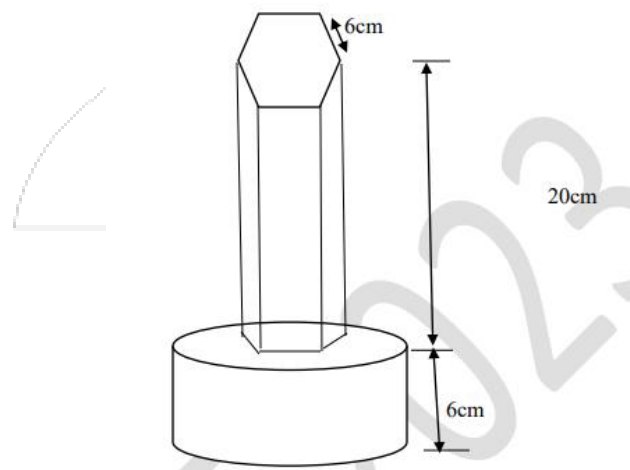
- 19.(a) Using a ruler and a pair of compasses only, construct triangle ABC such that lines $AB=5.5\text{cm}$, $BC=4.8\text{cm}$ and $AC=6.8\text{cm}$, Construct circle passing through vertices A, B and C **(6 marks)**
- a. Measure the radius of the circle **(1mark)**
- b. Measure the angle subtended at the center of the circle by chord AC **(1mark)**
- c. Hence calculate the area of the triangle AOC **(2marks)**

20. A particle P moves in a straight line such that t seconds after passing a fixed point Q, its velocity is given by the equation $2t^2 - 10t + 12$

Find

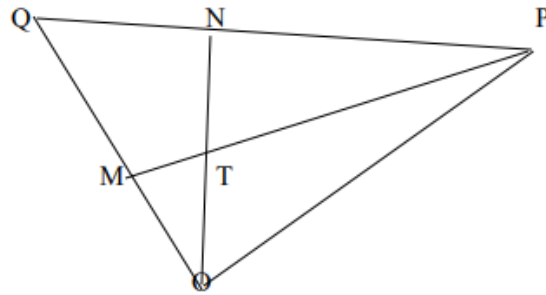
- a. The values of t when P is instantaneously at rest. **(2marks)**
- b. An expression for the distance moved by P after t seconds. **(2marks)**
- c. The total distance travelled by P in the first 3 seconds after passing point Q **(2marks)**
- d. The distance of P from Q when acceleration is zero. **(4marks)**

21. The figure below shows a model of a pillar to be constructed at the Canterbury. The model consists of a circular base of diameter 21cm and a uniform hexagon stand of sides 6cm and height 20cm.



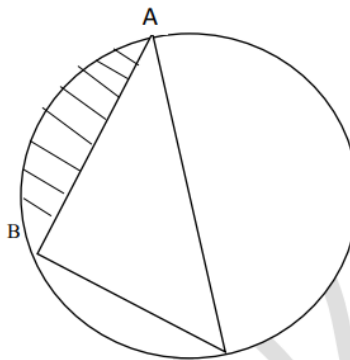
- a. Calculate the cross-sectional area of the hexagon to 2dp. **(3marks)**
- b. Calculate the total volume of the model to 2dp. **(3marks)**
- c. If the height of the red pillar is 52m and the constructor uses two bags of cement for every 500m^3 of the construction. Calculate the least number of bags of cement required **(4marks)**

22. The diagram below shows a triangle OPQ in which $QN:NP=1:2$, $OT:TN=3:2$ and M is the mid-point of OQ.



- (a) Given that $OP = \mathbf{p}$ and $OQ = \mathbf{q}$. Express the following vectors in terms of $\mathbf{p}$ and $\mathbf{q}$
- (i) PQ (1mark)
 - (ii) ON (2marks)
 - (iii) PT (2marks)
 - (iv) PM (1mark)
- (b) (i) Show that points P, T and M are collinear (3marks)
- (ii) Determine the ratio $MT : TP$ (1mark)

23. The diagram below shows a triangle ABC circumscribed in a circle with $AB=12\text{cm}$, $BC=12\text{cm}$, $BC=15\text{cm}$ and $AC=14\text{cm}$



Calculate to 4 significant figures

- (a) The angle ACB (3marks)
- (b) The radius of the circle (3marks)
- (c) The area of the shaded region (4marks)

24. If Nick gives a quarter of the money he owns to Tom, Tom will have twice as much as Nick. If Tom gives q shillings to Nick, then Nick will have thrice as much as Tom. Taking the initial amount owned by Nick and Tom to be x and y respectively;
- a. Express y and q in terms of x (7marks)
 - b. Given that Nick's initial amount was Kshs 40,000. calculate the value of q (1mark)
 - c. The initial amount owned by Tom (2marks)

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KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 5

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

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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

--

SECTION I (50 MARKS)

1. Given that $(2x+a)(x+1) = 2x^2 + bx - 3$ determine the values of a and b. **(2 mks)**
2. A bag contains 5 white balls, 3 black balls and 2 green balls. A ball is picked at random from the bag and not replaced. In three draws find the probability of obtaining white, Black and Green in that order. **(2mks)**
3. Christine deposited Kshs. 50,000 in a financial institution in which interest is compounded quarterly. If at the end of the second year she received a total amount of Kshs. 79,692.40, calculate the rate of interest per annum. **(3mks)**
4. Given that $2\sqrt{3} - \sqrt{3} = a + b\sqrt{c}$ find the values of a, b and c. **(4mks)**
 $1 + \sqrt{3} \quad 1 - \sqrt{3}$
5. Three quantities P,Q and R are such that P varies jointly with Q and the square of R. find the percentage decrease in P if Q is increased by 50% and R decreased by 20%. **(3mks)**
6. Solve for Θ **(3mks)**
 $8\cos^2 \Theta - 2 \cos \Theta = 3$
 For $0^\circ \leq \Theta \leq 180^\circ$
7. Find the percentage error in the perimeter of a regular pentagon whose side is 15.0cm. **(3mks)**
8. a) Show that the circle with equation $(x - 3)^2 + (y - 4)^2 = 25$ passes through the origin. **(1mk)**
 b) Find the coordinates of another point (not the origin) where the circle cuts x-axis. **(3mks)**
9. A survey carried out in a rural town on the number of young people who went for HIV test was shown in the table below:

% infected	36-39	40-43	44-47	48-51	52-55	56-59
No. of people	6	5	3	3	2	1

 Calculate the quartile deviation of the data. **(4mks)**
10. Given that $y = b - bx^2$ make x the subject. **(3mks)**
 $cx^2 - a$
11. Shopping centres X, Y and Z are such that Y is 12km south of X and Z is 15km from X, Z is on a bearing of 330° from Y. calculate the bearing of Z from X. **(3mks)**
12. a) Expand $(1 + \frac{1}{2}x)^7$ up to the term in x^3 . **(2mks)**
 b) Hence find the value of $(0.96)^7$ correct to 3 decimal places. **(2mks)**
13. Solve for x given that $\log_{15}(5x-10) - \log_{20}\left(\frac{x}{}\right) = \log_{40} 40 - \log_{}\left(\frac{x}{}\right)$ where x is not equal to zero. **(3mks)**
14. There are two grades of tea, grade A and Grade B. Grade A costs sh 80 per Kg while Grade B costs sh 60 per kg. in what ratio must the two be mixed in order to produce a blend costing sh 75 per kg? **(3mks)**

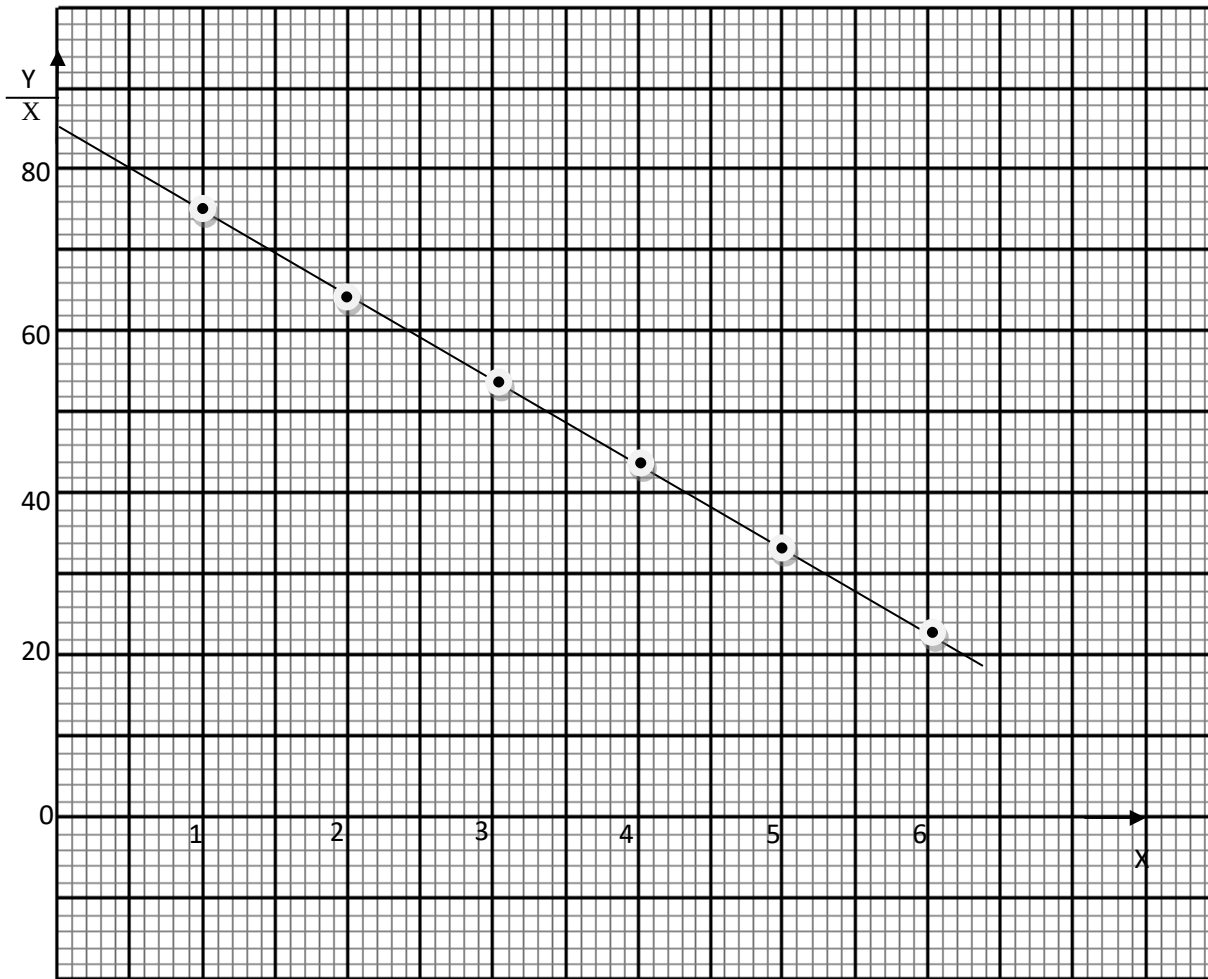
15. Use logarithm tables to evaluate.

(3mks)

$$13.4 \times 9$$

$$12 \times \log 4.82$$

16. The graph below shows the linear relation between two variable X and Y connected by the expression $Y = pX^2 + qx$.



Using the graph, estimate, to the nearest whole number, the value of:

i. P

(2mks)

ii. q

(1mk)

SECTION B

Answer Any Five Questions In This Section

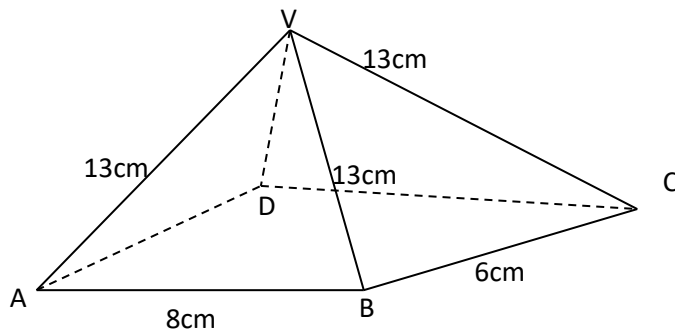
17. Two towns A(60°N , 25°W) and B(60°N , 155°E) are both on the same parallel of latitude and also on the same great circle. A pilot can fly from A to B along the parallel of latitude or along the great circle over the North pole.

a) Giving your answers to the nearest kilometer, determine which route is shorter and by how long (Take earth's radius = 6370km and $\pi = \frac{22}{7}$)

(6mks)

- b) The average speed of the aircraft is 600km/hr. calculate to the nearest minute the time taken by the pilot using either route) (4mks)

18. ABCDV is a rectangular based pyramid with AB = 8cm, BC=6cm and VA = VB=VC=VD=13cm.



- a) Draw the net of the solid. (2mks)
- b) Calculate the height of the pyramid. (2mks)
- c) A line is drawn from V through the mid points of BC and AD to V. Calculate the length of this line. (3mks)
- d) Determine the angle the plane VBC makes with plane VAD. (3mks)
19. A particle moves in a straight line and passes a point Q when $t=0$ sec but velocity $V=5\text{m/s}$, it accelerates at the rate of $a\text{ m/s}^2$ given by the formula $a = 6t + 4$ when t is time taken.
- a) Express the velocity of the particle at t seconds in terms of t . (2mks)
- b) What is the velocity at $t=3$ sec? (2mks)
- c) Calculate the distance covered between $t=1$ and $t=4$. (4mks)
- d) Find the acceleration when $t=2$ seconds. (2mks)

20. a) Complete the table below for the functions $y = \cos x$ and $y = 2 \cos (x + 30^\circ)$ for $0^\circ \leq x \leq 360^\circ$ (2mks)

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$\cos x$													
$2\cos (x+30^\circ)$													

- b) On the same axis, draw the graph of $y = \cos x$ and $y=2 \cos (x + 30^\circ)$ for $0^\circ \leq x \leq 360^\circ$. (4mks)
- c) State the amplitude of the graph $y = \cos x$. (1mk)
- ii) State the period of the graph $y = 2 \cos (x + 30^\circ)$ (1mk)
- d) Use your graph to solve $\cos x = 2 \cos (x + 30^\circ)$ (2mks)

21. Two tanks of equal volume are connected in such a way that one tank can be filled by pipe A in 1 hour 20 minutes. Pipe B can drain one tank in 3 hours 36 minutes but pipe C alone can drain both tanks in hours. Calculate:

- a) The fraction of one tank can be filled by pipe A in one hour. (2mks)

- b) The fraction of one tank that can be drained by both pipes B and C in one hour. **(4mks)**
- c) Pipe A closes automatically once both tanks are filled. Assuming that initially both tanks are empty and all pipes opened at once, calculate how long it takes before pipe A closes. **(4mks)**

22. The table below shows income tax rates.

Monthly income in the Kenya shillings	Tax rates percentage (%) in each shilling
Up to 10164	10
From 10165 to 19740	15
From 19741 to 29320	20
From 29321 to 37040	25
From 37041 and above	30

In one year, Mr. Kamau's monthly earning was as follows:

Basic salary	20,000
House allowance	12,000
Medical allowance	2,808
Transport allowance	1,764

- a) Calculate:
- Mr. kamau's taxable income. **(2mks)**
 - Tax charged on Mr. Kamau's earning **(4mks)**
- b) Mr. Kamau was entitled to the following tax reliefs:
- Monthly personal relief at the rate of 15% of the premium paid. If Mr. Kamau paid a monthly premium of Kshs. 2,500 and cooperative shares of Kshs. 5,000 per month, calculate his net salary. **(4mks)**

23. The second, third and fourteenth terms of arithmetic progression are the three consecutive terms of a geometric progression. The 10th term of the arithmetic progression is 18. Find:

- The first term and the common difference of the progression. **(4mks)**
- The sum of the first 10 terms of the Arithmetic progression. **(2mks)**
- The sixth term of the G.P. **(4mks)**

24. A certain uniform supplier is required to supply two types of shirts: one for girls labeled G and the other for boys labeled B. the total number of shirts must not be more than 400. She has to supply more of type G than of type B. however the number of type G shirts must not be more than 300 and the number of type B shirts must not be less than 80. By taking x to be the number of type G shirts and y to be the number of type B shirts.

