CEKENAS END OF TERM TWO EVALUATION EXAM-2021
121/1
MATHEMATICS ALT. A
Paper 1

SECTION I: (50MKS)
ATTEMPT ALL THE QUESTIONS FROM THIS SECTION

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

$$\frac{3}{8} \div \left(\frac{1}{2} - \frac{1}{3}\right) of \, \frac{3}{4} - \frac{1}{10}$$

2. Without using mathematical tables or calculator, evaluate (3mks)

$$\frac{\sqrt[3]{729 \times 125}}{\sqrt{11,025}}$$

3. The currency exchange rates of a given bank in Kenya are as follows

Currency	Buying	Selling
1 Sterling pound	135.50	135.97
1 US dollar	72.23	72.65

A tourist arrived in Kenya with 5000 US dollars which he converted to Kenya shillings upon arrival. He spent Kshs, 214,000 and converted the remaining to sterling pounds. How many pounds did he receive. (3mks)

4. Without using mathematical tables or calculator evaluate $6Log_2 \sqrt[3]{64} + 10Log_3 \sqrt[5]{243}$ (3mks)

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5. Simplify $\dfrac{9t^2 - 25a^2}{6t^2 + 19at + 15a^2}$ (3mks)

6. The base of a right pyramid is a rectangle of length 96cm and width 72cm. Each slant edge of the pyramid is 156cm. Calculate the volume of the pyramid. (3mks)

7. John bought two shirts and three pairs of trouser at Ksh 1750. IF he had bought three shirts and two pairs of trousers, he would have saved Khs 250. Find the cost of a shirt and a trouser. (3mks)

8. Three litres of water (density 1g/cm^3) is added to twelve litres of alcohol. (density 0.8g/cm^3). What is the density of the mixture? (3mks)

9. List the integral values of x which satisfy the inequalities below. (3mks)
$$2x + 21 > 15 - 2x \geq x + 6$$

10. Point B is 6 kilometers from A on a bearing of 150^0. Point C is 5km from A on a bearing of 120^0. Using a scale drawing of 1cm to represent 1km, find the distance of C from B. (3mks)

11. Charles keeps goats and sheep. The number of goats exceeds the number of sheep by 4, during drought ¼ of the goats and $^1/_6$ of the of the sheep died. If he lost a total of 64 animals, how many animals did he have originally. (4 mks)

12. Give that x is acute angle and $\cos x = \dfrac{2\sqrt{5}}{5}$ without using mathematical tables or calculator find Tan (90-x). (2mks)

13. Without using mathematical tables or calculator evaluate . (3mks)

$$\frac{8^{\frac{2}{3}} \times 100^{\frac{1}{2}}}{64^{\frac{2}{3}} \times 36^{-0.5} \times \left(\frac{1}{27}\right)^{\frac{1}{3}}}$$

14. The gradient of the tangent to the curve y=ax^3 +bx at point (1,1) is -5. Calculate the value of a and b.
(4 mks)
15. The sum of interior angles of a regular polygon is 24 times the size of an exterior angle.
    (a) Find the number of sides of the polygon (3mks)
    (b) Name the polygon (1 mk)
16. A rally car travelled for 2hrs 40minutes at an average speed of 120km/h. The car consumes an average of a litres for every 4 kilometers. A litre of fuel cost Ksh 60. Calculate the amount of money spent on fuel.
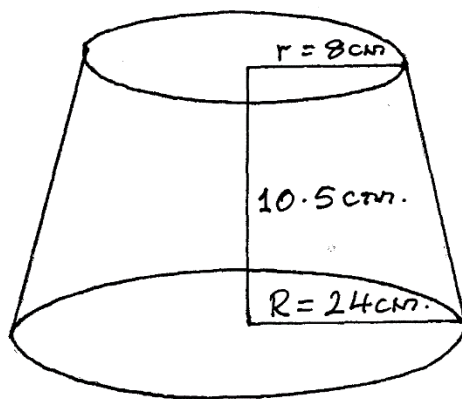(3mks?)

SECTION II
ANSWER ANY FIVE QUESTIONS

17. Three business business partners Kamau, Tatwa and Makau contributed Kshs 100,000, Ksh 80,000 and Ksh 50,000respectively to start a business. After one year the business realized a profit in which they shared in the ratio of their contributions.
    (a) If Makau's share of profit was Ksh. 20,000, how much was the total amount of profit? (3mks)
    (b) At the beginning of the second year, Makau boosted his shares by Ksh. 10,000. If the business profit increased by 20% at the end of the second year. Calculate
        (i) Kamau's share of the profit. (4mks)
        (ii) The difference between Kamau's and Tatwa's share of the profit. (3mks)

18. The following data was obtained from masses of some pregnant women in maternity clinic.

| Masses X (Kg)	$1.5 \le X < 5.5$	$5.5 \le X < 7.5$	$7.5 \le X < 13.5$	$13.5 \le X < 15.5$	$15.5 \le X < 20.5$
	16	20	18	14	15

(a) Represent the information in the table above on a histogram on the graph paper provided.
(6mks)
(b) Use the information in the table above to estimate
    (i) The mean mass (2mks)
    (ii) The median mass (2mks)
19. The figure below is a frustum of a solid cone of the base radius 24cm and top radius 8cm. The height of the frustum is 10.5cm. (Take $\pi = \dfrac{22}{7}$)
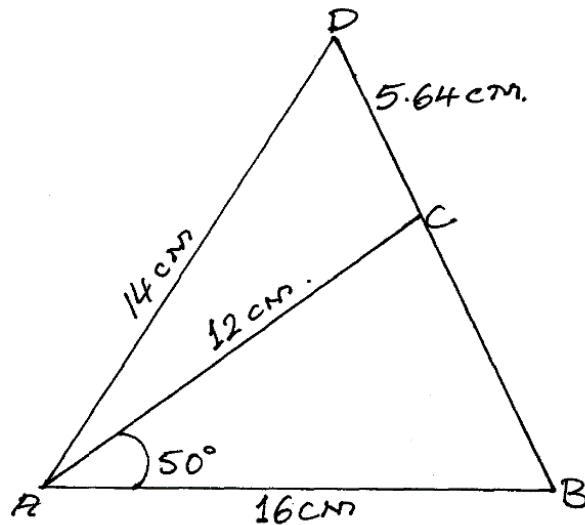

Calculate
(i) The height of the cone of the frustum was part of (2mks)
(ii) The slant height of the cone of the frustum was part of. (1mk)
(iii) The surface area of frustum (4 mks)
(iv) The volume of the frustum. (3mks)

20. The figure below shows two equal circles of radius 7cm, each with centres at X and Y. The two circles are in Contact at Q.
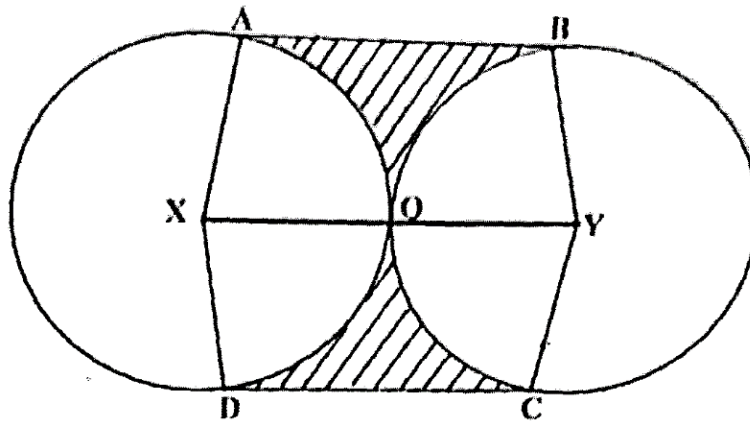
Given that angle AXD = angle BYC= 120^0 and lines AB, XQY and DC arc parallel. Calculate the area of:

(a) The minor sector XAQD (Take $\pi = \dfrac{22}{7}$) (2mks)

(b) The trapezium XABY. (5mks)

(c) The shaded region. (3mks)

21. A particle start from rest and moves in a straight line. Its velocity Vms^{-1} is given by V=t^2 -3t+2 where t is the time in seconds taken from point O.
   (a) Find
      (i) The velocity when t=3 (2mks)
      (ii) The displacement from O when t=3 (3mks)
      (iii) The acceleration of the particle when t= 3 (2mks)
   (b) At what time is the particle momentarily at rest. (3mks)

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22. The distance between towns M and N is 280km. a car and a lorry travel from M to N. The average speed of the lorry is N. The average speed of the lorry is 20km per hour less than that of the car. The lorry takes one hour and ten minutes more than the car to travel from M to N.
   (a) If the speed of the lorry is Xkm per hours find X. (6mks)
   (b) The lorry left town M at 8.1 5am. The car left town M and overtook the lorry at 12.1 5p.m. Calculate the time the car left town M. (4mks)

23. In the figure below, AB=16cm, AC=12cm, AD=14cm, CD=5.64cm and <CAB=50^0

Calculate to one decimal place.
    (a) The length BC (2mks)
    (b) The size of angle ABC (3mks)
    (c) The size of angle CAD (3mks)
    (d) The area of triangle ACD (2msk)

24. (a) Express $\dfrac{1}{x-2} - \dfrac{2}{x+5} = \dfrac{3}{x+1}$ in the form $ax^2 + bx + c = 0$ where a, b and c are constants,
       hence solve for x. (4 mks)
    (b) Wamuyu did M test and scored a total of 240 marks. She did two more tests which she scored 28 and 26 respectively. The mean score of the first M test was 6 more than the mean score for all the test she did. Find the total number of test that she did. (6mks)

CEKENAS END OF TERM TWO EXAM-2021
121/2
**MATHEMATICS ALT. A**
Paper 2
Nov-Dec-2021

SECTION I: (50MKS)

## ATTEMPT ALL THE QUESTIONS FROM THIS SECTION

1. Find the percentage error in the volume of a cone whose radius is 7.0cm and has an exact vertical height of 16cm. (3mks)
2. Solve for x in **Log$_3$(2x+1)=2+Log$_3$ (3x-11)** (3mks)
3. Two brands of tea A and B cost Kshs 45 and 32 per kg respectively. They are mixed such that the selling price of one kilogram of the mixture is Kshs 45. If a 25% profit is relised. find the ratio in which the two brands were mixed. (3mks)
4. Make a the subject of the formula (3mks)
$$\frac{1}{a} - \frac{1}{b} = \frac{1}{c}$$

5. Given that sin $(x+20)^0$ = -7660, find x to the nearest degree, for $0 \le x \le 360^0$ (3mks)
6. Expand $(x-y)^6$ (1 mks)

    (b) Use your expansion upto forth term to estimate the value of $(1.98)^6$ giving your answer to 4 significant figures. (2mks)
7. Express the following in surd form and simplify by rationalizing the denominator without ' using a calculator and leave your answer in the form $a + b\sqrt{c}$ (3 mks)
$$\frac{1 + \cos 30^0}{1 - \sin 60^0}$$

8. The points A and B have position vectors i + 7j + 2k and -5i + 5j + 6k respectively. The point C divides AB in the ratio : 3: -1 . Find the position vector of C in terms of i, j and k. (3 mks)

9 Jamais invests Ksh 60000 in a bank that pays an interest at a rate of 1.5% p.a compound interest. He wants to earn more than Ksh 10,000 interest. Determine the least time, in whole years that this will take(3 mks)

10. Line XY is the diameter of circle such that the coordinates are X (-1,1) and Y (5,1)
    i) Determine the centre and radius of the circle (2mks)

    ii)   Hence find the equation of the circle in the form $x^2 + y^2 + ax + by + C = O$ where a, b and c are constants.
(2mks)

11. A science club is made up of 5 boys and 7 girls. The club has 3 officials. Using a tree diagram or otherwise, find the probability that.
    (a)   The club officials are all boys   (2mks)
    (b)   Two of the officials are girls.   (2mks)

12. The figure below shows a triangle PQR which is drown to scale. Construct.
    (a)   The perpendicular bisector of QR.   (1mk)
    (b)   The locus of a point A which is always on the same side of QR as P and moves such that angle QAR is equal to angle QPR.   (2mks)
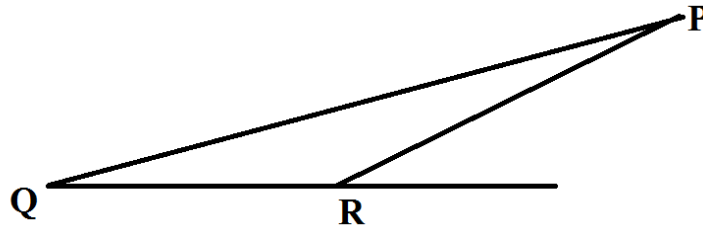
13. The graph below shows the variation.................allowed to cool from 80^0C
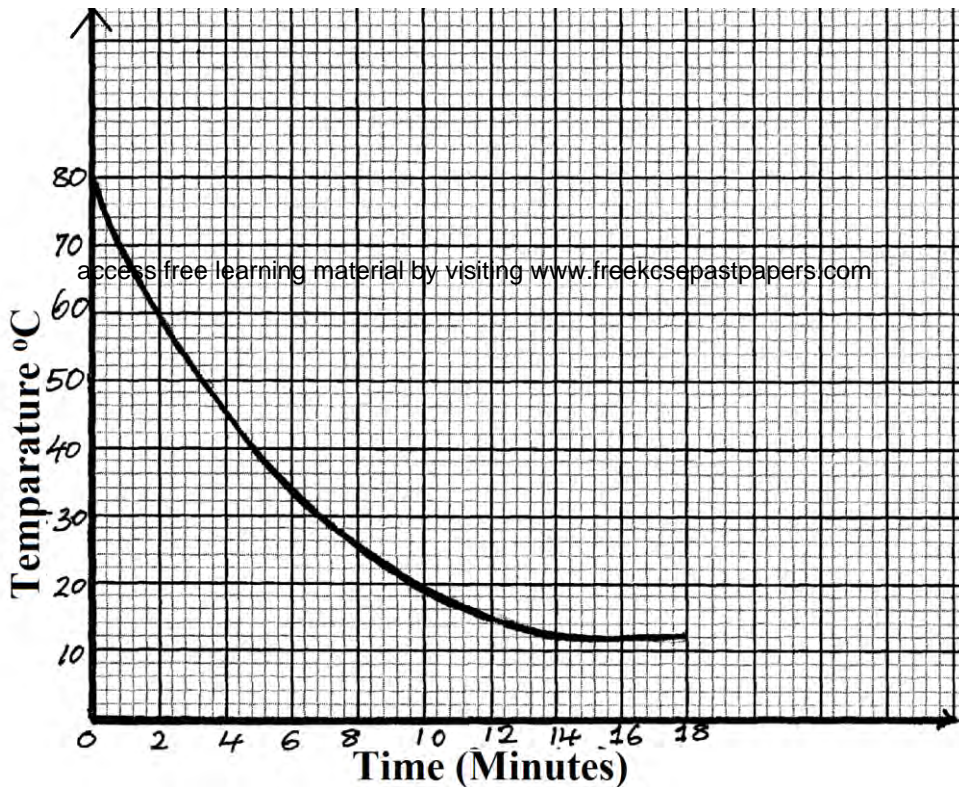
Determine the average rate of decrease of the temperature of the water between t=6 minutes and   t=14 minutes.   (2mks)

14. Two taps A and B can each fill an empty tank in 3 hours and 2 hours respectively. A drainage tap P can empty the full tank in 6 hours. Taps A and P are opened for 5 hours then closed.
    (a)   Determine the fraction of the tank that is still empty.   (2mks)
    (b)   Find how long would take to fill the remaining fraction of the tank if all the three taps are opened.   (2mks)

15. Under a transformation whose matrix is $\begin{pmatrix} k-1 & 2 \\ -k & k \end{pmatrix}$ a figure whose area is 4.5cm^2 is mapped on a figure whose area is 54cm^2. Find the two possible values of K.   (3mks)

5

16. Jesse started work 20years ago. In year 1 his annual salar was Ksh 170,000. His annual salary increased by 15,000 each year, so that his annual salary in year 2 was Ksh 185,000, in year 3 it was Ksh 200,000 and so on forming an arithmetic sequence. This continued until he reached his maximum annual salary of Ksh 320,000 in year k. His annual salary then remained at Ksh 320,000.
    a) Find the value of k   (1 mks)
    b) Calculate the total amount that Jesse has earned in the 20 years.   (2mks)

SECTION II
ANSWER ONLY FIVE QUESTIONS FROM THIS SECTION

17. a) Three quantities P, Q and R are such that P varies directly as Q and inversely as the square root of R. Given that P = 2250 when Q = 450 and R = 64, write down an equation connecting P, Q and R.
                                                                                               (4 marks)
        (i) If Q is decreased by 16% and R increased by 44%, calculate the percentage change in P.
                                                                                               (3 mks)
    b)   In a soccer competition, the number of goals (G) scored in a penalty shoot — out is partly constant and partly varies as the skill (S) of the player. Given that G = 8 when S =2 and G = 12 when S= 4, find the value of G when S 6.   (3 marks)

18. a) Complete the table below for the functions y =3 cos 2x + 2 and y=Sin 2x, giving your answer values to two decimal places.   (2mks)

x	0	30	60	90	120	150	180	210	240	270
$y = 3\cos 2x + 2$		3.5		−1	0.5		5			
Y=Sin 2x	0	0.87			-0.87		0		0.87	

    b) On the grid provided, draw the graphs of y =3 cos 2x +2 and Y=Sin 2x for $0 \le x \le 270^{0}$
            access free learning material by visiting www.freekcsepastpapers.com   (4 mks)
    c) Use your graph to solve the equation: Sin 2x-2=3cos 2x for $0 \le x \le 270^{0}$ (2mks)
    d) State the amplitude and the period of the wave y =3 cos 2x + 2   (2mks)

19. A. passenger plane takes off from airport A (60°N,5°E) and flies directly to another airport B (60°N, 1 7°E) along the parallel of latitude and then flies due North for 600 nautical miles to another airport C.
    (a) Find the position of airport C.   (2 marks)
    (b) Find the distance between airports A and B along a circle of latitude in nautical miles.   (2 marks)
    (c) If the plane travels at an average speed of 300 knots, find total flight time.   (2 marks)
    (d) Given that the plane left airport A at 9.2Oam, find the local time of arrival at airport C.   (2 marks)
    (e) Given the position of another airport D(70°N, 163°W), calculate to two decimal places the shortest distance between airports C and D in kilometers.   (2 marks)

20. The table below shows the mass of infants in a clinic.

Mass (kg)	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9
No of kids	2	4	5	7	10	6	3	2	1

    (a)   State modal frequency.   (1mk)
   (b)   Calculate the quartile deviation of the data to 2 decimal places.   (4mks)
    (c)   Using an assumed mean of 4.45
            Calculate to 1 decimal place
            (i)   Variance.   (4mks)
            (ii)   Standard deviation   (1 mks)

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

(a) On the graph paper provided, draw quadrilateral ABCD and its image $A^1B^1C^1D^1$ (3mks)

(b) Hence or otherwise , determine the area of ABCD and $A^1B^1C^1D^1$ (3mks)

(c) A transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ maps $A^1B^1C^1D^1$ on $A^2B^2C^2D^2$.

