KCSE MATHS 2022 LATEST PREDICTION EXAMS

KCSE PREDICTION 1 2022

PAPER 1

SECTION I (50 marks)

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

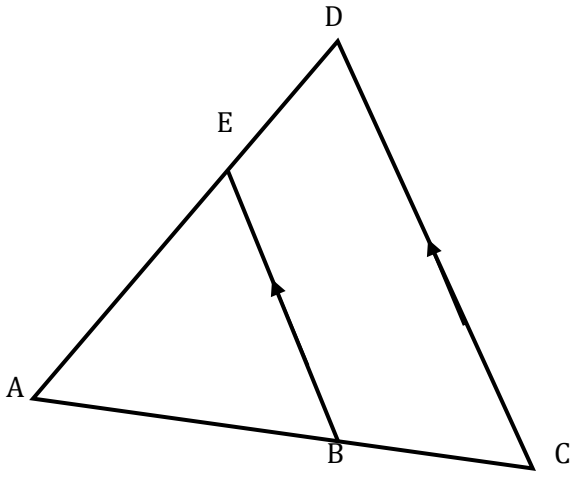
1. Evaluate (3 marks)

$$\frac{\frac{1}{3}of2\frac{1}{3}+\frac{2}{3}(1\frac{2}{3}-1\frac{1}{2})}{\frac{3}{4}of3\frac{1}{3}\div\frac{1}{4}}$$

2. Solve the inequality below. Hence state the integral values. (3 marks)

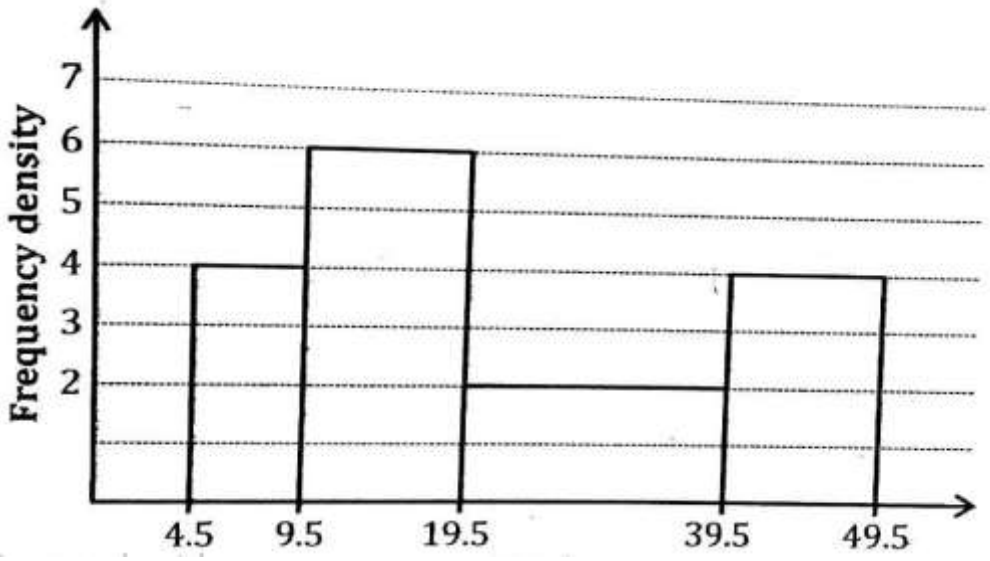
$$x < 2x + 7 \leq -\frac{1}{3}x + 14$$

3. The sum of interior angles of a triangle is given by $(10x - 2y)^0$ while that of a hexagon is given by $(30x - 24y)^0$. Calculate the values of x and y. (3 marks)
4. The equation of the line is given by $3y = 2x + 15$. Given that the L_1 cuts the x axis at a point A.
   a) Find the coordinates of A (2 marks)
   b) Find the angle the line L_1 makes with the x axis. (2 marks)
5. In the triangle below, BE is parallel to CD. BE=10cm, CD=15cm and the area of the trapezium BCDE is ***75cm²***, calculate the area of triangle ACD. (3 marks)



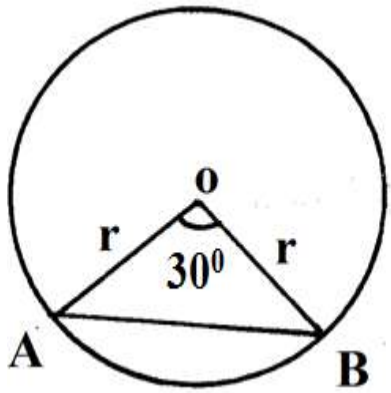
6. A and B are on the same side of the tower. The angles of elevation of the top of the towers from A and B are 32^0 and 50^0 respectively. If AB = 15cm. calculate the height of the tower to 2 decimal places. (4 marks)
7. Solve the equation $4^{x+1} \times \frac{1}{8}^{(2x-3)} = \sqrt{2}$ (3 marks)

8. The diagram below shows a histogram from marks obtained in a certain test.



Use the histogram to make the frequency table for the distribution. (3 marks)

9. A sales lady earns a basic salary of sh. 12400 per month. In addition, she gets a commission of 2% on the first sh. 80000 worth of goods and a commission of 3% on goods worth above sh. 80000. In a certain month, she earned a total of sh. 20000. Calculate the value of goods sold that month. (3 marks)
10. The figure below shows a circle centre O. Chord AB subtends 30^0 at the centre. If the area of the minor segment is $5.25cm^2$, find the radius of the circle. (3marks)



11. Simplify the following expression completely. (3 marks)

$$\frac{12a^2 - 3b^2}{2a^2 - ab - b^2}$$

12. A commercial bank in Kenya buys and sells foreign currency as shown in the table below.

	Buying (Ksh)	Selling(Ksh)
1 US $	100.36	100.92
1 Sterling pound	130.52	130.64

James who is going for studies in USA had Ksh. 1,236,600.

a) Calculate the amount of money in dollars he had to the nearest dollar. (1 mark)
b) His father who works in England sent him 4000 sterling pounds, while he was still in Kenya. Find the total amount in dollars he left with to USA. (2 marks)

13. Wekesa and Ndida working together can cultivate a piece of land in 6 days. Wekesa alone can complete the work in 15 days. After the two had worked for 4 days Wekesa withdrew the services. Find the time taken by Ndinda to complete the remaining work. (3 marks)
14. Given that $\sin\theta = \frac{3}{5}$ and $90^0 \leq \theta \leq 180^0$, find without using trigonometric tables, the value of $2tan\theta + 3cos\theta$ (3 marks)
15. Use square, square root and reciprocal tables only to evaluate the following giving your answer to 2 decimal places. (3 marks)

$$\frac{2}{\sqrt{34.46}} + \frac{2}{(8.67)^2}$$

16. The sum of digits formed in a two digit number is 16. When the number is subtracted from the number formed by reversing the digits, the difference is 18. Find the number (3 Marks)

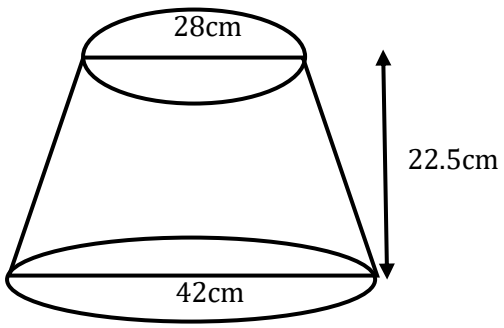
SECTION II(50 Marks)

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

17. A group of choir members decided to raise ksh. 3600 to buy a guitar. Each member was to contribute equal amount. In the preparation process five members transferred to another church, that meant the remaining contributors had to pay more to achieve the target.
    a) Show that the increase in the contribution per member was:
    $\frac{18000}{n(n-5)}$ if n is the initial number of members. (4 marks)

    b) If the increase in the contribution per member was Ksh. 24, what was the original contribution before the other members left? (4 marks)
    c) Calculate the percentage increase in the contribution before the others left. (2 marks)
18. a) Using a ruler and a pair of compasses only construct a rhombus A B C D such that AB = 6cm and <ABC = 135^o. (4 marks)

    (b) Drop a perpendicular from C to AB extended to meet AB at N. Measure BN and CN. (2 marks)
    (c) Bisect <ABC and <DAB, let the two bisectors meet at M. Measure MA. (2 marks)
    (d) Determine the area of triangle ABM. (2 marks)
19. A village Q is 7 km from village P on a bearing of 045^0. Village R is 5 km from village Q on a bearing of 120^0 and village S is 4 km from village R on a bearing of 270^0.
    a) Taking a scale of 1cm to represent 1 km, locate the four villages. (4 marks)
    b) Use the scale drawing to find the:
        i) Distance and bearing of the village R from village P. (2 marks)
        ii) Distance and bearing of village P from village S. (2 marks)
        iii) Area of the polygon PQRS to the nearest 4 significant figures. (2 marks)
20. The diagram below represents a solid frustum with base diameter 42cm and top diameter 28cm. the frustum is 22.5cm high and is made of a metal whose density is 3 g/cm^3 (take $\pi = \frac{22}{7}$



a) Calculate the volume of the metal in the frustum. (5 marks)

b) Calculate the mass of the frustum in kg. (2 marks)

c) The frustum is melted down and recast into a solid cube. In the process 20% of the metal is lost. Calculate to 2 decimal places the length of each side of the cube. (3 marks)

21. A solution whose volume is 80 litres is made up of 40% of water and 60% of alcohol. When x litres of water is added the percentage of alcohol drops to 40%.

a) Find the value of x. (4 marks)

b) Thirty litres of water is added to the new solution. Calculate the percentage of alcohol in the resulting solution. (2 marks)

c) If 5 litres of the solution in (b) above is added to 2 litres of the original solution. Calculate in the simplest form, the ratio of water to that of alcohol in the resulting solution. (4 marks)

22. A truck left town X at 11.45am and travelled towards town Y at an average speed of 60 km/hr. A car left town x at 2.15pm on the same day and travelled along the same road at an average speed of 100km/hr. The distance between the two towns is 500km.

a) Calculate the time of the day when the car overtook the truck. (4 marks)

b) The distance from Y when the car overtook the truck. (3 marks)

c) After overtaking the bus, both vehicles continued towards Y at their original speeds. Find how long the car had to wait at town Y before the ruck arrived.(3 marks)

23. (a) Complete the table below for the equation $y = x^2 - 6x + 5$. (2 marks)

x	0	1	2	3	4	5	6
x^2	0		4	9		25	
$-6x$	0	-6			-24		-36
5	5	5	5	5	5	5	5
y	5					0	

b) Draw the graph of $y = x^2 - 6x + 5$ using the values in the table. (3 marks)

c) use the graph to solve the equations.

i) $x^2 - 6x + 5 = 0$ (1 mark)

ii) $x^2 - 6x + 7 = 0$ (2 marks)

iii) $x^2 - 6.5x + 5 = 0$ (2 marks)

24. A business lady bought 100 quails and 80 rabbits for Sh. 25,600. If she had bought twice as many rabbits and half as many quails she would have paid Sh. 7,400 less. She sold each quail at a profit of 10% and each rabbit at a profit of 20%.

(a) Form two equations to show how much she bought the quails and the rabbits (2 Marks)

(b) Find the cost of each (3 Marks)

(c) Calculate the profit she made from the sale of the 100 quails and 80 rabbits (3 Marks)

(d) What percentage profit did she make from the sale of the 100 quails and 80 rabbits (2 Marks)

PAPER 2

SECTION 1 (50 MARKS): ANSWER ALL QUESTIONS IN THE SECTION.

1. Use Logarithms correct to four significant figures to evaluate. (4marks)

$$\sqrt[3]{\frac{24.36 \times 0.066547}{1.48^2}}$$

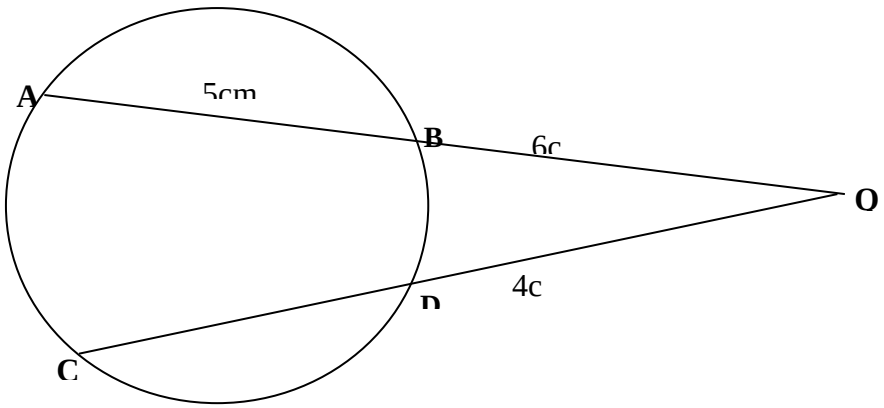
2. a)Given the vectors $\boldsymbol{a} = 3\boldsymbol{i} - \boldsymbol{j} + 2\boldsymbol{k}$, $\boldsymbol{b} = 4\boldsymbol{i} + 2\boldsymbol{j} - \boldsymbol{k}$ and $\boldsymbol{p} = 2\boldsymbol{a} - \boldsymbol{b}$. Express $\boldsymbol{p}$ in terms of $\boldsymbol{i}$, $\boldsymbol{j}$ and $\boldsymbol{k}$. (2 marks)

   b) Hence calculate $|\boldsymbol{p}|$ correct to 3 significant figures. (1 mark)

3. W varies directly as the cube of x and inversely as y. Find W in terms of x and y given that W = 80 when x = 2 and y = 5. (2 Marks)
4. A cold water tap can fill a bath in 10 minutes while a hot water tap can fill it in 8 minutes. The drainage pipe can empty it in 5 minutes. The cold water and hot water taps are opened for 4 minutes. After four minutes all the three taps are opened. Find how long it takes to fill the bath. (3 Marks)
5. 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 = $\begin{pmatrix} x & 4 \\ 3 & x+3 \end{pmatrix}$. Find the positive values of x (3 Marks)
6. Make P the subject of the formula in $L = \frac{2}{3}\sqrt{\frac{x^2 - PT}{y}}$ (3 Marks)
7. (a) Expand the expression $\left(1 + \frac{1}{2}x\right)^5$ in ascending order powers of x, leaving the coefficients as fractions in their simplest form. (2 Marks)

   (b) Use the first three terms of the expansion in (a) above to estimate the value of $(1.05)^5$ (2 Marks)
8. By rounding each number to the nearest tens, approximate the value of $\frac{2454 \times 396}{66}$

   Hence, calculate the percentage error arising from this approximation to 4 significant figures. (3 Marks)
9. Without using a calculator or mathematical tables, express $\frac{\sqrt{3}}{1 - Cos\ 30^0}$ in surd form and simplify (3 Marks)
10. Solve for θ in the equation $sin\ (3\theta + 120)^0 = \frac{\sqrt{3}}{2}$ for $0^0 \leq \theta^0 \leq 180^0$ (3Mark
11. The equation of a circle is $x^2 + y^2 + 6x - 10y - 2 = 0$. Determine the co-ordinates of the centre of the circle and its radius. (3 Marks)
12. Kamau deposited ksh.50,000 in a financial institution in which interest is compounded quarterly. If at the end of second year he received a total amount of ksh79,692.40. Calculate the rate of interest p.a (3 Marks)
13. Chords AB and CD in the figure below intersect externally at Q. if AB = 5cm BQ = 6cm and DQ = 4cm, calculate the length of chord CD. (3 Marks



14. Two containers have base area of $750cm^2$ and $120cm^2$ respectively. Calculate the volume of the larger container in litres given that the volume of the smaller container is $400cm^3$. (3 Marks)
15. (a) Find the inverse of the matrix $\begin{pmatrix} 3 & 2 \\ 5 & 4 \end{pmatrix}$ (1 Marks)

    (b) Hence or otherwise solve the simultaneous equations (3marks)

$3x + 2y = 4$
$5x + 4y = 9$

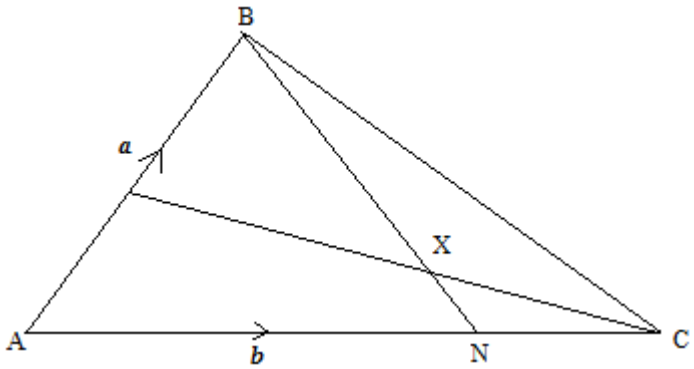
16. Solve for x in the equation. (3 Marks)

$Log_8 (x + 6) - Log_8 (x - 3) = \frac{2}{3}$

SECTION II (50 MARKS)

*Attempt **ONLY FIVE** questions from this section.*

17. In triangle ABC, shown below, AB = **a** AC = **b** point M lies on AB such that AM: MB = 2:3 and point N lies on AC such that AN: NC = 5:1 line BN intersects line MC at X.



a) Express the following in terms of ***a*** and ***b***

i) **BN** (1 mark)

ii) **CM** (1 mark)

b) Given that **BX** = k**BN** and **CX** = r**CM** where k and r are scalars

i) Write two different expressions for **AX** in term of a, b, k and r (4 marks)

ii) Find the values of k and r (4 marks)

18. A particle moves such that t seconds after passing a given point O is given by

$S = t(t - 2)(t - 1)$

a) Find its velocity when t = 2 second (3 marks)

b) Find its minimum velocity. (3 marks)

c) Find the time when the particles is momentarily at rest. (3 marks)

d) Find its acceleration when t = 3 seconds. (1mark)

19. 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)

20. (a) (i) Taking the radius of the earth, R= 6370km and $\pi = {}^{22}/_{7}$, calculate the shortest distance between the 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)

21. A married couple intends to have 3 children. They consult an expert who tells them that the probability of a male birth is 0.55.

(a) Draw a tree diagram to represent this occurrence. (2 marks)
(b) Find the probability that
(i) All the three children will be female. (2 marks)
(ii) At least a male is born. (2 marks)
(iii) At least 2 will be females, giving your answer to 3 s.f. (4 marks)

22. 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. (1mark)

(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 terms of the AP is 78. Calculate:

(i) the first term and common difference of the AP. (5marks)

(ii) the sum of the first nine terms of the AP. (2marks)

(iii) The difference between the fourth and the seventh terms of an increasing AP. (2marks)

23. a) Draw ΔPQR whose vertices are P(1,1)Q(-3,2) and R(0,3) on the grid provided (2marks)

b) Find and draw the image of ΔPQR under the transformation whose matrix is

$\begin{pmatrix} 3 & 0 \\ 1 & 1 \end{pmatrix}$ and label the image P'Q'R' (2mks)

c) P'Q'R' is then transformed into P^{11} Q^{11} R^{11} by the transformation with the matrix $\begin{pmatrix} -1 & 0 \\ 1 & 3 \end{pmatrix}$

Find the co-ordinates of P^{11} Q^{11} R^{11} and draw P^{11} Q^{11} R^{11} (3marks)

d) Describe fully the single transformation which maps PQR onto P^{11} Q^{11} R^{11} and find the matrix of this transformation (3marks)

24. For a sample of 100 bulbs, the time taken for each bulb to burn was recorded. The table below shows the result of the measurements.

Time (in hours)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
Number of bulbs	6	10	9	5	7	11	15	13	8	7	5	4

(a) Using an assumed mean of 42, calculate
(i) the actual mean of distribution (4 Marks)
(ii) the standard deviation of the distribution (3 Marks)
(b) Calculate the quartile deviation (3 Marks)

KCSE PREDICTION 2 2022
PAPER 1
SECTION A (50MKS)

ANSWER ALL THE QUESTIONS IN THIS SECTION

1. Simplify $\dfrac{\left(1\frac{3}{7}-\frac{5}{8}\right)+\frac{2}{3}\,of\ 1\frac{1}{5}}{\frac{3}{4}+1\frac{5}{7}\div\frac{4}{7}\,of\ 2\frac{1}{3}}$ (4mks)
2. A straight-line ax + by = 16 passes through A (2, 5) and B (3, 7). Find the values of a and b (3mks)
3. Simplify $\dfrac{2-x-x^2}{3x^2-2x-1}$ (3mks)
4. Solve for X where $0 \leq x \leq = \ 90^0$
   $\sin 2x\ - \cos(x-30) = 0$ (2mks)
5. Solve for X in
   $2x-4\ \leq 3x+2\ < 10-x$
   Hence represent your solution on a number line (3mks)
6. Two similar cylindrical solids have heights of 18 cm and 24 cm. The volume of the larger cylinder is 320cm^3, find the volume of the smaller cylinder (4mks)
7. Solve for X
   $8^{3x-2}\ x\ 16^{\frac{1}{2}X} = \frac{1}{4}$ (3mks)
8. A quantity P varies jointly as Q and inversely as on the square root of R. If Q is increased by 10% and R is reduced by 19%, find the percentage change in P (3mks)
9. Okedi sold goods whose marked price is sh. 340,000 at a discount of 2%. He was paid sh. 16660 as commission for the total sales. Calculate the percentage rate of commission (3mks)
10. The interior angle of a regular polygon is three and a half times the exterior angle. Determine the sides of the polygon (3mks)
11. Give that A = $\begin{pmatrix}2 & 3\\ 1 & 4\end{pmatrix}$, $B\begin{pmatrix}-1 & 3\\ 2 & -1\end{pmatrix}$;find matrix C where AC = B (3mks)

12. Amoit bought 2 pens and 5 exercise books at a cost of sh. 275. Allan bought 4 such pens and exercise books from the same shop at a cost of sh. 415 by letting sh. X and y to be the costs of a pen and a book respectively, find the cost of each item (4mks)
13. Okech left some money in his will to be shared amongst his wife, son and daughter in the ratio 4:3:2 respectively. If the daughter received sh. 120,000 less than the mother's share, find the total amount of money Okech left in his will. (2mks)
14. Use tables of reciprocals to find the reciprocal of 0.3758. Hence find the value $\frac{\sqrt[3]{0.125}}{0.3758}$ correct to 4.S.f (4mks)
15. A major sector of a circle subtends an angle of 150 at the centre. The radius of the circle is 7cm and the centre is at O as shown



If the sector is folded into a conical shape, calculate the radius of the cone correct to 1 d.p (3mks)

16. A Kenyan bank buys and sells currencies at the exchange rates below

Currency	Buying (ksh)	Selling (ksh)
1 euro	147.87	148.00
1 us dollar	74.22	74.50

An American tourist arrived in Kenya with 24,000 Euros. He converted all the euros to Kenya shillings at the bank. He spent a total sh. 200,000 while in Kenya and converted the rest into US dollars at the bank. Find the amount in dollars that he received. (3mks)

SECTION II (50MKS)

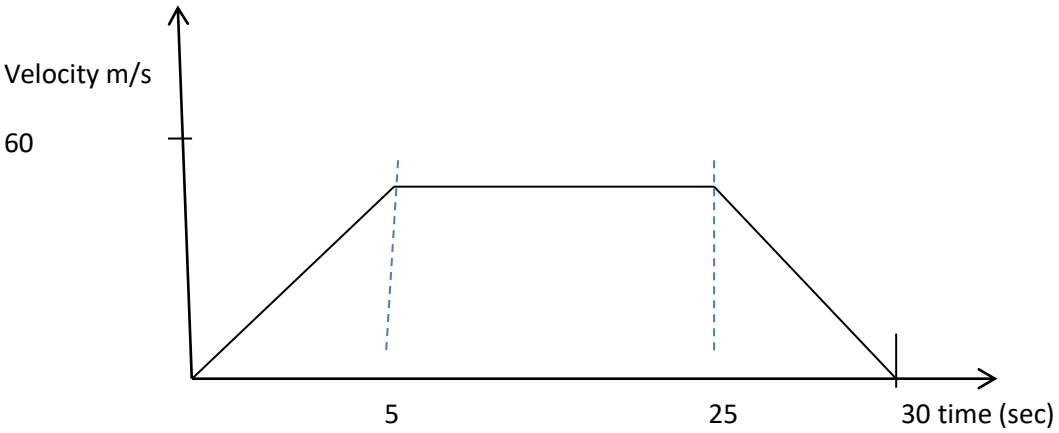
ANSWER ANY FIVE QUESTIONS IN THIS SECTION