- Write down in terms of x and y all the inequalities representing the information above. **(4mks)**
- On the grid provided below draw the inequalities and shade the unwanted regions. **(4mks)**
- Given that type G costs shs. 500 per shirt and type B costs shs. 300 per shirt use the graph above to determine the number of shirts of each type that should be made to maximize the sales. **(2mks)**

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 6

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

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SIGN.....

INDEX NO.....

ADM NO.....

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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

--

SECTION I (50 MARKS)

1. Evaluate

$$\frac{(2\frac{1}{4} - \frac{3}{4}) \times 3\frac{2}{3} \div 2\frac{1}{5}}{1\frac{4}{6} \div 1\frac{1}{4}}.$$

(3mks)

2. Use square roots, reciprocal and square tables to evaluate to 4 significant figures the expression

$$(0.06458)^{\frac{1}{2}} + \left(\frac{2}{0.4327}\right)^2$$

(4mks)

3. Three similar 21-inch television sets and five similar 17-inch television cost Ksh.129, 250. The difference between the cost of two 21-inch television sets and four 17-inch television sets is Ksh. 22,000. Calculate the price of a 21-inch television set and that of 17-inch television set.

(3mks)

4. Three numbers, 1400, 1960 and n, have a G.C.D and L.C.M of 70 and $2^2 \times 5^2 \times 7^2 \times 11$ respectively. Find the least possible value of n

(3mks)

5. Find the equation of a straight line which is equidistant from the points A (2,3) and B (6,1)

(3mks)

6. Solve for x in the equation.

$$9^{(2x-1)} \times 3^{(2x+1)} = 243$$

(3mks)

7. An open rectangular box measures externally 32cm long, 27cm wide and 15cm deep. The box is made up of metal 1cm thick. If it has a mass of 1.5kg, what is the density of the box to 4 significant figures?

(3mks)

8. Using the three quadratic identities only factorize and simplify:

(3mks)

$$\frac{(x - y)^2 - (x + y)^2}{(x^2 + y^2)^2 - (x^2 - y^2)^2}$$

9. An airplane leaves point A (60°S , 10°W) and travels due East for a distance of 960 nautical miles to point B. determine the position of B and the time difference between points A and B.

(3mks)

10. A salesman earns 3% commission for selling a chair and 4% commission for selling a table. A chair fetches K£ 75. One time, he sold ten more chairs than tables and earned seven thousand, two hundred Kenya shillings as commission. Find the number of tables and chairs sold.

(3mks)

11. A Kenyan company received US Dollars 200,000. The money was converted into Kenya shillings in a bank which buys and sells foreign currencies as follows:

Buying

Selling

(in Kenya shillings)

(in Kenya shillings)

1 US Dollar

77.24

77.44

1 Sterling Pound

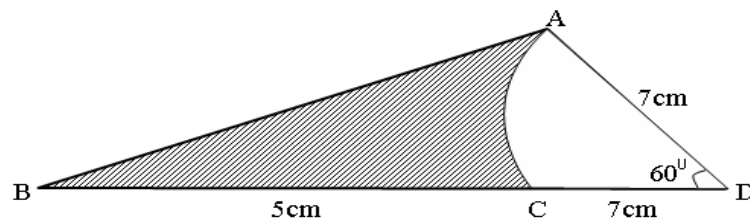
121.93

122.27

a) Calculate the amount of money, in Kenya shillings, the company received.

(1 marks)

- b) The company exchanged the Kenya shillings calculated in (a) above, into sterling pounds to buy a car from Britain. Calculate the cost of the car to the nearest sterling pound. **(2 marks)**
12. Tap A fills a tank in 6 hours, tap B fills it in 8 hours and tap C empties it in 10 hours. Starting with an empty tank and all the three taps are opened at the same time, how long will it take to fill the tank? **(3 marks)**
13. The length of a rectangle is increased by 20% while the width is decreased by 10%. Find the percentage change in area. **(3 marks)**
14. In the figure below, AC is an arc of a circle centre D. Angle ADC = 60° , AD = DC = 7cm and CB = 5cm.



Calculate

- a) The area of triangle ADB **(2 marks)**
- b) The area of the shaded region. **(2 marks)**
15. Solve $4 \leq 3x - 2 < 9 + x$, hence list the integral values that satisfies the inequality. **(3 marks)**
16. A transformation whose matrix is given by $\begin{pmatrix} 2x-1 & -3 \\ 2 & x \end{pmatrix}$ maps a triangle with area 8 cm^2 onto another triangle with area 72 cm^2 , calculate the value of x **(3 marks)**

SECTION II

17. The distance between two towns **A** and **B** is 760 km. A minibus left town **A** at 8:15a.m and traveled towards **B** at an average speed of 90km/h. A matatu left **B** at 10:35a.m and on the same day and travelled towards **A** at an average speed of 110km/h.
- (a)(i) How far from **A** did they meet? **(4mks)**
- (ii) At what time did they meet? **(2mks)**
- (b) A motorist starts from his home at 10:30 a.m on the same day and traveled at an average speed of 100km/h. He arrived at **B** at the same time as the minibus. Calculate the distance from **B** to his home. **(4mks)**
18. The income tax rates in a certain year are as shown below.

Income (k£ – p.a)	Rate (KSh. per £)
1 – 4200	2
4201 – 8000	3
8001 – 12600	5
12601 – 16800	6
16801 and above	7

Omar pays Sh. 4000 as P.A.Y.E per month. He has a monthly house allowance of KSh.10800 and is entitled to a personal relief of KSh. 1,100 per month. Determine:

- (i) his gross tax per annum in Kshs **(2 Marks)**
- (ii) his taxable income in K£ per annum **(2 marks)**
- (iii) his basic salary in Ksh. per month **(2marks)**
- (iv) his net salary per month **(2 mark)**

19. The parents of a certain mixed secondary school decided to buy a school van worth Ksh. 900,000. Each student was to contribute the same amount of money. 50 students were transferred from the school; as a result, each if the remaining students had to pay Ksh. 600 more.

- a) Find the original number of the students in the school. **(5mks)**
- b) Find the percentage change in contributions per student. **(3mks)**
- c) If the ratio of boys to girl in the school was 11: 7 find the amount money contributed by boys alone. **(2mks)**

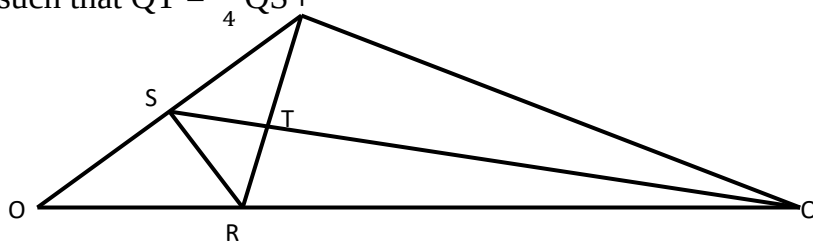
20. Using a ruler and a pair of compasses only construct triangle ABC such that angle BAC= 90° , AC= 5 cm and BC = 10 cm. **(3 marks)**

- (a) Circumscribe a circle on the triangle ABC constructed above **(3 marks)**
- (b) Measure the radius of the circle **(1 mark)**
- (c) Find the difference in the area of the circumcircle and the triangle. **(3 marks)**

21. The coordinates of a triangle ABC are A(1, 1) B(3, 1) and C (1, 3).

- (a) Plot the triangle ABC. **(1 mark)**
- (b) Triangle ABC undergoes a translation vector $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$. Obtain the image of A' B' C' under the transformation, write the coordinates of A' B' C'. **(2 marks)**
- (c) A' B' C' undergoes a reflection along the line X = 0, obtain the coordinates and plot on the graph points A'' B'' C'', under the transformation **(2 marks)**
- (d) The triangle A'' B'' C'' , undergoes an enlargement scale factor -1, centre origin. Obtain the coordinates of the image A''' B''' C'''. **(2 marks)**
- (e) The triangle A''' B''' C''' undergoes a rotation centre (1, -2) angle 120° . Obtain the coordinates of the image A^{iv} B^{iv} C^{iv}. **(2 marks)**
- (f) Which triangles are directly congruent. **(1 mark)**

22. The figure below shows triangle OPQ in which $OS = \frac{1}{3} OP$ and $OR = \frac{1}{3} OQ$. T is a point on QS such that $QT = \frac{3}{4} QS$



- (a) Given that $OP = p$ and $OQ = q$, express the following vectors in terms of p and q .
- (i) $\vec{SR}$ (1 Mark)
 - (ii) $\vec{QS}$ (2 Marks)
 - (iii) $\vec{PT}$ (2 Marks)
 - (iv) $\vec{TR}$ (2 Marks)
 - (v) show that point P, T, R are collinear. (3mks)

- 23 (a) (i) Fill the table below for the function.

$$y = 2x^2 + 5x - 12 \text{ for } -8 \leq x \leq 4$$

(2 marks)

X	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4
$2x^2$	128					18				2			32
$5x$	-40					-15				5			20
-12	-12					-12				-12			-12
Y	76					-9				-5			40

- (ii) Using the table, draw the graph of the function $y = 2x^2 + 5x - 12$. Use the scale 1cm to 1 unit on the x-axis and 1cm for 10 units for the y-axis (4 mark)
- b) Use the graph drawn above to solve the following equations.
- (i) $2x^2 + 5x - 12 = 0$ (2 marks)
 - (ii) $3 - 7x - 3x^2 = 0$ (2 marks)

24. The displacement, S meters of a moving particle after t seconds is given by $S = 2t^3 - 5t^2 + 4t + 3$

Determine:

- (a) The velocity of the particle when $t = 4$ seconds (3marks)
- (b) The value of t when the particle is momentarily at rest (3 marks)
- (c) The displacement when the particle is momentarily at rest (2 marks)
- (d) The acceleration of the particle when $t = 10$ seconds (2 marks)

KCSE 2023 FINAL PREDICTION**EXPECTED TRIAL 6**

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.**INSTRUCTIONS TO CANDIDATES**

- (a) Write your name and admission number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided.
- (c) This paper consists of two sections: **Section I** and **Section II**.
- (d) Answer all questions in **section I** and **only five** questions from **section II**.
- (e) Marks may be given for correct working even if the answer is wrong.
- (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

--

SECTION I (50 MARKS)

1. Use logarithms only to evaluate, correct to 4 decimal places. (4 marks)

$$\sqrt[3]{\frac{0.4591 \times 7.805^2}{629.3}}$$

2. Without using a calculator or mathematical tables, evaluate, leaving your answer in the form $a\sqrt{b} + c$, where a , b and c are integral values (3 marks)

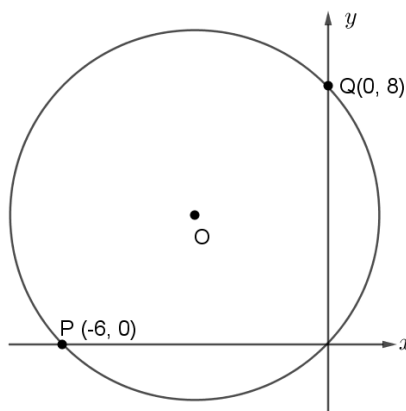
$$\frac{\tan 60^\circ}{1 - \cos 30^\circ}$$

3. Calculate the percentage error in the volume of a cone of radius 7.0 cm and height 20 cm. (3marks)

4. Make Q the subject of the formula (3 marks)

$$x = \frac{3a + 2bQ^2}{Q^2 - 2}$$

5. The figure below, O is the centre of the circle. P joined to Q passes through O



- (a) Calculate the radius and centre of the circle. (2 marks)

- (b) Express the equation of the circle in the form $(x - a)^2 + (y - b)^2 = r^2$ (2 marks)

6. Apudo wants to buy a computer on hire purchase. The cash price of the computer is Kshs. 40,000. Apudo makes a down payment of Kshs. 14, 000 followed by 16 equal monthly instalments of Kshs. 2,625. Calculate the rate of compound interest per month correct to 2 decimal places. (3 marks)

7. Without using logarithms table or calculator, solve for x in;

$$\log 5 - 2 + \log (2x + 10) = \log (x - 4)$$

(3 marks)

8. (a) Expand $(3+x)^6$ up to the terms in x^3 (1 marks)

- (b) Use the expansion in (a) above to estimate $(2.97)^6$ correct to 4 decimal places. (2 marks)

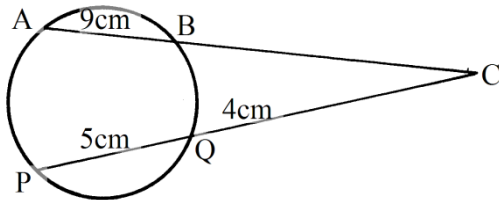
9. The value of a piece of land was Ksh. 400000 five years ago. Currently the piece of land is valued at Ksh. 587731.20. Find the annual rate of appreciation of the piece of land. (3marks)

10. Given that $\cos 2x^\circ = 0.8070$, find x to 1 decimal place when $0^\circ \leq x \leq 360^\circ$ (3marks)

11. Use completing of the square method to solve: $2x^2 - 6x + 4 = 0$ (3 marks)
12. An arc length of 18.5 cm subtends an angle of 1.2° at the centre of the circle. Find the diameter of the circle to one decimal place. (3 marks)
13. Fatima bought maize and beans from Kami. She mixed the maize and beans in the ratio 3: 2 she bought the maize at sh.90 per kg and the beans at sh.150 per kg. If she was to make a profit of 30% what would be the selling price of 1kg of the mixture. (3mks)
14. Solve for x given that the following is a singular matrix. (3mks)

$$\begin{pmatrix} 1 & 2 \\ x^2 & x + 3 \end{pmatrix}$$

15. The figure below shows a circle centre O. AB and PQ are chords intersecting externally at a point C. AB=9cm, PQ=5cm and QC =4cm, find the length BC. (3marks)



16. A body is moving along a straight line and its acceleration after t seconds is $(5 - 2t) \text{ ms}^{-2}$. Its initial velocity $V \text{ ms}^{-1}$ is 4 ms^{-1} . Find V in terms of t . (3marks)

SECTION II ATTEMPT 5 QUESTIONS ONLY

17. The table below represents marks scored in a mathematics test.

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79
No. of students	2	6	7	13	6	4	2

Using an assumed mean of 44.5, Determine

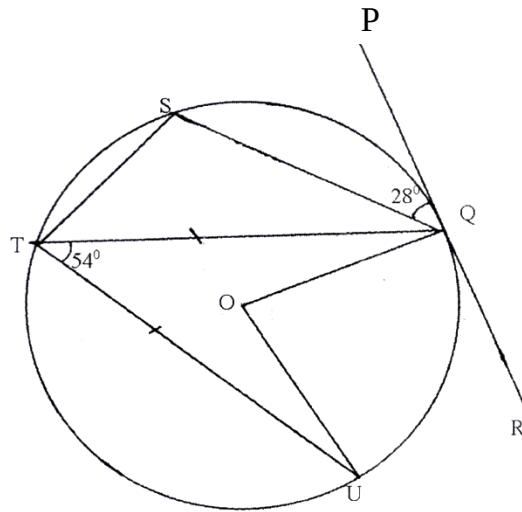
- i) Mean marks for the test (3 marks)
- ii) Standard deviation (4 marks)
- iii) Determine the pass mark if 30% of the students failed the exam. (3 marks)

18. (a) (i) Taking the radius of the earth, $R=6370\text{km}$ and $\pi = \frac{22}{7}$, calculate the shortest distance between two cities P(60°N , 29°W) and Q(60°N , 31°E) along the parallel of latitude. (3marks)

(ii) If it is 1200hrs at P, what is the local time at Q (3marks)

- (b) An aeroplane flew due south from a point A(60°N , 45°E) to a point B, the distance covered by the aeroplane was 8000km, determine the position of B. (4marks)

18. In the figure below, O is the centre of the circle. PQR is a tangent to the circle at Q. Angle PQS = 28° , angle UTQ = 54° and UT = TQ



Giving reasons, determine the size of

(a) Angle STQ

(2mks)

(b) Angle TQU

(2mks)

(c) Angle TQS

(2mks)

(d) Reflex angle UOQ

(2mks)

(e) Angle RQU

(2mks)

20. An arithmetic progression AP has the first term a and the common difference d .

(a) Write down the third, ninth and twenty fifth terms of the AP in terms of a and d .