On the same axis draw the image of $A^1B^1C^1D^1$ (2mks)

(d) Determine the matrix of the single transformation which Maps $A^2B^2C^2D^2$. onto ABCD. (3mks)

22. The diagram below shows the curve $y = x^3 - 3x^2 - 9x + k$, where k is a constant. The curve has a minimum point on the x-axis.

$y = x^3 - 3x^2 - 9x + k$
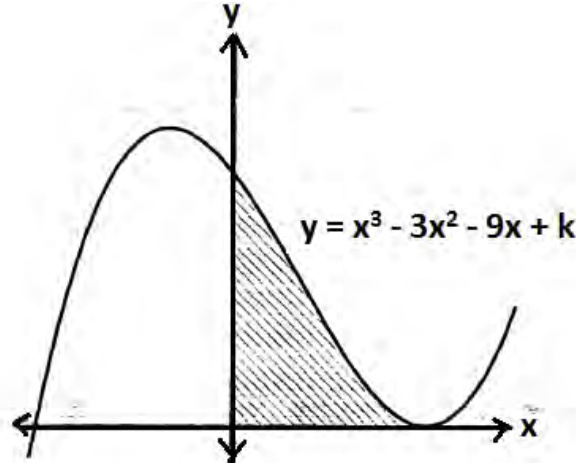
a) Find the value of k (5mks)
b) The coordinates of the maximum point of the curve. (2mks)
c) Find the area of the shaded region. (3 mks)

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23. PQRSV is a right pyramid on a horizontal square base of 10cm. The slant edge are all 8cm long. Calculate to one decimal place.

8cm
P
10cm
Q
10cm
R
S
V
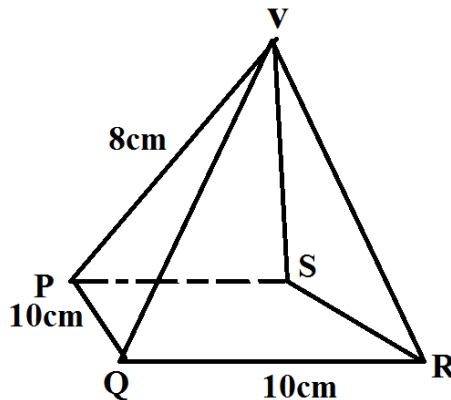
(a) The height of the pyramid. (2mks)
(b) The angle between
    (i) Line VP and the base PQRS. (2mks)
    (ii) Line VP and Line VR. (2mks)
    (iii) Planes VPQ and the base PQRS. (2mks)
    (iv) Volume of the pyramid.

24. Rapid Delivery Services has 1350 parcels to deliver to Thika from Nairobi. Their Lorries can carry 150 parcels at a time and their vans can take 90 parcels at a time. The company has only   twelve drivers available and at least four vans must be used.

   a) If the company has x lorries and y vans, form the inequalities to represent the above information.
   (4 marks)
   b) Draw the inequalities in (a) above by shading the unwanted part on the grid provided.   (3 marks)
   (c) The cost of one lorry journey is Ksh 3000 while the cost of one van journey is Ksh 2000. Use your graph to find how many lorries and how many vans will be needed to deliver parcels at the least cost and state the cost.   (3 marks)

KIRINYAGA WEST
121/1
MATHEMATICS PAPER 1
DECEMBER 2021

SECTION 1   (50 MARKS
Answer all the questions in this section in the spaces provided

1.   Without using a calculator evaluate :

$$\frac{1}{2}\left\{\frac{3}{5}+\frac{1}{4}\left(\frac{7}{3}-\frac{3}{7}\right)\text{of }1\frac{1}{2}\div5\right\}$$ (3mks)

2.   Given that the ratio x: y = 3 : 2. Find the ratio (x + y) : (5x -2y)   (3mks)

3.   Without using logarithm tables or calculator, evaluate:

$$\frac{(256)^{\frac{-1}{2}}\text{ x }(729000)^{\frac{-1}{3}}}{(3)^{-5}\text{ x }(5)^{0}\text{ x}(5)^{-2}}$$ (4mks)

4.   Express the numbers1470 and 7056, each as a product of its prime factors.
Hence evaluate.

$$\frac{1470^{2}}{\sqrt{7056}}$$, leaving the answer in prime factors.   (3mks)

5.   A line which joins the points **A**(3, k) and **B**(-2, 5) is perpendicular to another line whose equation is 5y + 2x =10. Find the value of k.   (3mks)

6.   The size of an interior angle of a regular polygon is 3 $\frac{1}{2}$ times that of its exterior angle. Determine the number of

sides of the polygon.   (3mks)

7.   The area of a rhombus is 60 cm². Given that one of its diagonals is 15 cm long. Calculate the perimeter of the rhombus.   (3mks)

8.   Simplify the expression.

$$\frac{9a^{2}\text{ - }25b^{2}}{6a^{2}+19ab+15b^{2}}$$ (3mks)

9.   Given that **sin**(90 – x)⁰ = 0.8, where x is an acute angle. Find without using a calculator, the value of Tan x⁰.
(3mks)

10. A flag post is supported to stand vertically on a level ground by a tight wire.
The wire is pegged at a distance of 8 metres from the foot of the pole as shown.

Wire

8 metres
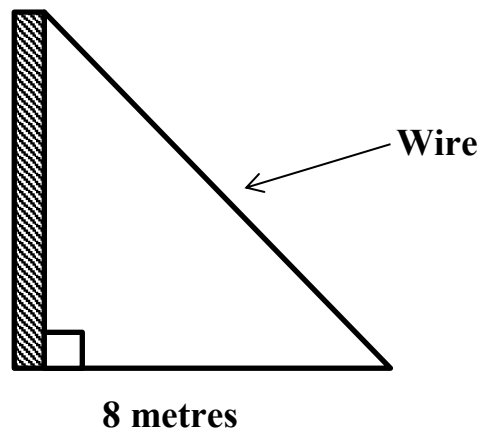
The angle which the wire makes with the ground is three times the angle it makes with the post. Calculate the length of the wire correct to 2 d.p.   (3mks)

11. Two matrices **M** and **N** are such $M = \begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix}$ and $N = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$

Given that the determinant of **MN** = 4. Find the value of k.   (3mks)

12. Without using mathematical tables or a calculator, evaluate

$$\frac{\sin 30^0 - \sin 60^0}{\tan 60^0}$$ (3mks)

13. Solve for x and y simultaneously given that :
$3^{\,2x-y} = 27^{\,-1}$ and $4^x \div 16^y = 1$ (3mks)

14. The straight line through the points **D**(6,3) and **E** (3, -2) meets the y-axis at the point F. Determine the co-ordinates of F.   (3mks)

15. Using a ruler and a pair of compasses only.
   a)   Construct triangle **ABC** in which **BC** = 8cm, angle **ABC** = 105^0 and **BAC** = 45^0.
                    (2mks)
   b)   Drop a perpendicular from **A** to meet **CB** produced at **P**.
       Hence find the area of triangle **ABC**.   (2mks)

16. The figure below shows a quadrilateral **ABCD** in which **AB** = 8cm,
   DC = 12cm, <**BAD** = 45^0, < **CBD** = 90^0 and < **BCD** = 30^0.
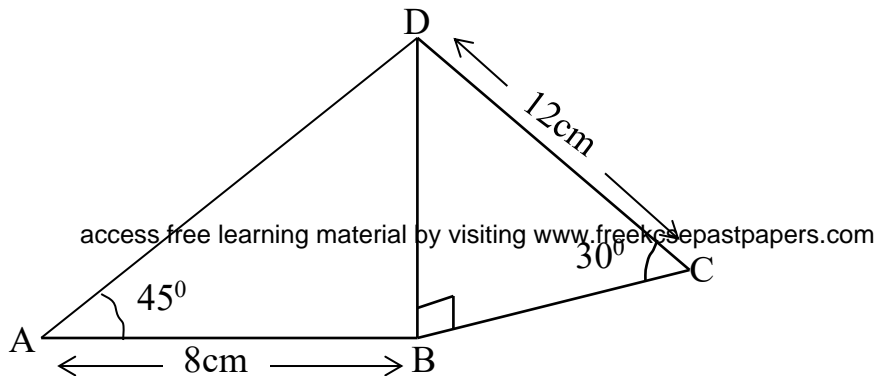
Find
   a)   the length of **BD**.   (1mk)
   b)   the size of angle **ADB**   (2mks)

SECTION II (50 marks)
Answer ONLY five questions in this section in the spaces provided

17. The distance between towns **A** and **B** is 280km. A van and a truck travel from **A** to **B**. The average speed of the truck is 20km/h less than that of the van.
   The truck takes 1hr 10min more than the van to travel from **A** to **B**.
   a)   If the speed of the truck is x km/hr, find x.   (5mks)
   b)   The truck left town **A** at 8.15a.m. The van left town **A** later and overtook the   lorry at 12.15p.m. Calculate the time the car left town **A**.   (5mks)

**18.** The table below gives some of the values of **x** and **y** for the function
   y = $^1/_2$x^2 +2x +1 in the interval $0 \le x \le 6$

x	0	1	2	3	4	5	6
y	1	3.5	7	11.5	17	23.5	31

   a)   Use the values in the table to draw the graph of the function on the grid provided.   (3mks)

b) i. Using the graph and the mid – ordinates rule with six (6)strips, estimate the area bounded by the curve, the x- axis the y- axis and line x= 6. (4mks)

ii. If the exact area of the region described in b(i) above is 78cm², calculate the percentage error made when the mid – ordinate rule is used. Give the answer correct to two decimal place. (3mks)

19. Four electricity posts **P, Q, R** and **T** stand on a level ground such that **Q** is 21m on a bearing of 060^0 from **P**, **R** is 15m to the south of **Q** and **T** is 12m on a bearing of 140^0 from **P**.

a) (i) Using a scale of 1cm to represent 3metres, draw a diagram to show the relative positions of the posts. (4mks)

(ii) Find the distance and the bearing of **R** from **T**. (3mks)

b) The height of the post at P is 8.4m. On a separate scale drawing, mark and determine the angle of depression of the foot of the post at R from the top of the post at P. (3mks)

20. a) Given that the matrix $M = \begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix}$ Find M⁻¹, the inverse of M. (2mks)

b) Jane bought 200 bags of sugar and 300 bags of rice for a total of kshs. 850,000/=. Tom bought 90 bags of sugar and 120 bags of rice for a total of kshs. 360,000/=. If the price of a bag of sugar is sh x and that of rice is sh y.
i. Form two equations to represent the above information. (2mks)
ii. Use the matrix M⁻¹, to find the prices of one bag of each item. (3mks)

c) Kori bought 225 bags of sugar and 360 bags of rice. He was given a total discount of kshs 33,300/=. If the discount on the price of a bag of rice was 2%. Calculate the percentage discount on the price of a bag of sugar. (3mks)

21. A straight line (L₁), $y = \dfrac{2}{3}x - \dfrac{2}{3}$ meets the x- axis at point **T**.

a) Determine the coordinates of T. (2mks)
b) A second line L₂ is perpendicular to line L₁ at **T**. Find the equation of line L₂ in the form ax + by = c where a, b and c are constants. access free learning material by visiting www.freekcsepastpapers.com (3mks)
c) A third line L₃ passes through (-4, 1) and is parallel to L1.
Find;
i. The equation of line L₃ in the form y = mx + c. (2mks)
ii. The co-ordinates of point S at which L₃ intersects L₂. (3mks)

22. In triangle **OAB**, **M** and **N** are points on **OA** and **OB** respectively, Such that **OM:MA** = 2:3 and **ON**: **NB** = 2:1. **AN** and **BM** intersect at **x**.

Given that **OA** = **a** and **OB** = **b**.

a) Express in terms of **a** and **b** :
i. **BM** (1mk)
ii. **AN** (1mk)

b) Taking **BX** = **kbm** and **AX** =**hAN**, where **k** and **h** are constants.
Express **OX** in terms of :
i. **a**, **b** and **k** only (2mks)
ii. **a**, **b** and **h** only (2mks)

c) Determine the values of **h** and **k**. (5mks)

23. A tailor bought a number of suits at a cost of kshs. 57, 600 from Joakim wholesalers. Had he bought the same number of suits from Pamoja wholesalers, it would have cost him shs. 480 less per suit. This would have enabled him to buy 4 extra suits for the same amount of money.
a) Find the number of suits the tailor bought. (6mks)
b) The tailor later sold each suit for shs 720 more than he had paid for it.
Determine the percentage profit he made (4mks)

24. The diagram below shows a bucket with a top diameter 30 cm and bottom diameter 20cm. The height of the bucket is 28 cm.
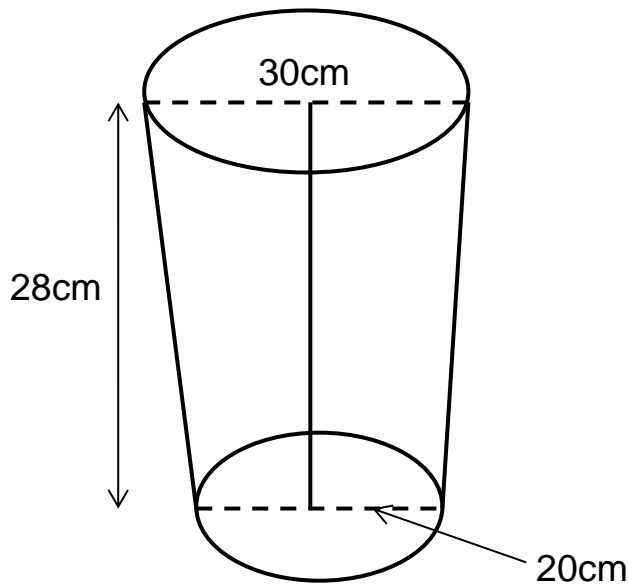
a) Calculate the capacity of the bucket in litres. (5mks)
b) Find the area of the metal sheet required to make 100 such buckets taking 10% extra for overlapping and wastage. (5mks)

KIRINYAGA WEST
121/2
MATHEMATICS PAPER 2
DECEMBER 2021

Section I. (50 marks)
Answer all questions in this section in the spaces provided.
1. Use logarithm tables to evaluate.

$$\sqrt[3]{\frac{0.0485 \times \log 3.846}{0.9834 + 88.4}}$$

(4mks)

2. Make n the subject of the equation.

$$\frac{r}{p} = \frac{m}{\sqrt{n-1}}$$

(3mks)

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

4. The length and width of a rectangle is stated as 12.40 cm and 8.5cm respectively. Calculate the percentage error in the area of the rectangle. (3mks)

5. Solve for x in the equation.
$\log_8 (x + 5) - \log_8(x - 3) = {}^2/_3$ (3mks)

6. a) Expand the expression $(1 + \frac{1}{2}x)^5$ in ascending powers of x, leaving the co-efficient as fraction in their simplest form. (1mk)
    b) Use the first three terms of the expansion in (a) above to estimate the value of $(1\frac{1}{20})^5$. (2mks)

7. Determine the area bounded by the curve $y = 4x - x^2$, the axis and the lines x= 1 and x = 2 (3mks)

8. Construct a circle centre x and radius 2.5cm. Construct a tangent from point P, 6cm from x to touch the circle at R. Measure the length PR. (4mks)

9. A pilot leaves point **T** $(60^0S, 10^0W)$ and flies due East for a distance of 960nm to point **X**. Determine The position of **X**. (3mks)

10. Write $\sin 45^0$ in the form $\dfrac{1}{\sqrt{a}}$ where a is a positive integer, hence simplify leaving the answer in surd form.