17. The diagonals of a rectangle P, Q, R, S intersect at (5, 3). Given that the equation of line PQ is 4y - 9x =13 and that of line PS is y -4x =5
    a) The co-ordinators of P (3mks)
    b) The co-ordinates of R (2mks)
    c) The equation of line RQ (2mks)
    d) The equation of a perpendicular line drawn to meet PR at (5,3) (3mks)
18. A bus left Malaba town at 6.00am and travelled at an average speed of 80km/h towards Nairobi which is 510km away. At 6.30am a salon car left Nairobi the same day following the same route and travelled at average speed of 100km/h towards Malaba. After 1 hour, the car had a puncture which took 15minutes to repair before proceeding with the journey;
    Determine

a) The distance covered by the bus in 30minutes (1mks)
b) The time of the day when car met the bus. (6mks)
c) The distance from Nairobi to the point where the car met with the bus (2mks)
d) The time of the day to the nearest minute when the bus got to Nairobi (1mk)

19. Points P, Q and R are a straight line on a level ground. An electricity pole is erected at P with a point X and Y on it. From point X, the angle of depression of point Q is 48^o while the angle of depression of R from Y which is 3m above X is 60^o
a) Illustrate the position of X, Y, P and R by sketching. (1mk)
b) Hence calculate to 1 d.p.
i) The length XP (3mks)
ii) The distance YQ (2mks)
iii) The distance PQ (2mks)
iv) The angle of elevation of Y from R given that PR = 8cm (2mks)

20. a) The figure shows a velocity- time graph of a car



i) Find the total distance covered by the car in metres (3mks)
ii) Calculate the deceleration of the car (3mks)
b) A lorry left kisumu at 8.00am and travelled towards the Nakuru at an average speed of 72km/h. At 8.30am a matatu left kisumu and followed the lorry at an average speed of 96km/h.
Determine the time of the day when the matatu caught up with the lorry (4mks)

21. The date below shows marks scored by 48 students in a geography exam.

Marks %	30-39	40-49	50-59	60-69	70-79	80-89
Students	6	10	x	9	12	2

a) Determine the value of x (2mks)
b) State the modal class (1mk)
c) Calculate the (3mks)
i) Mean mark
ii) Median mark (4mks)

22. a) Complete the table below for the equation $Y = x^2 + 3x - 6$ where $-7 \leq x \leq 4$

x	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4
y		4			6				-2			

(3mks)

b)Using the scale 1 cm to represent 1 unit on the X- axis and 1cm to represent 2 units on the Y - axis, draw the graph of $y = x^2 + 3x-6$ for $-7 \leq \times \leq 4$ (4mks)

c) Use your graph to solve for x in

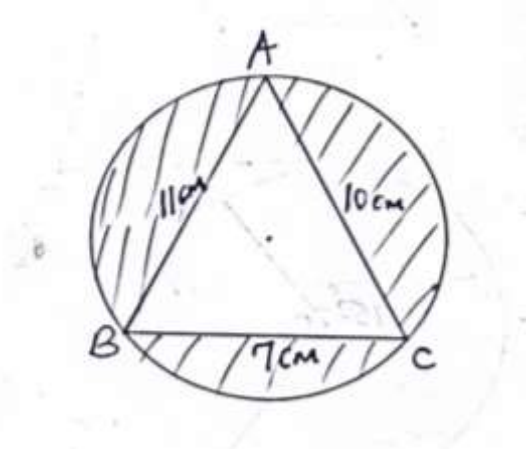
$x^2 + 3x-6 = 0$ (2mks)

d) State the;

i) Turning point of the curved (1mk)

ii) Equation of the line symmetry (1mk)

23. the figure shows triangle ABC inscribed in a circle where AC = 10cm, BC = 7cm and AB =11cm



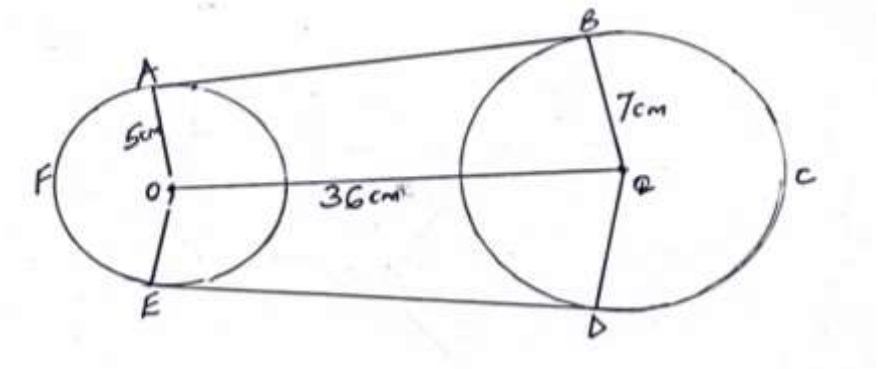
Calculate correct 1 d p ($use\ \pi\ = \frac{22}{7}$)

a) The size of the angle CAB (4mks)

b) The radius of the circle (2mks)

c) Hence, find the area of the shaded region (4mks)

ABCDEFGA is a belt tied around two wheels whose centres are O and Q forming a pulley system. Given that Q =36cm, AO = 5cm BQ = 7cm. calculate correct 1 d.p ($Take\ \pi\ = \frac{22}{7}$)



a) Angle AOQ (3mks)

b) The length of the belt in contact with

i) The wheel whose centre is O (2mks)

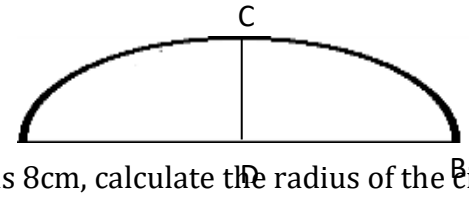
iii) The wheel whose centre is Q (2mks)

c) The length of AB, hence the total length of the belt (3mks)

PAPER 2

SECTION 1 (50 MARKS) *Answer all the questions in this section*

1. Use a calculator to find V if $\frac{1}{V} = \frac{1}{23.9} - \frac{1}{38.45}$ (2mks)
2. Solve for X in **Log (7X – 3) + 2 Log 5 = 2 + Log (X+3)** (3mks)
3. A quantity P is partly constant and partly varies as the square of Q. when Q = 2, P = 40 and when Q = 3, P = 65. Determine the equation connecting P and Q (3mks)
4. Expand $(1 - \frac{1}{2X})^6$ up to the fourth term; hence use your expansion to evaluate $\mathbf{0.996^6}$ correct to 4 decimal places. (4mks)
5. Simplify $\frac{\sqrt{5}+3}{\sqrt{5}-2}$. Give the answer in the form of $a + b\sqrt{c}$ where a, b and c are integers (3mks)
6. Given that **X-5**, **X-3** and **2X-3** are three consecutive terms of a geometric progression, find the possible values of X and the ratio **(2X+1):(X+2)** (4mks)
7. The figure below is a segment of a circle cut off by a chord AB. Line CD is a perpendicular bisector of chord AB.



   If AB is 24cm and CD is 8cm, calculate the radius of the circle. (3mks)
8. By completing the square, solve for x in the equation $\mathbf{2x^2 - 6 = x}$. (3mks)
9. Given that $\mathbf{y = \frac{b - bx^2}{cx^2 - a}}$ make x the subject (3mks)
10. The base and height of a right-angled triangle are 4cm and 5cm respectively. Calculate the percentage error in its area. (3mks)
11. Given that $\mathbf{P = \begin{pmatrix} 5 & 3 \\ 6 & 4 \end{pmatrix}}$, find ;
    a. Its inverse (1mk)
    b. The value of x and y if $\mathbf{P}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ (3mks)
12. The equation of a circle is given by $x^2 + y^2 + 6x - 10y - 30 = 0$. Determine the radius and center of the circle (3mks)
13. Find the value of X which satisfies the equation $5^{2x} - 6\times5^x + 5 = 0$ (3mks)
14. A scooter mixes oil and petrol in the ratio 5:19. If petrol costs Ksh. 130 per liter and oil costs Ksh. 250 per liter, find the cost of a liter of the mixture. (2mks)
15. Solve the pair of equations simultaneously (4mks)
    $2x - y = 3$
    $x^2 - xy = -4$
16. The cash price of a water pump is Ksh. 38,000. Mr. Ahero opts to buy the pump on hire purchase terms by paying a deposit of Ksh. 6,500 and 24 equal monthly installments. Calculate the amount of each installment, if simple interest of 20% p.a is charged. (3mks)

SECTION II (50 MARKS): Attempt any five questions in this section

17. The first term of an arithmetic sequence is equal to the first term of the geometric sequence. The second term of the arithmetic sequence is equal to the fourth term of the geometric

sequence, while the tenth term of the arithmetic sequence is equal to the seventh term of the geometric sequence.

a. Given that a is the first term and d is the common difference of the arithmetic sequence while r is the common ratio of the geometric sequence, write down two equations connecting the arithmetic and geometric sequences. (2mks)

b. Find the value of **r** that satisfies the geometric sequence (4mks)

c. Given that the tenth term of the geometric sequence is 5120, find the values of **a** and **d**(2mks)

d. Calculate the sum of the first 20 terms of the arithmetic sequence (2mks)

18. Three quantities R, S and T are such that R varies directly as S and inversely as the square of T.
    a. Given that R = 480 when S = 150 and T = 5, write an equation connecting R, S and T
    b. Find,
        i. the value of R when S = 160 and T = 1.6 (3mks)
        ii. the percentage change in R if S increases by 5% and T decreases by 20% (4mks)

19. The table below shows income tax rates

Monthly income in Kenya shillings	**Tax rate % in each**
Up to 9680	10 %
From 9681to18800	15 %
From 18801 to 27920	20 %
From 27921 to 37040	25 %
From 37041 and above	30 %

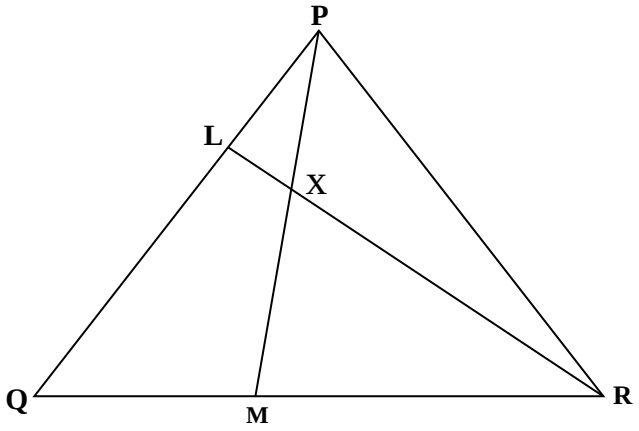
In that year Okumu's salary amounted to K£ 45,000 p.a and he received allowances totaling Ksh. 300,000 p.a. He was entitled to:-

(i) Monthly personal relief of Ksh. 1,056
(ii) Monthly insurance relief at the rate of 15% of the premium paid
Okumu paid a monthly premium of Ksh. 2,500 towards his life insurance policy

Calculate
(a) His gross monthly income in Ksh (2mks)
(b) The monthly income tax he pays (5mks)
(c) His net monthly income, if his other monthly deductions were: - Ksh. 4,800 to HELB, Ksh. 5,000 to his co-operative and Ksh. 2,800 towards a bank loan repayment. (3mks)

20. Square OABC with vertices O(0,0),A(2,0), B(2,2) and C(0,2) is mapped onto O'(0,0), A'(2,0), B'(5,2) and C'(3,2) by the matrix **T** = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$
    a. Find T (3mks)
    b. Draw O'A'B'C' and reflect it on the line x + y = 0 to obtain O"A"B"C" (4mks)
    c. What single matrix P maps OABC to O"A"B"C" (3mks)

21. In the triangle PQR below L and M are points on PQ and QR respectively such that PL: LQ = 1:3 and QM: MR = 1:2, PM and RL intersect at X. Given that **PQ = b** and **PR=c**,



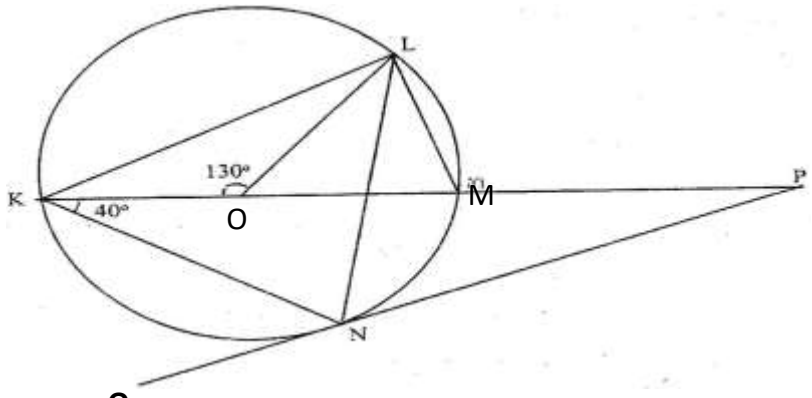
a. Express the following vectors in terms of **b** and **c**.
   i. **QR** (1mk)
   ii. **PM** (1mk)
   iii. **RL** (1mk)

b. By taking **PX =** h**PM** and **RX =** k**RL** where ***h*** and ***k*** are constants find two expressions of PX in terms of *h, k,* b and c. Hence determine the values of the constants ***h*** and ***k***. (6mks)

c. Determine the ratio **LX : XR** (1mk)

22. During a traffic crackdown, 1,000 motor cycles were sampled. 250 of these were found to lack necessary driving gear, 200 had no valid insurance and 300 lacked the driving license. Taking the sample to represent all motorcycles in the country;
   a. Represent the information in a tree diagram (3mks)
   b. Find the probability that, a motorcyclist at any given time
      i. Has no driving license (3mks)
      ii. Lacks a valid insurance but is in proper driving gear and has a valid driving license (2mks)
      iii. Has none of the offence (2mks)

23. In the figure below, K L M and N are points on the circumference of a circle centre O. The points K, O, M and P are on a straight line. PQ is a tangent to the circle at N. Angle KOL = 130^0 and angle MKN = 40^0



Find the values of the following angles, stating the reasons in each case:
   a. <MLN (2mks)
   b. <OLN (2mks)
   c. < LNP (2mks)
   d. <MPQ (2mks)
   e. <KNQ (2mks)

24. Complete the table below for y = Sin 2x and y = Sin$(2x+30)^0$ giving values to 2 d.p (1mk)

X^0	0^0	15^0	30^0	45^0	60^0	75^0	90^0	105^0	120^0	135^0	150^0	165^0	180^0
Sin 2x	0.00				0.87				-0.87				0.00
Sin $(2x+30)^0$	0.50				0.50				-1.00				0.50

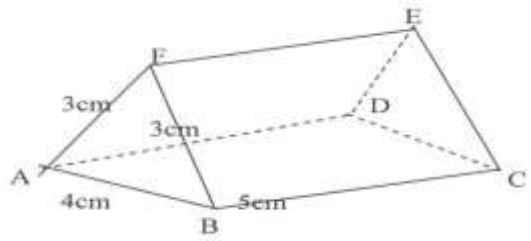
   a. Draw the graph of y = Sin 2x and y = Sin$(2x+30)^0$ on the same axis (4mks)
   b. Use your graph to solve Sin$(2x+30)^0$ - Sin 2x = 0 (1mk)
   c. Describe the transformation which maps the wave Sin 2x onto the wave Sin (2x +30) (2mks)
   d. State the amplitude and period of y = a cos (bx +c) (2mks)

KCSE PREDICTION 3 2022
PAPER 1
SECTION I (50 MARKS):
Answer all the questions in this section in the spaces provided.

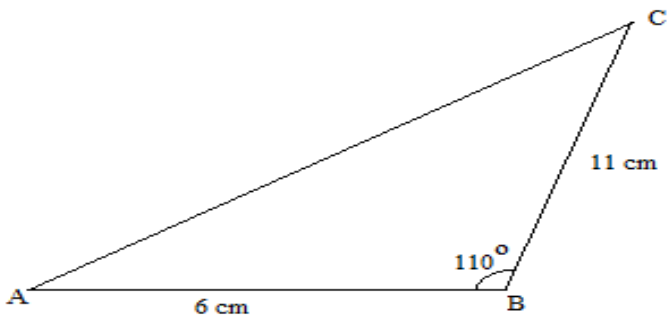
1. Without using a calculator evaluate. (3 marks)

$$\frac{\sqrt{\frac{1}{9}} of\ 2\frac{1}{3}+\frac{2}{3}\left(\frac{5}{3}-\frac{3}{2}\right)}{\frac{2}{5} of\ 3\frac{1}{3}\div\frac{1}{3}}$$

2. The distance between Jane's home and her school is $^4/_5$ of 8km. One day she run ¼ of the way and walked the rest of the journey. What distance did she walk? (3marks)
3. Otiende works for a coffee processing company as a sales man. He is paid on Monthly basis as per agreement below.
   a) A basic pay of sh. 20,000 per Month.
   b) A commission of 2% for goods sold up to a maximum of sh. 200,000.
   c) A commission of 4% for goods sold over sh. 200,000 in that Month.
   In a certain Month he sold goods worthy sh. 600,000. Calculate his total pay for that Month.(3marks)
4. The figure below is a triangular prism of uniform cross-section in which AF = FB =3cm, AB = 4cm and BC = 5cm. Draw a clearly labeled net of the prism. (3marks)



5. Solve for y in the equation. $8^{y+1} - 2^{3y+1} = 48$ (3marks)
6. Simplify the expression; $\frac{12x^2+ax-6a^2}{9x^2-4a^2}$ (3marks)
7. A line P whose equation is $y = {}^1/_3 x + 4$ is parallel to another line Q. Find the equation of line Q in the form $y = mx + c$ given that it passes through Point (3, 6) (3marks)
8. The figure below shows a triangle ABC in which AB = 6cm, BC = 11cm and angle ABC = 100^0. Calculate to the decimal places the length of AC. (3marks)



9. A football match between Bercelona FC and Liverpoo FC started at 1500hrs. It lasted for the official 90 minutes with a half time break of 15 minutes. The referee added five extra minutes for injuries and other stoppages. Find the time the match ended. (3marks)
10. Find the region defined by the following inequalities (3marks)
    $2y < x + 4$; $4y \geq -x - 4$; $x \leq 2$

11. The GCD three numbers is 6 and their LCM is 900. If two of the numbers are 36 and 60, find the least possible third number. (3 mark

12. The mass of two similar cans is 960g and 15000g. If the total surface area of the smaller can is 144cm^2, determine the surface area of the larger can.
(3 marks)

13. The width of a rectangular hall of Busiada Girls Secondary School is 16m less than its length. Calculate the length of the hall if its area is 32m^2. Hence calculate its perimeter.
(4marks)

14. Town A is 80km due east of town B. Town C is on a bearing of 234^0 form town B. If town C is 100km from town A, by scale drawing find the distance of town C from town B.
(4marks)

15. a) Find the inverse of the matrix $\begin{pmatrix} 7 & 4 \\ 3 & 2 \end{pmatrix}$. (1mark)

b) Using matrix method, solve the simultaneous equations. (2 ma

$$7x + 4y = 14$$
$$3x + 2y = 8$$

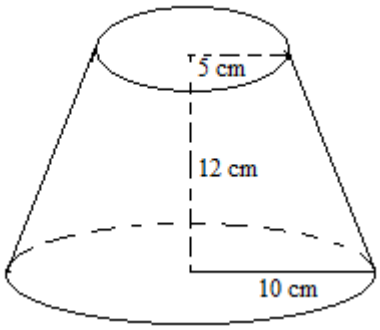
16. Use tables of square roots and reciprocals to find the value of x. (3marks)

$$x = \sqrt{\frac{1}{15.36} + \frac{3}{1.302}}$$

SECTION II (50 marks).

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

17. The figure below shows a frustrum. The top and bottom radii are 5cm and 10cm respectively, while the vertical height of the frustrum is 12cm.



Find the:-

a) Slant height of the frustum. (3marks)
b) Curved area of the frustum. (3marks)
c) Volume of the frustum. (4marks)

18. Bumala is a market centre 600km from Kisumu town.A bus starts from Kisumu for Bumala at 7.00am at an average speed of 80 km/h. At 8.30 am a car started from Kisumu to Bumala and moved at an average speed of 120 km/hr. Calculate

i) The distance bus covered before the car started moving. (3mark
ii) The relative speed for the two vehicles. (2marks)
iii) The time the car overtook the bus. (1 mark)
iv) Distance covered by the car before overtaking the bus. (2marks)
v) Distance from Bumala to the car at the time the car was overtaking the bus. (2m

19. The height of 36 students in a class was recorded to the nearest centimeter as follows:-

148	159	158	163	166	155	155	179	158
161	160	157	165	165	175	173	172	178
147	168	157	172	165	154	170	157	167
155	159	173	171	168	160	172	156	167

a) Make a frequency distribution table using a class interval of 5 and starting with the class

145 – 149. (2marks)

b) From the table above

i) Calculate the mean mark (3marks)

ii) Calculate the median (3marks)

d) Draw a frequency polygon using the table in (a) above. (2 marks)

20. Bujumba Boys Secondary School. Intends to buy a certain number of chairs For Ksh. 16,200. The supplier agreed to offer a discount of Ksh. 60 per chair which will enable the school to get 3 chairs more. Taking *y* as the originally intended number of chairs:-

a) Write an expression in terms of *y* for

i) Original price per chair. (1mark)

ii) Price per chair after discount. (1mark)

b) Determine

i) The number of chair the school originally intended to buy. (4mark

ii) Price per chair after discount. (2marks)

iii) The amount of money the school would have saved per chair of it got the intended number of chairs at a discount of 15%. (2marks)

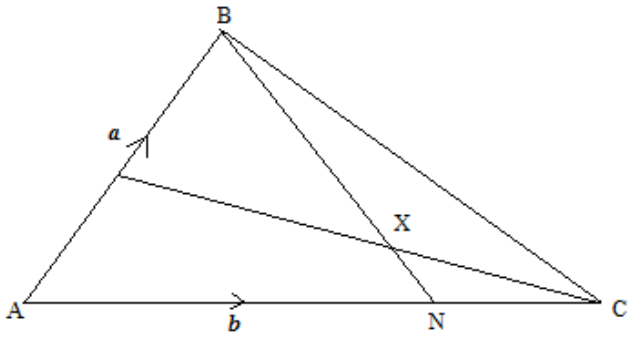
21. a) Without using a protractor, construct triangle ABC such that angle ABC = 60^0, BC = 8cm and AC = 9cm.Measure AB. (3marks)

b) Drop a perpendicular from A to BC and measure its length. (2mark

c) Hence calculate the area of triangle ABC. (2marks)

d) Locate a point D on BC such that the area of triangle ABC is three times that of triangle ABD. (3marks)

22. In triangle ABC, shown below, AB = a AC = b point M lies on AB such that AM: MB = 2:3 and point N lies on AC such that AN: NC = 5:1 line BN intersects line MC at X.



e) Express the following in terms of ***a*** and ***b***

i) **BN** (1 mark)

ii) **CM** (1 mark)

f) Given that **BX** = k**BN** and **CX** = r**CM** where k and r are scalars

i)Write two different expressions for **AX** in term of a, b, k and r (4marks)

ii) Find the values of k and r (4 marks)

23. A triangle ABC has vertices A(2,1), B(5,2) and C(0,4).

(a)On the grid provided plot the triangle ABC. (2 marks)

(b) $A^1B^1C^1$ is the image of ABC under a translation $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$. Plot $A^1B^1C^1$ and state its coordinates.(2 marks)

(c) Plot $A^{11}B^{11}C^{11}$ the image of $A^1B^1C^1$ after a rotation about the origin through a negative quarter turn. State its coordinates. (3 marks)

(d) $A^{111}B^{111}C^{111}$ is the image of $A^{11}B^{11}C^{11}$ after a reflection on the line y = 0. Plot $A^{111}B^{111}C^{111}$ and state its coordinates. (3 marks)

24. The displacement h metres of a particle moving along a straight line after t seconds is given by $h = -2t^3 + {}^3/_2\, t^2 + 3t$

(a) Find the initial acceleration. (3 marks)

(b) Calculate

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

(ii) Its displacement by the time it comes to rest momentarily. (2 ma

(c) Calculate the maximum speed attained. (2 marks)

PAPER 2

SECTION I (50 marks)

ATTEMPT ALL THE QUESTIONS IN THIS SECTION

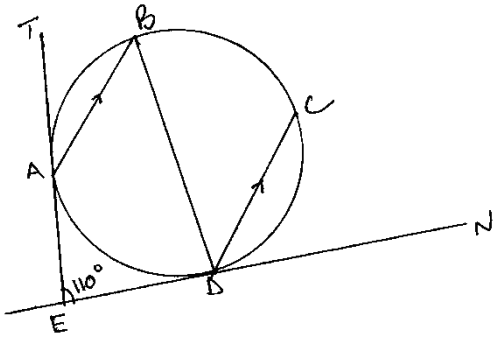
1. On average, the rate of depression of a water pump is 9% per annum. After three complete years it was Kshs. 150,700. Find its value at the start of the three years period. (3 marks)
2. John truncated $^{7}/_{9}$ to 3 decimal places. Calculate the percentage error resulting from the truncating.