(2mks)

(b) The AP above is increasing and the third, ninth and twenty fifth terms form the first three consecutive terms of a geometric progression (G.P).

The sum of the seventh and twice the sixth term of AP is 78. Calculate

(i) The first term and common difference of the A.P

(5mks)

(ii) The sum of the first 5 terms of the G.P

(3mks)

21. (a) complete the table for the curves $y = 3\sin(2x + 30^\circ)$ and $y = \cos 2x$, use the range $0 \leq x \leq 180^\circ$

X	0	15	30	45	60	75	90	105	120	135	150	165	180
$y = 3\sin(2x + 30^\circ)$	1.5		3		1.5		-1.5			-2.60	-1.00		1.5
$y = \cos 2x$	1			0		-0.866		-0.866	-0.5			0.866	1

(b) Using the scale Horizontal axis 1cm represent 30° , vertical axis 1cm represent 1 unit, draw the graphs of $y = 3\sin(2x + 30^\circ)$ and $y = \cos 2x$

(4 Marks)

(c) Use your graph to solve the equation $3\sin(2x + 30) = \cos 2x$ **(1 Mark)**

(d) Determine the following from your graph

(i) Amplitude of $y = 3\sin(2x + 30)$ **(1 Mark)**

(ii) Period of $y = 3\sin(2x + 30)$ **(1 Mark)**

(iii) Period of $y = \cos 2x$ **(1 Mark)**

22. The probability of Patrick passing his exam is 0.8 that of James is 0.6 while that of Lewis is 0.2.

(a) Draw a tree diagram to represent the above information **(2 marks)**

(b) Use your tree diagram to find the probability that;

i) Exactly two students pass in the exam **(2 marks)**

ii) At most two students pass the exam **(2 marks)**

iii) Only one student passes the exam **(2 marks)**

iv) At least one passes in the exam **(2 marks)**

23. A Quantity P varies partly as the square of m and partly as n . When $p = 3.8$, $m = 2$ and $n = -3$,
When $p = -0.2$, $m = 3$ and $n = 2$.

a) Find

i) The equation that connects p , m and n **(4marks)**

ii) The value of p when $m = 10$ and $n = 4$ **(1mark)**

b) Express m in terms of p and n **(2marks)**

c) If P and n are each increased by 10%, find the percentage increase in m correct to 2 decimal place. **(3marks)**

24. A trader bought 8 cows and 12 goats for a total of ksh.294, 000. If he had bought 1 more cow and 3 more goats, he would have spent ksh.337, 500.

a. Form two equations to represent the above information. **(2mks)**

b. Use matrix method to determine the cost of a cow and that of a goat. **(3mks)**

c. The trader sold the animals he had bought making a profit of 40% per cow and 45% per goat.

i. Calculate the total amount of money he received. **(3mks)**

ii. Determine his profit in Kenyan shillings. **(2mks)**

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 7

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and admission number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided.
- (c) This paper consists of two sections: **Section I** and **Section II**.
- (d) Answer all questions in **section I** and **only five** questions from **section II**.
- (e) Marks may be given for correct working even if the answer is wrong.
- (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

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SECTION I (50 MARKS)

Attempt All Questions in this section

1. Find the value of y given that (3 marks)

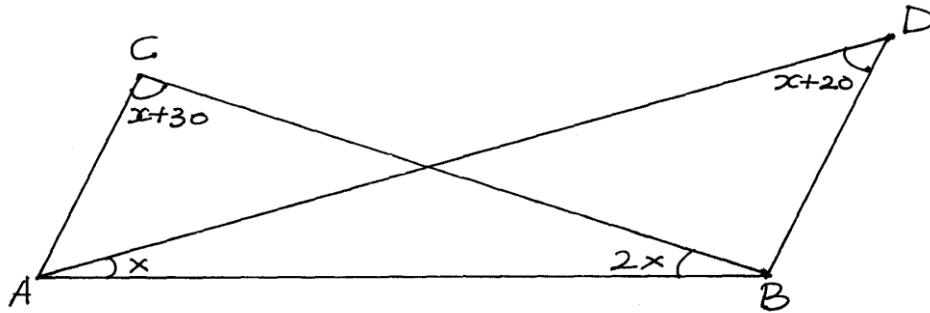
$$\frac{-2(5+3)-9 \div 3+5}{-3 \times -5y+2y \times 4} = 1$$
2. The length of a minute hand of a clock is 3.5cm. What will be the time if from 10.15am it sweeps through an area of 19.25cm²? (4marks)
3. Use reciprocal, square and square root table to evaluate to 4 significant figures, the expression (3marks)

$$\sqrt{\frac{1}{24.56} + 4.346^2}$$
4. Given that $\sin(90-x)^\circ = 0.8$, where x is an acute angle, find without using mathematical table the value of $2 \tan x + \cos(90-x)$ (3marks)
5. Find the equation of the tangent and the normal to the curve $y = 2x^3 - 3x^2 + 6$ at the point (2,10) (4marks)
6. Simplify $\frac{2y^2 + 3xy - 2x^2}{x^2 - 4y^2}$ (3marks)
7. Find greatest integral value of x which satisfies (3marks)

$$\frac{2x+3}{2} < \frac{8-3x}{5} < \frac{5x+6}{3}$$
8. One of the roots of the equation $x^2 + (k+1)x + 28 = 0$ is 4. Find the values of k and hence the second root (4marks)
9. Solve for x in the following without using a calculator or mathematical table. (3marks)

$$9^x (27^{x-1}) = \tan 30^\circ$$
10. A shear parallel to the x-axis maps point (1, 2) onto a point (5, 2). Determine the shear factors and hence state the shear matrix (invariant line is y=0) (3marks)
11. A solid is in the shape of a right pyramid on a square base on side 8cm and height 15cm. A frustum whose volume is a third of the pyramid is cut off. Determine the height of the frustum. (3 marks)
12. The interior angle of a regular polygon is 20° more than three times the exterior angle. Determine the number of sides of the polygon (2marks)
13. Three fifths of work is done on the first day. On the second day $\frac{3}{4}$ of the remainder is completed. If the third day $\frac{7}{8}$ of what remained is done, what fraction of work still remain to be done. (3marks)
14. A two-digit number is such that the sum of the digits is ten. If the digits are reversed, the new number formed is less than the original number by 18. Find the number (3marks)

15. In the figure below, $\angle CBD = 2\angle CAD$. Find the value of x (3marks)



16. Two boys, Ababu and Chungwa, on the same side of a tall building are 100m apart. The building and the two boys are in a straight line and the angles of elevation from the boys to the top of the building are 30° and 20° respectively calculate the height of the building. (3marks)

SECTION II (50 MARKS)

Attempt only five Questions from this section

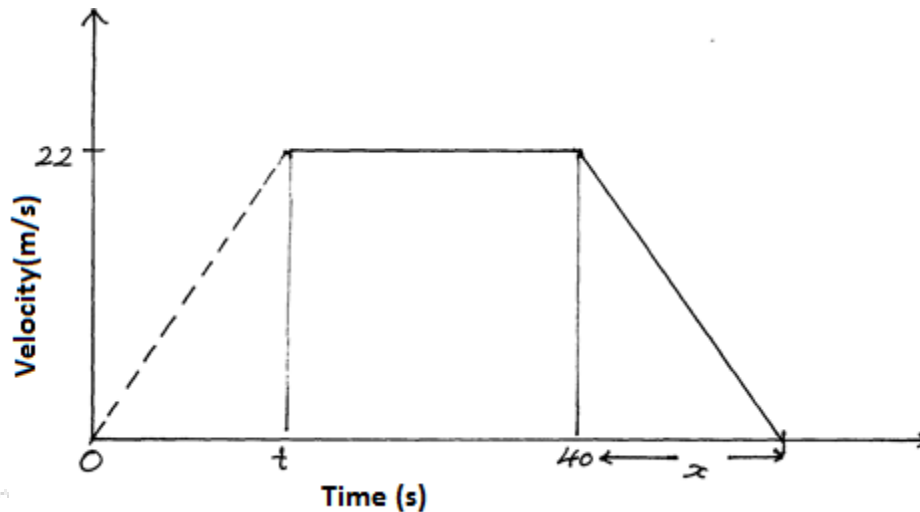
17. A business lady bought 100 quails and 80 rabbits for sh25600. If she had bought twice as many rabbits as half as many quails she would have paid sh7400 less. She sold each quail at a profit of 10% and each rabbit at a profit of 20%.

- Form two equations to show how much she bought the quails and the rabbits. (2marks)
- Using matrix method, find the cost of each animal. (5marks)
- Calculate the total percentage profit she made from sale of the 100 quails and 80 rabbits. (3marks)

18. A(3,7) B(5,5), C(3,1), D(1,5) are vertices of a quadrilateral

- On the grid provided below, plot ABCD on a Cartesian plan (2marks)
- $A^1B^1C^1D^1$ is the image of ABCD under a translation $T \begin{pmatrix} -6 \\ -9 \end{pmatrix}$ plot $A^1B^1C^1D^1$ and state its coordinates (2marks)
- Plot $A^{11}B^{11}C^{11}D^{11}$ the image of $A^1B^1C^1D^1$ after a rotation about (-1,0) through a positive quarter turn. State its coordinates. (3marks)
- $A^{111}B^{111}C^{111}D^{111}$ is the image of $A^{11}B^{11}C^{11}D^{11}$ after a reflection in the line $y=x+2$. Plot $A^{111}B^{111}C^{111}D^{111}$ and state its coordinates (3marks)

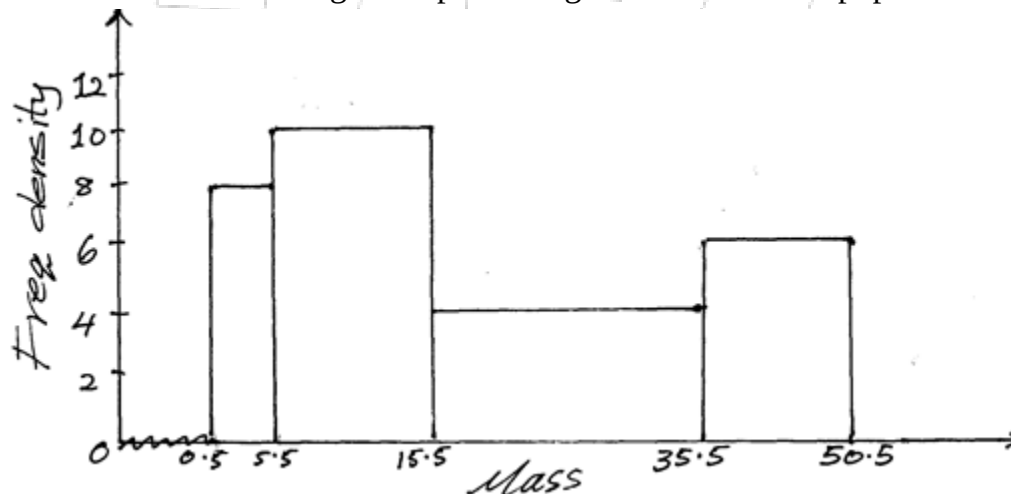
19. The figure below shows a velocity time graph of a journey of a car. The car start from rest and accelerates at $2\frac{3}{4} \text{ m/s}^2$ for t seconds until it is 22 m/s



Brakes are applied bringing it uniformly to rest. The total journey is 847 m long. Find.

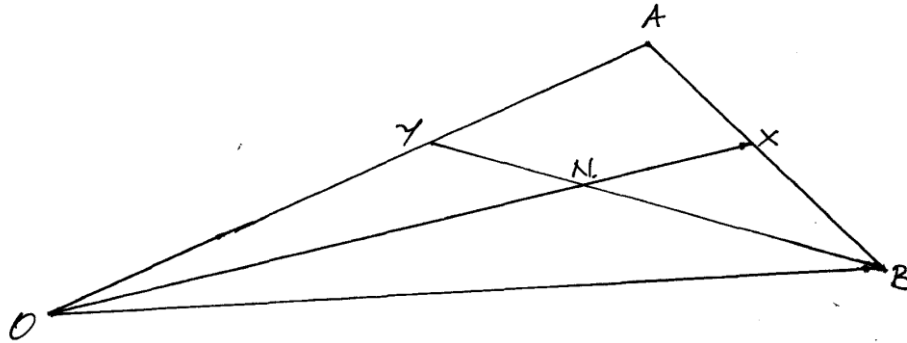
- The value of t , the acceleration time (2marks)
- The distance travelled during the first t seconds. (2marks)
- The value of x , the deceleration time (4marks)
- The rate of deceleration (2marks)

20. The diagram below shows a histogram representing the mass of some pupil in a school.



- Prepare a frequency distribution table of the data (3marks)
- From the table above, estimate
 - The mean mass of the pupils to 3 s.f (3marks)
 - The median mass (3marks)
 - How many pupils were 40 kg and above (1marks)

21. In the figure below $OY:YA=1:3$ $AX:XB=1:2$ $\vec{OA}=\vec{a}$ and $\vec{OB}=\vec{b}$. N is the point of intersection of $\vec{BY}$ and $\vec{OX}$



- a) Determine
 - i) $\vec{OX}$ (2marks)
 - ii) $\vec{BY}$ (1mark)
- b) Give that $\vec{BN} = k\vec{BY}$ and $\vec{ON} = h\vec{OX}$, express $\vec{ON}$ in two ways in terms of $\vec{a}$, $\vec{b}$, h and k (3marks)
- c) Find the value of h and k and hence show that O, N and X are collinear (4marks)

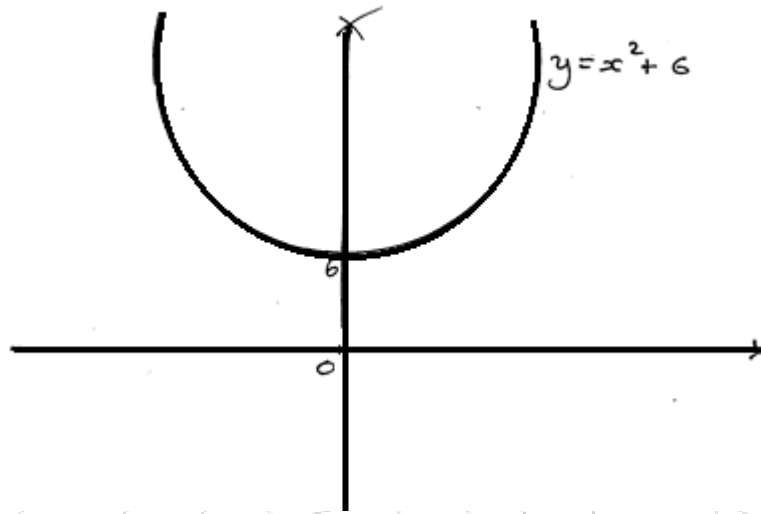
22. Using a ruler and a pair of compass only, construct triangle XYZ where XY is 6cm and $\angle XYZ$ is 135° and $YZ=7\text{cm}$ (2marks)

- a) Measure XZ (1mark)
- b) Drop a perpendicular from Z to meet line XY at K, measure ZK. (2marks)
- c) Bisect line XY and let the bisector meet line XZ at Q (1mark)
- d) Join Q to Y and measure angle XQY (2marks)
- e) Find the area of triangle XYZ (2marks)

23. Four towns are situated in such that a way that town Q is 500km on a bearing of 120° from P. Town R is 240 km on a bearing of 210° from town P, while town S is due north of town Q and due east of town P

- a) Draw a sketch diagram showing the relative position of P, Q, R and S (scale: 1cm : 100km) (3marks)
- b) Find by calculation
 - i) The distance QR (1mark)
 - ii) The distance QS (2marks)
 - iii) The angle PRSQ (2marks)
 - iv) The area of triangle PQS (2marks)

24. The figure below shows a sketch of the graph of $y = x^2 + 6$.



- a) Estimate the area bounded by the curve, the x-axis and the line $x = -4$ and $x = 4$ using
- i) The trapezium rule with 8 sides (3marks)
 - ii) The mid-ordinates rule with 8 strips (3marks)
- b) What percentage error is caused by estimating the area of the curve using the mid ordinates rule as in a (ii) above (4marks)

THIS IS THE LAST PRINTED PAGE!