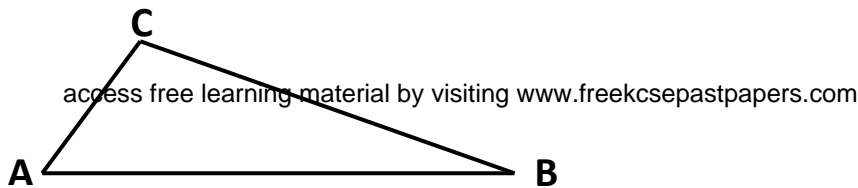$$\frac{\sqrt{8}}{1 + \sin 45^0}$$ (3mks)

11. Find the radius and centre of the circle whose equation is
     $3x^2 + 3y^2 - 12x + 18y - 9 = 0$ (3mks)

12. Determine the equation of the normal to the curve $y = \dfrac{4x^3 + 4}{x^2}$ at x = 2. (3mks)

13. Given that $x = i + 2j - k$, $y = i + 3j - 4k$ and $p = 2x - y$.

     Find the magnitude of **P** to 4 s.f. (2mks)

14. The figure below is a triangle **ABC**.

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    a) On the triangle, locate the locus of points equidistant from **AC** and **AB** and 5cm from **B**. (2mks)
    b) Shade the region R, inside the triangle which is less than 5cm from **B** and nearer to **AC** than **AB**. (1mk)

15. A tea blender buy two grades of tea at sh 60 and sh 80 per packet. Find the ratio in which he should mix them so that by selling the mixture at sh 90 a profit of 25% is realized. (3mks)

16. A contractor intends to transport 1000 bags of cement using a lorry and a pickup. The lorry can carry a maximum of 80 bags while the pickup can carry a maximum of 20 bags. The pickup has to make more than twice the number of trips the lorry makes and the total number of trips has to be less than 30. Form all the inequalities representing the situation, (4mks)

SECTION II (50 MARKS)
Answer only 5 questions in this section in the spaces provided.

17. The marked price of a TV is 25600. On cash payment a customer is given a discount of 5% on the marked price. The TV can also be bought on hire purchase terms by paying a deposit of sh 12640 and 16 equal installment of sh 1450 each. Calculate.
     i.   Cash price of the machine. (2mks)
     ii. The hire purchase price. (3mks)
     iii. Calculate the rate of compound interest charged per month for hire purchase terms. (4mks)
     iv. Find difference between cash price and hire purchase value. (1mk)

18. The 2nd and 5th terms of an arithmetic progression(A.P) are 8 and 17 respectively.
     The 2nd, 10th and 42nd terms of the A.P form the first three terms of a Geometric progression(G.P) Find :-
     a) The 1st term and the common difference of the arithmetic progression. (3mks)
     b) i.   The first three terms of the Geometric progression (G.P) (2mks)
         ii. The 10th term of the geometric progression (G.P) (2mks)

c) The sum of the first 10 terms of the G.P. (3mks)

19. In the figure below **ABC** is a tangent to the circle at **B**. Given that $< \mathbf{ABG} = 40^0, < \mathbf{BGD} = 45^0$ and $< \mathbf{DBE} = 25^0$.
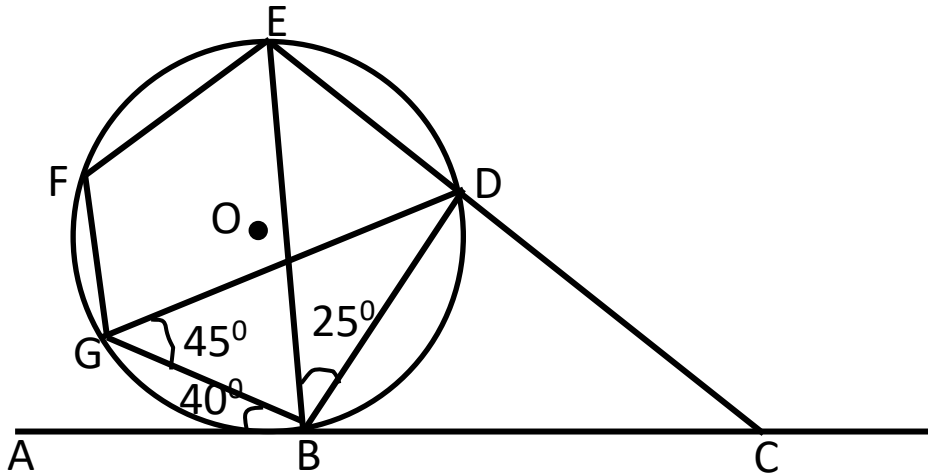
Find the size of the following angles giving reasons in each case.
a) $< \mathbf{BDG}$ (2mks)
b) $< \mathbf{DGE}$ (2mks)
c) $< \mathbf{EFG}$ (2mks)
d) $< \mathbf{CBD}$ (2mks)
e) $< \mathbf{BCD}$ (2mks)

20. A bag contains 5 red, 4 white and 3 blue beads. Two beads are selected at random one after another without replacement.
a) Draw a tree diagram and show the probability space. (3mks)
b) From the tree diagram, find the probability that :-
   i. The last bead selected is red. (2mks)
   ii. The beads selected were of the same colour. (2mks
   iii. At least one of the selected beads is blue. (3mks)

21. The scores for 100 students in a mathematics exam were recorded in the table below.

Marks	10–19	20–29	30-39	40-49	50-59	60-69	70-79	80- 89	90-99
Frequency	4	10	13	16	20	18	12	6	1

a) State the modal class. (1mk)
b) Using assumed mean of 54.5, calculate
   i. the mean (3mks)
   ii. Standard deviation (3mks)
c) Determine the 70th percentile (3mks)

22. The table below shows some values of the curves y =2 cos x and y = 3 sin x.
a) Complete the table for values of y = 2cos x and y = 3 sin x correct to 1 d.p. (2mks)

x^0	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
y = 2cosx				0		-1.7			- 1	0			
y = 3 sin x		1.5					0		-2.6				0

b) On the grid provided, draw the graphs of y = 2cos x and y = 3 sin x for $0^0 \leq x \leq 360^0$ on the same axes. Use 1cm represent 30^0 in the x-axis and 1cm represent 1 unit in the y axis. (5mks)
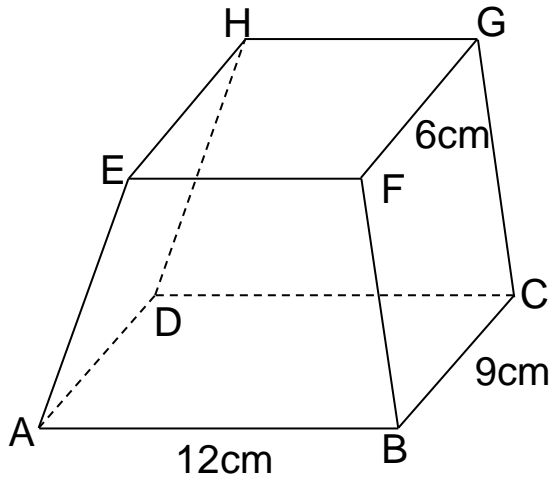c) Use the graph to find the values of x when 3sinx – 2 cos x = o (1mk)
d) Use your graph to find the values of y when 3sin x = 2cos x (1mk)

29

e) State the amplitude of the curve y = 3sinx. (1mk)

23. The figure below is a frustrum of a rectangular pyramid with AB = 12cm, EF = 8cm, BC = 9cm, FG = 6cm and height of 6cm.

Calculate :
a) The full height of the pyramid. (2mks)
b) Angle that the plane ABFE makes with the base ABCD. (3mks)
c) Angle that AC makes with line AE. (3mks)
d) Angle that plane BCGF makes with the base ABCD. (2mks)

24. OABC is a parallelogram with vertices O (0,0), A(2,0), B(3,2) and C(1,2). $O^1A^1B^1C^1$ is the image of OABC under transformation matrix

$$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$$ access free learning material by visiting www.freekcsepastpapers.com

a) i. Find the co-ordinates of $O^1A^1B^1C^1$. (2mks)
    ii. On the grid provided draw OABC and $O^1A^1B^1C^1$. (2mks)
b) i. Find $O^{11}A^{11}B^{11}C^{11}$ the image of $O^1A^1B^1C^1$ under the transformation

$$\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$$ (2mks)

    ii. On the same grid, draw $O^{11}A^{11}B^{11}C^{11}$ (1mk)
c) Find the single matrix that maps $O^{11}A^{11}B^{11}C^{11}$ onto OABC (3mks)

KIRINYAGA CENTRAL SUB-COUNTY EFFECTIVE 40 JOINT EXAMINATION-2021
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DECEMBER 2021

SECTION I (50 MARKS)
Answer ALL questions in this section

1. Without using a calculator, evaluate:

$$\frac{3\frac{2}{3} \text{ of } 21 + 3\frac{3}{4} \div \frac{3}{8} - 4\frac{1}{2} \times 3\frac{1}{3}}{5\frac{5}{8} \times 1\frac{7}{9} - \frac{5}{4} \text{ of } 4\frac{4}{5} + 2\frac{4}{5} \div \frac{7}{10}}$$

(3 marks)

2. a) Four wooden poles have lengths 280cm, 336cm, 476cm and 420cm. The owner wishes to cut them into shorter pieces of equal length. Find the greatest possible length of each piece if no wood is left over. (2 marks)

   b) The GCD of two numbers, x and 32 is 4, while the LCM is 224, find x. (2marks)

3. Find the area of a minor segment bonded by arc and a chord whose radius is 7cm and angle at the centre is 120^0. (3 marks)

4. Solve for x, $25^{x+1} - 5^{2x+1} = 2500$. (3 marks)

5. The equation of a curcve is $y = 3x^2 - 4x - 6$. Find the equations of the tangent and normal to the curve at the point (3,-2). (4 marks)

6. A seven sided polygon has two of its interior angles 140° and 160°, and the remaining angles are equal. Find the size of the equal angles. (3 marks)

7. Use square, square roots and reciprocal tables to evaluate the following expression. Give your answer correct to 2 decimal places. (3 marks)

$$\frac{17}{\sqrt{0.9736}} + 34.78^2$$

8. Simplify the expression $\dfrac{3a^3 - 4a^2b - 4ab^2}{4b^2 - 9a^2}$ (3 marks)

9. The masses of two similar solids are 96g and 324g. If the surface area of the smaller solid is 196 cm². Calculate the surface area of the larger solid. (3 marks)

10. An American citizen exchanged Y US dollars for Kenya shillings, he spent a four days in the country and paid Ksh 56700 for expenses. He later left the country and exchanged the remainder back to US dollar. He went back with 1950 dollars, find the value of Y to the nearest dollar. (3 marks)

Currency	Buying	Selling
1 US dollar	Ksh 99.35	Ksh 99.89

11. 12 men each working for 6 hours a day can build house in 6 days. How long would 36 men each working 3 hours a day take to build four similar houses? (3 marks)

12. Determine the values of k for which the matrix $\begin{pmatrix} 2k & 1 \\ k+3 & k \end{pmatrix}$ is singular. (3 marks)

13. A flag post stands on the top edge of a vertical cliff from a boat of sea, the angles of elevation of the top and bottom of the post are 60^0 and 62^0 respectively. If the height from the base of the cliff to the top of the post is 80 metres, calculate the height of the post is 2 decimal places. (3 marks)

14. A farmer sold his goats at Sh 6000 each and calves at Sh 18000 each. He sold less than nine calves and the total number of animals sold did not exceed sixteen. He obtained at least 180000 from the animals altogether. Write down all the inequalities that satisfy the above information. (3 marks)

15. Solve the following simultaneous equation. (3mks)
   $2x - y = 3$
   $x^2 - xy = -4$

16. The following data was obtained for the heights of 68 tree seedlings.

Height(cm)	$0.5 \le x \le 1.5$	$1.5 \le x \le 2.5$	$2.5 \le x \le 6.5$	$6.5 \le x \le 9.5$	$9.5 \le x \le 13.5$
Frequency	15	8	16	21	8

On the grid provided below, draw a histogram to represent the information shown above.
(3 marks)

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

17. Three vertices of a parallelogram ABCD are A(2,5), B(3,1) and C(8,6).
   a) Determine the co-ordinates of point D. (4 marks)
   b) Find the equation of BC in the term y = mx +c (3 marks)
   c) Calculate the ; i. x – intercept of BC.
       ii. y – intercept of BC access free learning material by visiting www.freekcsepastpapers.com (2 marks)
       iii. angle which AD makes with the horizontal. (1mark)

18. The masses of 120 men were recorded during a sports session as shown in the table below .

Mass in(kg)	50-55	55-60	60-65	65-70	70-75	75-80	80-85
Frequency	11	15	y	26	21	17	13

   a) Find the value of y. (1 mark)
   b) State the modal frequency. (1 mark)
   c) Calculate the ;
       i. Median (3 marks)
       ii. Mean using assumed mean. (4 marks)
       iii. Difference between the mean mass and the median mass. (1 mark)

19. a) At 8.00a.m Tom starts to cycle from town A to town B, 60km apart. Mary starts an hour later to travel from A to B by motorbikes, at a speed of 20km/hr faster than that of Tom. If both Tom and Mary arrive at B at the same time, calculate the speed of Tom to 2 significant figures. (5 marks)
   b) A train starts from rest and attains a velocity of 30m/s after 1 seconds. It then travels at this speed of 20 seconds and finally decelerates uniformly for 12 seconds and comes to rest. Calculate the acceleration of the train in;
       i.   the first 10 seconds (2 marks)
       ii. the last 12 seconds (1 mark)
       iii. find the distance travelled by the train. (2marks)

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

x	-3	-2	-1	0	1	2	3
$2x^3$	-54	-16			2	16	54
x^2	9	4	1	0	1	4	9
-5x	15	10			-5	-10	
+2	+2	+2	+2	+2	+2	+2	+2
y	-28				0	12	

b) On the grid provided draw the graph of $y = 2x^3 + x^2 - 5x + 2$ for $-3 \le x \le 3$. (3marks)

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

    i.   equation $0 = 2x^3 + x^2 - 5x + 2$ (2marks)

    ii.   equation $2x^3 + x^2 - 11x - 10 = 0$ (3marks)

21. A particle moves along a straight line such that its displacement S metres from a given point is

$$S = -3t^3 - \frac{9}{2}t^2 + 4t + 3$$ where t is time in seconds. Find:

a)   Find its initial acceleration (3marks)

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

c)   Its displacement by the time it comes to rest momentarily. (2 marks)

d)   The maximum velocity attained. (2marks)

22. a) Two variables P and Q are such that P varies partly as the square root of Q and partly as Q.
Determine the relationship between P and Q when Q = 16, P = 500 and when Q= 25, P = 800.