   (3marks)
3. Solve the equation $4\sin^2\Theta + 4\cos\Theta = 5$ for $0^o \leq \Theta \leq 360^o$ Give your answer in degrees.

   (3marks)
4. The first term of an arithmetic sequence is (2x+1) and the common difference is (x+1) if the product of the first and the second terms is zero, find the first three terms of the two possible sequences.

   (3marks)
5. TAE and EDN are tangents to a circle at A and D respectively. Line AB and DC are parallel chords; BD is another chord of the circle. Angle TAB is 46º. Find angle CDN giving reasons.

   (3 marks)

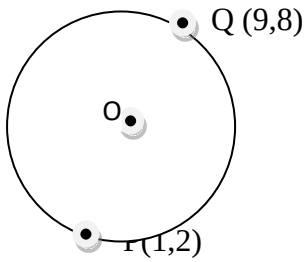


6. Use logarithm table to evaluate. (4marks)

$$\sqrt[4]{\frac{(27\times 0.0293)^2}{(825-94)\div 0.2861}}$$

7. a) Find the expansion of $\left(1-\frac{x}{3}\right)^7$ in ascending powers of x up to the term in x^2 (1mark)

   b) Use the expansion above to find $(0.99)^7$ to four significant figures (2marks)
8. P and Q are the points on the ends of the diameter of the circle below.



   (a) Write down in terms of X and Y the equation of the circle in the form:
   $ax^2 + by^2 + x + y + c = 0$ (2 marks)

   (b) Find the equation of the tangent at Q in the form $ax + by + c = 0$ (2 marks)

9. Given that $\overrightarrow{OA}$ = 3i +2j – 4k and $\overrightarrow{OB}$= 4i+5j-2k and that p divides AB in the ratio 3: -2, determine the position vector of p in terms of i, j and k (3marks)
10. The masses to the nearest kg of 50 adults were recorded as follows:

Mass (kg)	Frequency (f)
45-50	2
51-56	10
57-62	11
63-68	20
69-74	6
75-80	1

Calculate the quartile deviation. (3marks)

11. Machine A can complete a piece of work in 6 hours while machine B can complete the same work in 10 hours. If both machines start working together and machine A breaks down after two hours, how long will it take machine B to complete the rest of the work. (3marks)
12. Without using tables, rationalize the denominator in

$\frac{2\tan 45^0 - \tan 60^0}{4\tan 45^0 \sin 30^0 - \sqrt{3}}$ (3 marks)

13. Make n the subject of the formula (3 marks)

$$W = \frac{x^2}{(m-n)(m+n)}$$

14. In a transformation, an object with area 9cm^2 is mapped onto an image whose area is 54cm^2. Given that the matrix of transformation is $\begin{bmatrix} x & x-1 \\ 2 & 4 \end{bmatrix}$ find the value of x (3marks)
15. P varies as the cube of Q and inversely as the square root of R. If Q is increased by 20% and R decreased by 36%, find the percentage change in P. (3marks)
16. An arc subtends an angle of 0.9 radians. If radius of circle is 13cm, find the length of the arc. (3 marks)

SECTION II (50 MARKS)
(ANSWER ANY FIVE QUESTIONS FROM THIS SECTION)

17. The table below shows the Kenya tax rates in a year

Income (Ksh per annum)	**Tax rate (per £)**
1 – 116,160	10%
116,161 – 225,600	15%
225,601 – 335,040	20%
335,041 – 444,480	25%
Over 444,481	30%

In that year, Ushuru earned a basic salary of Ksh 30000 per month. In addition, he was entitled to a medical allowance of Ksh 2,800 per month and a traveling allowance of Ksh 1800 per month. He is housed by the employer and pays a nominal rent of 2000. He also claimed a monthly family relief of Ksh 1056. Other monthly deductions were union dues Ksh 445, WCPS Ksh 490, NHIF Ksh 320, COOP shares Ksh 1000 and risk fund Ksh 100
Calculate:

(a) Ushuru's annual taxable income. (2marks)

(b) The tax paid by Ushuru in that year. (5marks)

(c) Ushuru's net income in that year (3marks)

18. The masses of 50 loaves of bread were taken and recorded as in the table blow.

Mass (gms)	470-479	480-489	490-499	500-509	510-519	520-529	530-539
No. of loaves	1	3	11	21	8	4	2

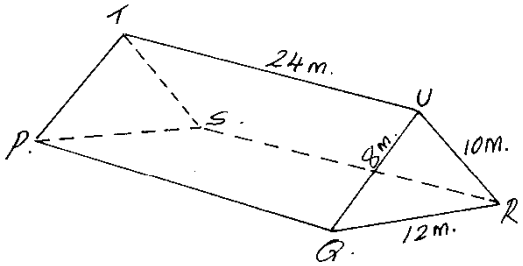
a. Using an assumed mean of 504.5, calculate the mean mass (3marks).
b. Calculate the
i. Variance. (4marks)
ii. Calculate the standard deviation. (2marks)

c. If 5 is added to each score and then divided by 3, write down the new standard deviation. (1mark)

19. In chemistry form 4 classes, $^1/_3$ of the class are girls and the rest boys, $^4/_5$ of the boys and $^9/_{10}$ of the girls are right handed while the rest are left handed. The probability that a right-handed student breaks a conical flask in any practical session is $^3/_{10}$ and the corresponding probability of a left-handed student $^4/_{10}$. The probabilities are independent of the students gender.

(a) Represent the above information on a tree diagram with independent probabilities. (2 marks)
(b) Determine the probability that student chosen at random form the class is left handed and does not break a conical flask 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)

20. The roof of a ware house is in the shape of a triangular prism as shown below



Calculate
(a) The angle between faces RSTU and PQRS (3marks)
(b) The space occupied by the roof (3marks)

(c) The angle between the plane QTR and PQRS (4marks)

21. A plane leaves an airport A (41.5^0N, 36.4^0W) at 9:00am and flies due north to airport B on latitude 53.2^0N. Taking π as $\frac{22}{7}$ and the radius of the earth as 6370Km,

a) Calculate the distance covered by the plane in km (4marks)

b) The plane stopped for 30minutes to refuel at B and flew due east to C, 2500km from B. Calculate:

i) position of C (3marks)

ii) The time the plane lands at C if its speed is 500km/h (3marks)

22. Complete the table below giving your values correct to 2 d.p. (2marks)

x	0^0	15^0	30^0	45^0	60^0	75^0	90^0	105^0	120^0
$3\cos x^0$	3.00		2.60		1.50		0	-0.78	
$4\sin(2x - 10^0)$		1.37		3.94	3.76		0.69		-3.06

(b) Draw the graphs of $y = 3\cos x^0$ and $y = 4\sin(2x - 10^0)$ on the same set of axis on the grid provided. (4marks)

(c) Use your graph to find values of x for which $3\cos x - 4\sin(2x - 10^0) = 0$. (2marks)

(d) State

(i) The amplitude of the graph $y = 3\cos x$. (1mark)

(ii) The period of the graph $y = 4\sin(2x - 10^0)$. (1mark)

23. a. Using a ruler, a pair of compasses only construct triangle XYZ such that XY = 6cm, YZ = 8cm and $\angle XYZ = 75^o$ (3marks)

(b) Measure

i. line XZ (1mark)

ii. $\angle XZY$ (1mark)

(d) Draw a circle that passes through X, Y and Z. (2marks)

(d) A point M moves such that it is always equidistant from Y and Z. Construct the locus of M and define the locus (3marks)

24. A manager wishes to hire two types of machines. He considers the following facts.

	Machine A	Machine B
Floor space	$2m^2$	$2m^2$
Number of operators	4	3

He has a maximum of $24m^2$ of floor space and a maximum of 36 men available. In addition he is not allowed to hire more machines of type B than of type A.

a) If he hires x machines of type A and y machines of type b write down all the inequalities that satisfy the above conditions.

(3marks)

b) Represent the inequalities on the grid and shade the unwanted region. (3marks)

c) If the profit from machine A is sh. 4 per hour and that from using machine B is ksh. 8 per hour. What number of machines of each type should the manager choose to give the maximum profit. (4marks)

KCSE PREDICTION 4 2022
PAPER 1
SECTION I (50 MARKS)
Attempt all questions in this section

1. Evaluate $\dfrac{-4 \text{ of } (-4 + -5 \div 15) + -3 - 4 \div 2)}{84 \div -7 + 3 - -5}$ (3 mks)

2. Simplify $\dfrac{9x^2 - 1}{3x^2 + 2x + 1}$ (1 mk)

3. Evaluate without using a calculator or mathematical table leaving your answers as a simplified fraction. (2 mks)

$$\frac{\frac{4}{11} \text{of} \frac{3}{4} - \frac{1}{20}}{\left(3 + \frac{1}{3}\right) \div \left(1 + \frac{1}{10}\right)}$$

4. A poultry farmer has twenty times as many hens as turkey and three quarters as many ducks as turkeys.

   (a) If there are t, turkeys, write down a simplified expression in terms of t for the total number of birds on the farm. (1 mk)

   (b) Give that he has 72 ducks, calculate as a percentage the sum of turkeys and ducks to the number of hens in the farm. (2 mks)

5. Use tables of reciprocals only to work out. (3 mks)

$$\frac{5}{0.0396} + \frac{12}{0.593}$$

6. A straight lines passes through points A(-2,6) and B(4, 2).

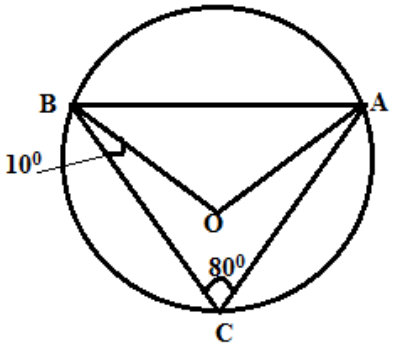
   (a) M is the midpoint of line AB. find the coordinates of N. (2 mks)

   (b) Determine the equation of a straight line passing through point M and is perpendicular to AB. (2 mks)

7. An open right circular core has radius of 5cm and a perpendicular height of 12cm. Calculate the surface area of the core. (take $\pi = 3.142$). (3 mks)

8. Moraa spends a total of sh. 970 on buying 3 text books and 5 pens. if had bought 2 textbooks and 8 pens she would have saved sh. 90. Find the cost of one textbook. (3 mks)

9. In the figure below O is the centre of the circle. $<BCA = 80^0$ and $<CBO = 10^0$. Determine the size of $<CAB$. (3 mks)



10. The table below shows speeds of vehicles measured to the nearest 10km/h as they passed a certain point.

Speed(km/h)	30	40	50	60	70	80	90	100	110
Frequency	1	4	9	14	38	47	51	32	4

a) Calculate the mean speed of vehicles (3 marks)

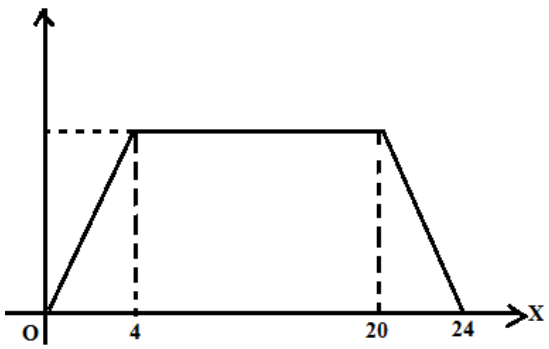
b) State the modal speed (1mark)

11. Find the of x if. (3 mks)

$$\left(\frac{27}{8}\right)^{x+7} = \left(\frac{4}{9}\right)^{-3x}$$

12. The image of a point K(1,2) after translation is K^1 (-1,2). what is the coordinate of the point R whose image is R^1 (-3,3) after undergoing the same translation. (3 mks)

13. The figure below is a velocity time graph for a car.



(a) Find the total distance travelled by the car (2 mks)

(b) Calculate the deceleration of the car. (2 mks)

14. Security light poles have been erected along both sides of a street in Kisii town. The poles are 50m apart along the left hand side of the road while they are 80m apart along the right hand side. At one end of the road the poles are directly opposite each other. How many poles will be erected by time the poles are directly opposite each other at end of the road? (3 mks)

15. The exterior angle of a regular polygon is equal to one third of the interior angle. Calculate the number of number of sides of the polygon. (3 mks)

16. Solve the following inequality and state the integral values

$\frac{1}{2}(24-4x) > 6\left(3x-\frac{4}{3}\right) \geq -\frac{2}{3}(42+3x)$ (3 mks)

SECTION II

Attempt only FIVE questions from this section

17. (a)Complete the table below for the function $y=7+2x-2x^2$ for the range $-3 \leq x \leq 4$.(2 marks)

X	-3	-2	-1	0	1	2	3	4
$-2x^2$		-8	-2	0		-8	-18	
2x	-6	-4		0		4	6	
7	7	7	7	7	7	7	7	7
Y		-5		7		3	-5	

(b) (i) On the grid provided draw the graph of $y=7+2x-2x^2$. (3 marks)

Take the scale:2 cm to represent 1 unit on x- axis

1 cm to represent 1 unit on y- axis

(ii) Use your graph to estimate the roots of $7+2x-2x^2=0$. (1 mark)

(c) (i) By drawing a suitable line on the same axes in (b) above solve the equation

$9+5x-2x^2=0$ (3marks)

(ii) State the co-ordinates of the turning point .(1 mark)

18. Paul is a sales executive earning sh 20,000 and a commission of 8% for the sales in excess of 100,000. In January 2014 he earned a total of 48000 in salaries and commissions.

(a) Determine the amount of sales he made in that month. (4 mks)

(b) If the total sales inn the month of February and march increased by 18% and then dropped by 25% respectively. Calculate.

(i) Paul`s commission in the month of February. (3 mks)

(b) If the total earnings in the month of march. (3 mks)

19. Two tasks are similar in shape. The capacity of the tanks are 1,000,000 litres and 512,00 litres respectively.

(a) Find the height of the smaller tank if the larger one is 300cm tall. (5 mks)

(b) Calculate the surface area of the tank if the smaller one has a surface area of $768cm^3$ (3 mks)

(c) Calculate the mass of the larger tank if the mass of the larger one is 800kg. (2 mks)

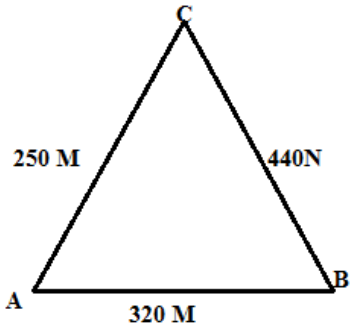
20. The vertices of a triangle ABC are A(2,5) B(4,3) and C(2,3). **P** represents half-turn about the origin.

(a) Draw triangle ABC and $A^1B^1C^1$ under **P**. (4 mks)

(b) **T** represents a reflection in the line x = 0 and **K** represents a translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$. Find the coordinates of $A^{11}B^{11}$ and C^{11} under **T** and $A^{111}B^{111}C^{111}$ under **K.** Hence, draw triangle $A^{11}B^{11}C^{11}$. (4 mks)

(c) Find the area of the triangle $A^{11}B^{11}C^{11}$. (2 mks)

21. Ombati owns a farm that is triangular in shape as shown below.



(a) Calculate the size angle BAC. (2 mks)
(b) Find the area of the farm in hectares. (3 mks)
(c) Ombati wishes to irrigate his farm using a sprinkler machine in the farm such that it is equidistant from points A. B and C.
(i) The sprinkler rotates in a circular motion so that the maximum point reached by the water jets is the vertices A, B and C. Calculate the area outside the farm that will be irrigated. (5 mks)

22. Trasnsline bus left Nairobi at 8.00 am and travelled Kisii at an average speed of 80km/h. A car left Kisii at 3.30 am and travelled to Nairobi at an average speed of 120km/h. Given that the distance between Nairobi and Kisii is 400km, Calculate.
(a) The time the car arrived in arrived in Nairobi. (3 mks)
(b) The time the two vehicles met. (4 mks)
(c) The distance from Nairobi to the meeting point. (2 mks)
(d) The distance of the bus from Kisii when the car arrived in Nairobi. (2 mks)

23. Town B is 102km on the bearing of 122^0 from town A. Town C is 94 km on bearing of 062^0 from B. Town D is on a bearing of 073^0 from A and 336^0C.
(a) Using a scale of 1cm to represent 20km, draw a scale diagram to show the relative positions of town A, B, C and D. (4 mks)
(b) Using your diagram, determine.
(i) The bearing B from D. (1 mk)
(ii) The bearing of A from C. (1 mk)
(iii) The distance from town A to D. (1 mk)
(iv) The distance from town B and D. (1 mk)

24. A particle moves along a straight line such that its displacement S metres from a given point is $S = t^3 - 5t^2 + 3t + 4$ where t is time in seconds. Find
a) The displacement of the particle at t = 5 (2marks)
b) The velocity of the particle when t = 5 (3 marks)
c) The values of t when the particle is momentarily at rest (3 marks)
d) Acceleration of the particle when t = 2 (2marks)

PAPER 2

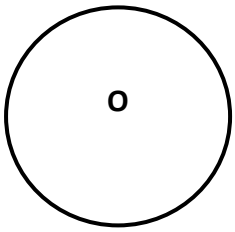
SECTION 1 (50 marks)

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

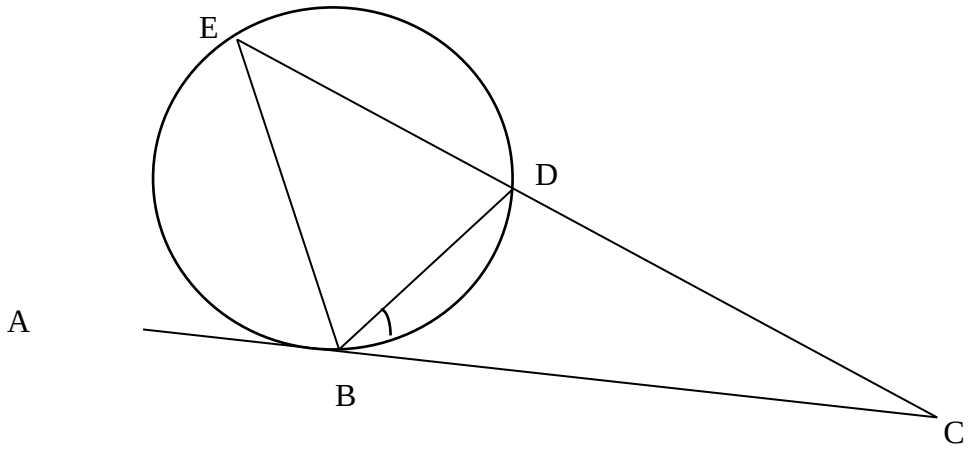
1. The external and internal radius of a cylindrical cement pipe are given as 20cm and 14cm respectively and its length is given as 140cm. Calculate the minimum volume of cement required to make such pipe. (Take $\pi = 3.142$) (3mks)
2. Solve for x in the equation $2\sin^2 x + 3\cos x = -1$ for $0^0 < x < 360^0$ (4mks)
3. A quadratic curve cuts the x – axis at points (-2, 0) and (3, 0). Find the equation of this curve in the form $ax^2 + by = c$ where a, b and c are integers. (3mks)
4. Expand $(2 + 3x)^6$ up to the term in x^3. Hence use your expansion to estimate $(2.09)^6$ (3mks)
5. Two quantities M and N are such that M varies partly as N and partly as the square of N. Determine the relationship between M and N given that when M is 1050, N = 10 and when M = 2200, N = 20. (3mks)
6. A dealer has two types of grades of tea, A and B. Grade A costs shs. 140 per kg while grade B costs shs.160 per kg. If the dealer mixes A and B in the ratio 3:5 to make a brand of tea which he sells at shs.180 per kg, calculate his percentage profit. (3mks)
7. The position vectors of A and B are given as $a = 2i - 3j + 4k$ and $b = -2i - j + 2k$ respectively. Find to 2 decimal places, the length of the vector $\overrightarrow{AB}$. (3mks)
8. Calculate the quartile deviation in
   18, 9, 14, 20, 23, 12, 16 (3mks)
9. Find the equation of a circle whose radius is 0.75 units and centre coordinates (0.75, -0.5). Leave your answer in the form;
   $x^2 + y^2 + ax + by + c = 0$ (3mks)
10. Solve for the exact value of x in the equation. (3mks)

    $2\log_{10}x + \log_{10}5 = 1 + 2\log_{10}4$
11. A plane leaves an airport A (38.5^0N, 37.05^0W) and flies due North to a point B on latitude 52^0N. The plane then flies due East to a point C 2400km from B. Determine the position of C. (Given that the radius of the earth is 6371km) (3mks)
12. Evaluate $\int_{-1}^{3}(2x^2 - 3x - 14)dx$ (3mks)
13. Using a ruler and a pair of compass only, construct common tangents from the point P to the circle below. (3mks)

    P

14. Given that $\frac{3 + 3\sqrt{5}}{3 + \sqrt{5}} \quad \frac{}{3 - \sqrt{5}} = a + b\sqrt{5}$. Find the values of a and b. (3mks)
15. In the figure below angle CBD = 37^0, angle BCD = 20^0 and ABC is a tangent to the circle at B.



(a) Find:

(i) Angle BED (2mks)

(ii) Angle ABE (2mks)

16. 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 ABC of the area 12.5cm^2 onto another triangle $A^1B^1C^1$. Find the area of triangle $A^1B^1C^1$. (3mks)

SECTION II(50marks)

*Answer **ANY FIVE** questions in this section in the spaces provided*

17. A transformation represented by matrix $\begin{bmatrix} 2 & 1 \\ 1 & -2 \end{bmatrix}$ maps **A**(0,0), **B**(2,0), **C**(2,3) and **D**(0,3) Onto $\mathbf{A^1B^1C^1}$ and $\mathbf{D^1}$ respectively

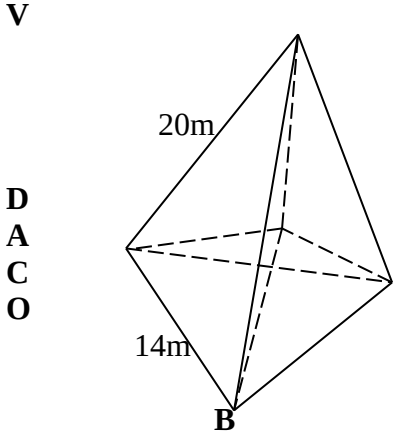
a) Draw **ABCD** and its image $\mathbf{A^1B^1C^1D^1}$ (4mks)

b) A transformation represented by $\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$ maps $\mathbf{A^1B^1C^1D^1}$ on $\mathbf{A^{11}B^{11}C^{11}D^{11}}$.