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 7

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and admission number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided.
- (c) This paper consists of two sections: **Section I** and **Section II**.
- (d) Answer all questions in **section I** and **only five** questions from **section II**.
- (e) Marks may be given for correct working even if the answer is wrong.
- (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

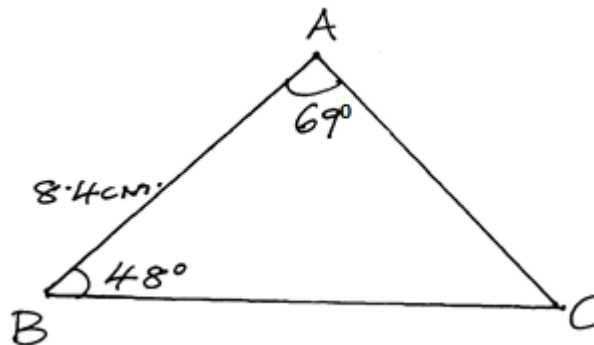
17	18	19	20	21	22	23	24	Total

Grand Total

--

SECTION I (50 MARKS)**Answer All Questions in this section**

- The area of a rectangle is 48.4cm^2 and its length is 9.37cm . Calculate the percentage error in width **(3marks)**
- The base of a triangle is $(3x - 2)\text{cm}$. The height of the triangle is 5cm shorter than its base. Given that the area of the triangle is 25cm^2 . Find length of the base. **(4marks)**
- Find the area of the triangle shown below **(3marks)**



- Express** the following expression in surd form and simplify by rationalising the denominator **(3marks)**

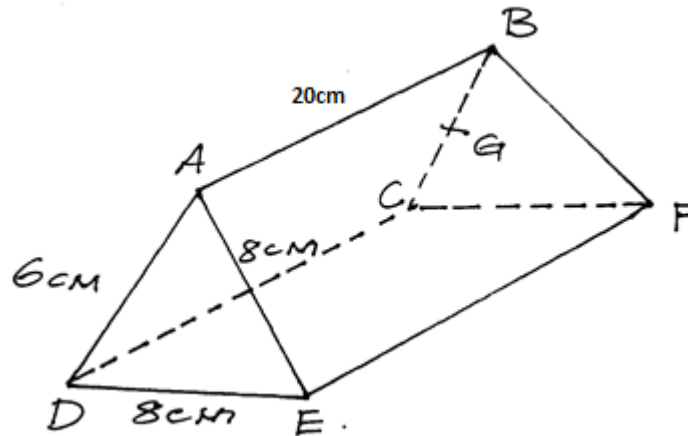
$$\frac{2}{1 - \tan 30}$$
- Solve for x in the expression $(\log_2 x)^2 + \log_2 x^3 = 10$ **(3marks)**
- The table below is part of the tax for monthly income for the year 2007

Monthly income (ksh)	Rate %
Under ksh 10165	10
From 10165 but under ksh19741	15
From 19741 but under ksh29317	20

In that year, John's monthly gross tax was Ksh 2885. Calculate his monthly income **(3marks)**

- A quantity E is partly constant and partly varies as square root of F .
 - Write down an equation connecting E and F where K and C are constants respectively.
 - If $F=25$ where $E=22$ and $F=49$ when $E=28$. Find the value of K and C **(3marks)**
- Expand $\left(1 + \frac{1}{2}x\right)^7$ in ascending power of x **(1mark)**
 - Using the first four terms of the expansion in (a) above estimate the value of $\left(1 + \frac{1}{30}\right)^7$ **(2marks)**
- Find the number of terms of the series $5+8+11+14+17+\dots$ that will give a sum of 2183 **(3marks)**
- Find the inverse of the matrix $M = \begin{pmatrix} 4 & -3 \\ 2 & 1 \end{pmatrix}$ hence find the co-ordinates of the point at which line $4x - 3y = 4$ and $2x + y = 7$ intersect **(3marks)**

11. A trader mixed grade I, II and III of coffee in the ratio 2:3:5 respectively. Grade I cost Sh650 per kg, grade II costs sh 500 per kg and grade III costs sh 420 per kg.
- Find the cost of one kg of the mixture (2marks)
 - If the trader sold the mixture at a profit of 20% calculate the selling price of 3kg of the mixture (2marks)
12. Solve for the equation $4\cos^2 x = 5 - 4\sin x$ for $0^\circ \leq x \leq 360$ (3marks)
13. The figure below has a cross-section of the prism which is an isosceles triangle of side AE= 8cm, DE= 8cm and AD=6cm, where AB=20cm



- If G is the mid-point of side BC find
 - GF (1mark)
 - AG (1mark)
 - The angle between line DF and plane ABCD (2marks)
- 14.a) Construct triangle PQR in which PQ=QR=5cm and angle PQR=90° (2marks)
- Draw the locus of S which moves in such a way that it is always on the same side of PR as Q and angle $\hat{PSR} = 45^\circ$ (1mark)
15. Determine the amplitude and period in the function $y = \frac{1}{2} \sin(3x - 60)$ (2marks)
16. Two towns P and Q are located on the equator such that P is due east of Q. The distance between the two towns is 1920nm. If the latitude of p is 50°E. Determine the longitude of Q (3marks)

SECTION B (50 MARKS)

Answer any five questions from this section

17. The cost of Jane's car at the beginning of year 2000 was sh 750,000. It depreciated in value by 7% per year for the first 3 years, by 8% for the next two years and 11% per year for the subsequent years.
- Find the value of the car at
 - The start of the year 2003 (2marks)

ii) The end of year 2007 (3marks)

b) At the beginning of 2008, Jane sold the car through Mary's dealers at 22% more than its actual depreciated value to Lucy. Taking Mary's sale price as the car's value after depreciation. Find the average monthly rate of depreciation for the 8 years. (5marks)

18. MNP is a triangle with vertices M(2,2), N(2,-2) and P(-1,-4). Draw the triangle MNP.

(1mark)

a) If vertex N(2,-2) is mapped to $N^1(5,-2)$ by a shear with x-axis invariant, draw triangle $M^1N^1P^1$, the image of triangle MNP under the shear. (2marks)

b) Find the matrix that represent the shear in (a) above (2marks)

c) A transformation where matrix is $T = \begin{pmatrix} 0 & 1 \\ 1 & 1.5 \end{pmatrix}$ maps triangle $M^1N^1P^1$ onto $M^{11}N^{11}P^{11}$. Draw the triangle $M^{11}N^{11}P^{11}$ (3marks)

d) Describe fully a single transformation that maps triangle $M^{11}N^{11}P^{11}$ back onto triangle MNP and give its transformation matrix. (2marks)

19. Complete the table below for the equation $y = x^3 - 3x^2 - 5x + 7$ (2marks)

x	-3	-2	-1	0	1	2	3	4	5
y	-32		8	7	0		-8		32

b) Draw the graph of $y = x^3 - 3x^2 - 5x + 7$ (3marks)

c) Use your graph to estimate the roots of the equation $x^3 - 3x^2 - 5x + 7 = 0$ (2marks)

d) Use your graph to solve the equation $x^3 - 3x^2 - 10x + 17 = 0$ (3marks)

20. The table below shows marks scored by 40 students in a test

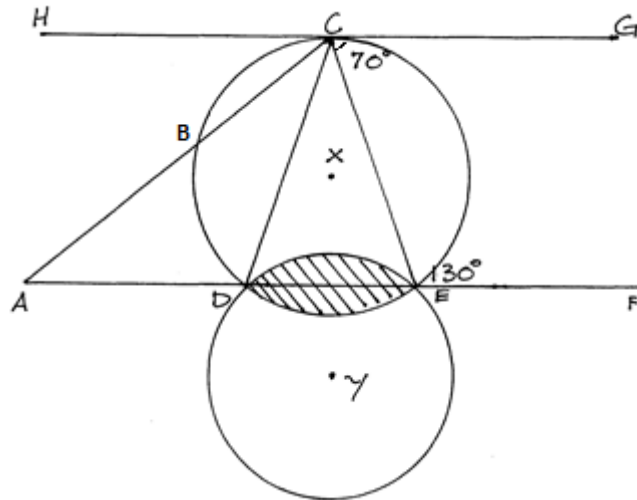
Marks	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
frequency	1	5	8	12	7	4	2	1

a) Calculate the upper quartile and lower quartile (4marks)

b) If 30% of students failed the test, find the pass mark (3marks)

c) The pass mark was set at 25 marks. How many students passed the test. (3marks)

- 21.) The diagram below shows two intersecting circles with centres X and Y. HG is a tangent to the circle centre X at C. Angle GCE=70° and angle CEF=130°. Given that CB=5cm, BA=4cm, AE=12cm and radius DY=6cm.



- a) Determine
 - i) Angle DXE (2marks)
 - ii) Length DE (2marks)
 - iii) Angle DYE (2marks)
- b) Calculate the area of the shaded region (take $\pi = \frac{22}{7}$) (4marks)

22.a) Wekesa has two fair tetrahedral solids one red and other green. The faces of red solid are numbered 1 to 4 while the faces of green solid are numbered 2, 3, 5 and 6. He tosses the two solids at the same time and recorded the number that is the bottom face of each solid. If k is the number that is at the bottom face of red solid while t is the number that is at the bottom face of green solid, find the probability that

- i) $2k+t=7$ (1mark)
- ii) $(2k+t)$ is at most 9 (1mark)
- iii) $2k \geq t$ (2marks)

b) In a group of 40 people, 10 are healthy and every person of the remaining 30 has either high blood pressure, a high level of cholesterol or both. Given that 15 have high blood pressure, 25 have high level of cholesterol and x have both. If a person is selected at random from this group. What is the probability that he/ she

- i) Has high pressure only (2marks)
- ii) Has high level of cholesterol only (1mark)
- iii) Has high blood pressure and high level of cholesterol (1mark)
- iv) Has either high blood pressure or high level of cholesterol (2marks)

23. A company was contracted to transport 1200 tonnes of sand. The company used type A and type B trucks to do the job. Each type A truck carries 10 tonnes of sand per trip while B carries 15 tonnes per trip. The total number of trips must not be less than 70 and type B truck must make at least twice as many trips as type A truck while the latter must make not less than 10 trips. Taking x to represent the number of trips made by type A trucks and y to represent the number of trips made by type B trucks
- a) Write down all the inequalities representing the above information **(4marks)**
 - b) Represent the inequality graphically **(4marks)**
 - c) The company makes a profit of sh2000 per trip made by each type A truck and sh 3000 per trip made by each type B truck.
 - i) Using a search line, determine the number of trips each type of truck must be made to maximise the profit **(1mark)**
 - ii) Hence calculate the maximum profit **(1mark)**
- 24.a)** Find the area of the region bounded by the curve $y = x^3 - x$ and the axes between the point $x = -1$ and $x = 1$ **(4 marks)**
- b) At a certain instant a body is moving in a straight line at 20cm/s. Its acceleration during the first 5 seconds of the subsequent motion is $(30 - 6t)$ cm/s² where t is the time in seconds. After 5 seconds it travels with a constant speed. Find
- i) Its velocity after 2 seconds **(2marks)**
 - ii) The greatest velocity attained **(2marks)**
 - iii) The distance travelled in 10 seconds **(2marks)**

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KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 8

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

SCHOOL.....

SIGN.....

INDEX NO.....

ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

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 (d) Answer all questions in **section I** and **only five** questions from **section II**.
 (e) Marks may be given for correct working even if the answer is wrong.
 (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

--

SECTION I (50 MARKS)

Answer **all** questions in this section in the spaces provided.

1. A normal year has 365 days while a leap year has 366 days. Find the number of days from the beginning of 1900 to end of 2000. **(2 marks)**
2. Find the exact value $2.\dot{2} + 3.2\dot{4}$ in its simplest form. **(3 marks)**
3. A mirror line maps point (4,3) onto (-2,7). Find the equation of the mirror line in double intercept form. **(4 marks)**
4. The average lap time of 3 cars in a racing competition is 36 seconds, 40 seconds and 48 seconds respectively. If they all start the race at the same time, find the number of times the slowest car will have been overlapped by the fastest at the time they all cross the starting point together again. **(4 marks)**
5. The table below shows patients who attend a clinic in one week and were grouped by age as shown in the table below.

Age x years	$0 \leq x < 5$	$5 \leq x < 15$	$15 \leq x < 25$	$25 \leq x < 45$	$45 \leq x < 75$
Number of patients	14	41	59	70	15

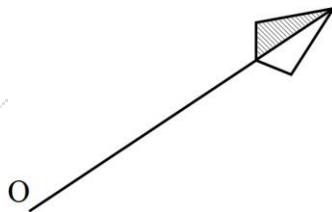
On the grid provided draw a histogram to represent the distribution.