(3 marks)

b) A variable p varies directly as the square of q and inversely as the square root, of r.
when **p** = 16, **q** = 8 and **r** = 81.

    i.   Find the equation connecting p, q and r (3 marks)

    ii.   find p when q = 30 and r = 36 (2 marks)

    iii. find the percentage change in p by increasing q by 20% and decreasing r by 9%. (2marks)

23. Kamene is a sales executive earning a salary of Ksh. 25,000 and a commission of 8% for the sales in excess of Ksh. 100, 000.
If in May she earned a total of Kshs 52000 in salaries and commission.

a) Determine the amount of sales she made in that month. (4 marks)

b) If the total sales in the month of June and July increased by 18% and then dropped by 30 % respectively, calculate

  i. Kamene' commission in the month of June. (3 marks)

  ii. Her total earnings in the month of July. (3 marks)

24. Four towns P,Q, R and S are such that Q is 84km directly due north of P. R is on a bearing of 295° from p at a distance of 80km. Town S is on a bearing of 340° from R at a distance of 60km.

a) Using a scale of 1cm to represent 20km make an accurate drawing to show the relative position of the towns. (3 marks)

b) From the drawing, find

    i.   the distance QR (2 marks)

    ii.   the distance PS. (2 marks)

    iii. the distance and bearing of Q and S. (3mks)

KAPSABET BOYS HIGH SCHOOL
MATHEMATICS
PAPER 1
SEPTEMBER- 2021

pound **SECTION I (50MKS)**

1. A rally car travelled for 2 hours 40 minutes at an average speed of 120km/h. the car consumes an average of 1 litre of fuel for every 4 kilometers. A litre of fuel costs Ksh.59. Calculate the amount of money spent on fuel.
(3mks)

2. One interior angle of a polygon is equal to 80^0 and each of the other interior angles are 128°. Find the number of sides of the polygon. (3mks)

3. (a) Using a pair of compasses and a ruler only construct a triangle ABC and such that AB= 4cm, BC =6cm and angle ABC=135°. (2mks)
   (b) Construct the height of triangle ABC in (a) above taking AB as the base, hence Calculate the area of triangle ABC. (2mks)

4. Solve the following inequalities and state the integral values (3mks)
   $2x – 2 \leq 3x + 1 < x + 11$

5. Without using mathematical tables or calculators, **evaluate** $\sqrt{\dfrac{1408 \times 0.594 \times 0.012}{6.05 \times 125}}$ leaving

   your answer as a simplified fraction (3mks)

6. Two similar solids have surface areas 48cm² and 108cm²respectively. Find the volume of the smaller solid if the bigger one has a volume of 162cm³. (3mks)

7. A triangle flower garden has an area of 28m². Two of its edges are 14 metres and 8 metres. Find the angle between the two edges. (3mks)

8. 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 ~~access free~~ same week. learning material by visiting www.freekcsepastpapers.com (3mks)

9. Simplify the expression: $\dfrac{9t^2 - 25a^2}{6t^2 + 19at + 15a^2}$ (3mks)

10. Use reciprocal and cube root tables to evaluate (3mks)

   $$\frac{5}{63.34} - \sqrt[3]{0.0169}$$

11. A Kenya company received US Dollars M. The money was converted into Kenya Shillings in a bank which buys and sells foreign currencies.

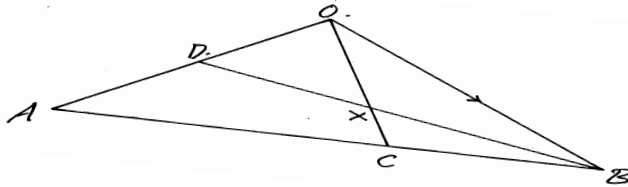 | | Buying (in Ksh) | Selling (in (Ksh) |
   |---|---|---|
   | 1 Sterling Pound | 125.78 | 126.64 |
   | 1 Us Dollar | 75.66 | 75.86 |

   (a) If the company received Ksh.15, 132,000, calculate the amount, M received in US Dollar.
   (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 (2mks)

12. 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)

13. Use logarithms tables to evaluate. (4mks)

   $$\sqrt[3]{\frac{36.72 \times (0.46)^2}{185.4}}$$

14. A certain two-digit number is equivalent to five times the sum of the digits. It is found to be 9 less than the number formed when the digits are interchanged. **Find** the number. (3mks)
15. A man standing 20m away from the foot of a vertical pole observes the top of the pole at an angle of elevation of 30^0. He begins to walk along a straight line on level ground towards the pole. **Calculate** how far he walked before the angle of elevation of the top of the pole becomes 80^0. (3mks)
16. Find the acute angle y if sin 4y = cos 2y (2mks)

SECTION B (50MKS)

17. Mambo 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 Mambo obtained the mass of the spirit as 10g. Calculate the density of the spirit. (2mks)

18. 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**   access free learning material by visiting www.freekcsepastpapers.com   (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**OC**, find h and k. (4mks)
(d) Hence express **OX** in terms of **a** and **b** only. (1mk)

19. 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)

20. A certain number of people agreed to contribute to buy novels worth sh. 1200. Five of them pulled out and the others agreed to contribute an extra Sh. 10 each. Their contribution brought novels worth sh.200 more than they originally expected.
    a) If the original number of people was x, write an expression of how much each was to contribute. (1mk)
    b) Write down two expressions on how much each contributed after the five pulled out and reduced them to a single equation. (2mks)
    c) Calculate how many people made the contribution (5mks)
    d) How much did each contribute? (2mks)

21. (a) In 2001 the total cost of manufacturing an article was Sh.1250 and this was divided between the cost of material, labour and transport in the ratio 8: 14: 3. In 2004 the cost of the material was doubled, labour cost increased by 30% and transport costs increased by 20%. Calculate the cost of manufacturing the article in 2004. (6mks)

(b) For the same article in (a) above, the cost of manufacturing in 2005 was sh. 1981 as a result of increase in labour costs only. Find the percentage increase in labour cost of 2004. (4mks)

22. The figure below shows a velocity – time graph of a car journey.
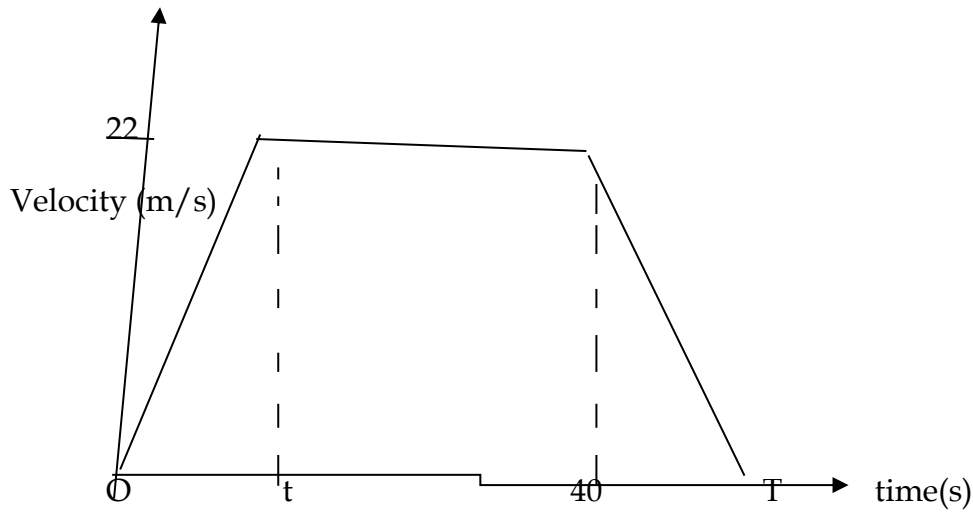
The car starts from rest and accelerates at $2.75 m/s^2$ for t seconds until its speed is 22m/s. It then travels at this velocity until 40 seconds after starting. Its breaks bring it uniformly to rest. The total journey is 847m long and takes T seconds.

Calculate the
(i)   Value of t (3mks)
(ii) Distance travelled during the first t seconds (2mks)
(iii) Value of T (3mks)
(iv) Final deceleration (2mks)

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23. 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 $A^1B^1C^1$.
   a) Draw triangle ABC and $A^1B^1C^1$.and state its coordinates (4mks)
   b) Triangle $A^1B^1C^1$ is then reflected in the line y = x to give triangle $A^{11}B^{11}C^{11}$.draw $A^{11}B^{11}C^{11}$.and state its coordinates 3mks
   c) If triangle $A^{11}B^{11}C^{11}$ is mapped onto $A^{111}B^{111}C^{111}$ whose co-ordinates are A^{111}(0, -2), B^{111}(4, -4) and C^{111}(0, -4) by a rotation. Find the centre and angle of rotation. (3mks)

24. The following are masses of 25 people taken in a clinic.

20	35	29	45	60
66	56	29	48	37
59	64	24	28	32
35	45	48	52	55
54	55	36	39	35

   (a) Using a class width of 8 and starting with the lowest mass of the people. Make a frequency distribution table for the data. (3mks)
   (b) Calculate the median mass of the people. (3mks)
   (c) On the grid provided, draw a histogram to represent the information. (4mks)

KAPSABET BOYS HIGH SCHOOL
MATHEMATICS
PAPER 2
SEPTEMBER- 2021

SECTION I (50MKS)

1. Simplify by rationalising the denominator
$$\frac{\sqrt{2} + \sqrt{3}}{\sqrt{6} - \sqrt{3}}$$
(3mks)

2. Find the value of x in the equation $\log_{10}(2x-1) + \log_{10} 3 = \log_{10}(8x-1)$. (3mks)
3. Find the compound interest on sh. 200,000 for 2 years at 14% pa. Compounded semi-annually. (3mks)
4. The ratio of 12th to 10th term in a geometric series is 9:1. Find the common ratio. (3mks)
5. i) Expand $(2 - ¼ x)^5$ (2mks)
   ii) Use your expansion to find the value of $(1.96)^5$ correct to 3 decimal places (2mks)

6. Chord WX and YZ intersect externally at Q. The secant WQ = 11cm and QX = 6cm while ZQ = 4cm.
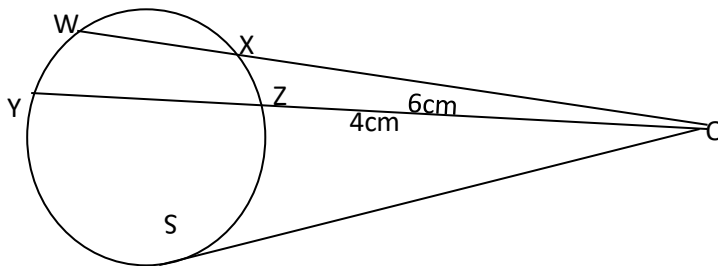
   (a) Calculate the length of chord YZ. (2mks)
   (b) Using the answer in (a) above, find the length of the tangent SQ. (2mks)

7. Given that $\begin{bmatrix} y-1 & y+1 \\ 3y & y \end{bmatrix}$ is a singular matrix, find the possible values of y. (3mks)

8. 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. (3mks)

9. 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. (3mks)
10. Solve $8 \cos^2 x – 2 \cos x – 1 = 0$ (3mks)

11. Make χ the subject of the formula:
$$A = \sqrt{\frac{3 + 2\chi}{5 - 4\chi}}$$
(3mks)

12. The position vectors of A and B are given as **a**= 2**i**-3**j**+4**k** and **b**= -2**i**-**j**+2**k** respectively. Find to 2decimal places, the length of the vector $\overrightarrow{AB}$. (3mks)

13. Find the centre and the radius of a circle whose equation is
    $x^2-6x+y^2-10y+30=0$ (3mks)

14. A point (x, y) is mapped onto (13, 13) by two transformations M followed by T where

    $T = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$ and $x = \begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$. Find the point (x y) (3mks)

15. Given that $2 \leq A \leq 4$ and $0.1 \leq B \leq 0.2$. Find the minimum value of $\dfrac{AB}{A-B}$ (3mks)

16. 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 (3mks)

SECTION II (50MKS)

17. The table below shows the rates of taxation in a certain year.

Income in K£ pa	Rate in Ksh per K£
1 – 3900	2
3901 – 7800	3
7801 – 11700	4
11701 – 15600	5
15601 – 19500	7
Above 19500	9

In that period, Juma was earning a basic salary of sh. 21,000 per month. In addition, he was entitled to a house allowance of sh. 9000 p.m. and a personal relief of ksh 105 p.m. He also has an insurance scheme for which he pays a monthly premium of sh. 2000. He is entitled to a relief on premium at 15% of the premium paid.

   (a) Calculate how much income tax Juma paid per month. (7mks)
   (b) Juma's other deductions per month were cooperative society contributions of sh. 2000 and a loan repayment of sh. 2500. Calculate his net salary per month. (3mks)

18. Wainaina has two dairy farm A and B. Farm A produces milk with 3 ½ percent fat and farm B produces milk with 4 ¾ percent fat. Determine;
   (a) The total mass of milk fat in 50kg of milk from farm A and 30kg from farm B. (3mks)
   (b) The percentage of fat in a mixture of 50kg of milk from A and 30kg of milk from farm B. (2mks)
   (c) Determine the range of values of mass of milk from farm B that must be used in a 50kg mixture so that the mixture may have at least 4 percent fat. (5mks)

19. A cupboard has 7 white cups and 5 brown ones all identical in size and shape. There was a blackout in the town and Mrs. Kamau had to select three cups, one after the other without replacing the previous one.
   (a) Draw a tree diagram for the information. (2mks)
   (b) Calculate the probability that she chooses.
       (i) Two white cups and one brown cup. (2mks)
       (ii) Two brown cups and one white cup. (2mks)
       (iii) At least one white cup. (2mks)
       (iv) Three cups of the same colour. (2mks)

20. (i) complete the table below, giving the values correct to 2 decimal places (2mks)

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
Cos 2X^0	1.00	0.87		0.00	-0.5		-1.00		-0.5	0.00	0.50	0.87	1.00
Sin (X^0+30^0)	0.50	0.71	0.87	0.97	1.00		0.87	0.71	0.50		0.00		-0.50

(ii) Using the grid provided draw on the same axes the graph of y=cos 2X^0 and y=sin(X^0+30^0) for
0^0≤ X ≤ 180^0. (4mks)

(iii) Find the period of the curve y=cos 2x^0 (1mk)

(iv) Using the graph, estimate the solutions to the equations;

(a) sin(X^0+30^0)=cos 2X^0 (1mk)

(b) Cos 2X^0=0.5 (1mk)

21. The 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 (4mks)
(ii) the standard deviation of the distribution (3mks)
(b) Calculate the quartile deviation (3mks)

22. (a) Using a ruler and a pair of compasses only, construct a parallelogram ABCD such that AB=9 cm, AD=7 cm and angle BAD=60º. (3mks)

(b) On the same diagram, construct:
(i) The locus of a point P such that P is equidistant from AB and AD; (1mk)
(ii) The locus of a point Q such that Q is equidistant from B and C; (1mk)
(iii) The locus of a point T such that T is equidistant from AB and DC; (1mk).
(c) (i) Shade the region R bounded by the locus of P, the locus of Q and the locus of T. (1mk)
(ii) Find the area of the region shaded in (d)(i) above. (3mks)

23. The points A (1,4), B(-2,0) and C (4,-2) of a triangle are mapped onto A^1(7,4), B^1(x,y) and
C^1 (10,16) by a transformation N = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$. Find

(i) Matrix N of the transformation (4mks)
(ii) Coordinates of B^1 (2mks)
(iii) A^{II}B^{II}C^{II} are the image of A^{1}B^{1}C^1 under transformation represented by matrix
M = $\begin{pmatrix} 2 & -1 \\ 0 & 0 \end{pmatrix}$ Write down the co-ordinates of A^{II}B^{II}C^{II} (2mks)
(v) A transformation N followed by M can be represented by a single transformation K. Determine K (2mks)

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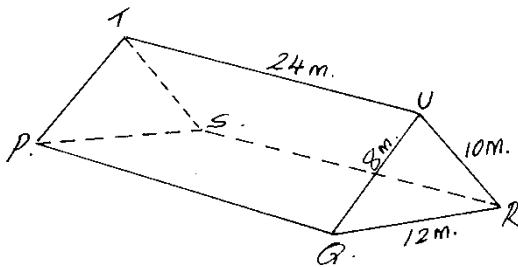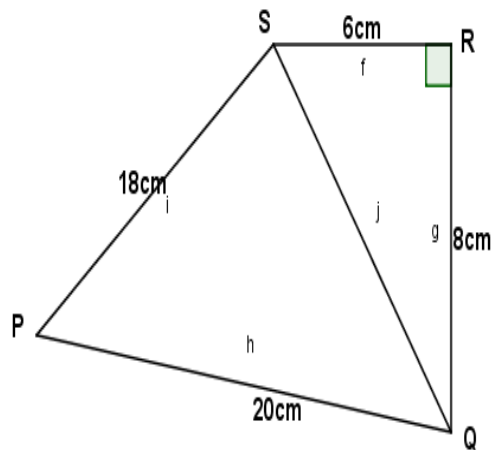

Calculate
(a) The angle between faces RSTU and PQRS (3mks)
(b) The space occupied by the roof (3mks)
(c) The angle between the plane QTR and PQRS (4mks)

LANG'ATA SUB - COUNTY JOINT EVALUATION TEST
121/1-
MATHEMATICS SET 1-PAPER 1

SECTION I: 50 MARKS (Attempt All the Questions)

1. Without using a calculator, evaluate $\dfrac{(-7)-(-6)\times(-8)+(-5)}{-7+(-3)\div2\times2}$ (3 marks)

2. A room measuring 6.3m by 8.4m is to be covered with square cement slabs. Find
   (a) Greatest size of the slab that covers the room without leaving a remainder (2 marks)
   (b) The number of slabs required to cover the room. (2 marks)

3. Four years ago, Mueni's age is three times that of her son. In five years time the sum of their ages will be 54 years. How old was mueni, when she got her son (3 marks)

4. Solve for y in $2^{(3x-2)} = \dfrac{4^{x+1}}{8^x}$ (3 marks)

5. An arc length of 16.8cm subtends an angle of 2.4radians at the centre. Find the exact radius of the circle. (3 marks)

6. Fifteen women working at the same rate would transplant 2400 seedlings in 8days. Find how many more days it would take 18 women to transplant 3600 seedlings. (3 marks)