Plot $\mathbf{A^{11}B^{11}C^{11}D^{11}}$ on the same graph. (3mks)

c) Determine the matrix of a single transformation that maps $\mathbf{A^{11}B^{11}C^{11}D^{11}}$ onto **ABCD**(3mks)

18. The diagram below shows a right pyramid with a square base **ABCD** and vertex **V**. **O** is the centre of the base. **AB** = 14m, **VA** = 20m and **N** is the midpoint of **BC.**



Find;

a) The lengths of **BO, VO** and **VN** (3mks)

b) The angle between **VO** and plane **VBC** (3mks)

c) The angle between **VB** and base **ABCD** (2mks)

d) The angle between **VDC** and **VBC** (2mks)

19. The table below shows the distribution of marks scored in a test by standard 8 pupils in one school.

Marks	**No. of pupils**
30 – 34	1
35 – 39	5
40 – 44	10
45 – 49	10
50 – 54	19
55 – 59	20
60 – 64	20
65 – 69	8
70 – 74	4
70 – 79	3

Using 57 as the assumed mean mark, calculate

(i) The actual mean for the grouped marks (3mks)

(ii) The 50^{th} percentile (3mks)

(iii) The standard deviation of the marks (4mks)

20. (a) Complete the table for the function $y = ½ \text{Sin}2x$, where $0^0 \leq x \leq 360^0$. (2mks)

	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0	300^0	330^0	360^0
2x	0^0	60^0	120^0	180^0	240^0	300^0	360^0	420^0	480^0	540^0	600^0	660^0	720^0
Sin2x	0^0	0.866			0^0				0.866				
y = ½ Sin2x	0^0	0.433			0^0								

(b) On the grid provided, draw the graph of the function $y = ½ \text{Sin}2x$ for $0^0 \leq x \leq 360^0$ using the scale 1cm for 30^0 on the horizontal axis and 4cm for 1 unit of y axis. (3mks)

(c) Use your graph to determine the amplitude and period of the function $y = ½ \text{Sin}2x$.(2mks)

(d) Use the graph to solve

(i) $½ \text{Sin}2x^0 = 0$ (1mk)

(ii) $½ \text{Sin } 2x^0 – 0.5 = 0$ (2mks)

21. Income tax rate were charged as follows in a given year.

Income in ksh. p.m	**Rate of tax in each sh.**
1 – 11, 180	10%
11, 181, - 21, 714	15%
21, 715 – 32, 248	20%
32, 249 – 42, 781	25%
42, 782 and above	30%

A teacher earns a basic salary of Ksh. 48, 000. He is housed by the employer and pays a rent of Ksh. 3,000 per month. His allowances are: Commuter Ksh. 2, 500 and medical Ksh. 3,500. He is entitled to a family relief of Ksh. 1,648 per month.

Determine his:

a) Taxable income per month (2mks)

b) Net tax per month (4mks)

c) In addition the following deductions are also made

NHIF	Ksh. 1,250
WCPS	Ksh. 1,200
Co – operative shares	Ksh. 3,000

Calculate the net salary. (3mks)

22. (a) The first term of an Arthmetric progression (AP) is 2. The sum of the first 8 terms of the AP is 156

(i) Find the common difference of the AP (2mks)

(ii) Given that the sum of the first **n** terms of the AP is 416, find **n** (2mks)

(b) The 3^{rd}, 5^{th} and 8^{th} terms of another AP form the first three terms of a Geometric Progression (GP). If the common difference of the AP is 3, find;

(i) The first term of the GP; (4mks)

(ii) The sum of the first 9 terms of the GP, to 4 significant figures. (2mks)

23. A married couple intends to have 3 children. They consult an expert who tells them that the probability of a male birth is 0.55.

(a) Draw a tree diagram to represent this occurrence (2mks)

(b) Find the probability that

(i) All the three children will be female (2mks)

(ii) At least a male is born (2mks)

(iii) At least 2 will be females, giving your answer to 3 s.f. (4mks)

24. A trader is required to supply two types of sweaters, type **A** and type **B**. the total number of sweaters must not be more than 400. He has to supply more of type A than type **B** sweaters. However the number of type **A** sweaters must not be more than 300 and the number of type **B**sweaters must not be less than 80. Let **x** be the number of type **A** sweaters and y be the number of type **B** sweaters.

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

(b) On the grid provided, draw the inequalities and shade the unwanted regions.(4mks)

(c) The profits were as follows;

Type A: sh. 600 per sweater

Type B: sh. 400 per sweater

(i) Use the graph to determine the number of sweaters of each type that he should make to maximize the profit. (1mk)

(ii) Calculate the maximum possible profit (1mk)

KCSE PREDICTION 5 2022

PAPER 1

SECTION I (50 marks)

Answer all questions in this section in the spaces provided

1. a) Evaluate $825\times 4+144\div 4 of\left(-36+30\right)$ **(2 marks)**

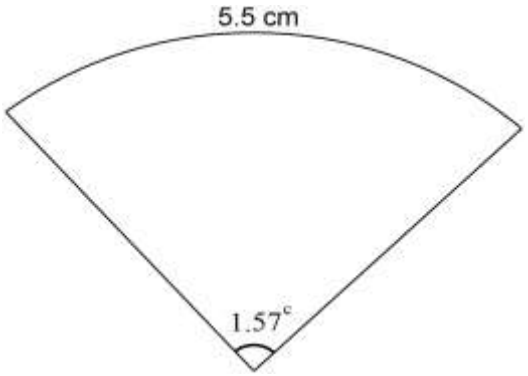
b) Write the total value of the digit in the thousands place of the results obtained in (a) above **(1 mark)**

2. Given the inequalities $2x-3\le 4x+7<x+13$ solve the inequalities and represent the solution on a number line. **(3 marks)**

3. Simplify completely

$$\frac{8x^2-2}{2x^3-7x^2+3x}$$ **(3 marks)**

4. The figure below shows a sector of a circle centre O.



Determine

(i) The radius OA of the circle **(2 marks)**

(ii) The perimeter of the sector **(2 marks)**

5. Solve for x in the equation **(3 marks)**

$$\left(\frac{1}{27}\right)^x\div 81=\sqrt[3]{729}$$

6. Christmas bulbs made of different colours are set to light after 8 seconds, 10 seconds and 14 seconds. How many times will they light simultaneously in one hour if they start together? **(3 marks)**

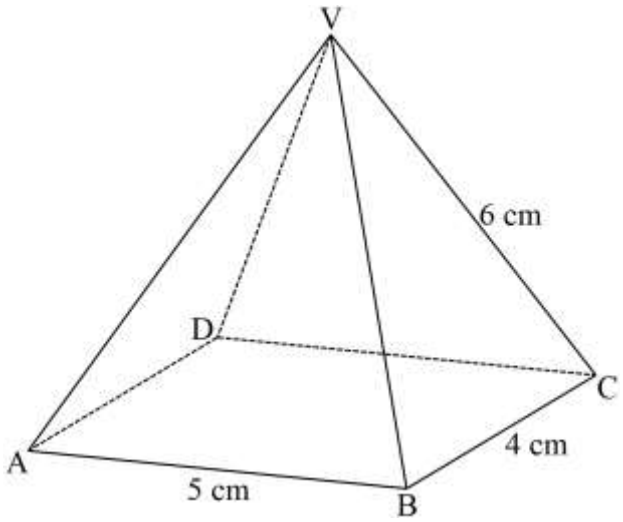
7. A bus left Nairobi at 7.00 a.m and travelled towards Mombasa at an average speed of 80 km/hr. At 8.00 a.m, a car left Mombasa towards Nairobi at an average speed of 120 km /hr. If the distance between Mombasa and Nairobi is 500 km , calculate the time of the day the two vehicles met **(4 marks)**

8. The position vectors of point P and Q are $2\underset{\sim}{i}+3\underset{\sim}{j}-\underset{\sim}{k}$ and $3\underset{\sim}{i}-2\underset{\sim}{j}+2\underset{\sim}{k}$ respectively. Find the magnitude of $\overrightarrow{PQ}$ to 4 significant figure.

(3 marks)

9. Solve the equation $2Cos\ 3x=\sqrt{3}\ \ for\ 0^0\le x\le 180^0$ (**2 marks)**

10. The diagram below represents a right rectangular based pyramid of 5 cm by 4 cm. The slant edge of the pyramid is 6 cm. Draw and label the net of the pyramid. **(3 marks)**



11. Two cylindrical containers are similar. The larger one has an internal cross-sectional area of 45 cm^2 and can hold 0.945 litres of liquid when full. The smaller container has internal cross-sectional area of 20 cm^2. Calculate the capacity of the smaller container. **(3 marks)**

12. Use logarithms correct to 4 decimal places to evaluate **(3 marks)**

$$\sqrt[5]{\frac{462\times\log 8}{7245}}$$

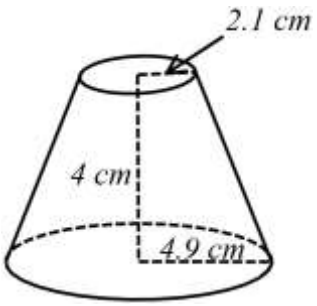
13. One interior angle of a polygon is a right angle and each of the other interior angles is 126°. Calculate the number of sides of the polygon. **(3 marks)**

14. Use the exchange rates below to answer this question.

	Buying	Selling
1 US dollar	103.00	103.20
1 UK £	125.30	125.95

A tourist arrived in Kenya from Britain with 8400 UK Sterling pounds (£). He converted the whole amount to Kenya shillings. While in Kenya, he spent $\frac{3}{4}$ of this money and changed the balance to US dollars. Calculate the amount of money, to the nearest US dollars, that he received. **(3 marks)**

15. The diagram below represents a solid of a conical frustrum. $\left(use\ \pi=\frac{22}{7}\right)$



Calculate the volume of the solid (4 marks)

SECTION II (50 marks)

*Answer **any five** questions in this section in spaces provided*

16. Given that a line L_1 passes through the points $A(-1,5)$ and $B(3,-1)$, find;

(a) The equation of line L_1 in the form $y = mx + c$ **(2 marks)**

(b) The equation of a line L_2, which is perpendicular bisector of line L_1. Leave your answer in the form $ax + by = c$, where a, b and c are integers. **(3 marks)**

(c) Given that another line L_3 is parallel to L_2 and passes through point $(-3,-5)$ and intersects line L_1 at point P. **(2 marks)**

(d) The coordinates of the point of intersection of lines L_1 and L_3 **(3 marks)**

17. (a) Draw the graph of the function $y = -x^2 + 4x - 1$ for $-1 \le x \le 5$. **(5 marks)**

x	-1	0	1	2	3	4	5
y							

(b) Use the graph above to solve the equations:

(i) $x^2 + 4x - 1 = 0$ **(2 marks**

(ii) $x^2 - 2x - 1 = 0$ **(3 marks)**

18. (a) Given that $P = \begin{pmatrix} 8 & 5 \\ 6 & 9 \end{pmatrix}$, find P^{-1} **(2 marks)**

(b) Matawi bought 8 T-shirts and 5 pairs of shorts at a total cost of ksh. 4400. Had he bought 6 T-shirts and 9 pairs of shorts, he would have spent ksh. 1000 more.

(i) Form two equations to represent the above information **(2 marks)**

(ii) Use the matrix method to determine the cost of a T-shirt and a pair of shorts **(3 marks)**

(c) Three months later the price of a pair of shorts went up. Matawi bought 5 T-shirts and 5 pairs of shorts at a total cost of ksh. 3650. Find the percentage increase in the price of a pair of shorts. **(3 marks)**

19. The marks of 50 students in a Mathematics test were taken from a form 3 class and recorded in the table below.

Marks (%)	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 – 90	91 – 100
Frequency (f)	2	5	7	9	11	8	5	3

(a) On the grid provided, draw a cumulative frequency curve of the data above. Use a scale of 1 cm to represent 5 students on the vertical scale and 1 cm to represent 10 marks on the horizontal scale. **(3 marks)**

(b) From your curve in (a) above;

(i) Estimate the median mark. **(1 mark)**

(ii) Determine the interquartile deviation. **(2 marks**

(iii)Determine the 10^{th} and 90^{th} percentile range. **(2 marks)**

(c) It is given that the students who scored over 45 marks pass the test. Use your graph in (a) above to estimate the percentage of students that pass the test. **(2 marks)**

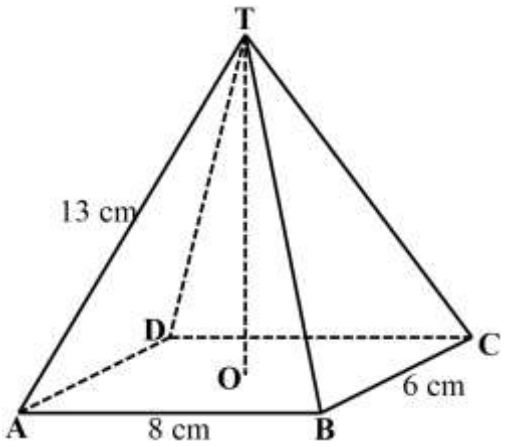
20. (a) On the Cartesian plane below , draw triangle ABC with vertices $A(0,-1)$, $B(4,3)$ and $C(2,2)$ **(1 mark)**

(b) Draw triangle $A'B'C'$, the image of ABC under a transformation defined by the translation vector $T = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$. Write down the coordinates of $A'B'C'$. **(3 marks)**

(c) $A"B"C"$ is the image of $A'B'C'$ under an enlargement, scale factor -2, centre $(3,1)$. On the same plane draw $A"B"C"$ and write down its coordinates. **(4 marks)**

(d) Draw $A'''B'''C'''$, the image of $A"B"C"$, under reflection in the line $x = 0$. **(2 marks)**

21. The figure below is of a right pyramid on a rectangle base of 8 cm by 6 cm and Its slant edge $TA = TB = TC = TD = 13$ cm.



Calculate:

(a) The length of AC **(1 mark)**

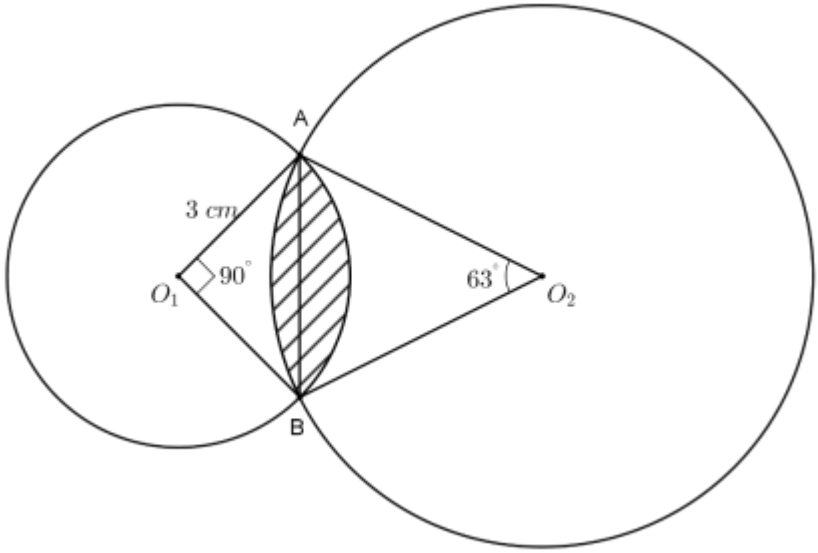
(b) The height of the pyramid **(1 mark)**

(c) The angle between TAB and plane TCD. **(2 marks)**

(d) The angle between TAB and plane TBC. **(4 marks)**

(e) The volume of the pyramid. **(2 marks)**

22. The figure below shows two circles, centres O_1 and O_2 intersecting at points A and B. The radius of the circle centre O_1 is 3cm. Further, $\angle AO_1B = 90^\circ$ and $\angle AO_2B = 63^\circ$.



Calculate correct to four significant figures

(a) The length of the common chord AB. **(2 marks)**

(b) The radius of the circle center O_2, **(2 marks)**

(c) Hence, calculate the area of the shaded region. $\left(use\ \pi = \frac{22}{7}\right)$ **(6 marks)**

23. During a surveying exercise to establish a housing estate a surveyor marked out four points W,X,Y and Z to represent an area to be left out for a shopping complex and social amenities. Point X is 240m on a bearing of 073^0 from point W. Point Y lies on a bearing of 145^0 at a distance of 300m from X. Z is directly south of W a distance of 320m.

(a) Draw a scale diagram to represent the relative positions of the area under survey
Scale 1cm represents 40m. **(4 marks)**

(b) Using the scale diagram in (a) above, determine

(i) The distance and bearing of point Z from Y. **(2 marks)**

(ii) The bearing of point X from point Z. **(1 mark)**

(iii) A road is to be constructed directly South of X to meet another road from Y westwards at point P. Find the area enclosed by triangle PXY in hectares. **(3 marks)**

PAPER 2

SECTION I (50 marks)

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

1. The roots of a quadratic equation are $x = 1\frac{1}{3}$ and $x = -\frac{1}{2}$. Form the quadratic equation in the form $ax^2 + bx + c = 0$ where a, b and c are integers. **(2 marks)**

2. Find the percentage error in estimating the volume of a cuboid whose dimensions are 8 cm by 4.20 cm by 5.6 cm. **(3 marks)**

3. The cash price of a television set is sh. 25 000. A customer paid a deposit of sh. 3 750 . He paid the amount owing in 24 equal monthly installments. If he was charged simple interest at the rate of 40% p.a How much was ;

(a) The carrying charge? **(2 marks)**

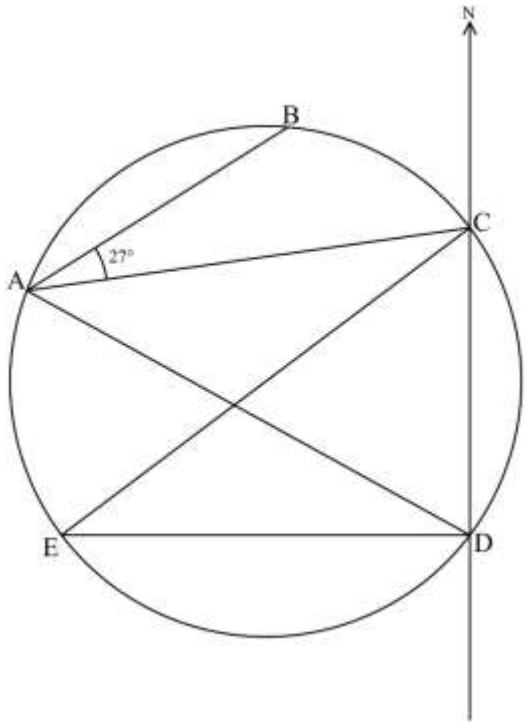
(b) Each installment? **(1 mark)**

4. Without using mathematical tables or a calculator, evaluate $3\log_4\left(\sqrt{3}\right) - \frac{1}{2}\log_4 3 + 3\log_4 2 - \log_4 6$

(3 marks)

5. Given that $2^{-3n^2}\left(a+x\right)^{-n} = 20^{-3n^2}$, make n the subject of the formula. **(3 marks)**

6. In the figure below, A, B, C, D and E are points on a circle. Point C is due north of point D and point E is due west of point D. Angle CAB = 27º. The angle of elevation of point B from point E is 87º.

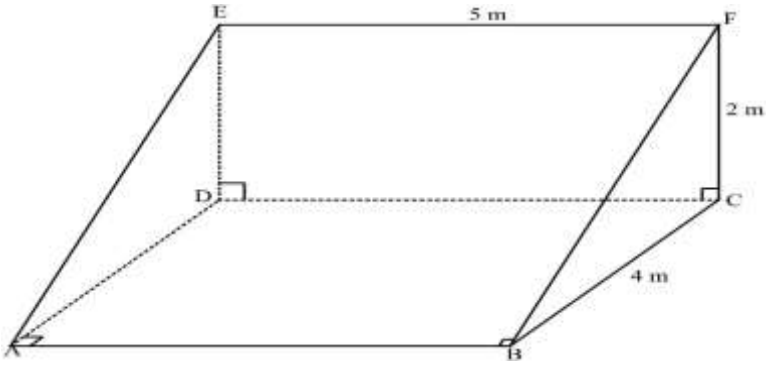


Find the size of angle of elevation of point B from the point D. **(3 marks)**

7. Given that $x = 2-\sqrt{3}$, find the value of $\left(x-\frac{1}{x}\right)^3$ **(3 marks)**

8. Expand $\left(x-y\right)^4$. Hence use the expression to find the value of $1{\cdot}58^4$, giving your answer correct to 4 significant figures. **(3 marks)**

9. The diagram below shows a wedge ABCDEF.



Calculate the angle between the lines BD and BF, correct to 1 decimal place. **(4 marks)**

10. State the amplitude and the phase shift of the curve $y = 2\cos\left(2x+90^\circ\right)$ **(2 marks)**

11. The tax authority collected the following amount of tax from different firms in a particular market.

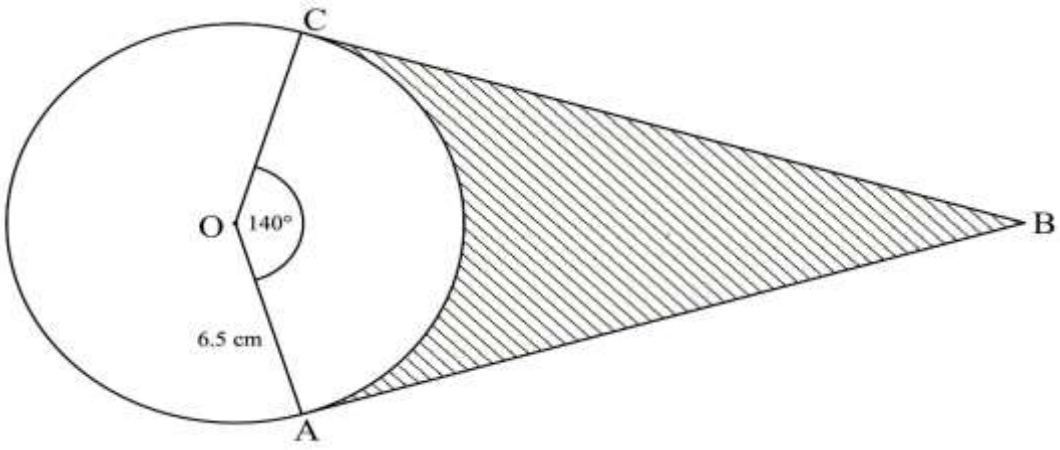
Amount of Taxes(Ksh)	10 000	11 000	12 000	13 000	14 000
No. of firms	3	12	18	12	3

Determine the quartile deviation of the data. **(3 marks)**

12. The position of towns P(0º,51ºW) and Q(0º,37ºE).Find the distance between the two towns in kilometers, correct to one decimal place. (3 marks)

13. A trader bought three kinds of nuts at Ksh. 10 per kg, Ksh. 8.40 per kg and Sh. 6 per kg. He mixed them in the ratio $3:5:4$ respectively and sold the mixed nuts making a profit of 25% in the process. At what price per kg did he sell them? **(3 marks)**

14. In the figure below, AB and CB are tangents to the circle, centre O and radius 6.5 cm. The arc AC subtends an angle of 140º at the centre of the circle.



Calculate the area of the shaded region, correct to 2 decimal places $\left(\text{Use } \pi{=}3{\cdot}142\right)$ **(4 marks)**

15. A square QRST with vertices Q(1,1),R(3,1),S(3,3) and T(1,3) is transformed by the matrix $\begin{pmatrix} 3 & 1 \\ 0 & 2 \end{pmatrix}$ to $Q'R'S'T'$. Find:

(a) the are of square QRST; **(2 marks)**

(b) the area of image $Q'R'S'T'$ **(2 marks)**

16. Find the radius and the centre of a circle whose equation of a circle is $x^2 + y^2 - 2x + 8y - 8 = 0$, hence draw the circle on the grid provided below**.** **(4 marks)**

SECTION II (50 marks)

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

17. (a) Complete the table below for values of $y = x^3 - 7x^2 + 8x + 16$ for $-2 \le x \le 6$ **(2 marks)**

x	–2	–1	0	1	2	3	4	5	6
$y = x^3 - 7x^2 + 8x + 16$	–36			18				6	

(b) On the grid provided, draw the graph of the function $y = -x^3 + 7x - 7x - 15$ for $-2 \le x \le 6$
Use a scale of 2 cm to represent 1 unit on the x – axis and 1 cm represent 5 units on the y – axis.**(3 marks)**

(c) Using the graph, determine:
(i) the average rate of change between $x = 1 \cdot 2$ and $x = 3 \cdot 1$ **(2 marks)**
(ii) The instantaneous rate of change of the curve at $x = -0 \cdot 5$, correct to one decimal place.
(3 marks

18. (a) An increasing arithmetic progression (AP) has first term as a and a common difference d. The ratio of the fifth term to the twelfth term of the A.P is 6:13.Given that product of first term a and the third term is 32. Find the;
(i) Value of a and the value of d. **(4 marks)**
(ii) Sum of the first five terms of the A.P. **(2 marks)**

(b) Determine the least number of terms that must be added together so that the sum of the progression is more than 700. **(4 marks)**

19. The table below shows some values of the curves $y = 2\cos\left(\frac{1}{2}x\right)$ and $y = \sin\left(\frac{1}{2}x\right)$

Complete the table for values of $y = 2\cos\left(\frac{1}{2}x\right)$ and $y = \sin\left(\frac{1}{2}x\right)$, correct to 1 decimal place.