(3 marks)

6. Three farmers, Formula-One, Method-Two and Way-Three are to share a grazing field. Formula-One has 5 cows, Method-Two has 7 cows and Way-Three has 4 cows. The three grazed for 3 days, 2 days and 4 days respectively. The owner of the field charged them ksh. 9000 which they were to share proportionately. How much money did Formula-One contribute? **(3 marks)**
7. a) Simplify the expression $\frac{3x+5}{2x} - \frac{2x+8}{3x}$. **(1 mark)**
 b) Hence solve $\frac{3x+5}{2x} - \frac{2x+8}{3x} = \frac{4}{5}$ **(2 marks)**
8. A solid in the shape of a regular nonagon with distance from the centre to any vertex as 10cm and length 3.5m has a density of $3.2gcm^{-1}$. Calculate to 3 significant figures the mass of the solid in kilograms. **(4 marks)**
9. Find the exact value of $\frac{3^{n+1} - 3 \times 3^{n-1}}{4 \times 3^{n+2}}$ **(3 marks)**
10. Use tables of natural tangents and square roots to find
 - a) $\tan 72.63^\circ$ **(2 marks)**
 - b) $\sqrt{0.5479}$ **(1 mark)**
 - c) Hence evaluate $\tan 72.63^\circ + \sqrt{0.5479}$ **(1 mark)**
11. Given the column vectors $a = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$, $b = \begin{pmatrix} -3 \\ -9 \end{pmatrix}$ and $c = \begin{pmatrix} 5 \\ -7 \end{pmatrix}$ and that $p = 2a - \frac{1}{3}b + c$. Find the magnitude of **p** to 3 significant figures. **(3 marks)**
12. Using the grid below, solve the simultaneous equations **below** **(3 marks)**

$$x + 3y = 9 \text{ and } 3x + 2y = 13$$

13. Under an enlargement with scale factor +2, point $P(2,9)$ is mapped onto $P'(-5,3)$. Determine the co-ordinates of the centre of enlargement. **(3 marks)**
14. A businessman sells two types of mobile phones Samsung and Nokia. The price of one Samsung and one Nokia is ksh. 2000 and ksh. 1600 respectively. He wishes to have at least 20 mobile phones. The number of Samsung phones, should be less or equal to the number of Nokia phones. He has ksh. 96 000 to spend. If he buys x Samsung phone and y Nokia phones, write down the inequalities for the above situation. **(3 marks)**
15. Complete the figure below to show a rotational symmetry of order 3 about point O. **(3 marks)**



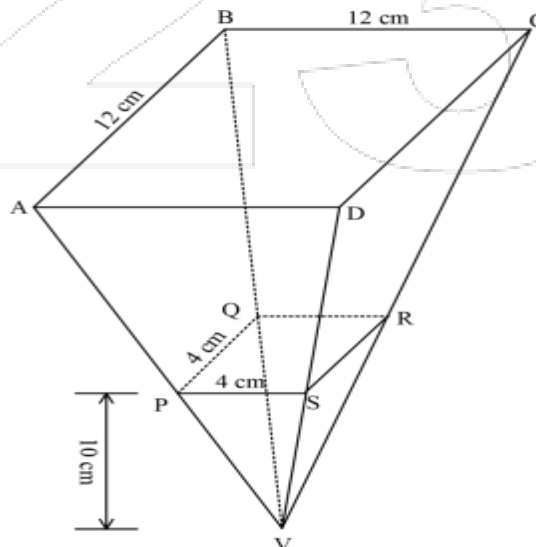
16. Solve for α in $2\sin(2\alpha + 20) - 2\cos(-\alpha - 30) = 0$ **(2 marks)**

SECTION II (50 MARKS)

(Answer ANY FIVE questions in the spaces provided)

17. The distance between Kipsigis Girls and Mbita School is 240km. During the Champions Jet 1 result release at Kipsigis Girls, Mbita School ferried their students using two buses, Scania and Isuzu. The Scania bus travelled 20km/h faster than the Isuzu bus whose speed was x km/h.
- a) Write an expression in terms of x for the time taken to cover the distance by;
- Isuzu bus **(1 mark)**
 - Scania bus **(1 mark)**
- b) The Isuzu bus left Mbita at 7.00 am. and 36 minutes later, the Scania bus left Mbita for Kipsigis. The two vehicles reached Kipsigis Girls at the same time. Form an equation in x hence find the speed of Scania bus. **(5 marks)**
- c) During the return journey, the two buses left Kipsigis at the same time and maintained their original speeds. The Scania bus developed a puncture after covering 100km which took 20 minutes to mend. If the two buses arrived at Mbita at the same time, find the average speed of Scania bus from the point where the tire was mended. **(3 marks)**
18. Sol is a sales lady with a company that pays her a basic salary of sh. 30,000 per month. She is also given commission on goods sold as follows,
- 0% for the first sh. 100,000
- 3% on the sales above sh. 100,000 up to sh. 300,000
- 7.5% of sales above sh. 300,000

- a) During the month of May, she sold 400 calculators at sh. 1250 per calculator. Calculate:
- How much she collected from the sale of calculators. **(2 marks)**
 - Her total earnings for the month of May. **(3 marks)**
- b) During the month of June, each calculator was sold at a discount of 16.8%. If Sol received a total of sh. 52,500 as her earnings, find the total number of calculators sold during the month of June. **(5 marks)**
19. Two quadratic curves intersect at points $(-2,0)$ and $(4,0)$.
- Determine the equations of the curves in the form $y = ax^2 + bx + c$. **(4 marks)**
 - Using trapezium rule with 6 strips, estimate the area bounded by the curves. **(4 marks)**
 - Estimate the area in (b) above using mid-ordinate rule with 3 trapezia. **(2 marks)**
20. A, B, C, D and E are such that B is 88 km on a bearing of 062° from A. C is 120 km on a bearing of 142° from B. D is $S38^\circ W$ of C at a distance of 90 km. E lies directly South of A and directly west of D. Using a scale of 1: 2,000,000;
- Determine the relative positions of A, B, C, D and E. **(4 marks)**
 - Find the bearing and distance of
 - E from C **(4 marks)**
 - D from A
 - Find the area covered by A, B, C, D and E in square kilometers. **(2 marks)**
21. The diagram below represents square based pyramid standing vertically. $AB = 12$ cm, $PQ = 4$ cm and the height of the pyramid PQSV is 10 cm.



- If PQRSV is a solid, find the volume of material used to make it.
- Find the;
 - Height of the frustum ABCDPQRS.

Given that $\angle SUR = 25^\circ$, $\angle URP = 60^\circ$, $TU = UX$ is parallel to the diameter; giving reasons calculate;

- a) $\angle TOU$ (2 marks)
- b) $\angle XUP$ (2 marks)
- c) $\angle STR$ (2 marks)
- d) Reflex $\angle SXU$ (2 marks)
- e) $\angle RPU$ (2 marks)

KCSE
23

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 8

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and admission number in the spaces provided above.
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- (c) This paper consists of two sections: **Section I** and **Section II**.
- (d) Answer all questions in **section I** and **only five** questions from **section II**.
- (e) Marks may be given for correct working even if the answer is wrong.
- (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

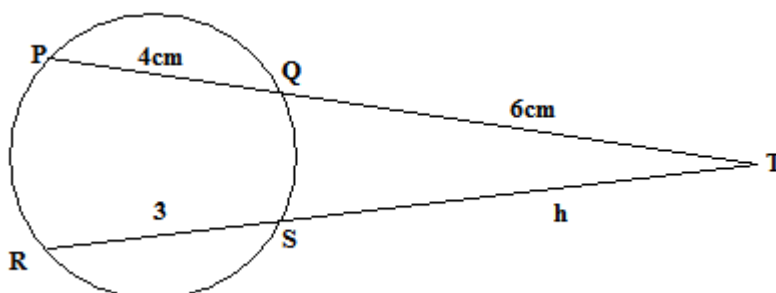
Grand Total

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SECTION I (50 MARKS)

Answer all the questions from this section

1. Solve the equation: $1 + 2 \cos\left(\frac{2}{3}x + 30^\circ\right) = 0$ for $0^\circ \leq x \leq 360^\circ$ (3 marks)
2. A rectangular block has a square base whose side is exactly 8 cm. Its height is measured to the nearest millimetre as 3.1 cm. Find the percentage error in calculating its volume. (3 marks)
3. If $a = \sqrt{7} + \sqrt{5}$ and $b = \sqrt{7} - \sqrt{5}$ find;
 - (a) The product ***ab*** (1 mark)
 - (b) $a^2 - b^2$ (2 marks)
4. Draw line $AB = 3 \text{ cm}$, P is a variable point such that $\angle APB = 60^\circ$. Draw the possible location of point P. (3 marks)
5. Use the first four terms of the expansion $(1 - x)^8$ to evaluate $(0.95)^8$ correct to 3 decimal places. (3 marks)
6. Make y the subject of the formula $x = \left(\frac{x^2y-2}{4y-3}\right)^{\frac{1}{4}}$ (3 marks)
7. Tap A can fill a bath in 5 minutes. Tap B can empty a full bath in 10 minutes. Both taps are opened at the same time. After 5 minutes, tap B is closed. How long will it take tap A to fill the bath completely from then. (3 marks)
8. Kola bought a television set on hire-purchase by paying a down payment of ksh. 5000 and monthly instalments of ksh. 1250 for 2 years. If interest rate charged was 12% p.a, what is the carrying charge to the nearest hundreds? (3 marks)
9. Use matrix method to for x and y in the following sets of equation.
 $2y - 3x = -4$ and $2y = 5x$ (3 marks)
10. Solve for x given that $\log(5x - 10) - \log\left(\frac{x}{15}\right) = \log 40 - \log\left(\frac{x}{20}\right)$ where $x \neq 0$ (3 marks)
11. Nine men have heights of 185, 179, 181, 181, 173, 182, 184, 178 and 176 all in cm. Using an assumed mean of 180, calculate the variance to 4 significant figures. (3 marks)
12. Given that $\mathbf{a} = 10\mathbf{i} + 6\mathbf{j} - 7\mathbf{k}$ and $\mathbf{b} = 2\mathbf{i} + 8\mathbf{j} + 4\mathbf{k}$, find $\left|2\mathbf{a} + \frac{1}{2}\mathbf{b}\right|$ (3 marks)
13. A farmer has 1000 m of fencing wire to fence a rectangular enclosure. Find the greatest possible area this farmer can fence. (3 marks)
14. The acceleration of a particle a m/s^2 is $2t - 3 \text{ m/s}^2$. Given that the particle has a velocity of 2 m/s after 1 second. Find its displacement in the fourth second. (4 marks)
15. In the figure below, chords PQ and RS intersect externally at T.



Given that $PQ = 4\text{cm}$, $QT = 6\text{cm}$ and $RS = 3\text{cm}$, find RT .

(3 marks)

16. In a shooting practice three soldiers A, B and C aim at a target. The probabilities of A, B and C hitting the target are $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{2}$ respectively. The three soldiers shot at the target only once; one after the other. What is the probability that the target was hit only once?

(4 marks)

Section II (50 Marks)

Answer any five questions from this section.

17. A ship sends a radio signal saying she is in distress and giving her position as $(60^\circ N, 45^\circ W)$. The signal is picked up by a ship A at $(60^\circ N, 30^\circ W)$ and a ship B at $(60^\circ 30' N, 45^\circ W)$. Both ships move at a speed of 25 *knots*.

- (a) Calculate the length of time that each captain should indicate that it will take to come to the rescue, assuming that A sails due West and B sails due south. (6 marks)
- (b) If the distressed ship is drifting due East at 5 *knots*. Find the new position she should radio call 16 hours later. (2 marks)
- (c) Find the local time and day at $X(60^\circ N, 30^\circ W)$ when the local time at $Y(0^\circ, 30^\circ E)$ is 0045H on Monday. (2 marks)
18. Two hundred people were asked how much water they drink per day. The table below shows the results.

Amount of water (X litres)	No. of people	Cumulative frequency
$0 < x \leq 0.5$	8	
$0.5 < x \leq 1$	27	
$1 < x \leq 1.5$	45	
$1.5 < x \leq 2$	50	
$2 < x \leq 2.5$	39	
$2.5 < x \leq 3$	21	
$3 < x \leq 3.5$	7	
$3.5 < x \leq 4$	3	

- (a) Develop a cumulative frequency column (1 mark)
- (b) On the grid provided below, draw a cumulative frequency curve using a scale of 2 cm for one litre on the x – axis and 1 cm for 20 people in the y- axis. (3 marks)
- (c) Using your graph;
- (i) Find the **median** (1 mark)
- (ii) The quartile **deviation** (2 marks)
- (iii) Find the number of people who consumed at least 2.6 litres per day. (1 mark)
- (iv) Find the percentage number of people who did not drink enough water given that the doctor recommends at least 1.8 litres per day. (2 marks)

19. Triangle ABC with vertices $A(2,4)$, $B(2,9)$ and $C(6,2)$ undergoes a transformation T denoted by the matrix $\begin{pmatrix} -0.6 & 0.8 \\ 0.8 & 0.6 \end{pmatrix}$ to obtain triangle $A_1B_1C_1$.

(a) Draw triangle ABC and its image under T on the same axes. **(4 marks)**

(b) Describe the transformation T fully. **(1 mark)**

(c) Under another transformation M, triangle $A_1B_1C_1$ is mapped on to triangle $A_2B_2C_2$ with $A_2(-2, -4)$, $B_2(-6, -7)$ and $C_2(2, -6)$. Find the matrix of transformation M **(4 marks)**

(d) Describe the single transformation that maps triangle $A_2B_2C_2$ onto triangle ABC **(1 mark)**

20. A relief organization has to transport at least 80 people and at least 18 tonnes of supplies to a site. There are two types of vehicles available; type A and type B. type A can carry 900 kg of supplies and 6 people while type B can carry 1350 kg of supplies and 5 people. There are at most 12 vehicles of each type available. By taking x to represent the number of vehicles of type A and y to represent the number of vehicles of type B.

(a) Write down all the four inequalities to represent the above information. **(4 marks)**

(b) On the grid provided, draw all the inequalities in (a) above. **(4 marks)**

(c) Use the graph in (b) above to determine the least number of vehicles of each type required at the site. **(2 marks)**

21. An arithmetic progression has the first term (a) and common difference (d).

(a) Write down the third, the ninth and twenty fifth terms of the AP. **(1 mark)**

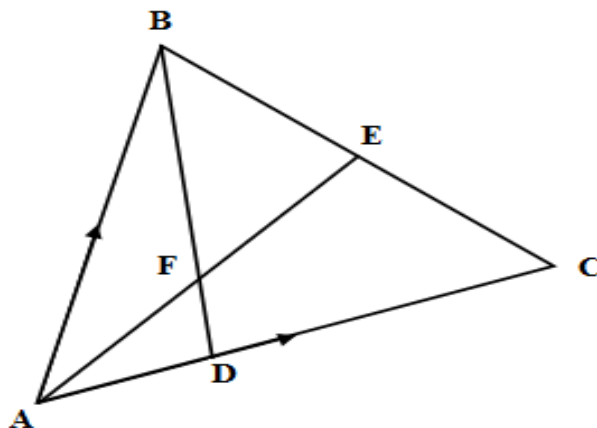
(b) The AP is increasing and the 3rd, 9th, and 25th terms form the first three consecutive terms of the GP. If the sum of the seventh term and twice the sixth terms of the AP is 78, calculate:

(i) The first term and the common difference of the A.P. **(4 marks)**

(ii) The common ratio of the GP **(2 marks)**

(iii) The sum of the first nine terms of the A.P. **(3 marks)**

22. In the figure below E is the midpoint of BC. AD: DC 3:2 and F is the meeting point of BD and AE.



a) If $AB = b$ and $AC = c$, find:

i) BD

(2 marks)

ii) AE

(2 marks)

b) If $BF = t BD$ and $AF = n AE$. Find the value of t and n .

(5 marks)

c) State the ratio of BD to BF .

(1 mark)

23. The table below shows income tax rates

Monthly taxable pay (k£)	Rate of tax ksh per £
1- 435	2
436 – 870	3
871 – 1305	4
1306 – 1740	5
Excess over 1740	6

A company employee earns a monthly basic salary of Ksh 28,000. He is also entitled to the following monthly allowances: house allowance of Ksh 9000, a medical allowance of sh 2000 and a commuter allowance of shs 1480.

(a) Calculate his total income tax.

(5 marks)

(b) He is entitled to a personal tax relief of Ksh 1056 per month. Determine the net tax.

(1 mark)

(c) If he received a 50% increase in his total income, calculate the corresponding percentage increase on the income tax.

(4 marks)

24. The equation of a curve is given $y = x^3 + 4x^2 - 2$

a) Determine the coordinates of the turning points of the curve, correct to 1 decimal place and state their nature

(4 marks)

b) Use the equation of the curve to complete the table below.