7. Simplify the following expression as far as possible (3 marks)
$$\frac{x}{x-2} - \frac{3x+6}{x^2-4}$$

8. Two regular polygons, A and B are such that the ratio of their sides 5:3. The sum of interior angles of polygon A exceeds that of polygon B by 720^0. Determine the size of the exterior angle of polygon A. (4 marks)

9. The position vector of B is $4\mathbf{i} +\mathbf{j} – 3\mathbf{k}$ and vector $\mathbf{AB} = 6\mathbf{i} – 3\mathbf{j} +2\mathbf{k}$. Find to 1decimal place, the length of position vector $\mathbf{OA}$. access free learning material by visiting www.freekcsepastpapers.com (3 marks)

10. Calculate to 4 significant figures, the area of quadrilateral PQRS below (3 marks)

11. The angle of depression of the foot of a watch tower from the top of a prison cell is 30^0 while the angle of elevation of the top of the watch tower from the same position is 45^0. If the height of the tower is 32m, calculate to 3 significant figures, the distance in metres between the watch tower and the prison cell. (3 marks)

12. Find the obtuse angle between the x- axis and the line whose equation is $3y - 2x = 4$. (3 marks)

13. Evaluate the following using tables of square roots and reciprocals (3 marks)
$$\sqrt{1843} + \frac{1}{0.0985}$$

87

14. Generate the inequalities that define region R in the figure below   (3 marks)
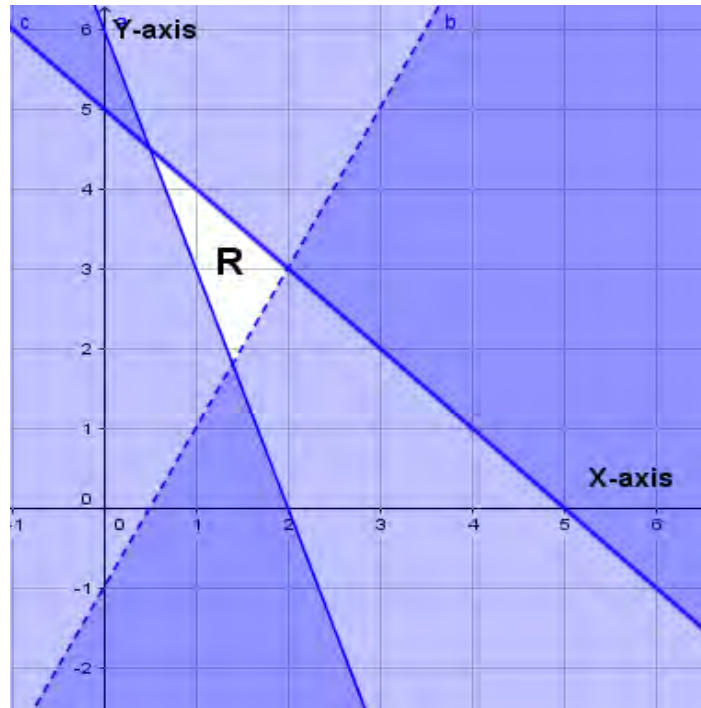
15. In Mr. Kiplagat's farm, a third of his animals are cows and a sixth is goats. Half of the remainder are sheep while the rest are pigs. If there are 20 pigs, find the total number of animals in the farm.   (3 marks)

16. In the figure below, ABCD is a uniform cross section of prism ABCDEFGH. Given that DE is one of the visible edges of the prism, complete the sketch.   (3 marks)
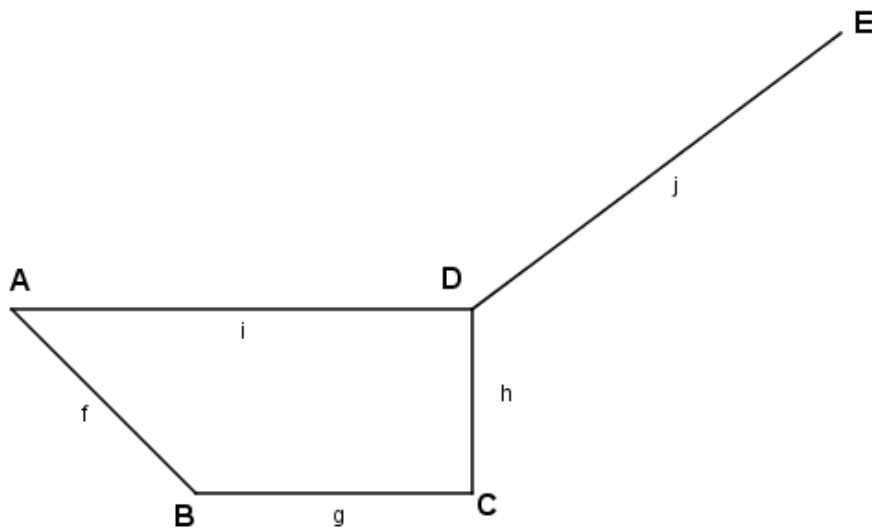
SECTION II: 50 MARKS (Attempt ONLY 5 Questions)

17. A fruit vendor in Makueni bought some mangoes at sh64 for every twelve and sold two-thirds of them at sh240 for every thirty mangoes and the other one-third at sh 225 for every thirty. In so doing the vendor made a profit of sh450. Determine

    (a) The number of mangoes the vendor bought. (4 marks)
    (b) The percentage profit the vendor made giving your answer to one decimal place (3 marks)
    (c) The profit the vendor would have made if he sold all the mangoes at sh240 for every thirty mangoes. (3 marks)

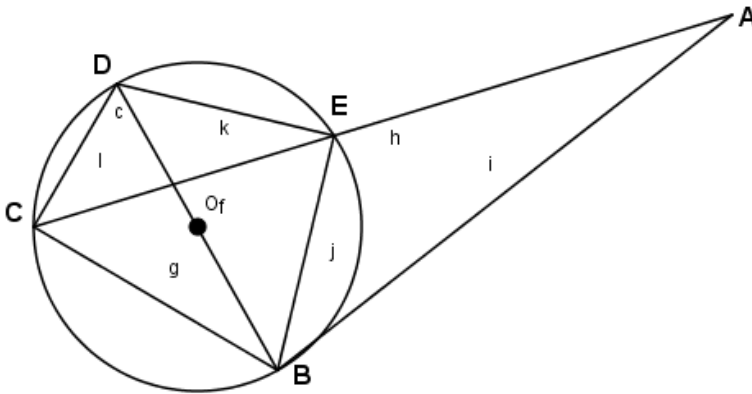18. (a) On the grid provided below, draw quadrilateral ABCD with vertices A$(-6,2)$, B$(-4,4)$, C$(-2,2)$ and D$(-4,6)$. (1 mark)

    (b). On the same grid draw A^{I}B^{I}C^{I}D^I, the image of ABCD under enlargement scale factor $-\frac{1}{2}$, centre the origin. (3 marks)

    (c) A^{II}B^{II}C^{II}D^{II} is the image of A^{I}B^{I}C^{I}D^I under rotation through -90^0 centre $(0,0)$. On the same grid draw and state the coordinates. (3 marks)

    (d) Draw A^{III}B^{III}C^{III}D^{III} the image of A^{II}B^{II}C^{II}D^{II} through reflection in the line $-x - y = 0$ (2 marks)

    (e) Describe the transformation that maps A^{I}B^{I}C^{I}D^I onto A^{III}B^{III}C^{III}D^{III} (1 mark)

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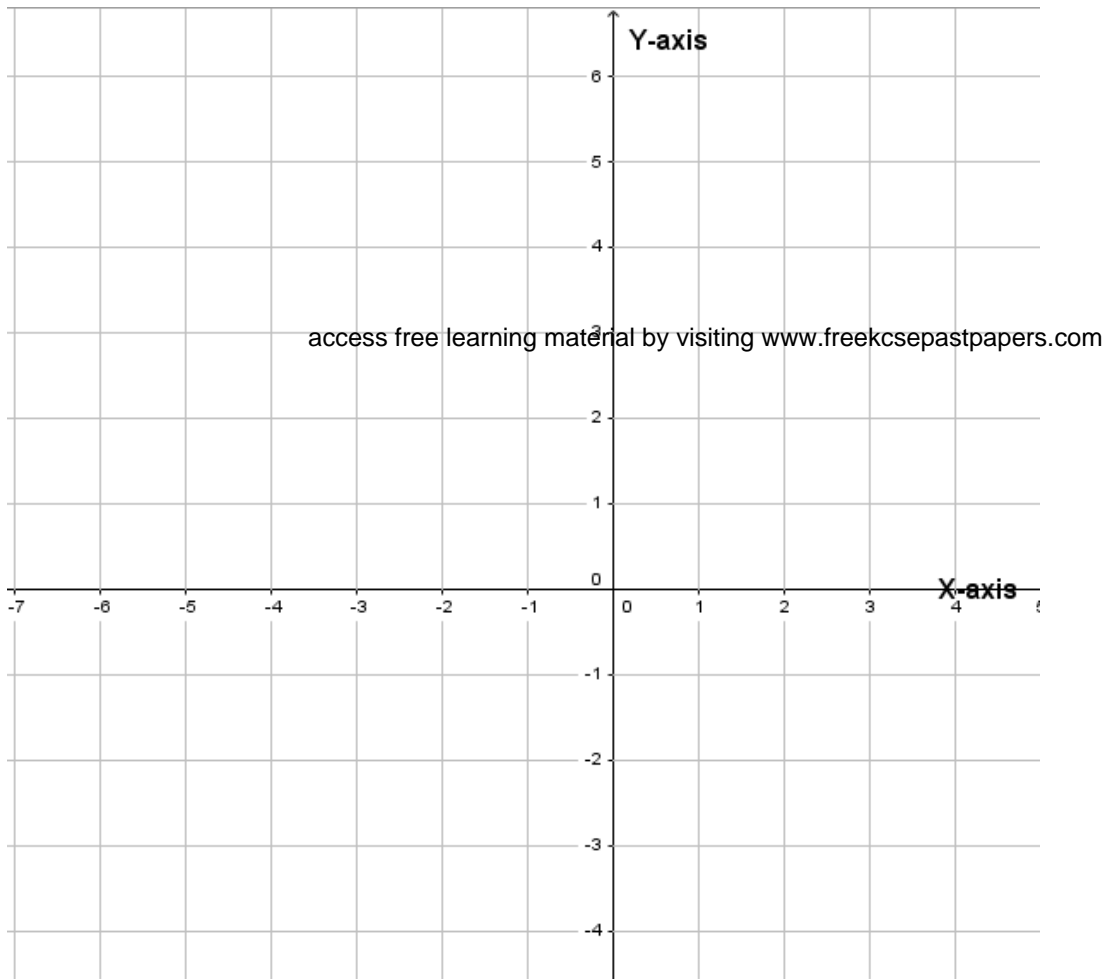
19. .(a) Use trapezium rule with 7 ordinates to estimate the area bound by the curve $y = \frac{1}{2}x^2 - 2x + 4$, lines $x = -1$, $x = 5$ and the x −axis (4 marks)

    (b) Use mid-ordinate rule with 6 strips to estimate the area in (a) above (4 marks)
    (c) Find the percentage change when the area is calculated using the mid-ordinate rule. (2 marks)

20. A matatu operates from town P to town Q which is 50km on a bearing of N30⁰E from town P. From town Q, the matatu operates 80km due west to another town R and finally operates due south to another town S which is on a bearing of 240⁰ from P.

   (a) Using a ruler and a pair of compasses only construct an accurate scale drawing that shows the route. Use a scale of 1cm represents 10km. (4 marks)

   (b) By measurement from your scale drawing determine
      (i) The distance and bearing of R from P (2 marks)
      (ii) The distance between town S and R (2 marks)
      (iii) The distance between town S and P (2 marks)

21. The diagram below shows a circle centre O. AB is a tangent to the circle at B. BD is a diameter and AEC is a straight line. BCDE is a cyclic quadrilateral in which angle BDE = 50⁰ and angle DEC =20⁰

Giving reasons, find the size of angle

   (a) CBD (2 marks)
   (b) ACD (2 marks)
   (c) ABC (2 marks)
   (d) BAC access free learning material by visiting www.freekcsepastpapers.com (2 marks)
   (e) ABE (2 marks)

22. The graph below is of a quadratic equation in the form y=ax²+bx+c. Use it to answer the questions below.
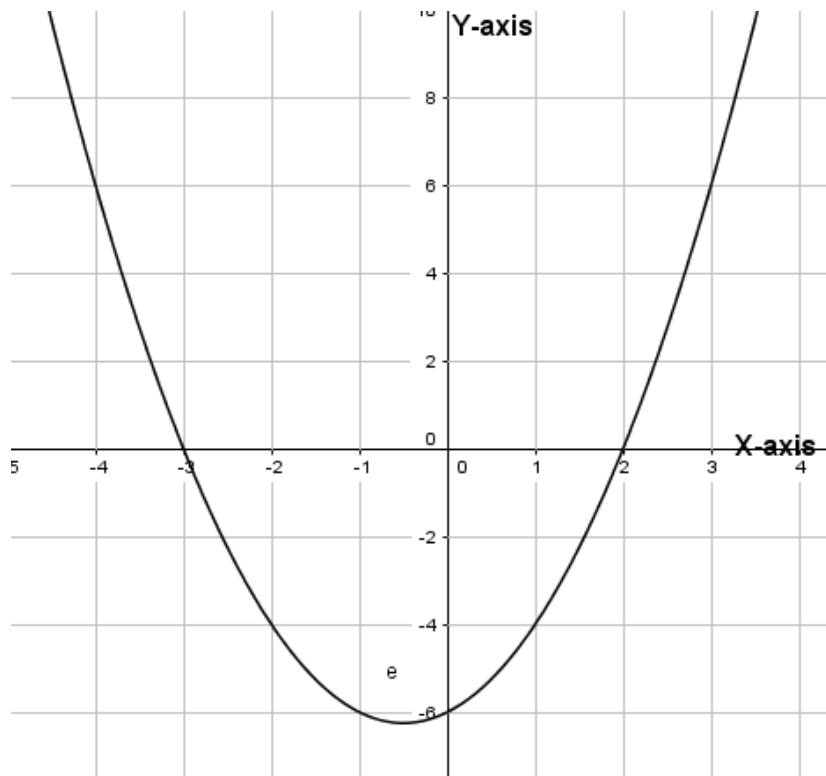
(a) State the roots of the equation of the curve (1 mark)

(b) Form the equation of the curve in the form $y = ax^2 + bx + c$ where a, b and c are constants.

(3 marks)

(c) Use the graph to solve the following equations

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

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

23. A pick-up and a matatu left Nairobi for Taveta. The speed of the pick- up was 20km/hr faster than that of the matatu. The distance between the two towns is 300km.

(a) If the pick- up arrived 45 minutes earlier than the matatu, find their speeds (4 marks)

(b) Given that the matatu had departed at 9.03am while the pick-up departed 30minutes later, find the time of day when the pick-up caught up with it matatu. (3 marks)

(c) Find the distance from Taveta when the pick-up caught with the matatu (2 marks)

24. A curve is represented by the function $y = x^3 - 6x^2 + 9x + 5$

(a) Find the point at which the curve cuts the y-axis (2 marks)

(b) Determine the stationary points of the curve (4 marks)

(c) Determine the nature of the points in (b) above (2 marks)

(d) In the space provided below, sketch the curve of $y = x^3 - 6x^2 + 9x + 5$ (2 marks)

LANG'ATA SUB - COUNTY JOINT EVALUATION TEST
121/2
MATHEMATICS SET 1-PAPER 2

SECTION I: 50 MARKS (Attempt All the Questions)

1. Use the method of completing the square to find the roots of $12x^2 + x - 6 = 0$ leaving your answers in fraction form. (3 marks)

2. Given that $\sin \theta = \frac{\sqrt{3}}{2}$, find $\cos(180 - \theta)^0$ without using a calculator or a mathematical table (3 marks)

3. The sum of the seventh term and the ninth terms of an arithmetic progression is -38. If the fourth term exceeds the sixth term by 6, find the common difference and the first term of the arithmetic progression.(3 marks)

4. Construct using a pair of compass and ruler only, rhombus PQRS of side 6cm and angle PQR $= 60^0$. Construct the locus of point M such that it is equidistant from Q and R. Mark point T on M such that it is equidistant from line SP and SR. (4 marks)

5. Three variables P, Q and R are such that P varies directly as Q and inversely as the cube root of R. When P=50, Q=2 and R=27. Find Q when P =25 and R=64. (3 marks)

6. Mr. Kiptoo deposited sh 20, 000 in a fixed deposit account. The bank pays compound interest at 8% per annum. If Mr. Kiptoo withdrew everything after $3\frac{1}{2}$ years, find to the nearest shilling, how much money he had.