(2 marks)

x^o	–360	–270	–180	–90	0	90	180	270	360
$y = \sin\left(\frac{1}{2}x\right)$	0				0				0
$y = 2\cos\left(\frac{1}{2}x\right)$	– 2.0		0				0		– 2.0

(b) Onthegrid provided, draw the graph of $y = 2\cos\left(\frac{1}{2}x\right)$ and $y = \sin\left(\frac{1}{2}x\right)$ for $-360^{o} \leq x \leq 360^{o}$ on the same axes. **(5 marks)**

(c) Use your graph in (b) above to find the values of;

(i) x in $2\cos\left(\frac{1}{2}x\right) - \sin\left(\frac{1}{2}x\right) = 0$ **(2 marks)**

(ii) y when $2\cos\left(\frac{1}{2}x\right) = \sin\left(\frac{1}{2}x\right)$ **(1 mark)**

20. The runway in Wilson airport is 3.22 km long and it is wide enough to accommodate the landing of two aircrafts simultaneously, An aircraft *x* landed at the runway with a speed of 144 km/hr and maintained this speed till the end of the runway when it took off again, Another aircraft *y* landed at runway half a minute later with a speed of 252 km/hr and followed *x* on the parallel runway throughout to the end of the runway when it also took off again.

(a) How far from starting point was *x* at the instant *y* overtook *x*. **(4 marks)**\

(b) Find the distance between the two planes at the instant when *y* is beginning to take off.**(3 marks)**

(c) Selina took a train from her home to the Nairobi. At a railway station she met another train travelling in the opposite direction at 25 km/hr. If the train she boarded was travelling at a speed of 15 km/hr and it took 10.8 seconds to completely pass the other train. Calculate the length of each train, if the train Selina boarded was twice as long as the train moving in the opposite direction. **(3 marks)**

21. The charge C in shillings per person for a certain seminar is partly fixed and partly inversely proportional to the total number of N of people.

(a) Write down an expression for C in terms of N. **(2 marks)**

(b) When 100 people attended the charge was Ksh 8,700 per person. While for 35 people charge is Ksh 10,000 per person. Calculate the fixed charges and hence state the equation connecting charge C. **(4 marks)**

(c) If a person had paid the full amount and doesn't attend, the fixed charge is refunded. A group of people paid but 10% of them did not attend. After the refund the organizers remained with Ksh574,000.Find the number of people initially in the group. **(4 marks)**

22. In certain game, $\frac{2}{3}$ of the players are boys while the rest are girls. 80% of the boys and 90% of the girls are right handed. The probability that a right handed player will break the rules of the game is 0.1 . Otherwise it is 0.3, these probabilities being independent of the sex of the player.

(a) Draw a tree diagram to represent this information. **(2 marks)**

(b) Use your tree diagram in (a) above determine;

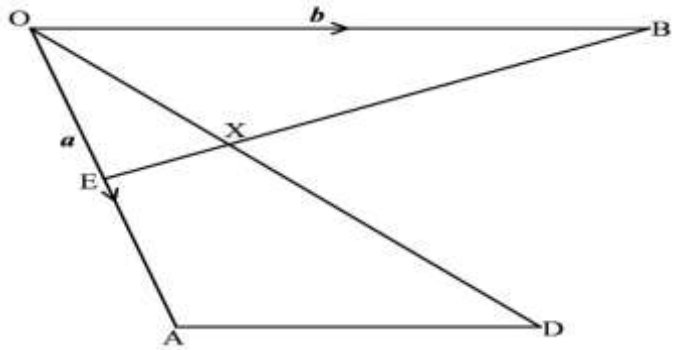
(i) The probability that a player chosen at random from the game is left handed. **(2 marks)**

(ii) The probability that a game rule is broken is a session. **(2 marks)**

(iii) The probability of a girl breaking a rule of the game**.** **(2 marks)**

(iv) The probability that a boy who is right handed doesn't break the rules and a girl who is left handed break rules of the game. **(2 marks)**

23. In the diagram drawn below, point D and E are such that $\mathbf{AD} = \frac{1}{3}\mathbf{OB}$ and $\mathbf{OE} = \frac{1}{3}\mathbf{OA}$



(a) Given that vectors $\mathbf{OA} = \boldsymbol{a}$ and $\mathbf{OB} = \boldsymbol{b}$, express in terms of **a** and **b:**

(i) **OD** **(1 mark)**

(ii) **BE** **(1 mark)**

(iii) **BD** **(2 marks)**

(b) Line OD and BE intersect at X such that $\mathbf{OX} = k\mathbf{OD}$ and $\mathbf{BX} = h\mathbf{BE}$ where k and h, express **OX** in two different ways **(2 marks)**

(c) Using the expressions in (b) above, determine.

(i) the values of k and h. **(3 marks)**

(ii) Hence state the ratio in which k divides **OD**. **(1 mark)**

24. A plan for a national stadium is in the form a pentagon ABCDE inscribed in a circle, a hockey pitch is to be constructed outside the stadium. The centre of the pitch is fixed at a point X. Given that the angle DAC = 36º, angle $\mathrm{ACB} = 42^{\circ}$ AE = ED,BC = AB and that the tangent at C meets ED produced at X.

(a) Calculate the angles of the pentagon. **(4 marks)**

(b) Giving reasons, calculate $\angle \mathrm{DXC}$. **(3 marks)**

(c) Given that $\mathrm{DX} = 20\ \mathrm{m}$, calculate the area of triangle CDX **(3 marks)**

KCSE PREDICTION 6 2022
PAPER 1
SECTION I (50 Marks)

Answer ALL Questions in this Section

1. Evaluate without using tables or calculator.

$$\sqrt{\frac{0.0625 \times 2.56}{0.25 \times 0.08 \times 0.5}}$$ **(3 Marks)**

2. Simplify $\frac{x+4}{x-4} - \frac{5x+20}{x^2-16}$. **(3 Marks)**

3. Evaluate without using log tables. **(3 Marks)**

$$\frac{\log_{10} 343 - \log_{10} 125}{\log_{10} {}^{7}/_{5}}$$

4. Solve the following inequalities and represent the solution on a single number line. **(3 Marks)**

$$-2x + 3 < 5$$

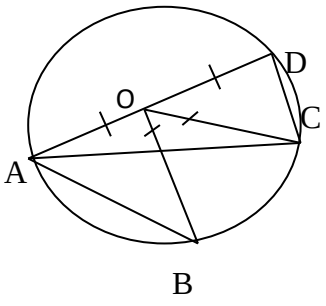
$$4 - {}^{3}/_{2}\,x \geq -8$$

5. The scale of a map is 1: 200. Calculate the actual area of a triangular field whose sides are 6cm, 8cm and 10cm on the map. **(4 Marks)**

6. 24 mean each working 10 hours a day take 4 days to complete a piece of work. How many more days will it take 15 men each working 8 hours a day to complete the same piece of work. **(3 Marks)**

7. Find the value of x in $({}^{1}/_{2})^{x} \times ({}^{1}/_{8})^{1-x} = 32$. **(3 Marks)**

8. The figure below shows a circle ABCD, centre O. BO is perpendicular to the diameter AOD and ∠COD = 42°.



Calculate:

a) ∠CAD **(2 Marks)**

b) ∠BAC **(2 Marks)**

9. Given that $\sin x = {}^{2}/_{3}$, find without using tables.

$tan\ x$ **(2 Marks)**

10. A three digit number is such that twice the hundreds digit is more than the tens digit by 2. The units digit is thrice the hundreds digit. When the digits are reversed, the number is increased by 594. Find the

number.

(4 Marks)

11. If $2m + 3n : 5m - n = 3 : 2$, calculate the ratio m : n. **(3 Marks)**

12. A dealer sells a car battery to a customer at a profit of 22%. The customer sells it to a friend for Sh.4800, at a profit of 8%. Find: -

a) How much it cost the dealer to buy the battery. **(2 Marks)**

b) How much it cost the dealer to buy the battery. **(2 Marks)**

13. Given vectors $\underset{\sim}{PQ} = \begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix}$ and $\underset{\sim}{RS} = \begin{pmatrix} 6 \\ a-1 \\ 15 \end{pmatrix}$ are parallel, find the value of a, hence calculate $\left|\underset{\sim}{RS}\right|$.

(3 Marks)

14. Find the greatest common factor of x^3y^2 and $4xy^4$. Hence factorise completely the expression $x^3y^2 - 4xy^4$. **(3 Marks)**

15. Express 2.4545……. in the form $^p/_q$ where p and q are integers and $q \neq 0$. **(3 Marks)**

16. Given that $a = 2.5$ and $b = 6.15$, find the percentage error in $b - a$. **(3 Marks**

SECTION II (50 Marks)

Answer any FIVE Questions in this Section.

17. Towns A and B are 580km apart. A matatu started from town A and travelled towards town B at an average speed of 90km/h at 7.30 a.m. One and a half hours later a car travelled from town B towards town A at an average speed of 120km/h.

a)

i) At what time did the two vehicles meet? **(2 Marks)**

ii) How far from B did the two vehicles meet? **(2 Marks)**

b) If the matatu took a total of 30 minutes to drop and pick travellers along the way, calculate the time it arrived at town B. **(2 Marks)**

c) A rally driver starts from B towards A at 10.00 a.m. at an average speed of 180km/h.

i) At what time did the rally driver overtake the car? **(2 Marks)**

ii) How far from A did the rally driver overtake the car? **(2 Marks)**

18. The figure below shows marks obtained by 60 students in a test.

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of pupils	2	2	3	8	23	13	6	2	1

a) Calculate the mean mark. **(3 Marks)**

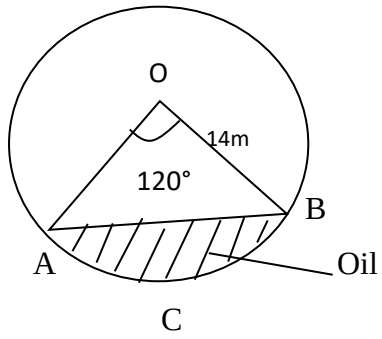
b) Calculate the median. **(3 Marks)**

c) State the modal class. **(1 Mark)**

d) Represent the information on a histogram. **(3 Marks)**

19. The figure shows the cross-section of a cylindrical tank containing some oil and lying horizontally. The tank is 4m long.

O is the centre of the circle, radius 14m. ∠AOB=120°.



Calculate:

i) The length of chord AB. **(2 Marks)**

ii) The area of segment ABC. **(3 Marks)**

iii) The volume of oil in the tank. **(2 Marks)**

iv) The area of the tank in contact with the oil. **(3 Marks)**

20. Given that $y = x^2 + 3x - 5$, complete the following table and use it to answer the questions that follow. **(2 marks)**

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

a) Using a scale of 1cm to represent 1 unit on both axes plot the graph of $y = x^2 + 3x - 5$. **(3 Marks)**

b) On the same grid draw the line $y = 2 - x$. **(3 Marks)**

c) Use your graph to estimate the roots of the equation. **(2 Marks)**

$$x^2 + 4x - 7 = 0$$

d) Give the least value of y for the curve $y = x^2 + 3x - 5$. **(1 Mark)**

e) Give the range of values of x for which $x^2 + 3x - 5$ is less than or equal to $2-x$. **(1 Mark)**

21. The vertices of a triangle are at $(3, 1)$, $B\ (5, 3)$ and $C\ (5, 0)$. Under a rotation R, the images of A and B are $A'(0, 0)$ and $B'(-2, 2)$ respectively.

i) Draw the two triangles on the Cartesian plane. **(2 Marks)**

ii) Find the centre and angle of rotation **(2 marks)**

iii) State the coordinates of C' the image of C. **(1 mark)**

iv) Triangle $A'B'C'$ is reflected in the line $y = -2$ to get $A^2B^2C^2$. Draw triangle $A^2B^2C^2$. State the coordinates of $A^2B^2C^2$. **(2 marks)**

v) $\Delta A^3B^3C^3$ is the image of $\Delta A^2B^2C^2$ under an enlargement centre (0, -5) and scale factor = 2. Draw $\Delta A^3B^3C^3$ and state its coordinates. **(3 marks)**

22. Three straight lines L_1, L_2 and L_3 are such that;

L_1 cuts the y-axis at $y = 5$ and has a gradient of 2.

L_2 is perpendicular to L_1 at the point where L_1 cuts the x-axis.

L_3 is parallel to L_2 and passes through the point (1, 2).

a) Find the equations in the form $y = mx + c$ of

i) L_1 **(2 Marks)**

ii) L_2 **(2 Marks)**

iii) L_3 **(2 Marks)**

b) Determine the coordinates of the point at which L_3 is perpendicular to L_1. **(3 Marks)**

23. Use a ruler and a pair of compasses only to construct a triangle ABC with AB = 3.8 cm, BC = 4.2 cm and ∠ABC=75°. **(2 marks)**

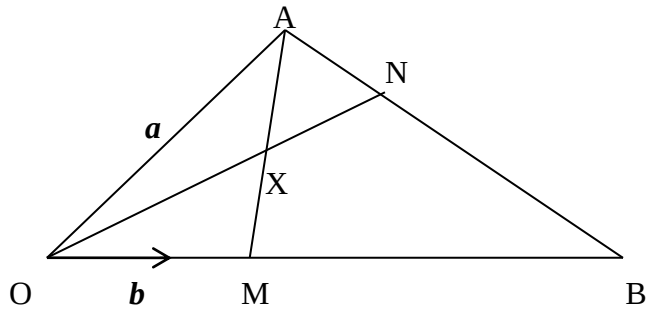
a) Measure AC. **(1 Mark)**

b) Drop a perpendicular from B to meet AC at N. Measure BN and AN. **(2 Marks)**

c) Calculate the area ofΔABN. **(2 Marks)**

d) Construct a perpendicular bisector of AB and BC to meet at O. Use OA as the radius to draw a circle. Find the area of the circle. **(3 Marks)**

24. In the figure below AN = ¼ AB and OM = $^2/_3$ OB. **OA = a** and **OB = b**. The lines AM and ON intersect at point$X$.



a) Express in terms of $\boldsymbol{a}$ and $\boldsymbol{b}$.

i) ON

ii) AM

iii) AN

iv) AB

v) MB

PAPER 2

SECTION I (50 Marks)

Answer ALL Questions in this Section

1) Use logarithm tables to evaluate. **(4 Marks)**

i. $\dfrac{32.95}{\sqrt{5.25 \times 0.069}}$

2) A two-digit number is such that the sum of its digits is 9. If the digits are reversed the new number formed exceeds the original number by 9. Find the number. **(3 Marks)**

3. The perimeter of a triangular field is 120m. Two of the sides are 21m and 40m. Calculate the largest angle of the field. **(3 Marks)**

4. Solve for x in the logarithmic equation.

$\log_{10}(3x + 4) - \log_{10}(3 - x) = 1$ **(3 Marks)**

5. Given that $\underset{\sim}{x} = 2\underset{\sim}{i} - 3\underset{\sim}{j} + \underset{\sim}{k}$, $\underset{\sim}{y} = 3\underset{\sim}{i} - 4 - \underset{\sim}{k}$, and $\underset{\sim}{z} = \underset{\sim}{j} + \underset{\sim}{k}$ and that $\boldsymbol{OR} = 3\underset{\sim}{x} - \underset{\sim}{y} + \underset{\sim}{z}$.

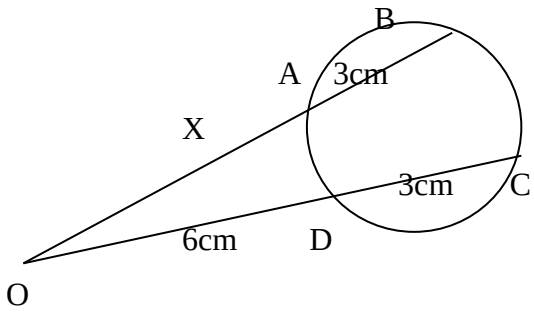
Find the magnitude of vector **OR** correct to 3 significant figures. **(3 Marks)**

6. Make x the subject of the equation.

$3y = y + \dfrac{P}{q + \frac{1}{x}}$ **(3 Marks)**

7. Two letters are selected from the word ECONOMICS, find the probability that the letters are a constant and a vowel in that order. **(2 Marks)**

8. In the circle below, $OA = xcm, AB = 3cm, OD = 6cm$ and $DC = 3cm$.



Find the value of x. **(3 Marks)**

9. Simplify and leave your answer in surd form. **(3 Marks)**

$$\frac{1 + \sqrt{5}}{2 + \sqrt{5}} + \frac{1 - \sqrt{5}}{2 - \sqrt{5}}$$

10. Omolo bought a new car for Ksh.800, 000. After 5 years he sold it through a second hand car dealer. The dealer charged a commission of 4% for the sale of the car. If Omolo received Ksh.480, 000, calculate the annual rate of depreciation of the car. **(3 Marks)**

11. Expand $(1 + 3x)^6$ upto the fourth term, hence evaluate $(1.3)^6$ to 2 significant figures.**4 Marks)**

12. A trader has 3 grades of tea P, Q and R. Grade P costs Shs.140 per kg, grade Q costs Shs.160 per kg and grade R costs sh.256 per kg. The trader mixes grade P and grade Q in the ratio 5:3 to make a brand of tea which he sells at Shs.180 per kg. Calculate the percentage profit he makes. **(3 Marks**

13. Each interior angle of a regular polygon of n sides exceeds each exterior angle of regular polygon of $3n$ sides by 8^0. Find the value of n. **(3 Marks)**

14. A quantity P is partly constant and partly varies as the square root of Q.

i) Using constants k and m, write down an equation connecting P and Q. **(1 Mark)**

ii) If Q = 25 when P = 20 and Q = 49, when Q = 30; find the values of k and m. **(2 Marks)**

15. Use matrix method to find the point of intersection of lines $5x - 1 = 7y$ and $2 - 5y = 4x$. **(3 Marks)**

16. The equation of a circle centre (a, b) is $2x^2 + 2y^2 - 12x - 20y + 60 = 0$. Find the value of a and b **(3 Marks)**

SECTION II (50 Marks)

Answer any FIVE Questions in this Section.

17. A church has a sitting capacity of 468 people with the members sitting in rows which have 3 long benches and 2 short ones. The long bench takes 2 people more than the short bench. Let the number of people sitting on the short bench be x.

d) Form an expression in x for the number of rows of benches. **(2 Marks)**

e) A new pastor finds this arrangement crowded and decides that by having one more person on each long bench, he can take out some rows and still sit the same number of people. Find an expression in x for the new number of rows of benches. **(2 Marks)**

f) If one row of benches was taken out, find the original number of people per row. **(6 Marks)**

18. A form three class has 32 students. They are distributed between four houses as follows: -

House	Boys	Girls
Chania	6	2
Athi	3	3
Tana	4	6
Mara	5	3

Two students are selected at random from the class. Find the probability that both students will be: -

e) From Chania **(3 Marks)**

f) Girls **(2 Marks)**

g) Boys of Tana House **(2 Marks)**

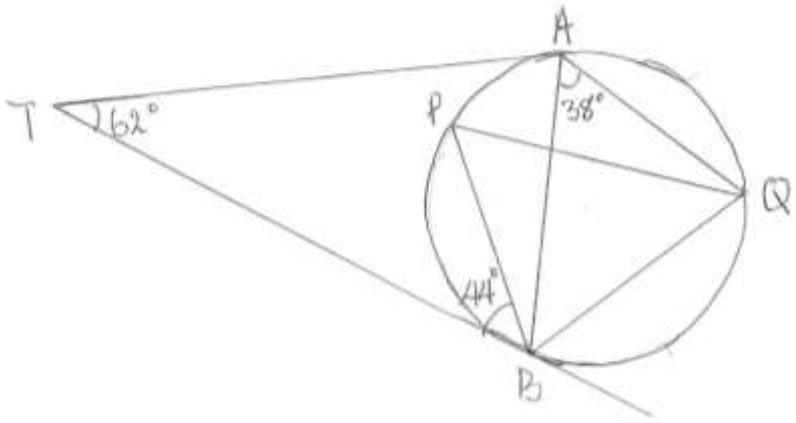
h) Either boys or from Mara House **(3 Marks)**

19. A tank is filled by tap A in 16 minutes. Tap B can empty the same tank in 24 minutes. Starting with an empty tank, both taps are turned on for 8 minutes and then tap B is turned off. Find: -

a) The time taken to fill the tank. **(6 Marks)**

b) The capacity of the tank if A delivered 18400 litres. **(4 Marks)**

20. In the diagram below TA and TB are tangents to the circle at A and B respectively. TBR is a straight line. The straight lines AB and QP intersect at K. ∠QAB=38°, ∠PBT=44° and ∠ATB=62°.



Calculate:

i) ∠PAB **(1 Mark)**

ii) ∠PBA

(2Marks)

iii) ∠ABQ **(2 Marks)**

iv) ∠AKP **(3 Marks)**

v) If AK=KB=3cm and KQ=2cm, calculate the length QP. **(3 Marks)**

21. The data collected from an experiment involving two variables X and Y was recorded as shown below.

X	1.1	1.2	1.3	1.4	1.5	1.6	
Y	-0.3	0.5	1.4	2.5	3.8	5.2	

The variables are known to satisfy a relation of the form $y = ax^3 + b$ where a and b are constants.

a) For each value of x in the table above, write down the value of x^3 **(2 Marks)**

b) By drawing a suitable straight line graph, estimate the value of a and b. **(6 Marks)**

c) Write down the relationship connecting y and x. **(2 Marks)**

22. The table below shows income tax rates for the year 2011.

Taxable Income (Sh. p.a.)	Tax Rate (%)
1 – 121 968	10
121 696 – 236 880	15
236 881 – 351 792	20
351 793 – 466 704	25
Above 466704	30

In the year 2011, Ole Sayeye's monthly earnings were as follows: -

Basic salary	Sh.42,800
House allowance	Sh.15,000
Medical allowance	Sh.2,880
Transport allowance	Sh.2,664
Hardship allowance	30% of Basic salary

Mr. Ole Sayeye was entitled to a monthly tax relief of Sh.1,162. Calulate: -

c) His annual taxable income. **(2 Marks)**

d) The monthly tax paid by Ole Sayeye. **(5 Marks)**

e) Ole Sayeye got a salary increment equal to 50% of the year 2011 allowances. Calculate the percentage increase in the tax paid. **(3 Marks)**

23. a) The first term of an arithmetic progression (AP) is 2. The sum of the first 8 terms of the AP is 156.

i) Find the common difference of the AP. **(2 Marks)**

ii) Given that the sum of the first n terms of the AP is 416, find n. **(4 Marks)**

b) The 3^{rd}, 5^{th} and 8^{th} terms of another AP form the first three terms of geometric progression (GP). If the common difference of the AP is 3, find: -

The 1^{st} term of the G.P. **(4 Marks)**

24. a) The weight of a metal rod varies jointly as the square of its length and inversely as the square root of its radius. Given that the length of the metal rod was increased by 5% and the radius decreased by 36%, what was the percentage change in weight. **(6 Marks)**

b) If the weight of the metal rod is 6N when the length is 12cm and radius 25cm, find the weight of the metal rod when the length is 15cm and radius 81cm. **(4 Marks)**

KCSE PREDICTION 7 2022

PAPER 1

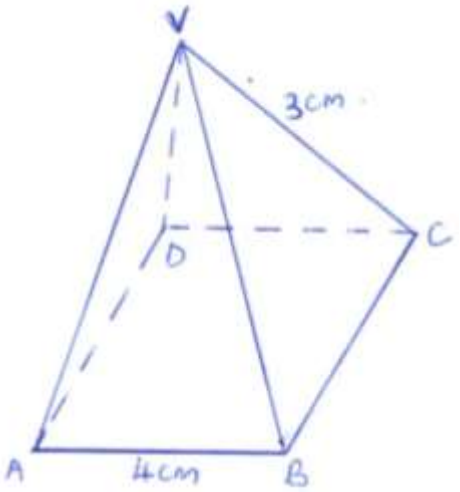
SECTION I (50 Marks)

Answer all questions in the spaces provided in this section.