(1 mark)

x	-4	-3	-2	-1	0	1
y	-2		6	1		

c)i) On the grid provided, use the solutions in part (a) and the values in the table in part (b) to draw the curve for $-4 \leq x \leq 1$.

(3 marks)

ii) Use the graph to solve the equation $x^3 + 4x^2 - 2 = 0$

(2 marks)

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 9

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

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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

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SECTION I (50 MARKS)

*Answer **all** questions in this section in the spaces provided.*

1. Without using a calculator evaluate

$$5 \times 6 + (-76) \div 4 + 27 \div 3$$

$$(-5) \div 3 \times (-4)$$

(3marks)

2. (a) Express 2268 in terms of its prime factors

(1mark)

(b) Hence determine the smallest positive number x such that $2268x$ is a perfect square.

(2marks)

3. Elvis arrived in Kenya with 5000 sterling pound, he exchanged it to Kenya Shilling and spent sh. 267 100. Before jetting out of the country, he exchanged the balance into Euros. Using the exchange rates below, calculate the amount he obtained in Euros in Kenya shillings. (3marks)

Currency
1 Sterling pound
1Euro

Buying
114.20
101.20

Selling
114.50
101.30

4. Simplify the expression

$$\frac{2x^2+3x-2}{x^3-4x}$$

(3marks)

5. When two wires of length 179m and 234m are divided into pieces of equal lengths a remainder of 3m is left in each case. Find the least number of pieces that can be obtained.

(3marks)

6. Without using calculator, solve for n in the equation

$$1 - \left(\frac{1}{3}\right)^n = \frac{242}{243}$$

(3marks)

7. Solve for y in the equation

$$\frac{7-y}{4} - \frac{9-2y}{3} = \frac{1}{2}$$

(3marks)

8. Two similar solids have surface area of 48cm^2 and 108cm^2 respectively. Find the volume of the smaller solid if the bigger solid has a volume of 162cm^3

(3 marks)

9. Use reciprocal table only to evaluate $\frac{1}{0.325}$

(3marks)

Hence, evaluate $\frac{\sqrt{0.25}}{0.325}$ to 1.d.p

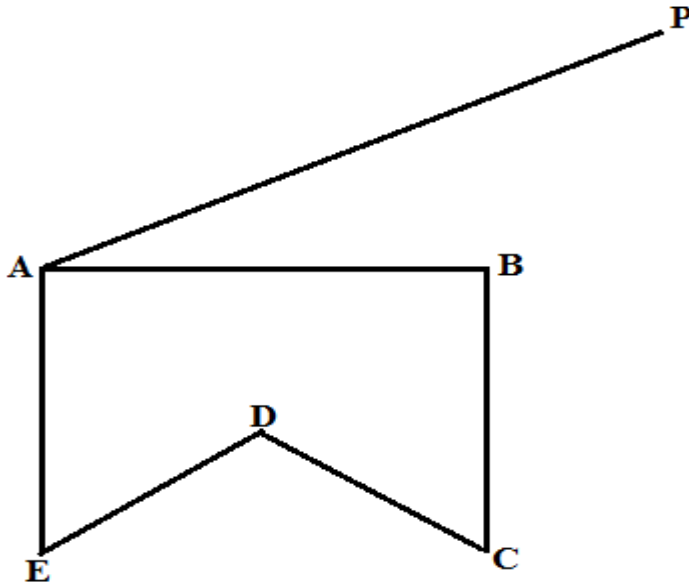
10. A plot measuring 1.2m by 19.1 m is surrounded by a path 0.5m wide. Find the area of the path in square metres.

(3marks)

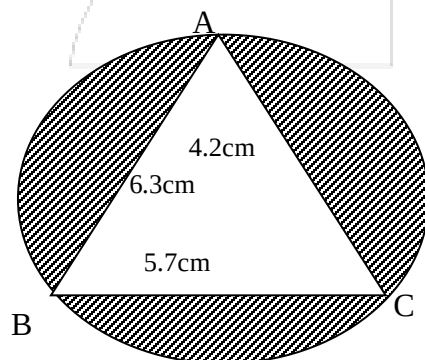
11. The interior angle of a regular polygon is 60° more than its exterior angle, find the number of sides of the polygon.

(3marks)

12. In the figure below ABCDE is a cross-section of a solid. The solid has a uniform cross-section. Given that AP is an edge of the solid, complete the sketch showing the hidden edges with a broken lines. (3 marks)



13. If $\tan x = \frac{1}{\sqrt{3}}$ find without using tables or calculator the value of $\sin(90-x) + \cos(90-x)$ leaving your answer in simplified surd form (3marks)
14. A line perpendicular to the line $3y-2x=2$ passes through the point $(-3,2)$. Determine the equation of the line and write it in the form $ax+by=c$ where a, b, and c are constant. (3marks)
15. The circle below whose area is 18.05cm^2 circumscribes triangle ABC where $AB = 6.3\text{cm}$, $BC = 5.7\text{cm}$ and $AC = 4.2\text{cm}$. Find the area of the shaded part. (4 Marks)

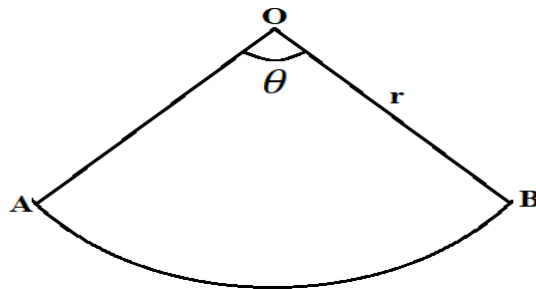


16. In a book store, books packed in cartons are arranged in rows such that there are 50 cartons in the first row, 48 cartons in the next row, 46 in the next and so on.
- (a) How many cartons will there be in the 8th row? (2 Marks)
- (b) If there are 20 rows in total, find the total number of cartons in the book store. (2 Marks)

SECTION II (50 Marks)

*Answer any **five** questions from this section in the spaces provided.*

17. The figure below represents a sector of a circle radius r units. The area of the sector is 61.6 cm^2 and the length of the arc AB is one tenth of the circumference of the circle from which the sector was obtained. (Take $\pi = \frac{22}{7}$)

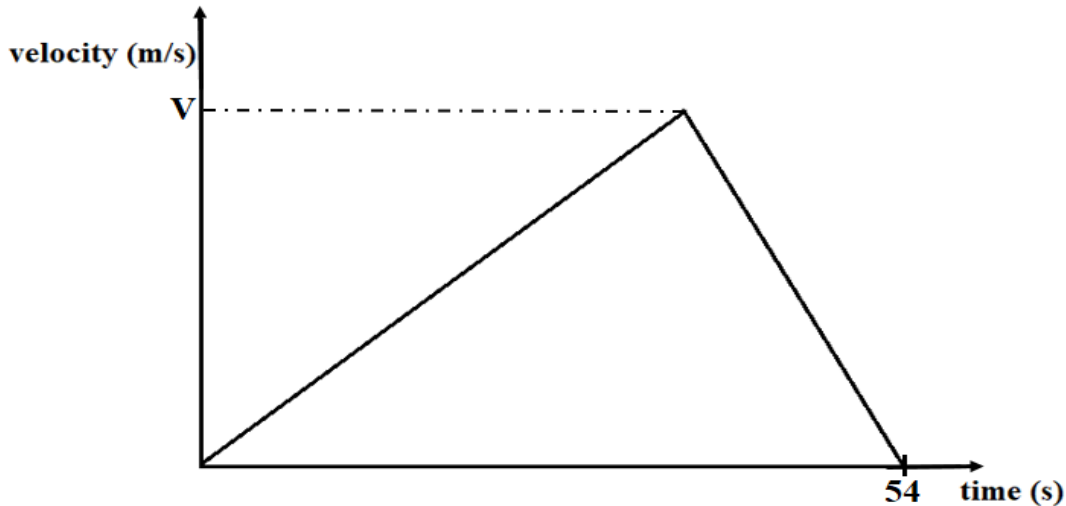


- a) Calculate;
- the angle θ subtended by the sector at the centre. (2 marks)
 - The radius r of the circle. (3 marks)
- b) If the sector above is folded to form a cone;
- Calculate the base radius of the cone. (2 marks)
 - The volume of the cone. (3 marks)
18. Two factories A and B produce both chocolate bars and eclairs. In factory A, it costs Kshs x and Kshs y to produce 1 kg of chocolate bars and 1 kg of eclairs respectively. The cost of producing 1 kg of chocolate bars and 1 kg of eclairs in factory B increases by the ratio 6:5 and reduce by the ratio 4:5 respectively.
- Given that it costs Kshs 460 000 to produce 1 tonne of chocolate bars and 800kg of eclairs in factory A and Kshs 534 000 to produce the same quantities in factory B, form two simplified simultaneous equations representing this information. (3 marks)
 - Use matrix method to find the cost of producing 1 kg of chocolate bars and 1 kg of eclairs in factory A. (5 marks)
 - Find the cost of producing 100 kg of chocolate bars and 50 kg of eclairs in factory B. (2 marks)
19. The following measurements were recorded in a field book of a farm in metres ($xy = 400\text{m}$)

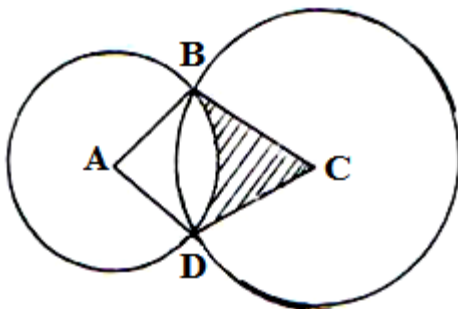
	Y	
	400	
C60	340	
	300	120D
	240	100E
	220	160F
B100	140	
A120	80	
	x	

- (a) Using a scale of 1cm representing 4000cm, draw an accurate map of the farm. (3 Marks)
 (b) If the farm is on sale at Kshs. 80,000.00 per hectare, find how much it costs. (7 Marks)

20. The figure below shows a velocity-time graph of an object which accelerates from rest to a velocity of $V \text{ ms}^{-1}$ then decelerated to rest in a total time of 54 seconds.



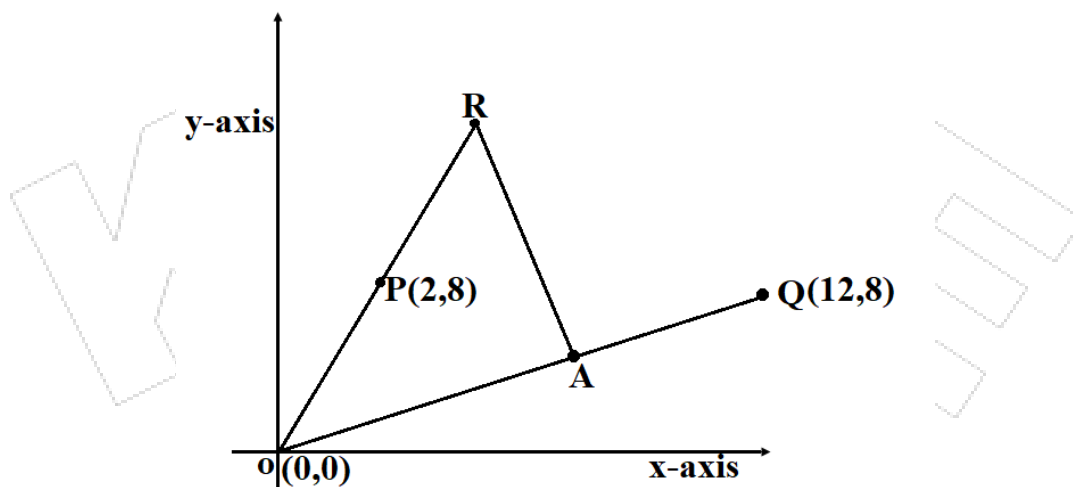
- a) If it covered a distance of 810 metres;
 i) Find the value of V . (2 marks)
 ii) Calculate its deceleration, given that its initial acceleration was $1\frac{2}{3} \text{ ms}^{-2}$ (2 marks)
- b) A bus left town X at 10.45 am and travelled toward town Y at an average speed of 60 km/h. A car left town X at 11.45 am on the same day and travelled along the same road toward Y at an average speed of 100km/h. The distance between town X and town Y is 500km.
 i) Determine the time of the day when the car overtook the bus. (3 marks)
 ii) Both vehicles continued towards town Y at their original speeds. Find how long the car had to wait in town Y before the bus arrived. (3 marks)
21. In the diagram below, two circles, centres A and C and radii 7cm and 24cm respectively intersect at B and D. $AC = 25\text{cm}$.



- (a) Show that angle $ABC = 90^\circ$. (3 Marks)
 (b) Calculate
 (i) the size of obtuse angle BAD (3 Marks)
 (ii) the area of the shaded part (4 Marks)

22. (a) a straight line L_1 whose equation is $9y - 6x = -6$ meets the x-axis at Z. Determine the coordinates of Z. (2 marks)
- (b) A second line L_2 is perpendicular to L_1 at Z. Find the equation of L_2 in the form $ax + by = c$, where ,b and c are integers. (3 marks)
- (c) a third line L_3 passes through the point (2,5) and is parallel to L_1 . Find:
- i) The equation of L_3 in the form $ax + by = c$, where a, b and c are integers. (2 marks)
- ii) The coordinate of point R at which L_2 intersects L_3 . (3marks)

23. In the diagram below, the coordinates of points O, P and Q are (0,0), (2,8) and (12,8) respectively. A is a point on OQ such that $4OA=3OQ$. Line OP produced to R is such as $OR=5OP$.



- a) Find vector RA . (3 marks)
- b) Given that point L is on PQ such that $PL:LQ=12:5$, find vector RL . (4 marks)
- c) Show that R, L and A are collinear. (2 marks)
- d) Find the ratio of $RL:LA$. (1 marks)

24. Five points, P, Q, R, V and T lie on the same plane. Point Q is 53km on the bearing of 055° of P. Point R lies 162° of Q at a distance of 58km . Given that point T is west of P and 114km from R and V is directly south of P and $S40^\circ E$ from T.
- a) Using a scale of $1:1,000,000$, show the above information in a scale drawing (3 marks)
- b) From the scale drawing determine:
- i) The distance in km of point V from R. (2 marks)
- ii) The bearing of V from Q. (2 marks)
- iii) Calculate the area enclosed by the points PQRVT in squares kilometers. 3 marks)

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KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 9

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and admission number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided.
- (c) This paper consists of two sections: **Section I** and **Section II**.
- (d) Answer all questions in **section I** and **only five** questions from **section II**.
- (e) Marks may be given for correct working even if the answer is wrong.
- (f) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used, except where 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

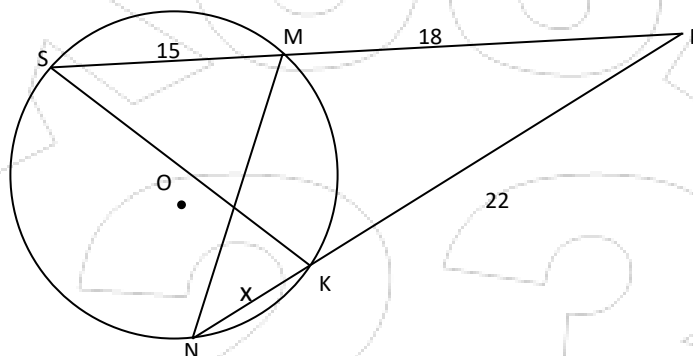
17	18	19	20	21	22	23	24	Total

Grand Total

--

SECTION I (50 MARKS)**Answer all the questions**

- Find matrix X given that $AX - X = \begin{pmatrix} -4 \\ -10 \end{pmatrix}$ where $A = \begin{pmatrix} 2 & 3 \\ -2 & 4 \end{pmatrix}$ (3 marks)
- The cost of providing a commodity consists of transport, labour and raw material in the ratio 8:4:12 respectively. If the transport cost increases by 12 % labour cost 18 % and raw materials by 40 %, find the percentage increase of producing the new commodity (3 marks)
- Find the number of terms in the series $\frac{8}{81} - \frac{4}{27} + \frac{2}{9} - \dots - 1\frac{11}{16}$ (3marks)
- Using binomial expansion simplify $\frac{(2+\sqrt{3})^4}{(2-\sqrt{3})^4}$ leaving your answer in the form $a+b\sqrt{c}$ where a, b and c are rational numbers (3marks)
- The figure below shows external intersection of two chords SM and NK which are produced to meet at P . Given that SOK is the diameter of the circle and that $SM=15\text{cm}$, $MP=18\text{cm}$ and $PK=22\text{cm}$



- Calculate the value of x representing length of chord NK . (1 marks)
 - Calculate the radius of the circle (2marks)
- Determine the equation of a circle if the coordinates of the end points of its diameter are $A(-4,4)$ and $B(6,-12)$ leaving your answer in the form of $ax^2 + by^2 + cx + dy + e = 0$ where a, b, c, d and e are integers. (3 marks)
 - Make 'c' the subject of the formula if $v^2 = \frac{r}{3} + \sqrt{\frac{1+c^2}{r^2}}$ (3marks)
 - Find the area enclosed by the curve $y = 81 - x^2$ and the x -axis using mid-ordinate rule with 9 strips. (4marks)
 - Without using a calculator or tables, find the value of x in $\log_{2.5}\left(\frac{1}{x}\right) - 1 - \log_{2.5}(x) = 3\log_{2.5}\left(\frac{1}{x}\right) - \log_{0.5} 2$ (3marks)
 - Solve for θ in the equation $6\cos^2 \theta - \sin \theta - 4 = 0$ in the range $-180^\circ \leq \theta \leq 180^\circ$ (3 marks).