(3 marks)

7. Calculate the equation of a circle centre A below leaving your answer in the form $ax^2 + by^2 + cx + dy - e = 0$ where a, b, c, d and e are constants. (3 marks)
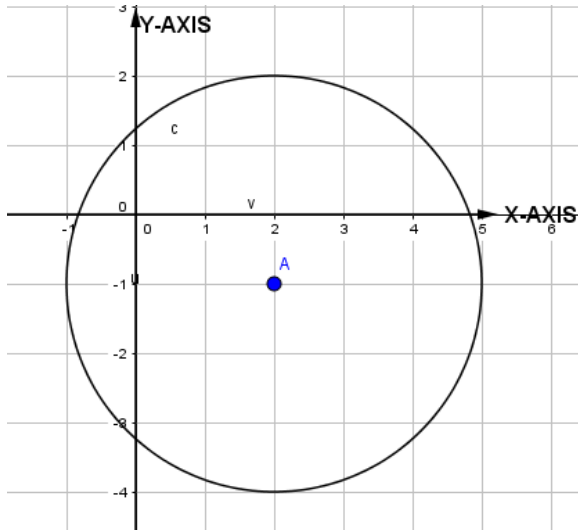
8. Calculate to 2 decimal places, the percentage error in the surface area of a hemisphere with radius is 7.0cm. (3 marks)

9. Solve for y in the logarithmic equation $\log_2(7y + 3) - \log_2(2 - y) = 1$ (3 marks)

10. Under a transformation whose matrix is $T = \begin{pmatrix} a - 2 & -2 \\ a & a \end{pmatrix}$ an object is mapped onto an image such the ratio of area of the object to that of the image is 0.25. Determine the possible values of a. (3 marks)

11. A cold water tap running alone fills a bath in 10minutes while a hot water tap fills in in 15minutes. The drainage pipe can empty the full bath in 8minutes. The cold and hot water taps are left running 4 minutes and then the drainage pipe is opened. Determine how long it will take to fill the bath. (4 marks)

12. Determine the amplitude, period and phase angle of the curve $\frac{1}{2}y = 2\cos(3x + 15)^0$ (3 marks)
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13. The coefficient of fourth term of the binomial expression $(2a - \frac{1}{2}y)^5$ is -5. Determine the value of a. (3 marks).

14. Make T the subject of the formula in $3Q = \sqrt{\frac{M - 2TP}{2T}}$ (3 marks)

15. Simplify the following by rationalising the denominator (3 marks)
$$\frac{\sqrt{21}}{\sqrt{7} - \sqrt{3}} - \frac{\sqrt{21}}{\sqrt{7} + \sqrt{3}}$$

16. The figure below shows chords AF and CE intersecting internally at point D. AB is a tangent intersecting with chord CE externally at point B. Given that AB= 12cm, AD= 5cm, CD= 4cm and EB= 9cm, find the length of DF in cm. (3 marks)
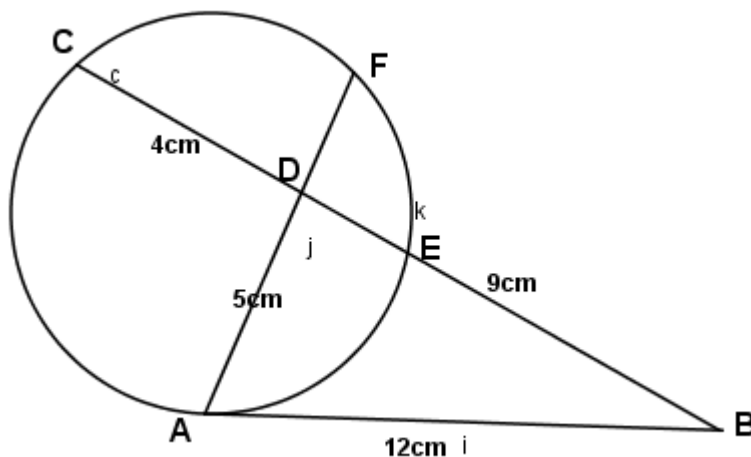
SECTION II: 50 MARKS
(Attempt ONLY 5 Questions)

17. The table below shows monthly income tax rates in Kenya for the year 2005.

Monthly taxable income In Ksh	Tax rates (percentages)
1 - 9680	10%
9681 - 18800	15%
18801 - 27920	20%
27921 - 37040	25%
37041 and above	30%

In that year, Mrs Mulmulwas gross income was Ksh 26500 per month and she is entitled to a personal relief of ksh1056.
   (a) Calculate her PAYE   (4 marks)
   (b) At the beginning of 2006, she received a salary increment of 50%. Calculate the increase in her PAYE.
                                                                                                (6 marks)

18. The acceleration a m/s^2 of a moving particle is given by the formula $a = -12t + 12$ where t is time in seconds elapsed after recording of the moving particle started. When the recording started, the particle was moving at a speed of 18m/s.
   (a) Determine
       (i)   the velocity of the particle after 4 seconds   (3 marks)
       (ii) the time t when the particle is momentarily at rest   (3 marks)
   (b) The distance covered during the fourth second   (4 marks)

19. The figure below shows a right pyramid VPQRS which stands on a rectangular base PQRS. Side PQ= 12cm, QR = 9cm and each slant edge of the pyramid is 20cm long.

access free learning material by visiting www.freekcsepastpapers.com
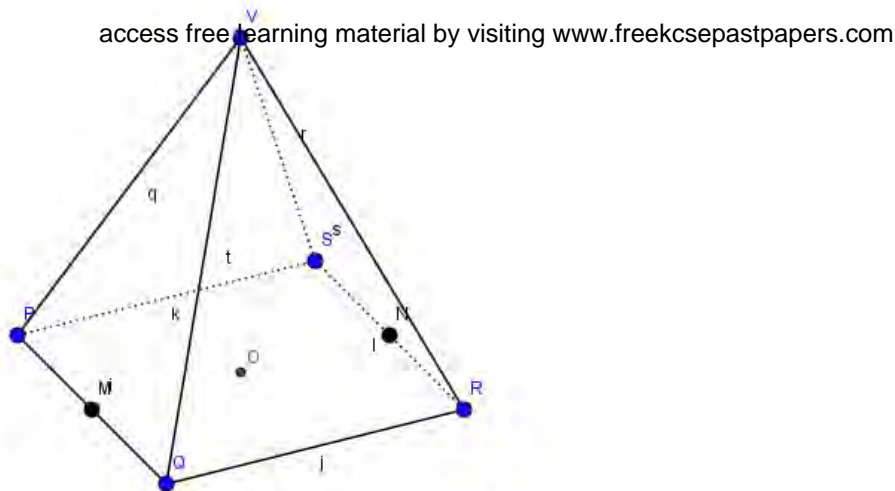
   (a) Calculate to 4 significant figures
       (i)   The vertical height of the pyramid   (2 marks)
       (ii) The volume of the pyramid   (2 marks)
   (b) M and N are the midpoints of PQ and RS respectively. Calculate to 1 decimal place.
       (i)   The size of the angle between planes PVQ and VRS   (3 marks)
       (ii) The size of the angle between the planes VPQ and PQRS   (3 marks)

20. Lang'ata Estate water reservoir is supplied with water by two taps T and R. The probability that tap T fails is 10% and the probability that tap R fails is 20%.
   (a) Draw a tree diagram to illustrate this information   (2 marks)
   (b) Calculate in percentage, the probability that
       (i)   Both taps are working   (2 marks)

      (ii)   Both taps are not working   (2 marks

      (iii)   Only one tap is working   (2 marks)

      (iv)   At least one tap is working   (2 marks)

21. The position of towns M and N on the earth's surface are $(60^0N, 130^0W)$ and $(60^0N, 50^0E)$ respectively. Taking radius of the earth to be 6370km, calculate in nautical miles

    (a) The distance between the two towns along a parallel of latitude   (3 marks)

    (b) The distance between the two towns along the north pole   (2 marks)

    (c) Which route is shorter and by how many miles   (2 marks)

    (d) Another town Y is 900nm south of N. Determine the position of N.   (3 marks)

22. The diagram below shows triangle OAB in which OM: MB=1:3 and AN: NB= 1:2. The lines ON and AM meet at X.

(a) Given $OA = a$ and $OB = b$ express the following vectors in terms of a and b.

      (i)   **AB**   (1 mark)
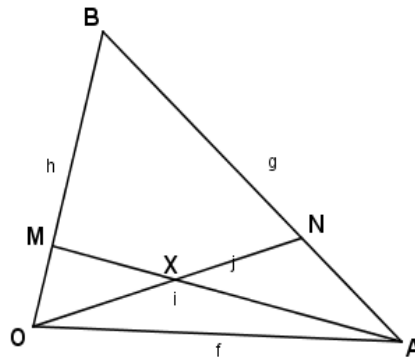
      (ii)   **AM**   (1 mark)

      (iii)   **ON**   (2 marks)

    (b) You are also given that $OX = hON$ and $AX = kAM$. By expressing OX in two ways, find the values of h and k.   (5 marks)

    (c) State the ratio in which M divides AX   (1 mark)

23. The distribution below shows mathematics scores for 20 students of Zion academy.

Marks	Number of students
20 - 29	2
30 - 39	4
40 - 49	3
50 - 59	7
60 - 69	4

    (a) Calculate to 4significant figures the quartile deviation of the above distribution

                                                            (6 marks)

    (b) Using working meaning of 44.5, calculate the mean score of the test   (4 marks)

24. (a) Complete the table below for the equation $y = x^3 - 2x^2 - 4x + 7$ (2 marks)

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

    (b) Using the scale 1cm to represent 1 unit on the x-axis and 1 unit to represent 5 units on the y-axis, draw the graph of $y = x^3 - 2x^2 - 4x + 7$ (3 marks)

    (c). Use your graph to solve the equations

      (i) $x^3 - 2x^2 - 4x + 2 = 0$ (2 mark)

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

CASPA AMUKURA PARISH EXAM
121/1
MATHEMATICS PAPER 1

SECTION A (50MKS)
ANSWER ALL THE QUESTIONS IN THIS SECTION

1. Simplify $$\dfrac{\left(1\frac{3}{7}-\frac{5}{8}\right)+\frac{2}{3}\text{ of }1\frac{1}{5}}{\frac{3}{4}+1\frac{5}{7}\div\frac{4}{7}\text{ of }2\frac{1}{3}}$$
   (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 $0 \le x \le = 90^0$
   $\sin 2x - \cos(x - 30) = 0$
   (2mks)

5. Solve for X in
   $2x - 4 \le 3x + 2 < 10 - x$
   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 320cm³, find the volume of the smaller cylinder
   (4mks)

7. Solve for X

   $8^{3x-2} \times 16^{\frac{1}{2}X} = \dfrac{1}{4}$
   (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 $\dfrac{\sqrt[3]{0.125}}{0.3758}$ 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
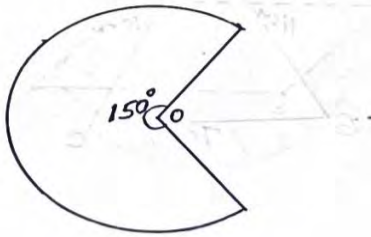
If the sector is folded into a conical shape, calculate the radius of the cone correct to 1 d.p
(3mks)

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 48º while the angle of depression of R from Y which is 3m above X is 60º
    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)

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

Velocity m/s
60

5   25   30 time (sec)
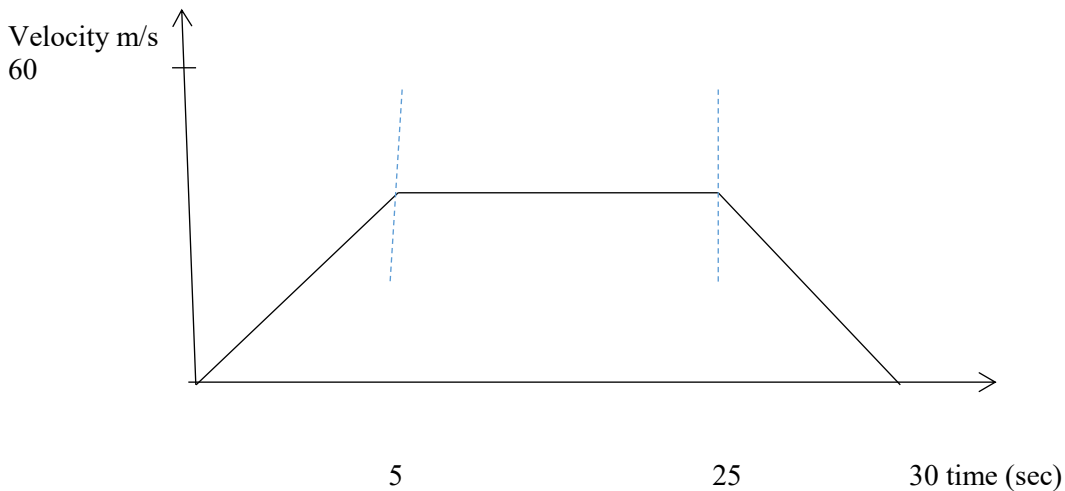
 i) Find the total distance covered by the car in metres   (3mks)
 ii) Calculate the deceleration of the car   (3mks)
 b) A lorry left kisumu at 8.00am and travelled towards the Nakuru at an average speed of 72km/h. At 8.30am a matatu left kisumu and followed the lorry at an average speed of 96km/h.Determine 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)
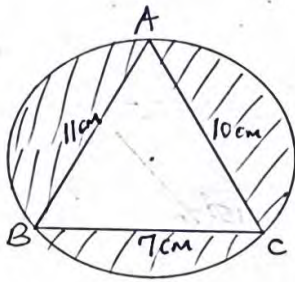 c) Calculate the
     i). Mean mark   (3mks)
     ii). Median mark   (4mks)

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 $-7 \leq x \leq 4$ (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)

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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 $\pi = \frac{22}{7}$)
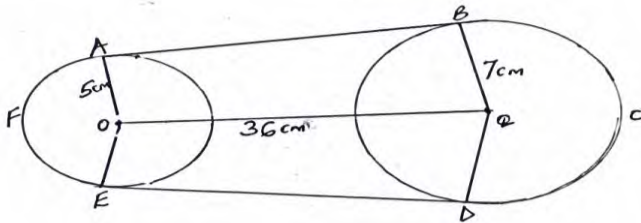
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a) Angle AOQ (3mks)
b) The length of the belt in contact with
   i) The wheel whose centre is O (2mks)
   ii) The wheel whose centre is Q (2mks)

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

CASPA AMUKURA PARISH 2021 EXAMINATION
FORM FOUR
121/2   MATHEMATICS Paper 2

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

1. Use a calculator to find V if $\dfrac{1}{V} = \dfrac{1}{23.9} - \dfrac{1}{38.45}$ (2mks)

2. Solve for X in $\quad$ 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 $(1 - \dfrac{1}{2X})^6$ up to the fourth term; hence use your expansion to evaluate 0.996^6 correct to 4 decimal places. (4mks)

5. Simplify $\dfrac{\sqrt{5}+3}{\sqrt{5}-2}$. 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.
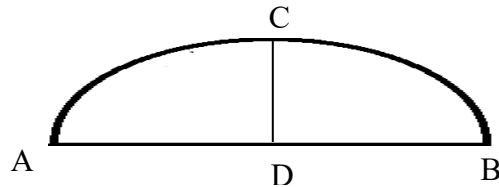
If AB is 24cm and CD is 8cm, calculate the radius of the circle. (3mks)

8. By completing the square, solve for x in the equation $2x^2 -6 = x$. (3mks)

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9. Given that y = $\dfrac{b - bx^2}{cx^2 - a}$ 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 P = $\begin{pmatrix} 5 & 3 \\ 6 & 4 \end{pmatrix}$, find ;
    a. Its inverse (1mk)

    b. The value of x and y if $P\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ (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 $5^{2x} - 6 \times 5^x + 5 = 0$ (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 (3mks)
    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 (Ksh)	Tax rate % in each shilling
Up to 9680	10 %
From 9681 to 18800	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,
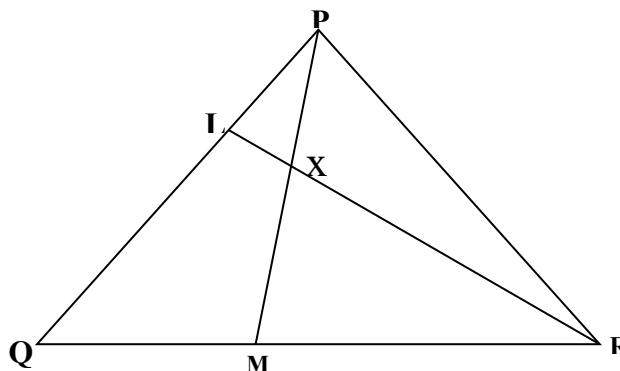
a. Express the following vectors in terms of b and c.
    i)   QR   (1mk)
    ii) PM   (1mk)
    iii) RL   (1mk)

b. By taking PX = hPM and RX = kRL 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