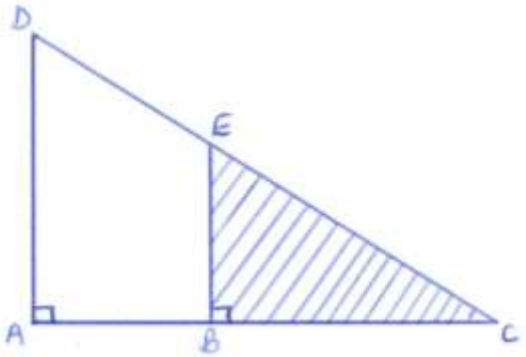
1. Evaluate without using a calculator; (3 marks)

$$\frac{\frac{5}{6}\ of\ \left(4\frac{1}{3}-3\frac{5}{6}\right)}{\frac{5}{12}\times\frac{3}{25}+1\frac{5}{9}\div 2\frac{1}{3}}$$

2. Solve for $x$in the equation $125^{-x}\times 5^{2(x-2)}=25^{(x+2)}$ (3 marks)
3. A cylindrical tank of diameter 1.4 m and height 1.2 m is two – thirds full of water. The tank if filled using a cylindrical bucket of diameter 35 cm and diameter 20 cm. Find the number of buckets required to fill the tank. (3 marks)
4. The figure below shows a right pyramid with a square base of side 4 cm and a slant height of 3 cm. Draw the net of the pyramid. (3 marks)



5. A square room is covered by a number of whole rectangular slabs of sides 60 cm by 42 cm. calculate the least possible area of the room in square metres. (3 marks)
6. The distance from **A** to **B** is d km and that from **B** to **C** is x km. if a bus maintains an average speed of 50 km/h between **A** and **B** and 60 km/h between **B** and **C**, it takes 3 hours to travel from **A** to **C**. If it maintains 60 km/h between **A** and **B** and 50 km/h between **B** and **C**, the journey takes 8 minutes less. What is the distance from **A** to **C** via **B**? (4 marks)
7. (a) Using a ruler and a compass only, construct triangle ABC in which BC = 8 cm, angle ABC = 30° and angle ACB = 45° . (2 marks)
   (b) At A drop a perpendicular to meet BC at D and measure AD. (2 marks)
8. The position vectors of A and B are $\binom{2}{5}$ and $\binom{8}{-7}$ respectively. Find the magnitude of the vector $\overrightarrow{AB}$ (3 marks)
9. A man sets off by bus on a journey of 130 km. after the bus has travelled 119 km at an average speed of 42 km/hr, it breaks down and he is immediately given a lift by a passing cyclist who takes him to his destination at average speed of 66 km/h.
   Calculate;
   a) The time taken for the whole journey. (2 marks)
   b) His average speed for the whole journey. (2 marks)
10. Find the area of the shaded region in the figure below given that AD = 15 cm, BE = 3 cm, AB = 3 cm, $\angle DAB=\angle EBC=90°$. (3 marks)



11. Write the expression below in surd form and rationalize the denominator. (3 marks)

$$\frac{1-\cos 60°}{1+\tan 30°}$$

12. Solve the equations below using matrix method. (3 marks)

$x + y = 8$

$2y - 3x = 1$

13. Expand and simplify $(1-4x)^6$ up to the expansion of the term in x^3. (3 marks)

14. Use reciprocals tables to evaluate $\frac{10}{0.625} + \frac{4}{1.5}$ (3 marks)

15. At the end of his stay in Kenya, a French tourist had 3 420 French francs which he decided to change into Euros. Given the exchange rate was;

1 French franc = Ksh. 11.25

1 Euro = Ksh. 72.50

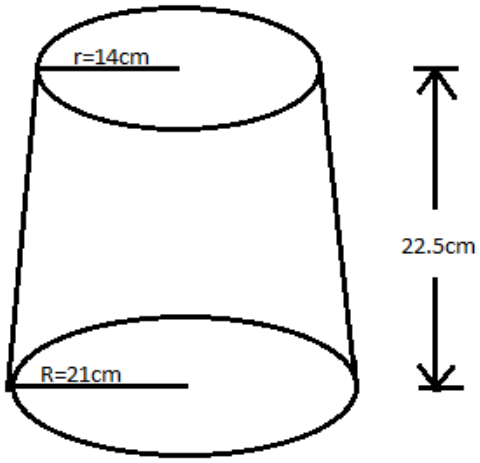
Calculate the number of Euros he received if the bank charged him 2% commission. (3 marks)

16. A number ***m*** is such that if its reciprocal is added to three times itself the result is 4. Form an equation in ***m*** and solve it. (3 marks)

SECTION II (50 Marks)

Answer ONLY FIVE questions in the spaces provided.

17. The diagram represents a solid frustum with base radius 21cm and top radius 14cm. The frustum is 22.5cm high and is made of a metal whose density is 3 g/cm^3. (Take $\pi = \frac{22}{7}$)



a) Calculate

(i) The volume of the metal in the frustum. (5 marks)

(ii) The mass of the frustum in kg. (2 marks)

b) The frustum is melted down and recast into a solid cube. In the process 20% of the metal is lost. Calculate to 2 decimal places the length of each side of the cube. (3 marks)

18. A line L_1 passes through the points $(-2, 3)$ and $(-1, 6)$ and is perpendicular to L_2 at $(-1, 6)$.

a) Find the equation of L_1. (2 marks)

b) Find the equation of L_2 in the form $ax + by - c = 0$ where a, b and c are constants. (2 marks)

c) Given that another line L_3 is parallel to L_1 and passes through point $(1,2)$, find the x and y intercepts of L_3 . (3 marks)

d) Find the point of intersection of L_2 and L_3. (3 marks)

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

x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
y	38		21		10		5		6		13		26		45		70

b. Use the completed table and mid ordinate rule to estimate the area bounded by the curve, the $x-$ axis and the lines $x = -3$ and $x = 5$ (3 marks)

c. Use calculus to calculate the actual area in part b above. (3 marks)

d. Calculate to 3 significant figure the percentage error when mid ordinate rule is used to estimate the area. (2 marks)

20. On the grid provided, draw the square whose vertices are $A(6,-2), B\ (7,-2), C\ (7,-1)\ and\ D\ (6,-1)$.

(b) On the same grid, draw:

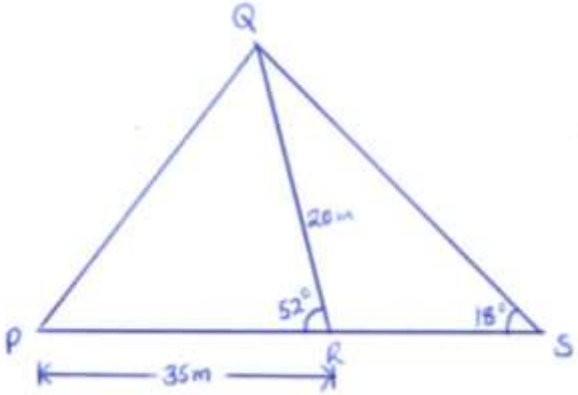
(i) $A'B'C'D'$ the image of ABCD, under an enlargement scale factor 3 centre $(9,-4)$ (3 marks)

(ii) $A''B''C''D''$ the image of $A'B'C'D'$ under a reflection in the line $x = 0$ (2 marks)

(iii)$A'''B'''C'''D'''$ the image of $A''B''C''D''$ under a rotation of $+90°$ about $(0,0)$.(2 marks)

(c) Describe a single transformation that maps $A'B'C'D'$ onto $A'''B'''C'''D'''$. (2 marks)

21. The figure below represent two neighboring plots with QR as their common boundary.



Find to 2 decimal places,

i. The length of boundary PQ. (3 marks)

ii. The length of boundary RS. (3 marks)

iii. The angle RQS. (1 mark)

iv. Area of triangle QRS. (3 marks)

22. The velocity $V\ m/s$ of a particle projected into space is given by the formula $V = 5t^2 - 2t + 9$ where t is the time in seconds elapsed since projection.

Determine;

a. The acceleration of the particle when $t = 4$ seconds. (3 marks)

b. The value of t which minimizes the acceleration. (2 marks)

c. The velocity of the particle when acceleration is minimum. (2 marks)

d. The total distance covered by the particle between $t = 1$ to $t = 4$ seconds. (3 marks

23. (a) The ratio of Juma's and Akinyi's earnings was 5: 3. Juma's earnings rose to Ksh 8 400 after an increase of 12%. Calculate the percentage increase in Akinyi's earnings given that the sum of their earnings was Ksh. 14 100 (6 marks)

(b) Juma and Akinyi contributed all the new earnings to buy maize at Ksh 1 175 per bag. The maize was then sold at ksh 1 762.50 per bag. The two shared all the money from the sales of the maize in the ratio of their contributions. Calculate the amount that Akinyi got. (4 marks)

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

a) Find the value of y when $x = 1$ (1 mark)

b) Determine the stationary points of the curve. (5 marks)

c) Find the equation of the normal to the curve at $x = 1$. (4 marks)

PAPER 2

SECTION I (50 Marks)

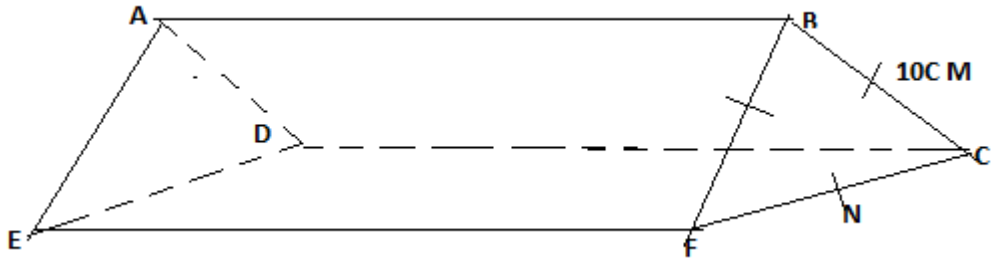
Answer all the questions in the spaces provided in this section.

1. Solve for x in the equation (2 marks)
$$log\ (5x - 15) - log(2x - 3)\ = 1$$

2. Given that z varies directly as the square of x and inversely as the square root of y. If $x\ =\ 2, y\ =\ 9$ when $z\ =\ 3$, find z when $x\ =\ 3$ and $y\ =\ 4$. (3 marks)

3. Calculate the exact value of compound interest earned on Sh. 20 000 for $1\frac{1}{2}$ years at the rate of 12% p.a, compounded half yearly. (3 marks)

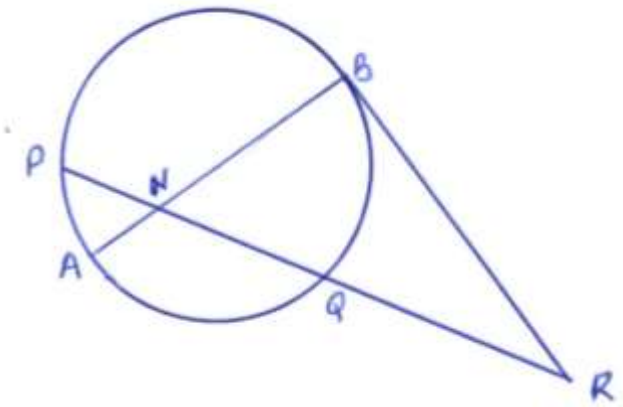
4. The triangular prism shown below has the sides AB =DC =EF = 12 cm. The ends are equilateral triangles of sides 1ocm. The point N is the midpoint of FC (3Marks)



a) Find the length of BN (1 mark)
b) Find the angle between the line EB and the plane CDEF (2 marks)

5. Evaluate $\frac{1+\sqrt{5}}{2+\sqrt{5}}+\frac{1-\sqrt{5}}{2-\sqrt{5}}$ (3 marks)

6. In the figure below, AB is a diameter of the circle. Chord PQ intersects AB at N. A tangent to the circle at B and meets PQ produced at R.



Given that PN = 14 cm, NB = 4 cm and BR = 7.5 cm, calculate the length of;
a) NR (2 marks)
b) AN (2 marks)

7. Solve the quadratic equation by completing the square method. (3 marks)

$2x^2 - 5x = -3$

8. Mogutu and Onacha working together can do a piece of work in 6days. Mogutu working alone takes 5days longer than Onacha. How many days does it take Onacha to do the work alone? (3 marks)

9. In an experiment, water was heated and its temperature changes recorded at intervals of 2 minutes as shown in the table below.

Time (Min)	0	2	4	6	8	10	12	14	16
Temperature (℃)	25	35	42.5	50	60	67.5	77.5	85	92.5

a) On the grid provided, plot the points and draw the line of best fit. (3 marks)

b) Use the line of best fit to estimate the time taken for the temperature of the water to be 75℃. (1 mark)

10. State the amplitude and the phase angle of the curve $4y = \cos(5x - 40^0)$ (2 marks)
11. Calculate the semi-interquartile range of 3,4,1,2,3,6,8,5,7,9. (3 marks)
12. Points A and B lie on latitude 15°N andtheir longitudes differ by 25°. An aircraft takes 8 hours to fly between the points. Calculate its speed in knots. (3 marks)
13. Given the points P(-6,-3) , Q(-2,-1) and R(6,3) express Vectors $\overrightarrow{PQ}$ and$\overrightarrow{QR}$ as column vectors and hence show that the points P,Q and R are collinear (4 marks)
14. During inter-school competitions, rugby and football teams from Ranje sec school took part. The probability that the rugby would win their first match was $\frac{1}{8}$ while that the handball team could lose was $\frac{4}{7}$. Find the probability that at least one team won the first match. (3 marks)
15. The original area of an object after two successive transformations given by $\begin{bmatrix}2 & 1\\3 & 5\end{bmatrix}$ and $\begin{bmatrix}3 & 1\\0 & 1\end{bmatrix}$ in that order becomes 168 square units. Find the original area of the object. (3 marks)
16. Evaluate $\int_{-1}^{3}(3x+1)(2x-2)$ (4 marks)

SECTION II (50 Marks)

Answer ONLY FIVE questions in this section

17. An arithmetic progression of 41 terms is such that the sum of the first five terms is 560 and the sum of the last five terms is -250. Find:
    a) The first term and the common difference (5 marks)
    b) The last term (2 marks)
    c) The sum of the progression (3 marks)
18. A pavement is of length $(x-1)m$ and width $(x-8)m$. The area of the pavement is $4.56\ m^2$.

a) (i) Write a quadratic equation for the area of the pavement in the form $ax^2 + bx + c = 0$ where a, b and c are constants. (2 marks)

(ii) Using the method of completing square, find the actual length and width of the pavement. (6 marks)

b) The pavement is covered with rectangular tiles measuring 0.4 m by 0.3 m. determine the number of tiles used to cover the pavement completely. (2 marks)

19. The table below shows the masses measured to the nearest Kg of 200 people.

Mass kg	40-49	50-59	60-69	70-79	80-89	90-99	100-109
No of people	9	27	70	50	26	12	6

a) Draw a cumulative frequency curve for the data above. (4 marks)

b) Use your graph to estimate

i. The median mass. (1 mark)

ii. The number of people whose mass lies between 70.5 kg and 75.5 kg (1 mark)

c) From your graph find

i. The lower quartile (1 mark)

ii. the upper quartile (1 mark)

iii. the interquartile range (2 marks)

20. Without using a protractor, construct line XY = 8cm

a) Construct the locus of all points R such that $\angle XRY = 60°$ (4 marks)

b) Construct the locus of all points P such that the area of triangle XPY is 16 cm^2.(3 marks)

c) Mark all the points where the locus of R intersects the locus of P with the letters A,B,C and D (3 marks)

21. Given that $y = 2\sin 2x$ and $y = 3\cos(x + 45°)$;

a) Complete the table below

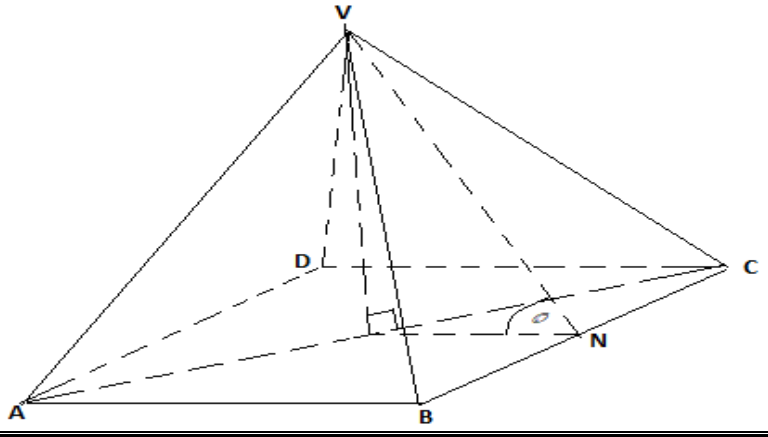
$x°$	0	20	40	60	80	100	120	140	160	180
$2\sin 2x°$	0.00		1.97		1.68	-0.68	-1.73		-1.28	0.00
$3\cos(x + 45°)$	2.12	1.27		-0.78		-2.46			-2.72	-2.12

b) Use the data to draw the graphs of $y = 2\sin 2x°$ and $y = 3\cos(x + 45°)$ for $0° \leq x \leq 180°$ on the same axes. (3 marks)

c) State the amplitude and period of each curve. (2 marks)

d) Use the graph to solve the equation $2\sin 2x - 2\cos(x + 45°) = 0$ for $0° \leq x \leq 180°$. (2 marks)

22. The figure below shows a right pyramid standing on a rectangular base ABCD. AB = 8cm, BC = 15cm and each slant edge is 12 cm long M is the midpoint of BC.



Calculate to one decimal place

a) the vertical height of the pyramid (3 marks)
b) the volume of the pyramid (2 marks)
c) the angle between plane VBC and the base (3 marks)
d) the angle between line VA and the plane ABCD (2 marks)

23. Income rates for income earned were charged as follows.

Income in sh. per month	Rate in Ksh. per sh.20
1 – 8, 400	2
8401 – 18, 000	3
18001 – 30, 000	4
30, 001 – 36, 000	5
36, 001 – 48, 000	6
48, 001 and above	7

A civil servant earns a monthly salary of ksh.19, 200. His house allowance is ksh.12, 000 per month. Other allowances per month are transport ksh.13, 000 and medical allowance ksh.2, 300. He is entitled to a family relief of ksh.1, 240 per month. Determine

(a) (i) His taxable income per month (2 marks)

(ii) Net tax (5 marks)

(b) In addition, the following deductions were made.

NHIF sh.230
Service charge ksh.100
Loan repayment ksh.4, 000
Cooperative shares of ksh.1, 200

Calculate his net salary per month (3 marks)

24. Radon Company has two types of machines A and B for juice production. Type A machine can produce 800 litres per day while type B machine can produce 1 600 litres per day. Type A machine needs four operators and type B need seven operators. At least 8 000 litres must be produced daily and the total number of operators should not exceed 41. There should be two or more machine of each type.
Let x be the number of machines of type A and y for type B.

a) Form all inequalities in x and y to represent the above information. (4 marks)
b) In the grid provided below, draw the inequalities and shade the unwanted region. (4 marks)
c) Use the graph in (b) above to determine the least number of operators required for maximum possible production. (2 marks)

KCSE PREDICTION 8 2022

PAPER 1

SECTION I (50 MARKS)

Answer ALL the questions from this section.

1. Find the reciprocals of 0.216 correct to 3 decimal places hence evaluate;

$$\frac{\sqrt[3]{0.512}}{0.216}$$ (3 marks)

2. Without using a calculator, evaluate;

$$\frac{1\frac{1}{5}-1\frac{1}{3}}{\frac{1}{8}-\left(-\frac{1}{2}\right)^2}-\frac{7}{15}\ \text{of}\ 2$$ (4 marks)

3. Three bells ring at intervals of 9 minutes, 15 minutes and 21 minutes.
The bells will next ring together at 11.00pm. Find the time the bells had last rang together. (3 marks)

4. Simplify the expression.

$$\frac{6x^2-13x+6}{4x^2-9}$$ (3 marks)

5. Without using a calculator or mathematical tables, solve the equation

$2\log_{10} x - 3\log_{10} 2 + \log_{10} 32 = 2$ (4 marks)

6. A line L passes through point (3, 1) and is perpendicular to the line $2y = 4x + 5$.
Determine the equation of line L. (3 marks)

7. A forex bureau in Kenya buys and sells foreign currencies as shown below.

Currency	Buying (Ksh)	Selling (Ksh)
Chinese Yuan	12.34	12.35
South African rand	11.28	11.37

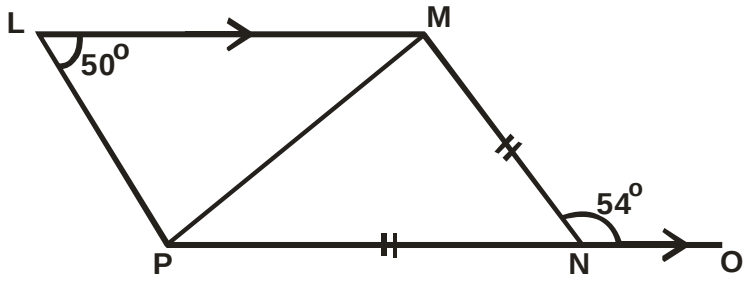
A businesswoman from China converted 195,250 Chinese Yuan into Kenya shillings.

a) Calculate the amount of money in Kenya shillings that she received. (1 mark)
b) While in Kenya, the businesswoman spent Ksh.1,258,000 and then converted the balance into South African Rand. Calculate the amount of money to the nearest Rand that she received. (3 marks)

8. The seventh term of an A.P is 20 and the sum of the first 20 terms is 610.
Find the first term and the common difference. (3 marks)

9. The points P, Q and R lie on a straight line. The position vectors of P and R are $2i + 3j + 13k$ and $5i - 3j + 4k$ respectively. Q divides PR internally in the ratio 2 : 1. Find
a) The position vector of Q. (2 marks)
b) Distance of Q from the origin. (1 mark)

10. In the figure below, $\angle MNO = 54^o$, $\angle PLM = 50^o$, PN = NM and PO is parallel to LM.
Find the value of $\angle LPM$. (3 marks)



11. Two matrices A and B are such that $A = \begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 2 \\ 3 & -4 \end{pmatrix}$. Given that the determinant of AB = 10, find the value of k. (3 marks)

12. Two pipes A and B can fill an empty tank in 3 hours and 5 hours respectively. Pipe C can empty the full tank in 4 hours. If the three pipes A, B and C are opened at the same time, find how long they will take to fill the tank. (3 marks)

13. Determine the equation of the normal to the curve $y = x^2 - 3x + 1$ at a point (-2, 3) giving your answer in the form $ax + by = c$. (3 marks)

14. The size of each interior angle of a regular polygon is five times the size of exterior angle. Find the number of sides of the regular polygon. (3 marks)

15. Find the integral values of x which satisfy the inequalities.
$x + 8 > 4x - 6 \geq 3(4 - x)$ (2 marks)

16. John had two bags A and B containing sugar. If he removed 2kg from bag A and added to bag B, the mass of sugar in bag B would be four times the mass of sugar in bag A. If he added 10kg of sugar to the original amount of sugar in each bag, the mass of sugar in B would be twice the mass of the sugar in bag A.
Calculate the original mass of sugar in each bag. (3 marks)

***SECTION II* (50 MARKS)**

Answer any FIVE questions from this section

17. The table below shows the height measured to the nearest cm of 101 pawpaw trees.

Height in cm	20 – 24	25 – 29	30 – 34	35 – 39	40 – 44	45 – 49	50 – 54	55 – 59
Frequency	2	15	18	25	30	6	3	2

a) State the modal class. (1 mark)
b) Calculate to 2 decimal places.
i) The mean height (4 marks)
ii) The difference between the mean height and the median height. (5 marks)

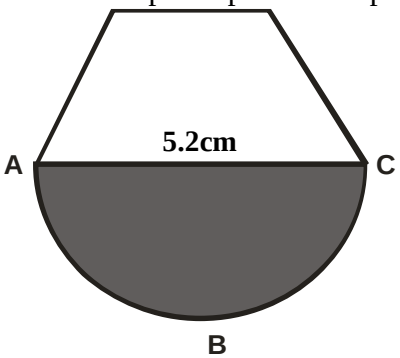
18. Three pegs R, S and T are on the vertices of a triangular plan field. R is 300m from S on a bearing of 300º and T is 450m directly South of R.
a) Using a scale of 1cm to represent 60m, draw a diagram to show the position of the pegs. (3 marks)
b) Use the scale drawing to determine;
i) The distance between T and S in metres. (2 marks)
ii) The bearing of T from S. (1 mark)
c) Find the area of the field in hectares correct to one decimal place. (4 marks)

19. Mr. Mutuku owns a bicycle which he sometimes rides to go to work. Out of 21 working days in a month he only rides to work for 18 days. If he rides to work the probability that he is bitten by a rabid dog is $\frac{4}{15}$ otherwise it is only $\frac{1}{13}$. When he is bitten by the dog, the probability that he will get treatment is $\frac{4}{5}$ and if he does not get treatment the probability that he will get rabies is $\frac{5}{7}$
a) Draw a tree diagram to show the events. (3 marks)
b) Using the tree diagram above determine the probability that
i) Mr. Mutuku will not be bitten by a rabid dog. (2 marks)
ii) He will get rabies. (2 marks)
iii) He will not get rabies. (3 marks)

20. The volume $V cm^3$ of a solid depends partly on r^2 and partly on r^3 where r is one of the dimensions of the solid.
When r = 1, the volume is $54.6 cm^3$ and when r = 2, the volume is $226.8 cm^3$.
a) Find the expression for V in terms of r. (5 marks)
b) Calculate the volume of solid when r = 4. (3 marks)
c) Find value of r for which the two parts of the volume are equal. (2 marks)

21. The equation of a curve is given by $y = 5x - \frac{1}{2}x^2$
a) Draw the curve of $y = 5x - \frac{1}{2}x^2$ for $0 \leq x \leq 6$. (3 marks)
b) By integration find the area bounded by the curve, the line x = 6 and the x-axis. (3 marks)
c) i) On the same graph in (a) draw the line y = 2x (1 mark)
ii) Determine the area bounded by the curve and the line y = 2x (3 marks)

22. The diagram below shows a cross section of a bottle. The lower part ABC is a hemisphere of radius 5.2cm and the upper part is a frustum of a cone. The top radius of the frustum is one third of the radius of the hemisphere. The hemisphere part is completely filled with water as shown in the diagram.