11. Wambua deposited 6,400 in an investment account which pays 30% interest rate per annum compounded semi – annually for 3 years. Muinde invested one and a half times that of Wambua at $12\frac{1}{2}\%$ per annum simple interest for 6 years. Find whose investment earned more interest and by how much give your answer to the nearest **shilling**. (3marks)

12. (a) Expand and simplify the binomial expression. (2 Marks)

$$\left(2 - \frac{1}{2}y\right)^5$$

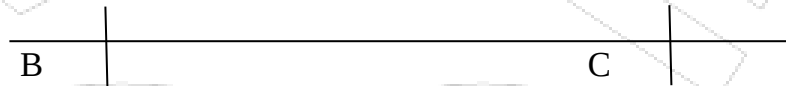
- (b) Use the first four terms of the simplified expression in (a) above to evaluate to 5 significant figures. $(1.98)^5$. (2 Marks)

13. Use logarithms to evaluate $\sqrt[3]{\frac{5.27 \times \cos^2 82.48}{\log 6.7}}$ (3marks)

14. Form the quadratic equation whose roots are $x = -\frac{5}{3}$ and $x = 1$ (2 marks)

15. A biased coin is weighted such that its tail is twice as likely to appear as the head. Find the probability that that a tail and a head appear when the coin is tossed twice. (3marks)

16. Line BC below is a side of a triangle ABC and also side of a parallelogram BCDE.



Using a ruler and a pair of compasses only construct:

- (i) The triangle ABC given that $\angle ABC = 120^\circ$ and $AB = 6$ cm. (1 mark)
 (ii) The parallelogram BCDE whose area is equal to that of the triangle ABC and point E is on line AB. (3 marks)

SECTION II (50 marks)

Answer only five questions from this section

17. ABCD is a quadrilateral with coordinates $A(2, 1)$, $B(3, 2)$, $C(3, 4)$ and $D(0, 3)$. ABCD is mapped onto $A'B'C'D'$ under transformation **T** given by a shear with x – axis invariant such that $A'(4, 1)$.
- a) Determine the 2×2 transformation matrix representing **T** and hence determine the coordinates of B' , C' and D' . (2 marks)
- b) $A'B'C'D'$ is transformed to $A''B''C''D''$ under a transformation **H** such that $A''(-6, -9)$ and $D''(-12, -15)$. Determine the 2×2 matrix representing **H** and hence determine the coordinates of B'' and C'' . (3 marks)
- c) $A''B''C''D''$ mapped onto $A'''B'''C'''D'''$ under a transformation **V** representing a reflection in the line $y = -x$. Determine the 2×2 matrix representing **V** and hence determine the coordinates of $A'''B'''C'''D'''$. (3 marks)

18. The following table shows heights of 200 seedlings of the same species measured to the nearest cm.

Height(cm)	frequency					
70- 79	7					
80-84	30					
85-89	66					
90-94	57					
95-99	27					
100-109	13					

a) Calculate the:-

i) Quartile deviation

3marks

b) Standard deviation using a working mean of 102

3marks

c) Draw an ogive curve representing the above information and use it to determine the percentage number of seedling whose height ranges between $85 \leq H \leq 93$.

(4marks)

19. In order to ensure optimal health a lab technician needs to feed the rabbits on a daily diet containing a minimum of 24grams of fat, 36grams of carbohydrates and 4grams of protein. Rather than order rabbit food that is custom blended it is cheaper to order food X and food Y and blend them for an optimal use. One packet of food X contains 6grams of fat ,12 grams of carbohydrates ,2 grams of proteins and costs Sh 50. While one packet of food Y contains 12grams of fat,12 grams of carbohydrates,1 gram of proteins and it costs Sh 60

a). Form all the inequalities to represent the information above.

(4 marks).

b). Graph all the **inequalities**

(4marks)

c). Determine the number of packets of type X and Y feed that should be used for optimal health at minimum cost.

(2marks)

20. Mr Kibet's PAYE per month is ksh 29,522. The ratio of his basic salary to taxable allowances is 13: 9. He is housed by his employer and pays a nominal rent of ksh 9000. His taxable pay is his gross pay plus 15% of his gross pay less the nominal rent. He is entitled to a personal relief of ksh 1056 per month. The following tax rates are used in the tax computation.

Income per annum (k£ per annum)	Rates (Ksh per K£)
1-5808	2
5809-11280	3
11281-16756	4
16753-22224	5
22225 and over	6

Calculate:

- a) His basic salary per month **7marks.**
 b) The percentage change in his PAYE if his taxable pay increases by 10% **3marks**

21. A group of students wish to build up a pile of toy bricks so as to have 2 bricks in the top row, 4 bricks in the second row, and 6 bricks in the third row and so on. If they have 3000 bricks

- a) How many rows can they complete and how many bricks are they left with? **(4marks)**
 b) Calculate the least number of bricks they should add to have all bricks used with no remainder? **(2marks)**
 c) Counting from the top, the 3rd row, 9th row, 27th row and so on form a geometric progression. If rows forming this progression are to be summed up, calculate the total number of bricks forming this arrangement after the number of bricks in (b) above have been included. **(4marks)**

22. P and Q are two points on latitude 60°S. Their longitudes are 30°E and 150°W respectively.

Find to one decimal place : (Take the radius of the earth = 6370km and $\pi = \frac{22}{7}$)

- a) The distance in km between P and Q along the parallel of latitudes. **(2marks)**
 b) The shortest distance along the earth's surface between P and Q. **(3marks)**
 c) A weather forecaster reports that the center of a cyclone at (30°S 120°W) is moving due south at 24 knots. How long will it take to reach a point (45°S, 120°W). **(2marks)**
 d) A plane leaves P at 1400hrs to Q at a speed of 900 knots along the shortest route. Determine the time at Q when the plane arrived. **(3marks)**

23. A curve is represented by the following function; $y = x^3 - 4x^2 + 5x - 2$. Use the curve to answer the following questions;

- a). Find $\frac{dy}{dx}$ **(1 mark)**
 b). (i). Determine the values of the stationary points of the curve. **(4marks)**
 (ii). Determine the nature of each stationary point on the curve **(2 marks)**
 c). In the space provided, sketch the curve of $y = x^3 - 4x^2 + 5x - 2$ **(3 marks)**

24. Three quantities A,B and C are such that A varies directly as the square root of B and inversely as the square of C.

- a). Given that $A = 4$ when $B = 64$ and $C = 5$, find
 i). The law connecting A, B and C **(4 marks)**
 ii). A when $B = 16$ and $C = 10$ **(2 marks)**
 b). If B is increased by 44% and C decreased by 20%, find the percentage change in A. **(4 marks)**

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KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 10

121/1

MATHEMATICS

PAPER 1

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

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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

--

SECTION I (50 MARKS)

Answer all the questions in the spaces provided.

1. Evaluate without using tables or calculators

(2mks)

$$\frac{6}{7} \text{ of } \frac{14}{3} \div 80 \times \frac{-20}{3}$$

$$-2 \times 5 \div (14 \div 7) \times 3$$

2. The line $y = 3x + 3$ meets the line L_1 at the point $(2, 9)$ and at right angles. Find the points at which the two lines intersect with the x -axis.

(3mks)

3. Given that $p = 5a - 3b$ where $a = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$ and $b = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$, find :

- a) Column vector p .

(2mks)

- b) P' the image of p under a translation vector

$$\begin{bmatrix} -6 \\ 4 \end{bmatrix}$$

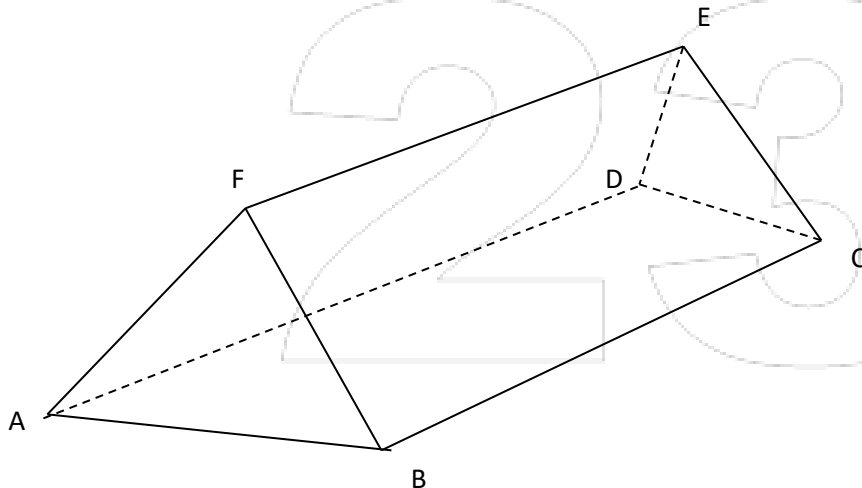
(1mk)

4. Solve the following inequalities and represent the solution on a number line.

(3mks)

$$4x - 3 \leq 6x - 1 < 3x + 8$$

5. The figure below shows a triangular prism of uniform cross section. $AF = FB = 4\text{cm}$. $AB = 7\text{cm}$, $BC = 12\text{cm}$. given that angle $BAF = 30^\circ$, find the total surface area of the prism. (3mks)



6. Use tables of cubes, cubes roots and reciprocals to evaluate;

(4mks)

$$23.5^3 - 3 \sqrt[4]{4411} + \frac{1}{0.0071}$$

7. The density of a substance A is given as 13.6g/cm^3 and that of a substance B as 11.3g/cm^3 . Determine, correct to one decimal place, the volume of B that would have the same mass as 50cm^3 of A.

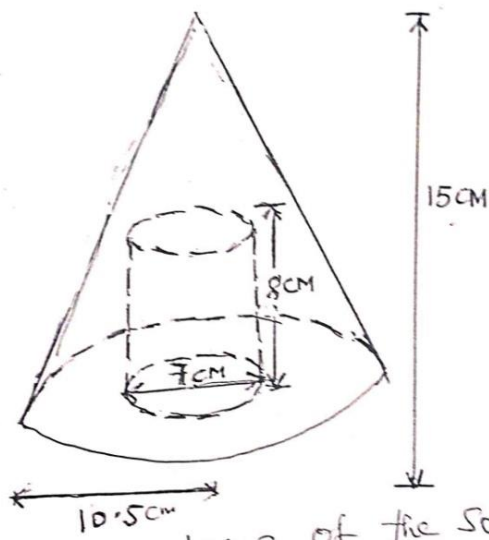
(3mks)

8. Find x in $2(4^x) - 10(2^x) + 8 = 0$ (3mks)
9. The sum of interior angles of a regular polygon is 24 times the size of the exterior angle. Find the number of sides of the polygon. (3mks)
10. Triangle ABC has its vertices at A(3, 0), B(2,3) and C(5,1) if A'(5, 0), B'(3,6) and C'(9,2) is the image of ABC under enlargement. On the same axes and grid provided below, determine the centre of enlargement and linear scale factor. (3mks)
11. The following measurements were recorded in a field book of a farm using XY as the base line XY=400M.

	Y	
C60	340	
	300	120D
	240	100E
	220	160F
B 100	140	
A 120	80	
	X	

Using a suitable scale, draw an accurate map of the farm. (4mks)

12. Waceke is a saleslady. She is paid Ksh15,375 per month. She is also paid a commission of $4\frac{1}{2}\%$ on the amount of money she makes from her sales. In a certain month, she earned a total of Ksh. 28,875. Calculate the value of her sales that month. (3mks)
13. Two buses P and Q leave Kisumu at 7.30am and 9.30am respectively. If their speeds are 60km/h and 100km/h respectively, find when Q catches up with P. (3mks)
14. The figure below shows a solid cone. It has a cylindrical hole drilled into it. The diameter of the hole is 7cm and its height 8cm. The radius of the cone is 10.5cm and its vertical height is 15cm.



Calculate the volume of the solid. (3mks)

15. Simplify completely:

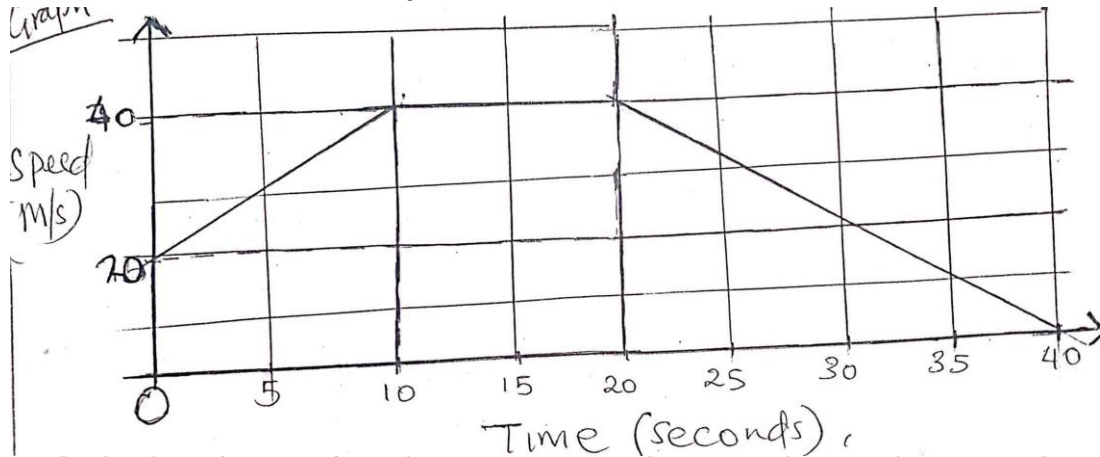
(3mks)

$$\frac{(a+2b)^2 - (2a-b)^2}{ab^2 - a^2}$$

16. The figure below represents a speed time graph for a cheetah in 40 seconds.

Calculate the total distance covered by the cheetah.