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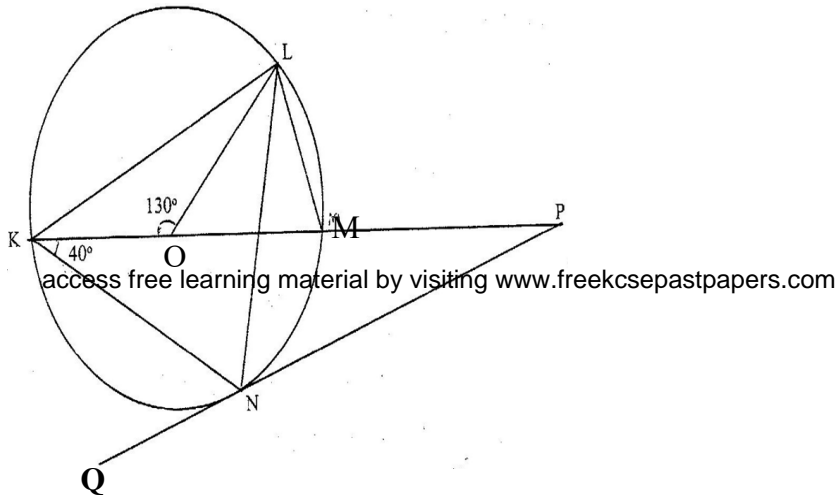
    Find the values of the following angles, stating the reasons in each case:
    a. <MLN   (2mks)
    b. <OLN   (2mks)
    c. < LNP   (2mks)
    d. <MPQ   (2mks)
    e. <KNQ   (2mks)

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

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

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

$$\frac{0.0084 \times 1.23 \times 3.5}{2.87 \times 0.056}$$

2. Use the prime factors of 7056 and 74088 to evaluate (4 marks)

$$\frac{\sqrt[3]{74088}}{\sqrt{7056}}$$

3. A bus left Nairobi and travelled towards Busia at an average speed of 90 km/h. After $2\frac{2}{9}$ hours, a car left Nairobi and travelled along the same road at an average speed of 170 km/h. If the distance between Nairobi and Busia is 800 km, Determine the distance the car travelled to catch up with the bus. (3 marks)

4. Factorize $16a + 12b - 8a^2 - 6ab$ (2 marks)

5. Find the area of the triangle below correct to 4 .s.f (2 marks)

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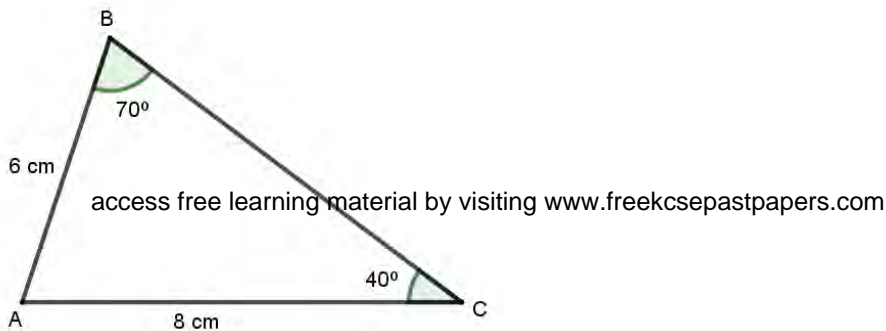
6. Without using mathematical tables or a calculator, solve for x in: (3 marks)

$$\frac{81^x}{9^{x+1}} = 3\sqrt{3}$$

7. B is on a bearing of $N30°E$ from A and C is due East of B. The distance from A to B is 600km and the distance from B to C is 400km. Calculate the distance from A to C. (3 marks)

8. The length of three wires were 30m, 36m and 84m .pieces of wire of equal length were cut from the three wires. Calculate the least number of pieces obtained (3 marks)

9. Given that $\sin x = \frac{4}{5}$ where x is an acute angle, find the value of $\cos(180 - x)°$ (3 marks)

10. A Kenyan bank buys and sells foreign currencies as shown below

|	Buying (Ksh)	Selling (Ksh)
1 Hong Kong dollar	9.74	9.77
1 South African rand	12.03	12.11

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A tourists arrived in Kenya with 105 000 Hong Kong dollars and changed the whole amount to Kenyan shillings. While in Kenya, she Spent Ksh. 403 897 and changed the balance to South African rand before leaving for South Africa. Calculate the amount, in South African rand that she received. (3 marks)

11. Given the column vectors $a = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$, $b = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$, $c = \begin{pmatrix} -2 \\ -1 \end{pmatrix}$ and that $\check{p} = 2\check{a} - 4\check{b} + 3\check{c}$

    a) Express P as a column vector (2 marks
    b) Hence find its magnitude (2 marks)

12. (a) Using a ruler and a pair of compass only construct triangle PQR such that PQ = 4 cm, QR = 6 cm and $\angle PQR = 60°$ (2 marks)
    (b) Hence construct an escribed circle to triangle PQR touching line PR. (2 marks)
13. Solve the inequality sand state the integral values of x. (3 marks)
$$4 - 3x < x + 12 \leq \frac{-3x + 29}{2}$$
14. Determine the point of intersection of the lines $2x - 3y = 8$ and $x + 2y = -3$ using matrix method. (3 marks)
15. Use graphical method to solve the pair of simultaneous equations (3 marks)
$$2x + y = 3$$
$$5x + 3y = 7$$
16. Njoroge boarded a bus that took off at 9.45pm on a Sunday to visit his sister in Nairobi. The bus took 8 hours 20 minutes to arrive in Nairobi. After 10 minutes he took a taxi that took 42 minutes to arrive at his sister's home. Find the day and time in 24hr system when Njoroge arrived at his sister's home. (3 marks)

SECTION II (50 Marks)
Answer any five questions only in this section

17. The figure below ABCDEFGH is a frustum. The distance of the frustum is 2cm.
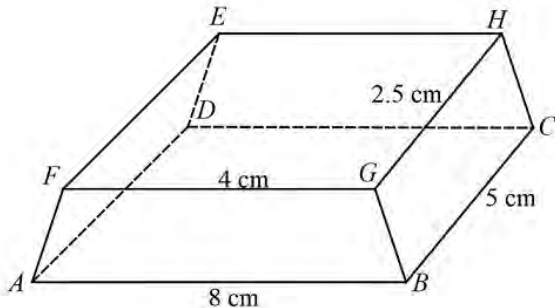
    Calculate
    a) The altitude of the pyramid (5 marks)
    b) The volume of the frustum (5 marks)

18. A line **L₁** with then equation $-mx + 2y = 3$ passes through the point $(-3, 1)$.
    Calculate;
    a) The value of **m** (2 marks)
    b) The angle the line makes with x – axis correct to 4 significant figures. (2 marks)
    c) The equation of line **L₂** parallel to **L₁** and passes through (2,6). Leave your answer in the form
$$\frac{x}{a} + \frac{y}{b} = 1.$$ (3 marks)
    d) The equation of the line **L₃** perpendicular to **L₁** at $(-3,1)$. Give your answer in the form $ax + by = c$ (3 marks)

19. The vertices of quadrilateral OPQR are O (0,0), $P(2, 0), Q(4, 2)$ and $R(0, 3)$. The vertices of its image under a rotation are $O'(1, -1), P'(1, -3) \ Q'(3, -5)$ and $R'(4, -1)$.

a) (i) On the grid provided, draw OPQR and its image $O'P'Q'R'$ (2 marks)
   (ii) By construction, determine the centre and angle of rotation. (3 marks)
b) On the same grid as (a) (i) above, draw $O''P''Q''R''$, the image of $O'P'Q'R'$ under a reflection in the line
   $y = x$ (3 marks)
c) From the quadrilaterals drawn, state the pairs that are:
   i. Directly congruent; (1 mark
   ii. Oppositely congruent (1 mark)

20. Below is a cylinder of diameter 21m in which a hole in the shape of a cuboid has been drilled through the centre as shown below.
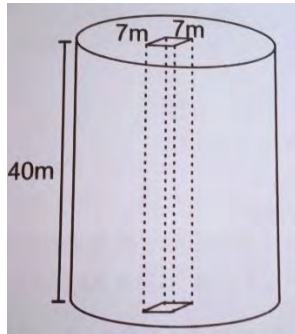
Given that the cylinder has a height of 40m
a) Determine the total surface area of the cylinder (7 marks)
b) Volume of the solid. (3 marks)

21. The table below shows the marks obtained by 40 students in an examination.

Marks	$5 - 14$	$15 - 29$	$30 - 34$	$35 - 44$	$45 - 49$
Frequency f	2	2	7	15	x

a) Find the value of x. (2 marks)
b) On a grid, draw a histogram to represent the data. (5 marks)
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c) By drawing a straight line on the graph, determine the median mark. (3 marks)

22. The figure below shows a triangular garden XZY. $XZ = 6cm$, $XY = 4cm$ and $angle\ XZY = 40°$.
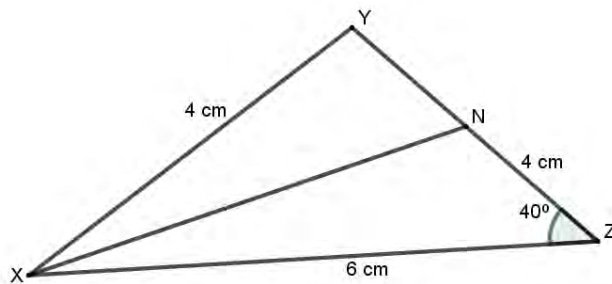
A point N lies on the line ZY such that $ZN = 4cm$. Find correct to 2 decimal places
   a) $\angle ZNX$ (3 marks)
   b) Length of ZY (3 marks)
   c) Length of NY (2 marks)
   d) Area of the garden (2 marks)

23. (a) Draw the graph of the function $y = 10 + 3x - x^2$ for $-2 \le x \le 5$ (4 marks)

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

(b) Use trapezoidal rule with 5 strips to estimate the area of the curve from $x = -1$ to $x = 4$
(2 marks)

(c) Use integration to find the actual area of the curve from $x = -1$ to $x = 4$. (2 marks)

(d) Find the percentage error of the estimated area to the actual area of the region correct to 2 decimal places
(2 marks)
`
24. The displacement of a particle after t seconds is given by $s = 40t^3 - t^2 - 3t + 3$.
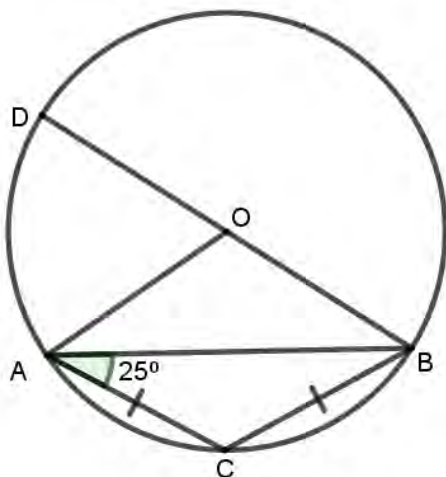Find
    a) Displacement of the particle when t = 2 (2 marks)
    b) The values of t when the particle is momentarily at rest (3 marks)
    c) The velocity when the particle is momentarily at rest (2 marks)
    d) The acceleration when the particle is momentarily at rest (3 marks)

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SECTION I (50 Marks)

1. Simplify giving $\dfrac{4}{5+\sqrt{2}}$ access free learning material by visiting www.freekcsepastpapers.com $\dfrac{3}{5-\sqrt{2}}$ your answer is surd form with a rational denominator.
(3 marks)

2. A shopkeeper mixes 3kg of beans costing Sh. 120 per kg and 6 kg of maize costing Sh. 60 per kg. At what price must he sell the mixture so as to make profit of 30%? (3 marks)

3. Three quantities Q, h and r are such that Q varies jointly with **h** and the square of **r**. When $h = 15$ and $r = 3$, $Q = 675$. Find
    a) An equation connecting Q, h and r (2 marks)
    b) The value of Q when $h = 12$ and $r = 4$ (1 mark)

4. In the figure below, O is the centre of the circle. BOD is the diameter. AC = BC and angle $BAC = 25°$.

Find the size of ∠AOD (2 marks)

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5. Solve the following simultaneous equations using substitution method (4 marks)

$$3x + 4y = 6$$
$$4x - 6y = 1$$

6. In a certain firm there are 6 men and 4 women employees. Two employees are chosen at random to attend a seminar. Determine the probability that a man and a woman are chosen. (3 marks)

7. Find the equation of the tangent to the curve $y = 6x^2 - x - 4$ at the point A (1, 1). (3 marks)

8. The figure below shows a sector of a circle.
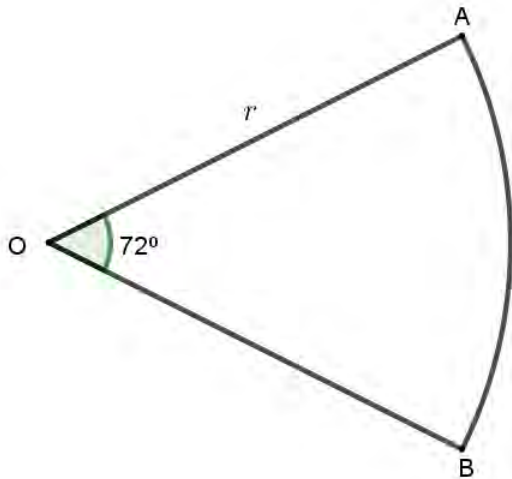
If the area is $30.8\ cm^2$, calculate the length of the arc AB. (2 marks)

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9. In a math's test the scores of eight form four students in a certain school were as follows
   $43, 48, 54, 55, 56, 57, 62, 65$ .Calculate the standard deviation of the scores (4 marks)

10. A triangle XYZ in which $XY = 12.4\ cm, YZ = 15.6\ cm\ and\ \angle XZY = 60°$ is inscribed in a circle. Calculate the radius of the circle correct to 1 decimal place. (2 marks)

11. The figure below shows a cuboid.
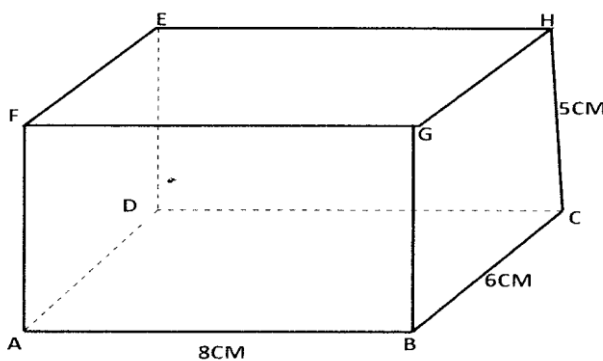
Calculate
   a) The length BE. (2 marks)
   b) The angle between BE and plane ABCD correct to (4 s.f) (2 marks)

12. For the last 5 years the value of a car has been depreciating at a constant rate of 12 % per annum. The present value of the car is Ksh 316 640. Calculate the value of the car at the beginning of the 5 year period
   (3 marks)

13. Find scalars **m** and **n** such that $m\begin{pmatrix} 4 \\ 3 \end{pmatrix} + n\begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$ (3 marks)

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

15. Find the value of x given that $2\log 15 - \log x = \log 5 + \log(x - 4)$ (4 marks)

16. A circle whose centre is at $(1, 3)$ has the x – axis as its tangent. Determine the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ where *a, b* and *c* are integers. (4 marks)

SECTION II (50 Marks)
Instruction: Answer any five questions in this section.