When the container is inverted, the water now completely fills on the frustum part.

a) Determine the height of the frustum part. (7 marks)

b) Find the surface area of the frustum part of the bottle. (3 marks)

23. A bus left Nairobi at 7.00a.m and travelled towards Eldoret at average speed of 80km/h. At 7.45am, a car left Eldoret towards Nairobi at an average speed of 120km/hr. The distance between Nairobi and Eldoret is 300km. Calculate

a) The time the bus arrives at Eldoret. (2 marks)

b) The time of the day the two vehicles met. (4 marks)

c) The distance from Nairobi to where the two vehicles met. (2 marks)

d) The distance of the bus from Eldoret when the car arrived at Nairobi. (2 marks)

24. a) Complete the table below for the function $y = 2x^3 + 5x^2 – x – 6$. (3 marks)

x	–4	–3	–2	–1	0	1	2
$2x^3$	–128	–54					
$5x^2$							
-x	4	3					
-6	–6	–6	–6	–6	–6	–6	–6
y	–50				–6	0	

b) Draw the graph of $y = 2x^3 + 5x^2 – x – 6$ for $-4 \leq x \leq 2$ (3 marks)

c) By drawing a suitable line, use the graph in (b) to solve the equations

i) $2x^3 + 5x^2 + x – 4 = 0$ (2 marks)

ii) $2x^3 + 5x^2 – x + 2 = 0$ (2 marks)

PAPER 2

SECTION I (50 MARKS)

Answer ALL the questions from this section.

1. Use logarithms to evaluate, (4 marks)

$$\sqrt[3]{\frac{45.3 \times 0.00697}{0.534}}$$

2. Make P the subject of the formula

$d = \sqrt[3]{\frac{P}{q-P}}$ (3 marks)

3. Find the circle centre and radius whose equation is

$3x^2 + 3y^2 + 18x – 6y + 18 = 0$ (3 marks)

4. The volumes of two similar cylindrical containers are $27cm^3$ and $64cm^3$ respectively. Given that the height of the smaller container is 12cm,find the height of the larger container. (2 marks)

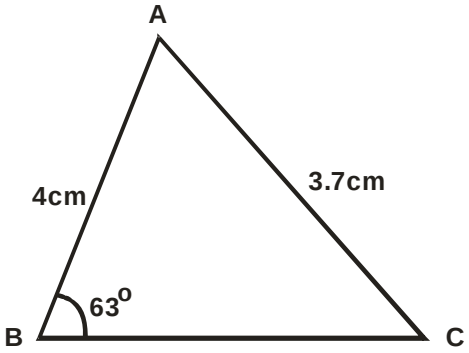
5. $3cm^3$ of water is added to $2cm^3$ of a certain medicine which costs sh.12 per cm^3. The chemist sells the diluted medicine at sh.6 per cm^3. Calculate the percentage profit. (3 marks)

6. Given that $4y = 3 \sin\frac{2}{5}$ for $0 < \theta < 360^o$. Determine

a) The amplitude of the curve (1 mark)

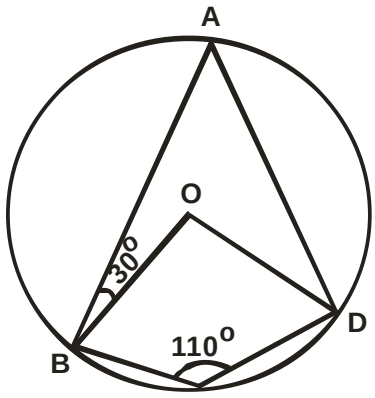
b) The period of the curve. (1 mark)

7. Find the length BC of the following triangle if AC = 3.7cm, AB = 4cm and angle ABC = 63^o. (3 marks)



8. Solve for x in the equation
$27^{x-1} \times 3^{x+1} = 729$ (3 marks)

9. In the figure below ABCD is a cyclic quadrilateral. Point O is the centre of the circle.
$\angle ABO = 30^o$ and $\angle BCD = 110^o$.



Calculate the size of angle ADB. (2 marks)

10. Three people Mutua, Wanza and Kiilu contributed money to start a business. Mutua contributed a quarter of the money and Wanza two fifths of the reminder. Kiilu's contribution was one and a half times that of Mutua. They borrowed the rest of the money from a bank which was sh.60,000 less than Kiilu's contribution. Find the total amount required to start the business. (4 marks)

11. Simplify $\frac{\sqrt{3}}{\sqrt{3}-\sqrt{2}}$ (3 marks)

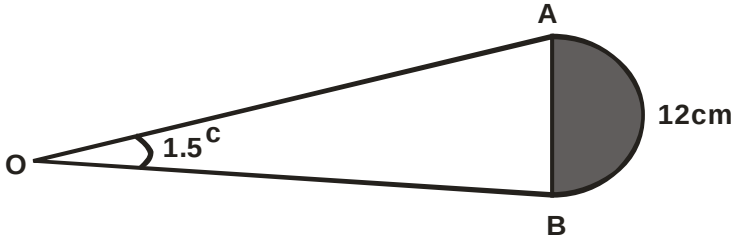
12. Expand $\left(2-\frac{1}{4}x\right)^5$ and use the first three terms to find the value of 1.975^5 to four significant figures. (4 marks)

13. The radius of a spherical ball is measured as 7cm correct to the nearest centimeter. Determine to 2 decimal places, the percentage error in calculating the surface area of the ball. (3 marks)

14. Given that $\tan\theta = \frac{1}{\sqrt{5}}$ where θ is an acute angle, find without using tables or calculator $\sin(90-\theta)$ leaving your answer in the simplified surd form. (4 marks)

15. 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. (3 marks)

16. The diagram below shows sector AOB of a circle centre O. $\angle AOB = 1.5^C$ and arc AB is of length 12cm.



a) Determine the radius OA of the circle. (1 mark)
b) Calculate the area of the shaded region. Give your answer correct to 3 s.f. (3 marks)

SECTION II (50 MARKS)

Answer any FIVE questions from this section

17. The table below shows the taxation rates.

Income (£ per month)	Rate %
0 – 382	10
383 – 754	15
755 – 1126	20
1127 – 1498	25
1499 – 1870	30
1871 – 2242	35
Over 2242	40

Njeri is housed by her employer but pays a nominal rent of sh.1200 per month. She is entitled to a personal relief of sh.950 per month. If her monthly P.A.Y.E is sh.7024,

a) Calculate her gross income. (5 marks)

b) In addition to the tax the following monthly deductions are also made

Sacco shares Ksh. 1200
Coop loan Ksh.1500
Union dues Ksh.300
Calculate

i) Her monthly salary. (3 marks)

ii) Net monthly salary (2 marks)

18. Use a ruler and compasses only for all construction in this question.

a) Construct a triangle ABC in which AB = 8cm, BC = 7.5cm and $\angle ABC = 112\frac{1}{2}^{o}$. (3 marks)

b) Measure the length of AC. (1 mark)

c) By shading the unwanted region show the locus of P within the triangle ABC such that AP $\leq$ BP, AP > 3cm. Mark the required region as P. (3 marks)

d) Construct a normal from C to meet AB produced at D. (1 mark)

e) Locate the locus of R in the same diagram such that the arc of triangle ARB is $\frac{3}{4}$ the arc of the triangle ABC (2 marks)

19. In the triangle PQR below, L and M are points on PQ and QR respectively such that PL : LQ = 1 : 3 and Qm : mR = 1 : 2. Pm and RL intersect at X. Given that PQ =b and PR = c

s

a) Express the following vectors in terms of b and c.

i) $\underset{\sim}{QR}$ (1 mark)

ii) $\underset{\sim}{Pm}$ (1 mark)

iii) $\underset{\sim}{RL}$ (1 mark)

b) By taking $\underset{\sim}{PX} = h\underset{\sim}{Pm}$ and $\underset{\sim}{RX} = k\underset{\sim}{RL}$ where h and k are constants. Find two expressions of PX in terms of h, k, b and c. Hence determine the values of the constants h and k. (6 marks)

c) Determine the ratio $\underset{\sim}{LX} : \underset{\sim}{XR}$. (1 mark)

20. OABC is a parallelogram with vertices O(0, 0), A(2, 0), B(3, 2) and C(1, 2).

$O^IA^IB^IC^I$ is the image of OABC under a transformation matrix $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$.

a) i) Find the coordinates of $O^IA^IB^IC^I$ (2 marks)

ii) On the graph provided, draw OABC and $O^IA^IB^IC^I$ (2 marks)

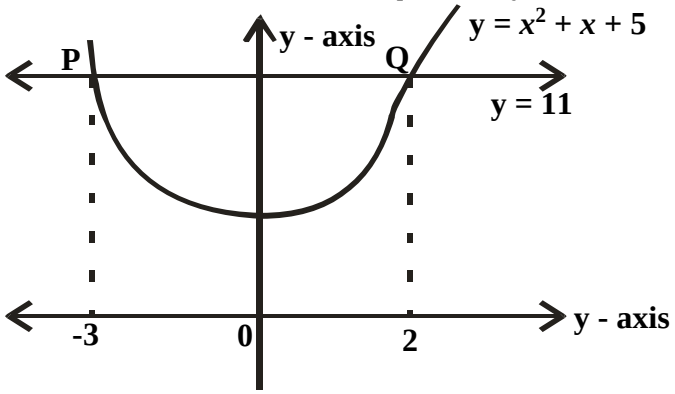
b) i) Find $O^{II}A^{II}B^{II}C^{II}$, the image of $O^IA^IB^IC^I$ under the transformation matrix $\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$. (2 marks)

ii) On the same grid, draw $O^{II}A^{II}B^{II}C^{II}$. (1 mark)

c) Find the single matrix that maps $O^{II}A^{II}B^{II}C^{II}$ onto OABC. (3 marks)

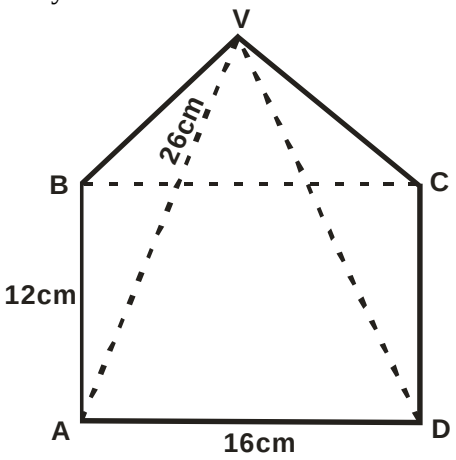
21. An aircraft leaves town P (30°S, 17°E) and moves directly towards Q (60°N, 17°E). It then moved at an average speed of 300 knots for 8 hours Westwards to town R. Determine
    a) The distance PQ in nautical miles. (2 marks)
    b) The position of town R. (4 marks)
    c) The local time at R if local time at Q is 3.12p.m (2 marks)
    d) The total distance moved from P to R in kilometers. (Take 1nm = 1.853km) (2 marks)

22. The figure below is a sketch of a curve whose equation is $y = x^2 + x + 5$. It cuts the line $y = 11$ at points P and Q.



    a) Find the area bounded by the curve $y = x^2 + x + 5$ and the line $y = 11$ using the trapezium rule with 5 strips. (5 marks)
    b) Calculate the difference in the area if the mid-ordinate rule with 5 ordinates was used instead of the trapezium rule. (5 marks)

23. The figure below represents a rectangular based pyramid VABCD. AB = 12cm and AD = 16cm. Point O is vertically below V and VA = 26cm.



    Calculate:
    a) The height, VO, of the pyramid. (4 marks)
    b) The angle between the edge VA and the plane ABCD. (3 marks)
    c) The angle between the planes VAB and ABCD. (3 marks)

24. The distances S metres from a fixed point O, covered by a particle after t seconds is given by equation $S = t^3 - 6t^2 + 9t + 5$
    a) Calculate the gradient to the curve at t = 0.5 seconds. (3 marks)
    b) Determine the values of S at the maximum and minimum turning points of the curve. (4 marks)
    c) On the space provided, sketch the curve of $S = t^3 - 6t^2 + 9t + 5$. (3 marks)

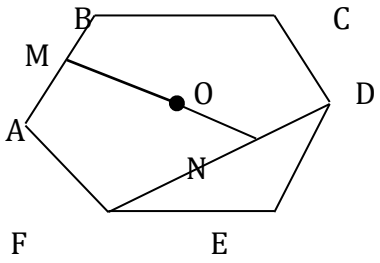
KCSE PREDICTION 9 2022
PAPER 2
SECTION 1: (50 MARKS)

Attempt ALL Questions in this section

1. Evaluate: (3marks)

$$\frac{8 \times \frac{1}{3} \text{ of } 9 \div 2}{(12+2x3) - \frac{2}{3} \text{ of } 144 \div 12}$$

2. Given that $\cos (x - 20)^0 = \sin (2x + 32)^0$ and x is an acute angle, Find $\tan (x - 4)^0$ (3 Marks)
3. A rhombus A B C D with its side 15cm and diagonal AC = 24cm. Find the length of the other diagonal BD. (2marks)
4. The figure below is a regular hexagon. O is the centre and M is the mid point of AB.



Find angle: (i) EFD (1mark)
(ii) MNF (2marks)

5. Simplify the expression: (4marks)

$$\frac{4x^2 - xy - 3y^2}{32x^2 - 18y^2}$$

6. A man invests KSh. 24,000 in an account which pays 16% interest p.a. The interest is compounded quarterly. Find the amount in the account after 1 ½ years. (3 Marks)
7. Solve for x given that (3 Marks)
$Log_{10}(x - 1) + 1 = Log_{10}(x - 4)$
8. A seven sided polygon has three of its angles equal to θ and the other angles are $(2\theta - 30)$, $(\theta + 28)$, $3(\theta - 4)$ and $(126 - \theta)$.Calculate the value of θ (3 marks)
9. Pipe A can fill a tank in 2 hours, pipes 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 closed (2 Marks)
   (b) To fill the tank with all the pipes open (2 Marks)

10. The travel timetable below shows the departure and arrival time for a bus plying between two towns M and R, 300 kilometres apart.

TOWN	**ARRIVAL**	**DEPARTURE**
M		0830h
N	1000h	1020h
P	1310h	1340h
Q	1510h	1520h
R	1600h	

Calculate the average speed for the whole journey. (3marks)

11. Simplify the following expression without using tables or calculator: (3marks)

$$\frac{4 \cos 60^0 + 16 \cos^2 45 + 2 \sin 30}{\sin^2 45}$$

12. Given that PQ = $\begin{pmatrix} 9 \\ 2 \end{pmatrix}$ and OQ = $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$, determine:

OP and find the magnitude of OP giving your answer in surd form. (3marks)

13. A tourist arrived from USA and changed his US $1500 TO Ksh. He spent Ksh. 3000 per night in a hotel for 20 nights and a further Ksh. 9000 daily for the entire period. He left for South Africa having changed the balance to South African Rand.
Calculate the amount of South African Rands he left with, if the bank buys and sells currencies using the table below.

Currency	Buying	Selling
1 US Dollar ($)	78.4133	78.4744
1 Sterling Pound (£)	114.1616	114.3043
1 South African Rand	7.8842	7.9141

14. Two similar containers can hold 1000ml and 8 litres of water respectively. The larger has a surface area of 800cm^2. Find the surface area of the smaller container. (3marks)
15. Use squares square roots and reciprocal tables to evaluate (3marks)

$$3.045^2 + \frac{1}{\sqrt{49.24}}$$

16. The sum of digits formed in a two digit number is 16. When the number is subtracted from the number formed by reversing the digits, the difference is 18. Find the number (3 Marks)

SECTION II (50 MARKS)

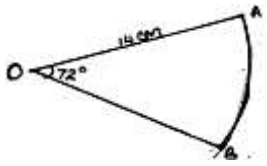
Answer any five questions in this section

17. A group of choir members decided to raise 3600/= to buy a guitar. Each member was to contribute equal amount. In the preparation process five members transferred to another church, which meant the remaining contributors had to pay more to achieve the target.
(a) i) find an expression in terms of n for the original contribution (1mk)
ii) find an expression in terms of n for the new contribution by the remaining members. (1mk)
iii)Show that the increase in the contribution per member was:
Sh. $\frac{18{,}000}{n(n-5)}$ if n is the initial number of members. (3mks)
(b) If the increase in the contribution per member was sh. 24, what was the original contribution before the other members left? (3mks)
(c) Calculate the percentage increase in the contribution before the others left. (2mks)
18. The table below shows the marks scored by form four students in a mathematical test.

Marks	$5 \le X \le 14$	$5 \le X \le 24$	$5 \le X \le 34$	$5 \le X \le 54$	$5 \le X \le 64$	$5 \le X \le 84$	$5 \le X \le 94$
Frequency	3	10	22	72	87	98	100

(a) State the modal class. (1mark)
(b) Calculate the mean mark. (3marks)
(c) Calculate the 70th percentile mark. (3marks)
(d) Draw a histogram to represent this information. (3marks)

19. The figure below shows a sector of a circle. If the radius OA = 14cm and the angle AOB = 72^0.



(a) Calculate the area of the sector. (2marks)
(b) The sector is folded to form a cone. Calculate:-
(i) The radius of the cone formed. (2marks)

(ii) The volume of the solid formed. (3marks)

(c) A solid cone of same size in (b) above is melted down and casted into circular washers. Each washer has an external diameter of 4cm, internal diameter of 1½ cm and 0.3cm thick. Calculate number of washers made. (3marks)

20. A bus left Kisumu for Nairobi at an average speed of 60km/hr. After 1½ hours another car left Kisumu for Nairobi along the same route at an average speed of 100km/h. If the distance between Kisumu and Nairobi is 500km, determine:-

(a) (i) The distance of the bus from Nairobi when the car took off. (2marks)

(ii) The distance the car travelled to catch up with the bus. (4marks)

(b) Immediately the car caught up with the bus, the car stopped for 25 minutes. Find the new average speed of which the car travelled in order to reach Nairobi at the same time as the bus. (to the nearest whole number). (4marks)

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

(a) Given that P = 16 when Q = 2 and R = 3. Determine the value of R when P = 288 and Q = 4. (5marks)

(b) Q decreases by 30% while R increases by 40%. Find the percentage decrease or increase in P. (5marks)

22. A triangle with A (-4, 2), B (-6,6) and C (-6,2) is enlarged by a scale factor -1 and centre (-2,6) to produce triangle $A^IB^IC^I$. Triangle $A^IB^IC^I$ is then reflected in the line y = x to give triangle $A^{II}B^{II}C^{II}$.

(a) Draw triangle ABC, $A^IB^IC^I$ and $A^{II}B^{II}C^{II}$ and state the coordinates of $A^IB^IC^I$ and $A^{II}B^{II}C^{II}$. (6marks)

(b) If triangle $A^{II}B^{II}C^{II}$ is mapped onto $A^{III}B^{III}C^{III}$ whose co-ordinates are A^{III} (0,-2) B^{III} (4,4) and C^{III} (0, -4) by a rotation. Find the centre and angle of rotation. (4marks)

23. A straight line passes through the points (8, -2) and (4,-4).

(a) Write its equation in the form ax + by +c = 0, where a, b and c are integers. (3 Marks)

(b) If the line in (a) above cuts the x-axis at point P, determine the coordinates of P. (2 Marks)

(c) Another line, which is perpendicular to the line in (a) above passes through point P and cuts the y axis at the point Q. Determine the coordinates of point Q.(3 Marks)

(d) Find the length of QP (2 Marks)

24. (a) Draw a regular pentagon PQRST of sides 7cm. On it draw a line AR such that it is a line of symmetry to the figure. (4marks)

(b) Locate a point M on AR such that M is equidistant from P and Q, hence measure the shortest distance of M from TS. (2marks)

(c) Shade the region within the figure such that a variable X must lie, given that X satisfies the following conditions: (4marks)

(i) X is nearer to PT than to PQ.

(ii) RX is not more than 7.5cm.

Angle PXT is greater than 90^0

PAPER 2

SECTION A (5OMARK)

Answer All questions in this sections

1. Using logarithm table only, evaluate-: (4mks)

$$\sqrt[3]{\frac{849.6 \; x \; 2.41}{3941}}$$

2. All prime numbers between ten and twenty are arranged in descending order to form a number.

(i) Write down the number. (1mk)

(ii) State the total value of the third digit of the number formed

in (i) above. (1mk)

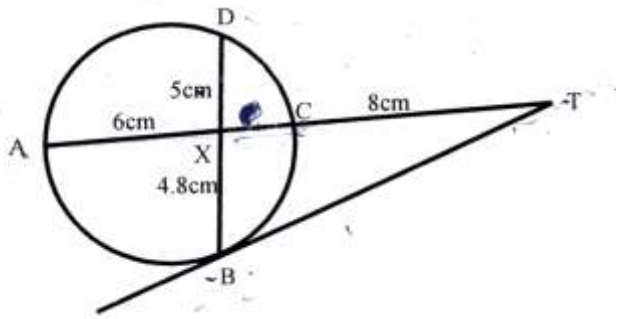
3. Without using a mathematical tables or calculators, simplify (3mks)

$$\frac{3}{\sqrt{7}-\sqrt{2}} - \frac{2}{\sqrt{2}+\sqrt{7}}$$

4. Find the values of x for which $\begin{pmatrix} -x & 4x \\ 2x & -2 \end{pmatrix}$ has no inverse. (3mks)
5. The dimensions of a rectangle are given as 4.1cm by 2.8cm. Calculate the relative error in the area. (3mks)
6. A quantity P varies partly as n and partly as the square of n. When P= –3, n=–1 and when P=18, n=2. Find P when n=1. (3mks)
7. Determine the centre and the radius of the circle given by equation. (3mks)
   $x^2+ y^2 – 6x + 4y – 12=0$
8. Given that $\mathbf{x}=3\mathbf{i} + 2\mathbf{j} – 4\mathbf{k}$, $\mathbf{y}=3\mathbf{i} + 5\mathbf{j} – 2\mathbf{k}$ and $\mathbf{z}= –4\mathbf{i} +3\mathbf{j} +5\mathbf{k}$ and that $\mathbf{p}=4\mathbf{x}–2\mathbf{y} +3\mathbf{z}$
   Find the magnitude of **p** to 4 s.f. (4mks)
9. A perpendicular is drawn from a point (-4,5) to the line 3y – x =2. Find the equation of the perpendicular. (3mks)
10. Solve the equation $3x^2 + x – 4=0$ by the method of completing the square. (3mks)
11. Solve the equation (3mks)
    $\text{Log } 20 + \log(2x + 5) – 2=\log(2x – 4)$
12. (a) Expand $(1 – 2x)^6$ in ascending powers of x up to the term in x^3. (2mks)
    (b) Hence evaluate $(1.02)^6$ to 4 d.p. (2mks)
13. Make s the subject of the formulae. (3mks)

$$a=\sqrt{\frac{S^2+q}{p^2}}$$

14. In the diagram below, BT is a tangent to the circle at B. AXCT and BXD are straight lines AX=6cm , CT=8cm, BX=4.8cm and XD=5cm.