(3mks)



SECTION II

Answer any five questions in this section.

17. A rectangular tank whose internal dimensions are 2.4m by 2.5m by 3.7m is two thirds full of juice.

a. Calculate the volume of the juice in litres.

(3mks)

b. The juice is packed in small packets in a shape of right pyramid with equilateral triangles of sides 20cm. the height of each packet is 15cm. a full packet is sold at kshs. 50 per packet.

Calculate:

i. The volume of the juice in cm^3 of each packet to the nearest whole number.

(3mks)

ii. The number of full packets of juice.

(2mks)

iii. The amount of money realized from the sale of juice.

(2mks)

18. The masses in kilograms of patients who attended a clinic on a certain day were recorded as follows.

67	49	57	58	69	58	39	61	51	47
38	59	46	52	60	72	59	49	54	52
69	62	58	67	63	59	65	58	49	44
49	41	70	58	54	60	60	59	42	41
79	52	51	48	54	59	62	73	48	54

a) Starting with the class 35-39, make a frequency distribution table for the data.

(2mks)

b) Calculate the mean mass.

(3mks)

ii) Calculate the median mass.

(3mks)

c) On the grid provided draw a frequency polygon to represent the data.

(2mks)

19. The position vectors of A, B and C are $3\mathbf{i} - 2\mathbf{j}$, $-6\mathbf{i} + 4\mathbf{j}$ and $-9\mathbf{i} - 3\mathbf{j}$ respectively.

- a. State the column vectors.
 - i. AB (2mks)
 - ii. CB (2mks)
- b. Find the distance from A to C. (2mks)
- c. Find the coordinates of the mid point of AC. (2mks)
- d. If point C' is the image of C under translation vector $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

Find the co-ordinates of C'. (2mks)

20. Complete the table below for the function $y = x^2 - 3x + 6$ in the range $-2 \leq x \leq 8$. (2mks)

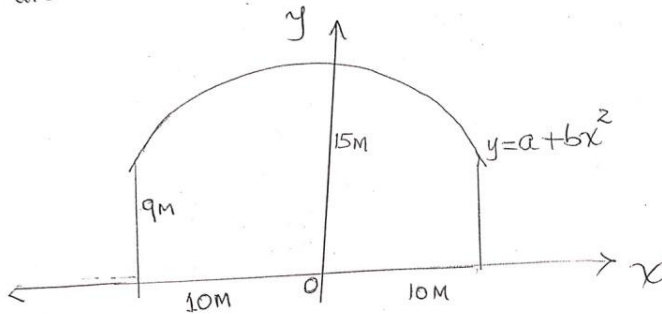
X	-2	-1	0	1	2	3	4	5	6	7	8
Y											

- a. Use the trapezium rule with 10 strips to estimate the area bounded by the curve, $y = x^2 - 3x + 6$, the lines $x = -2$, $x = 8$ and the x - axis. (3mks)
 - b. Use the mid - ordinate rule with 5 strips to estimate the area bounded by the curve, $y = x^2 - 3x + 6$, the lines $x = -2$, $x = 8$ and the x - axis. (3mks)
 - c. By integration, determine the actual area bounded by the curve $y = x^2 - 3x + 6$, the lines $x = -2$, $x = 8$, and the x - axis. (3mks)
21. The corner points A, B, C and D of a ranch are such that B is 8km directly East of A and C is 6km from B on a bearing of 30° . D is 7km from C on a bearing of 300° .
- a. Using a scale of 1cm to represent 1km, draw a diagram to show the positions of A, B, C and D. (4mks)
 - b. Use the scale drawing to determine:
 - i. The bearing of A from D. (1mk)
 - ii. The distance BD in kilometers. (2mks)
 - iii. The perimeter of the ranch in kilometers. (3mks)

22. Johana and Muchiru contributes Ksh. 150,000 and Ksh. 180,000 every year respectively for a business, after one year Jacob joined the business and contributed Ksh. 135,000.

- a. Calculate the ratio of their investment after three years of business. (3mks)
- b. They agreed that 30% of the profits after 3 years be used to cater for the costs of running the businesses while the remaining would be shared proportionally. Calculate each person's share if the profit after 3 years was shs. 240,000. (4mks)
- c. If each re-invested their shares back into the business, find the new individual investment at the beginning of the fourth year. (3mks)

23. The figure below shows the end wall of a building with the axes shown and 1M as the unit of measurement. The roof line is given by $y = a + bx^2$, where a and b are constants.



- State the value of a . (1mk)
- Calculate the value of b . (3mks)
- Calculate the values of y for $x = 2, 4, 6, 8$ and complete the table below. (2mks)

X	-10	0	2	4	6	8	10
Y	9	15					9

- Calculate the area of the wall. (4mks)

24. A ball is thrown upwards and its height after t seconds is 5 meters, where $s = 20t - 5t^2$. Find

- The greatest height reached and the time when it is reached. (3mks)
- The time when it returns to the original level. (3mks)
- Its velocity after 3 seconds. (2mks)
- Its acceleration during the throw. (2mks)

KCSE 2023 FINAL PREDICTION

EXPECTED TRIAL 10

121/2

MATHEMATICS

PAPER 2

TIME: 2½ HOURS

NAME.....

SCHOOL..... SIGN.....

INDEX NO..... ADM NO.....

Kenya Certificate of Secondary Education.

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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

--

SECTION I (50 MARKS)

Answer ALL the questions in this section.

1. Use logarithms to evaluate:

$$\sqrt[3]{\frac{45.3 \times 0.00697}{0.534}} \quad (4 \text{ marks})$$

2. a) Expand $\left(1 - \frac{1}{2}x\right)^6$ up to fourth term. (2 marks)

- b) Use the expansion above to evaluate $(0.98)^6$ (2 marks)

3. The data below represents the ages in months at which 11 babies started walking:
9, 15, 12, 9, 8, 13, 7, 11, 13, 14 and 10.

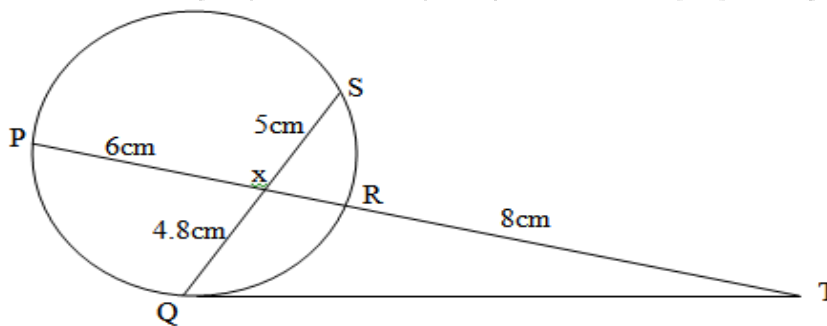
Calculate the interquartile range of the above data (3 marks)

4. The fifth term of an arithmetic progression is 11 and the twenty fifth term is 51.

Calculate the first term and the common difference of the progression. (3 marks)

5. If $\frac{\sqrt{3}-2\sqrt{2}}{3\sqrt{2}+\sqrt{3}} = a\sqrt{b} + c$ Find the values of a, b and c. (3 marks)

6. In the figure below QT is a tangent to the circle at Q. PXRT and QXS are straight lines.
PX = 6cm, RT = 8cm, QX = 4.8cm and XS = 5cm.



Find the length of QT (3 marks)

7. Solve for x in the equation below:

$$\log 3(x + 3) = 3 \log 3 + 2 \quad (3 \text{ marks})$$

8. Pipe A can fill a tank in 2 hours, Pipe B and C can empty the tank in 5 hours and 6 hours respectively. How long would it take:

- a) To fill the tank if A and B are left open and C is closed. (2 marks)

- b) To fill the tank with all pipes open. (2 marks)

9. A transformation is represented by the matrix $\begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix}$. This transformation maps a triangle ABC of the area 12.5cm^2 onto another triangle A'B'C'. Find the area of triangle A'B'C'. (3marks)

10. Make P the subject of the formula $XY^P = Q^{PX}$ (3 marks)

11. The coordinates of the end points of diameter are A(2,4) B(-2,6). Find the equation of a circle in the form $ax^2 + by^2 + cx + dy + e = 0$ (3 marks)

12. A bag contains 10 balls of which 3 are red, 5 are white and 2 green. Another bag contains 12 balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and a ball picked at random. Find the probability the ball so chosen is red. (3 marks)

13. Use the trapezium rule with seven ordinates to find the area bounded by the curve $y = x^2 + 1$ lines $x = -2$, $x = 4$ and x – axis **(3 marks)**
14. Wanjiku pays for a car on hire purchase in 15 monthly instalments. The cash price of the car is Ksh.300, 000 and the interest rate is 15%p.a. A deposit of Ksh.75, 000 is made. Calculate her monthly repayments. **(3 marks)**
15. The length and breadth of a rectangular floor garden were measured and found to be 4.1m and 2.2m respectively. Find the percentage error in its area. **(3 marks)**
16. The gradient function of a curve is given $\frac{dy}{dx} = 3x^2 - 8x + 2$. If the curve passes through the point, (2, -2), find its equation. **(3 marks)**

SECTION II (50 MARKS)

Answer five questions only from this section

17. The following table shows the rate at which income tax was charged during a certain year.

Monthly taxable income in Ksh.	Tax rate %
0 - 9860	10
9861 - 19720	15
19721 - 29580	20
29581 - 39440	25
39441 - 49300	30
49301 - 59160	35
over 59160	40

A civil servant earns a basic salary of Ksh.35750 and a monthly house allowance of sh.12500. The civil servant is entitled to a personal relief of sh.1062 per month. Calculate:

- a) Taxable income **(2 marks)**
- b) Calculate his net monthly tax **(5 marks)**
- c) Apart from the salary the following deduction are also made from his monthly income.

WCPS at 2% of the basic salary

Loan repayment Ksh.1325

NHIF sh.480

Calculate his net monthly earning. **(3 marks)**

18. a) Complete the table below for $y = \sin 2x$ and $y = \sin (2x + 30)$ giving values to 2d.p

X	0	15	30	45	60	75	90	105	120	135	150	165	180
Sin 2x	0				0.87				-0.87				0
Sin (2x + 30)	0.5				0.5				-1				0.5

(2 marks)

- b) Draw the graphs of $y = \sin 2x$ and $y = \sin (2x + 30)$ on the axis. **(4 marks)**

- c) Use the graph to solve $\sin (2x + 30) - \sin 2x = 0$ (1 mark)
 d) Determine the transformation which maps $\sin 2x$ onto $\sin (2x + 30)$ (1 mark)
 e) State the period and amplitude of $y = \sin (2x + 30)$ (2 marks)

19. A plane S flies from a point P (40°N , 45°W) to a point Q (35°N , 45°W) and then to another point T (35°N , 135°E).

- a) Given that the radius of the earth is 6370km find the distance from P to Q in Km.
 (Take $\pi = \frac{22}{7}$) (2 marks)
 b) Find in nm
 (i) The shortest distance between Q and T. (2 marks)
 (ii) The longest distance between Q and T (to the nearest tens) (2 marks)
 c) Find the difference in time taken when S flies along the shortest and longest routes if its speed is 420 knots (4 marks)

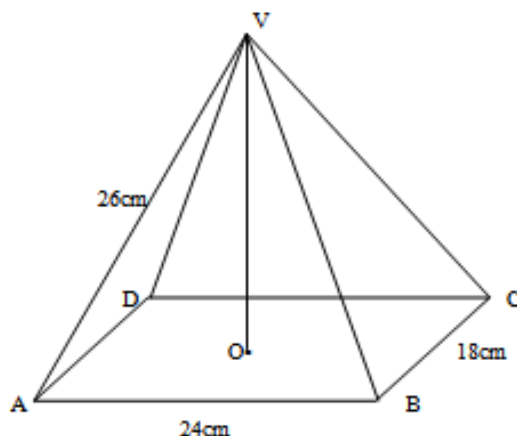
20. The following table shows the distribution of marks obtained by 50 students.

Marks	45 – 49	50 – 54	55 – 59	60 – 64	65 – 69	70 – 74	75 – 79
No. of students	3	9	13	15	5	4	1

By using an assumed mean of 62, calculate

- a) the mean (5 marks)
 b) the variance (3 marks)
 c) the standard deviation (2 marks)

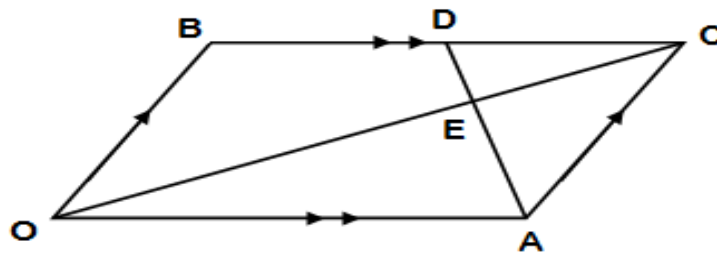
21. The diagram below represents a pyramid standing on rectangular base ABCO. V is the vertex of the pyramid and $VA = VB = VC = VD = 26$ cm. M is the midpoints of BC and AC respectively. $AB = 24$ cm and $BC = 18$ cm.



Calculate:-

- The length of the projection of line VA on plane ABCD (2marks)
- The angle between line VA and the plane ABCD. (2marks)
- The size of the angle between the planes VBC and ABCD. (2marks)
- The vertical height of the pyramid. (2marks)
- The volume of the pyramid (2marks)

22. A parallelogram OACB is such that $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$. D is the mid-point of BC. $\mathbf{OE} = h\mathbf{OC}$ and $\mathbf{AE} = k\mathbf{AD}$.



- Express the following in terms of $\mathbf{a}$, $\mathbf{b}$, h and k .
 - $\mathbf{OC}$ (1 mark)
 - $\mathbf{OE}$ (1 mark)
 - $\mathbf{AD}$ (1 mark)
 - $\mathbf{AE}$ (1 mark)
- Find the values of h and k . (4 marks)
- Determine the ratios:
 - $\mathbf{AE} : \mathbf{ED}$ (1 mark)
 - $\mathbf{OE} : \mathbf{OC}$ (1 mark)

23. A uniform distributor is required to supply two sizes of skirts to a school: medium and large sizes. She was given the following conditions by the school.

- The total number of skirts must not exceed 600.
- The number of medium size skirts must be more than the number of large size skirts.
- The number of medium size skirts must not be more than 350 and the number of large size skirts must not be less than 150. If the distributor supplied x medium size and y large size skirts.

(a) Write down, in terms of x and y , all the linear inequalities representing the conditions above. (4mks)

(b) On the grid provided, represent the inequalities in (a) above by shading the unwanted regions. (4mks)

The distributor made the following profits per skirt.: Medium size = Sh.300., Large size = Sh.250. Determine the maximum profit. (3mks)

24. (a) On the same diagram construct:-

i) Triangle PQR such that $PQ = 9\text{cm}$, $PR = 7\text{cm}$ and $\angle RPQ = 60^\circ$ **(2 marks)**

ii) The locus of a point M such that M is equidistant from P and Q. **(1 mark)**

iii) The locus of a point N such that $RN \leq 3.5\text{cm}$. **(1 mark)**

b) On the diagram in part (a)

i) Shade the region B, containing all the points enclosed by the locus on M and the locus of N such that $PM \geq QM$. **(2 marks)**

ii) Find the area of the shaded region in (i) above **(4 marks)**



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CAUTION TO KCSE 2023 CANDIDATES:

**IN CASE / ON EVENT YOU REALIZE PART OF THESE
QUESTIONS WERE DIRECTLY OR INDIRECTLY LIFTED IN
THE FINAL KCSE 2023 EXAMINATIONS PLEASE DO NOT
PANIC!**

KILA LA HERI