Find the length of BT. (2mks)

15. On average, the rate of depreciation of a water pump is 9% per annum. After three complete years it was Kshs.150,700. Find its value at the start of the three years period. (3mks)
16. Find the inverse of the matrix $\begin{pmatrix} 3 & 2 \\ 5 & 4 \end{pmatrix}$ (4mks)

    Hence or otherwise solve the simultaneous equations
    $3x +2y =4$
    $5x +4y =9$

SECTION II (50marks) answer any five questions only

17. The table below shows a monthly income tax rate for the year 2005.

Monthly taxable income in Ksh	Tax rate percentage
1 – 9860	10%
9681 – 18800	15%
18801 – 27920	20%
27921 – 37040	25%
37041 and above	30%

Peters monthly earning in 2005 were as follow;
Basic salary Ksh.35,600, house allowance Kshs.12,000, Medical allowance Kshs.2,800, transport allowance Kshs.3,400, Peter was entitled to monthly tax relief of Kshs.1,056.

Calculate:

(a) His monthly taxable income (2mks)
(b) The monthly tax paid by Peter. (5mks)
(c) In addition to tax the following deductions were made to Peters monthly income
- Service charge of Ksh.100
- Health insurance fund 320

2% of his basic salary as widow and child pension . Calculate Peters net pay that month. (3mks)

18. (a) Fill in the table for the function $y = x^3 - 2x^2 - x + 2$ (2mks)

x	-4	-3	-2	-1	0	1	2	3	4
y		-40			2				30

(b) Draw the graph $y= x^3 - 2x^2 - x +2$ on the graph paper. (3mks)
(c) Use the graph to solve
(i) $x^3 - 2x^2 - x + 2=0$ (1mk)
(ii) $x^3 - 2x^2 - 5 + 6=0$ (4mks)

19. There are 2 bags A and B. Bag A has 4 white balls and 6 red balls. Bag B has 2 white balls and 3 red balls. Each bag has an equal chance of being picked. If a bag is selected randomly and 2 balls picked with replacement in bag A and without replacement in bag B. Find the probability that:
(a) They are both white. (2mks)
(b) They are of different colors. (3mks)
(c) At least one ball is red (2mks)
(d) None of the balls is white. (3mks)

20. The table below shows marks obtained by form three students in Kiswahili third term exam.

Marks	20-25	26-30	31-39	40-45	46-51	52-59	60-68	69-75	76-80
Frequency	2	8	14	24	30	20	10	8	4

(a) Calculate the mean (2mks)
(b) Draw an ogive (3mks)
From the ogive curve in (b) above
(i) estimate the median. (1mk)
(ii) estimate the quartile deviation. (2mks)
(iii) if 40% of the students are to pass, determine the pass mark. (2mks)

21. (a) Using a ruler and pair of compasses only, construct triangle ABC in which AB=9cm, BC=8.5cm and angle BAC=60º (3mks)

(b) One the same side of AB as C:

(i) Determine the locus of a point P such that <APB=60^0 (3mks)

(ii) Construct the locus of R such that AR >B 4cm (2mks)

(iii) Determine the region T such that <ACT ≥ <BCT (2mks)

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

(a) Write down the third, ninth and twenty –fifth terms of the progression. (3mks)

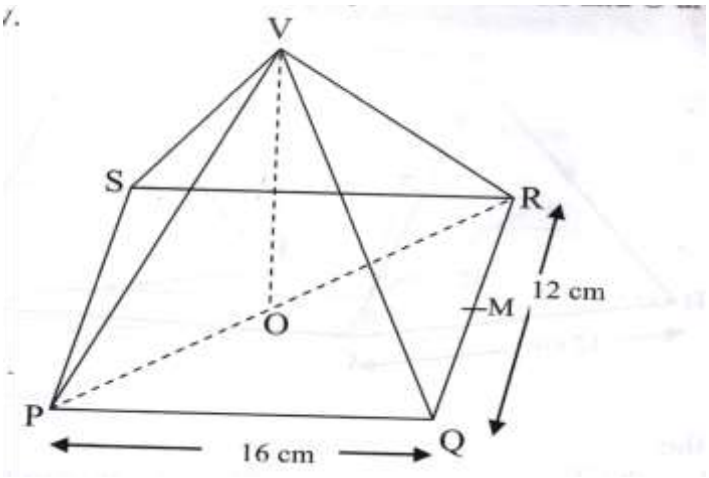
(b) The progression is increasing and the third, ninth and twenty-fifth terms form the first three consecutive terms of a geometric progression. If the sum of the seventh term and twice the sixth term of the arithmetic progression is 78.

Calculate

(i) The first term and the common difference. (4mks)

(ii) The sum of the first nine terms of the arithmetic progression. (3mks)

23. The figure below represents a right pyramid with vertex V and a rectangular base PQRS.VP=VQ=VR=VS=18cm. PQ=16cm and QR=12cm.



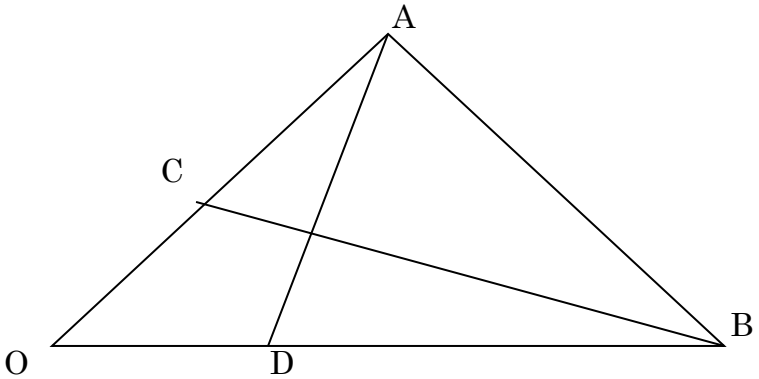
M an d O are the midpoint of QR and PR respectively. Find

(a) the length of the projection of line VP on the plane PQRS. (3mks)

(b) the size of the angle between line VP and the plane PQRS. (3mks)

(c)the size of the angle between the planes VQR and PQRS. (4mks)

24. The diagram given below show triangle OAB. OA=a, OB=b, C divides OA in the ratio 2:3 and D divides OB in the ratio 3:4 while AD and BC meet at E.



Find in term of a and b

(a) (i) OC (1mk)

(ii) CB (1mk)

(b) Given that CE=mCB and DE=nDA where m and n are scalars

(i) Write down two distinct expressions for OE (4mks)

(ii) Hence find the values of m and n (3mks)
(iii) Find OE in terms of a and b only (1mk)

KCSE PREDICTION 10 2022
PAPER 1
SECTION I (50 marks)

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

1. Without using mathematical tables or calculators, ***evaluate*** $\sqrt{\frac{1408 \times 0.594 \times 0.012}{6.05 \times 125}}$ leaving your answer as a simplified fraction (3mks)

2. Two similar solids have surface areas 48cm^2 and 108cm^{2}respectively. Find the volume of the smaller solid if the bigger one has a volume of 162cm^3. (3mks)

3. A triangle flower garden has an area of 28m^2. Two of its edges are 14 metres and 8 metres. Find the angle between the two edges. (2mks)

4. A watch which looses a half a minute every hour.It was set read the correct time at 0445hr on Monday. Determine in twelve hour system the time the watch will show on Friday at 1845hr the same week. (3mks)

5. Find the least whole number by which $2^5 \times 5^4 \times 7^3$ must be multiplied with to get a perfect cube. What is the cube root of the resulting number? (3mks)

6. A woman went on a journey by walking, bus and matatu. She went by bus $\frac{4}{5}$of the distance, then by matatu for $\frac{2}{3}$ of the rest of the distance. The distance by bus was 55km more than the distance walked. Find the total distance. (3mks).

7. Simplify the expression: $\frac{9t^2 - 25a^2}{6t^2 + 19at + 15a^2}$ (3mks).

8. Solve the simultaneous equations

X y = 4 and x + y = 5 (4mks)

9. The size of an interior angle of regular polygon is $3x^o$. While its exterior angle is $(x - 20)^o$. Find the number of sides of the polygon. (3mks)

10. A Kenya company received US Dollars M. The money was converted into Kenya Shillings in a bank which buys and sells foreign currencies.

	Buying (in Ksh)	Selling (in (Ksh)
1 Sterling Pound	125.78	126.64
1 Us Dollar	75.66	75.86

(a) If the company received Ksh.15, 132,000, calculate the amount, M received in US Dollar. (2mks)

(b) The company exchanged the above Kenya shillings into Sterling pounds to buy a car in Britain.

Calculate the cost of the car to the nearest Sterling pound. (2mks)

11. A plot in a shape of rectangle measurers 608m by 264m. Equidistance fencing posts are Placed along its length and breadth as far apart as possible. Determine

a) The maximum distance between the posts. (1mk)

b) The number of posts used. (2mks)

12. Given that $\sin (x - 30)^0 - \text{Cos } (4x)^0$. Find the $\tan (2x+30)^0$ (3mks)

13. A trader sold a dress for Ksh 7200 allowing a discount of 10% on the marked price. If the discount had not been allowed the trader would have made a profit of 25% on the sale of the suit. Calculate the price at which the trader bought the dress. (3mks)

14. In august, Joyce donated $\frac{1}{6}th$ of her salary to a children's home while Chui donated $\frac{1}{5}th$ of his salary to the same children's home. Their total donation for August was Kshs 14820. In September, Joyce donated $\frac{1}{8}th$ of her salary to the children's home while Chui donated $\frac{1}{12}th$ of his salary to the children's home. The total donation for September was Kshs 8675. Calculate Chui's monthly salary. (4mks)

15.Simplify completely $\frac{3^{n+3} - 3^{n+1}}{4 \times 3^{n+2}}$ (3mks)

16.In what ratio should grade **A** tea costing Sh. 180 per kg be mixed with grade **B** tea costing Sh. 300 per kg to produce Nganomu Tea which when sold at Kshs 270 a profit of 20% is realized? (3mks)

SECTION II (50 MARKS)

Answer any five questions from this section in the spaces provided

. 17. Atambo poured spirit into a test tube which has hemispherical bottom of inner radius 1.5cm. He noted that the spirit is 8cm high.

(a) What is the area of surface in contact with spirit? (4mks)

(b) Calculate volume of spirit in the test tube. (4mks)

(c) If Atembo obtained the mass of the spirit as 10g. Calculate the density of the spirit. (2mks).

18.A bus left Nairobi at 7.00 am and traveled towards Eldoret at an average speed of 80Km/hr. At 7.45am a car left Eldoret towards Nairobi at an average speed of 120Km/hr. The distance between Nairobi and Eldoret is 300 km. Calculate:

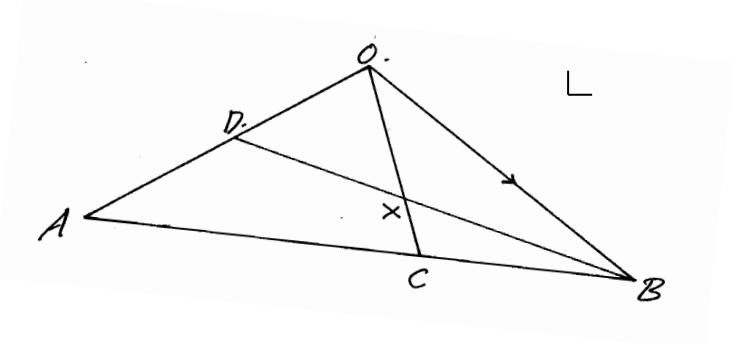
(a) The time the bus arrived at Eldoret. (2mks)

(b) The time of the day the two met. (4mks)

(c) The distance of the bus from Eldoret when the car arrived in Nairobi. (2mks)

(d) The distance from Nairobi when the two met. (2mks)

19. The figure below C is a point on AB such that AC**:** CB=3:1 and D is the mid –point of OA. OC and BD intersect at X.



Given that **OA** = **a** and **OB** = **b**

(a) Write the vectors below in terms of **a** and**b**.

(i) **AB** (1mk)

(ii) **OC** (2mks)

(iii) **BD** (1mk)

(b) If **BX** = h **BD**, express **OX** in terms of **a**, **b**, and h. (1mk)

(c) If **OX** = K**OL**, find h and k. (4mks)

(d) Hence express **OX** in terms of **a** and**b** only. (1mk).

20. (a) Using a ruler and a pair of compasses only, draw a triangle ABC such that AB = 5cm,BC = 8cm and <ABC = 60°. Measure AC and <CAB. (4mks)

(b) Find a point O in Δ ABC such that OA = OB = OC. (2mks).

(c) Construct a perpendicular from A to BC to meet BC at D. Measure AD. Hence calculate the area of the Δ ABC (4mks)

21. A boy started walking due East from a dormitory 100m South of a bore-hole. He walked to the school library from which the bearing of the bore-hole is 315°. He then walked on a bearing of 030° to the water tank. From the water tank he went west to the bore-hole.

(a) Using a scale of 1cm to represent 20m, construct a diagram to show the positions of the tank, borehole, dormitory and library. (5mks).

(b) Find the distance and bearing of the bore-hole from the water tank. (3mks)

(c) Calculate the total distance covered by the boy. (2mks).

22. The table below shows the amount in shillings of pocket money given to students in a particular school.

Pocket Money (Ksh)	210 – 219	220- 229	230- 239	240- 249	250- 259	260- 269	270- 279	280- 289	290- 299
No. of Students	5	13	23	32	26	20	15	12	4

(a) State the modal class. (1mk)

(b) Calculate the mean amount of pocket money given to these students to the nearest shilling. (4mks).

(c) Use the same axes to draw a histogram and a frequency polygon on the grid provided(5mks)

23. (a)Given that $y = 7 + 3\chi - \chi^2$, complete the table **below**. (2mks)

χ	-3	-2	-1	0	1	2	3	4	5	6
y	-11			7						-11

(b)On the grid provided and using a suitable scale draw the graph of $y = 7 + 3\chi - \chi^2$.(3mks)

(b)On the same grid draw the straight line and use your graph to solve the equation $\chi^2 - 4\chi - 3 = 0$. (3mks)

(c)Determine the coordinates of the turning point of the curve. (2mks)

24. A straight line L_1 has a gradient $^{-}½$ 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. (2mks)

(b) The gradient of L_2. (1mk)

(c) The equation of L_2. (2mks)

(d) The equation of a line passing through a point S (0, 5) and is perpendicular to L_2. (3mks)

(e) The equation of a line through R parallel to L_1. (2mks)

PAPER 2

SECTION A: (50MARKS)

Answer all questions in this section in the spaces provided.

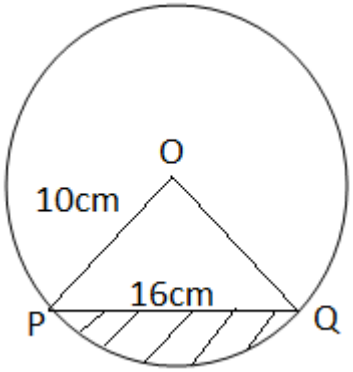
1. Use logarithms tables to evaluate. (4mks)

$$\sqrt[3]{\frac{36.72\times(0.46)^2}{185.4}}$$

2. If A = 2.3, B = 8.7 and C = 2.0. Find the percentage error in calculating $\frac{A+B}{C}$ (3mks)
3. Given that $M=i-3j+4k$, $W=6i+3j-5k$ and $Q = 2M + 5N$, find the magnitude of Q to 3 significant figures. (3mks)
4. Solve the following equation $2^{2x+3} - 2^{x+4} = 17(2^x) - 4$ (4mks)
5. If $\frac{1}{3-\sqrt{5}} - \frac{2+2\sqrt{5}}{3+\sqrt{5}} = a + b\sqrt{c}$, find the value of a, b and c (3mks)

6. Pipe A can fill an empty water tank in 3hrs while Pipe B can fill the same tank in 6hrs. When the tank is full it can be emptied by Pipe C in 8hrs. Pipe A and B are opened at the same time when the tank is empty. If one hour later Pipe C is also opened, find the total time taken to fill the tank. (3mks)

7. The figure below shows a circle center O, radius 10 cm. The chord PQ = 16cm. Calculate the area of the unshaded region. (4mks)



8. The mean weight of 36 students is 45kg; two of the students leave and the mean weight increases by 0.5kg. If one of the students who left weighed 43kg, find the weight of the other one. (3mks)
9. Use the trapezium rule to estimate the area bounded by the curve $y + x^2 = 4$ and the lines $y = 0$, $x = -2$ and $x = 2$ using four strips. (3mks)
10. $4x^2 - 10x + 4y^2 + 12y - 1 = 0$ represents a circle centre C (a, b) and of radius K. Find the values of a, b and K. (3mks)
11. Make x the subject of the equation (3mks)

$$\frac{t}{s} = \frac{b}{\sqrt{x-4}}$$

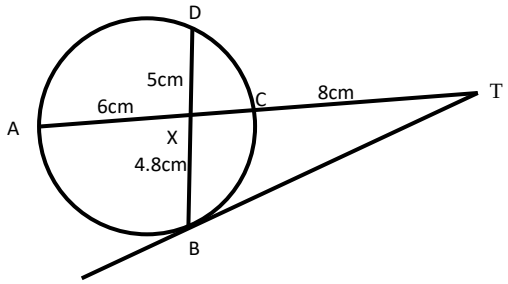
12. Use reciprocal, square and cube root tables to evaluate to 4 significant figures, the expression. (3mks)

$$\sqrt[3]{\frac{9}{0.03746} + 0.6042^2}$$

13. (a)Expand the expression $(1 + ½x)^5$ in ascending powers of x, leaving the coefficients as fractions in their simplest form. (2mks)

    (b) Use the first three terms of the expansion in (a) above to estimate the value of $(1^1/_{20})^5$. (2mks)

14. In the diagram below, BT is a tangent to the circle at B. AXCT and BXD are straight lines. AX = 6cm, CT = 8cm, BX = 4.8cm and XD = 5cm.



Find the length of BT. (2mks)

15. Find x if Cos x = $\frac{\sqrt{3}}{2}$ for $-180^0 \leq x \leq 180^0$. (2mks)

16. The following were recorded on a field note book by a surveyor. Taking the base line as 550m. Find the area in m². (3mks)

		B			
		550	120	TO	A
C	150	450			
		250	90	T O	D
E	60	40			
		F			

SECTION II (50mrks)

Attempt any FIVE questions from this section

17. Mr. Kobe is a civil servant who earns a monthly salary of Ksh. 21200. He has a house allowance of Ksh. 12000 per month, other taxable allowances are commuter Ksh. 1100, medical allowance Ksh. 2000. He is entitled to a personal relief of Ksh. 1240 per month.

    Using the income rates below, solve the questions that follow.

Income in Ksh. per month	Rates in Ksh per sh 20
1 – 8,400	2
8401 – 18,000	3
18001 – 30,000	4
30001 – 36,000	5
36001 – 48,000	6
Above 48,000	7

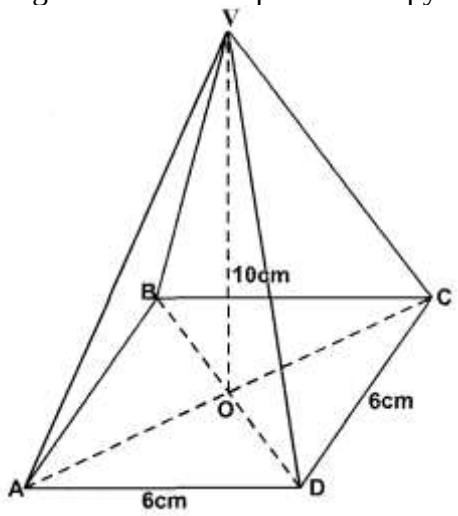
Determine;

a) i) His monthly taxable income. (2mks)

ii) Net tax (PAYE) (5mks)

b) In addition to the PAYE, the following deductions were made. Ksh. 250 for NHIF, Ksh. 120 service charges, he repays a loan at sh. 4500 and contributes towards savings at sh. 1800 every month. Calculate his net salary per month. (3mks)

18. The figure below is a square based pyramid ABCDV with AD=DC = 6cm and height V = 10cm



a) State the projection of VA on the base ABCD. (1mk)

b) Find:

i) The length of VA (3mks)

ii) The angle between VA and ABCD (2mks)

iii) The angle between the planes VDC and ABCD (2mks)

iv) Volume of the pyramid (2mks)

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

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

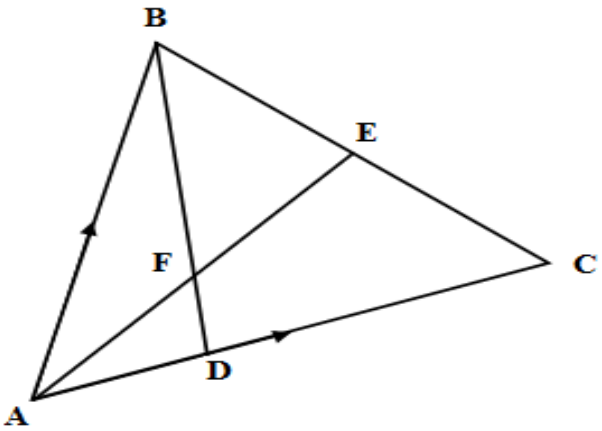
b) Draw the graphs of y=sin 2x and y = sin (2x + 30) on the axis. (4mks)

c) Use the graph to solve $sin\ (\ 2x\ +\ 30) - sin\ 2x\ =\ 0$ (1mk)

d) Determine the transformation which maps $sin\ 2x\ onto\ sin\ (2x\ +\ 30)$ (1mk)

e) State the period and amplitude of $y\ =\ sin\ (\ 2x\ +\ 30)$ (2mks)

20. 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 (2mks)

ii) AE (2mks)

b) If BF = *t* BD and AF = *n* AE. Find the value of t and n. (5mks)

c) State the ratio of BD to BF. (1mk)

21. The position of two towns **X** and **Y** are given to the nearest degree as **X** (45^0 N, 110^0 W) and **Y** (45^0 N, 70^0 E)**.** Take $\pi = 3.142$, **R** = 6370km.Find:

(a) The distance between the two towns along the parallel of latitude in km. (3mks)

(b) The distance between the towns along a parallel of latitude in nautical miles. (3mks)

(c) A plane flew from **X** to **Y** taking the shortest distance possible. It took the plane 15hrs to move from **X** and **Y**. Calculate its speed in Knots. (4mks)

d) If the plane left town **X** on Monday 12:45PM. Find the local time it arrived at town **Y**. (3mks)

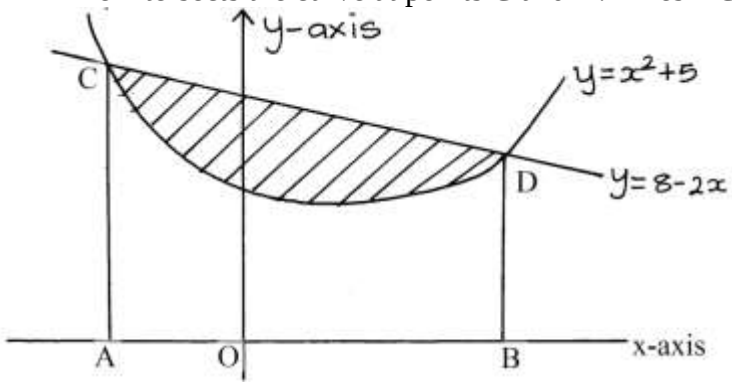
22. The 2^{nd} and 5^{th} terms of an arithmetic progression are 8 and 17 respectively. The 2^{nd}, 10^{th} and 42^{nd} terms of the A.P. form the first three terms of a geometric progression. Find

(a) The 1^{st} term and the common difference. (3mks)

(b) The first three terms of the G.P and the 10^{th} term of the G.P. (4mks)

(c) The sum of the first 10 terms of the G.P. (3mks)

23. The diagram below, not drawn to scale shows part of the curve $y = x^2 + 5$ and the line y = 8-2x. The line intersects the curve at points C and D. Lines AC and BD are parallel to the y-axis.



(a) Determine the coordinates of C and D. (4mks)

(b) Use integration to calculate the area bounded by the curve and the x-axis between the points C and D. (3mks)

(c) Calculate the area enclosed by the lines CD, CA, BD and the x-axis. (3mks)

(d) Hence determine the area of the shaded region. (1mk)

24. Using a ruler and pair of compasses only.

a) Construct triangle ABC in which AB = 9cm, AC = 8cm and angle BAC = 60^0. Measure BC (2mks)

b) On the same side of AB as C, draw the locus of a point such that angle APB = 60^0 (3mks)

c) A region T is within the triangle ABC such that AT > 4cm and angle ACT ≥ angle BCT. Show the region T by shading it. (5mks)