17. Three consecutive terms in a G.P are 3^{2x+1}, 9^x and 81 respectively.
    a) Calculate the value of x (2 marks)
    b) Find the common ratio of the series. (2 marks)
    c) Calculate the sum of the first 10 terms of the series. (3 marks)
    d) Given that the 5th and 7th terms of the G.P in (a) above form the first two consecutive terms of an A.P Calculate the sum of the 1st 20 terms of the A.P. (3 marks)

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

Taxable pay per month (KSh)	Tax rates (%)
$1 - 9680$	10
9681 – 18800	15
$18801\ - 27920$	20
$27921\ - 37040$	25
37041 and above	30

That year Kazembe paid a true tax of Ksh 5,212 per month. His total monthly taxable allowances amounted to Ksh 15,220 and he was entitled a monthly personal relief of K.sh 1,162 .Every month the following deductions were made

* NHIF   - Ksh 320
* UNION DUES   - Ksh 200
* CO-OPERATIVE SHARES   - Ksh 7500

    a) Calculate Kazembe's gross tax (1 mark)
    b) Calculate Kazembe's monthly basic salary in K.sh (6 marks)
    c) Calculate his monthly net salary (3 marks)

19. (a) Draw a circle centre O and radius 4 cm. (1 mark)
    (b) From any point A on the circumference, draw two chords AB = 7 cm and AC = 7.5 cm on the opposite sides of the centre. (2 marks)
    (c) Join B to C and locate the orthocenter (H) of triangle ABC. Join OH and measure OH (4 marks)
    (d) Use the midpoint of OH as the centre to inscribe a circle to triangle ABC and measure its radius. (3 marks)

20. The position of two towns X and Y are given to the nearest degrees as $X(45°N, 10°E)$ and $Y(45°N, 70°E)$.
    a) Find the difference in longitude (1 mark)
    b) The distance between the towns in:
       i. Kilometers (take the radius of the earth = 6371km and $\pi = \frac{22}{7}$) (3 marks)
       ii. Nautical miles (take 1 nautical mile to 1.853 km) (2 marks)
    c) The local time at X when the local time at Y is 2.00 pm (2 marks)
    d) Calculate the speed of the aeroplane moving from X to Y in; (2 marks)
       i. Km/hr
       ii. Knots

21. A soda manufacturing company supplies two types of drinks, Fanta and Coke. The total number of crates must not be more than 400.The company must supply more crates of Fanta than Coke. However the number of crates

of Fanta must not be more than 300 and the number of crates of coke must not be less than 80. Taking x to represent Fanta and y to represent Coke,

a) Write down all inequalities representing the given information (4 marks)
b) Represent the inequalities on the grid provided (4 marks)
c) The profit obtained was as follow
   Fanta Sh. 300 per crate
   Coke Sh. 200 per crate
   i. Use the graph to determine the number of crates of each type that should give maximum profit (1 mark)
   ii. Calculate the maximum profit (1 mark)

22. (a) Complete the table below for the functions $y = 2\cos x$ and $y = \sin 2x$ for $-180° \le x \le 180°$ (2 marks)

$x°$	$-180°$	$-150°$	$-120°$	$-90°$	$-60°$	$-30°$	$0°$	$30°$	$60°$	$90°$	$120°$	$150°$	$180°$
$2x°$	$-360°$	$-300°$				$-60°$			$120°$			$300°$	
$2\cos x$			-1		1				1				-2
$\sin 2x$	0				-0.87			0.87			-0.87		

(b) On the grid provided, on the same axis draw the graphs $y = 2\cos x$ and $y = \sin 2x$ for $-180° \le x \le 180°$ (4 marks)

(c) Use the graphs in (b) above to find;
   i) The value of x such that for $2\cos x - \sin 2x = 0$ (1 mark)
   ii) State the amplitude and period of the graph $y = 2\cos x$ (2 marks)
   iii) Find the difference in value of y when $x = -45°$. (1 mark)
   iv)

23. The diagram below shows triangle OAB in which N is the mid-point of AB and M is a point on OA such that OM: MA $= 2:1$.

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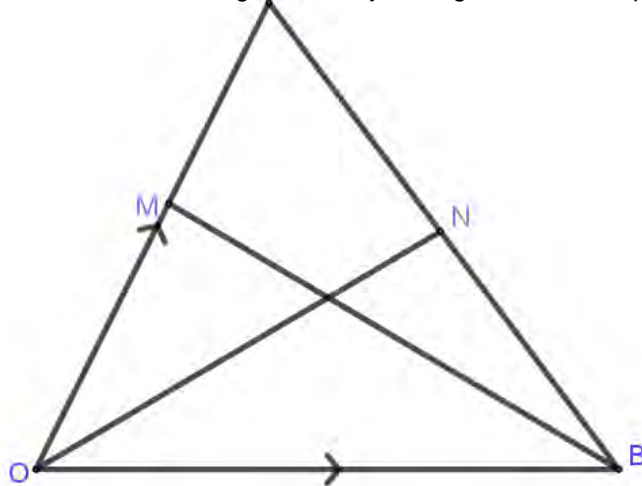
Given that $\overrightarrow{OA} = \breve{a}$ and $\overrightarrow{OB} = \breve{b}$.
a) Express in terms of $\breve{a}$ and $\breve{b}$.
   i) $\overrightarrow{AB}$ (1 mark)
   ii) $\overrightarrow{ON}$ (2 marks)
   iii) $\overrightarrow{BM}$ (1 mark)
b) Lines ON and BM meet at X such that $OX = hON$ and $MX = kMB$ where h and k are constants.
   i) Express OX in terms of $\breve{a}, \breve{b}$ and h. (1 mark)
   ii) Express OX in terms of $\breve{a}, \breve{b}$ and k. (1 mark)
   iii) Hence find the value of h and k. (3 marks)
c) Find the ratio OX: XN. (1 mark)

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24. A triangle with vertices at P(1,1) , Q(-3,2) and R (0,3) is transformed by a matrix $\begin{bmatrix} 3 & 0 \\ 1 & 2 \end{bmatrix}$ to triangle P'Q'R'.

   a) Determine the coordinates of the image   (2 marks

   b) On the grid provided draw the object and the image   (2 marks)

   c) *P'Q'R'* is then transformed by the transformation with the matrix $\begin{bmatrix} \frac{2}{3} & 0 \\ -\frac{2}{3} & 2 \end{bmatrix}$ to *P"Q"R"* .Find the coordinates

   of *P"Q"R"* and draw *P"Q"R"*   (3 marks)

   d). Find a single matrix which maps PQR onto P''Q''R''   (3 marks).

SAMIA SUB-COUNTY JOINT EVALUATION TEST-2021
121/1
MATHEMATICS ALT. A
DEC – 2021

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)

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

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 the points A (2, 6) and B (4, 0)
   (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)
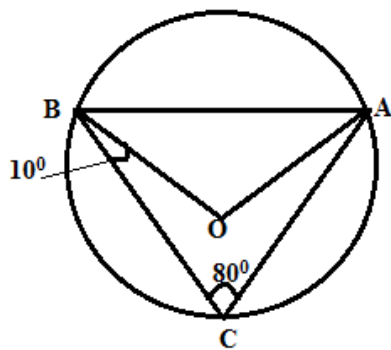
10. The table below shows speeds of vehicles measured to the nearest 10km/h as they passed a certain point.

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.
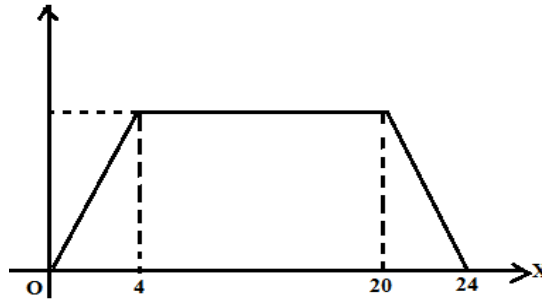
(a) Find the total distance travelled by the car (2 mks)
(b) Calculate the deceleration of the car. (2 mks)

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≤ x ≤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 turningpoint. (1 mark)

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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^{1}B^{1}C^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.

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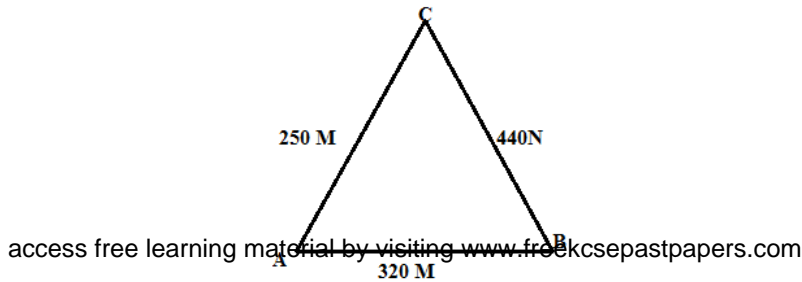
    (a) Calculate the size angle BAC. (2 mks)
    (b) Find the area of the farm in hectares. (3 mks)
    (c) Ombati wishes to irrigate his farm using a sprinkler machine in the farm such that it is equidistant from points A. B and C.
    (i) The sprinkler rotates in a circular motion so that the maximum 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^{0}C.
    (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)

SAMIA SUB – COUNTY JOINT EXAMINATIONS
121/2
MATHEMATICS PAPER 2
DECEMBER – 2021

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 π = 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.
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    (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

O

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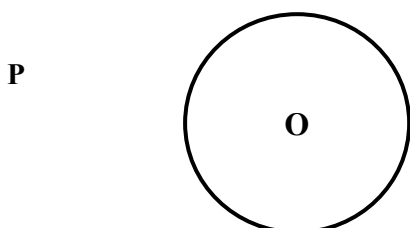
14. Given that $\dfrac{3 + 3\sqrt{5}}{3 + \sqrt{5}}$ $3 - \sqrt{5} = a + b\sqrt{5}$. Find the values of a and b. (3mks)

15. In the figure below angle CBD = 37^0, angle BCD = 20^0 and ABC is a tangent to the circle at B.

B.
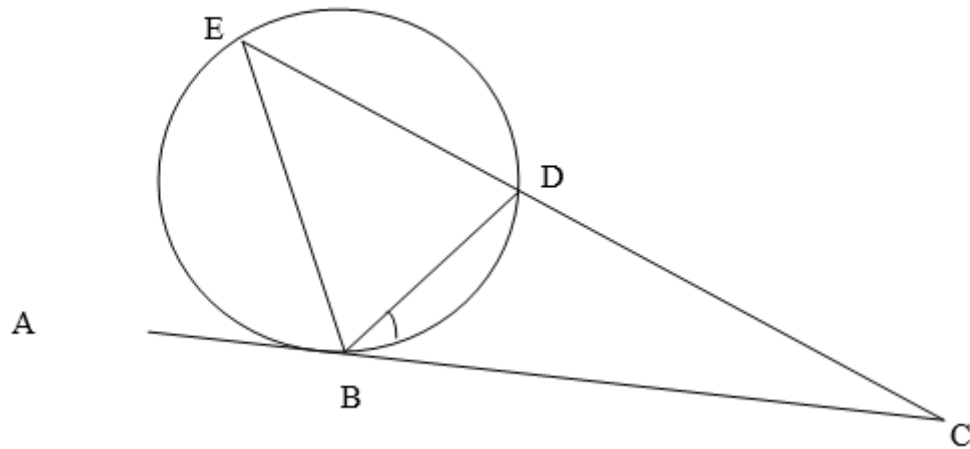
(a) Find:
(i) Angle BED (2mks)
(ii) Angle ABE (2mks)

16. A transformation is represented by the matrix $\begin{vmatrix} 1 & 3 \\ 4 & 2 \end{vmatrix}$. This transformation maps a triangle

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ABC of the area 12.5cm^2 onto another triangle ABC of the area 12.5cm^2 onto another triangle A^{1}B^{1}C^1. Find the area of triangle A^{1}B^{1}C^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 **A^{1}B^{1}C^1** and **D^1** respectively
a) Draw **ABCD** and its image **A^{1}B^{1}C^{1}D^1** (4mks)

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

Plot **A^{11}B^{11}C^{11}D^{11}** on the same graph. (3mks)
c) Determine the matrix of a single transformation that maps **A^{11}B^{11}C^{11}D^{11}** onto **ABCD**. (3mks)

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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.**
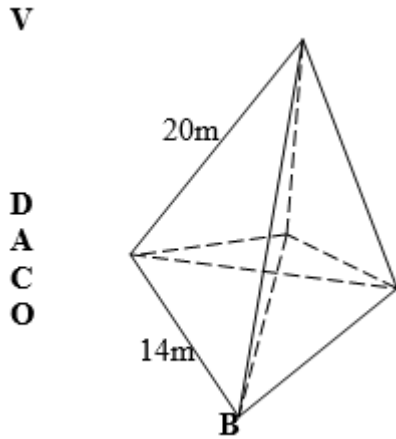
Find;
    a) The lengths of **BO, VO** and **VN**   (3mks)
    b) The angle between **VO** and plane **VBC**   (3mks)
    c) The angle between **VB** and base **ABCD**   (2mks)
    d) The angle between **VDC** and **VBC**   (2mks)

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 50th percentile   (3mks)
    iii)   The standard deviation of the marks   (4mks)
20. (a) Complete the table for the function y = ½ Sin2x, where $0^0 \leq x \leq 360^0$.   (2mks)

x	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 Sin2x 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 Sin2x.   (2mks)
    (d) Use the graph to solve
        (i) ½ $Sin2x^0$ = 0   (1mk)
        (ii) ½ Sin $2x^0$ – 0.5 = 0   (2mks)

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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 3rd, 5th and 8th 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)

NAMBALE DIOCESE JOINT EVALUATION
121/1
MATHEMATICS PAPER 1

SEC I: (50 marks)
Answer all questions in this section

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

$$\frac{(-16)-36}{18\div(-6)-10} - \frac{4(-17+5)}{8}$$

2. Three metal rods of lengths 234cm, 270cm and 324cm were cut into short pieces all of the same length to make window grills. Calculate the length of the longest piece that can be cut from each of the rods and hence the total number of pieces that can be obtained from the rods. (3mks)

3. A point P has the coordinates (1, 2, 3). If **PQ** = 5**i** + **j** + 2**k** , find.
    (a)   the coordinates of point Q. (2mks)
    (b)   the modulus of **PQ**. (1mk)

4. The size of an exterior angle of a regular polygon is $3\frac{1}{2}$ times that of its exterior angle. Determine the sum of interior angles of the polygon. (4mks)

5. Evaluate using square root, reciprocal and square tables only. (3 mks)

$$\frac{1}{\sqrt{0.7235}} - \frac{1}{10.56}$$

6. Solve for x and y in the following equations (4mks)
    $2^x + 3^y = 59$
    $2^{x+3} - 3^{y+2} = 13$

7. Solve the inequalities and represent the solution on number line. (3mks)
    $3x - 9 < 5x + 3 \le 2x - 6$ ccess free learning material by visiting www.freekcsepastpapers.com

8. A Kenyan bank buys and sells foreign currencies as shown below.

	Buying (ksh)	**Selling (ksh)**
1 Sterling pound (£)	130.10	130.54
1 South African Rand	9.52	9.58

A businessman on a trip to Kenya had £50000 which he converted to Kenya shillings .While in Kenya he spent 80% of the money and changed the remaining amount to South African Rand.Calculate to the nearest Rand the amount he received. (3mks)

9. Simplify the expression (3mks)
    $$\frac{2x^2 - 3xy - 2y^2}{4x^2 - y^2}$$

10. The volumes of two similar cans are 125cm³ and 216cm³ respectively. If the base area of the smaller can is 75cm², find the base area of the larger can. (3 marks)

$$(\text{Take } \pi = \frac{22}{7}).$$

11. Find the perimeter of the figure below to 4 s.f. (3 marks)
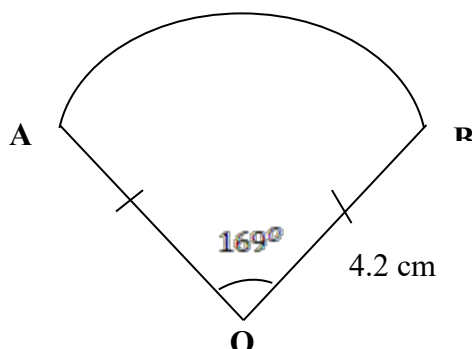
12. Thirty men working at the rate of 10 hours a day can complete a job in 14 days. Find how long it would take 40 men working at the rate of 7 hours a day to complete the same job. (3mks)

13. The curved surface area of a cylindrical container is 1980cm^2. If the radius of the container is 21cm, calculate to one decimal place the capacity of the container in litres (3 mks)

14. In the figure below PQRS is a rhombus, $\angle SQR = 55°$, $\angle QST$ is a right angle and TPQ is a straight line.

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Find the size of the angle STQ. (3 marks)

15. From a viewing tower 30metres above the ground, the angle of depression of an object on the ground is 30^0 and the angle of elevation of an aircraft vertically above the object is 42^0.Calculate the height of the aircraft above the ground to the nearest whole number (3mks)
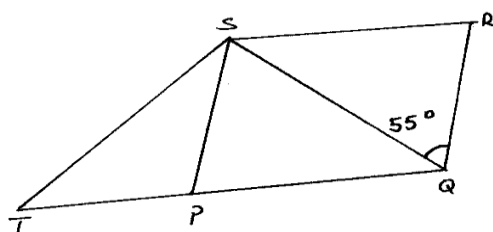
16. Joan earns a commission of 3% on sales up to sh. 150000. She gets an additional commission of 1.5% on any sales above this. In one month she sells goods worth sh. 385000 at a discount of 2%. Calculate the amount of commission she received. (3mks)

SEC. II: (50 marks)
Answer ONLY FIVE questions from this section

17. A straight line L_1 passes through the points P (5, 2) and Q(3, 4).
    (a) Find the equation of L_1 in the form **ax +by+ c = 0** where *a*, *b* and *c* are integers. (3 mks)
    (b) A line L_2 passes through a point R (0 ,3) and is perpendicular to L_1.
        (i) Find the equation of L_2 in the form **y= m x+ c** where *m* and *c* are constants. (2 mks)
        (ii) Determine the point of intersection between L_1 and L_2. (3 marks)
    (c) Another line L_3 is parallel to L_1 and passes through R. Find the x – intercept of L_3. (2 marks)

18. 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 14cm and ∠AOB=120°. $(\pi = \frac{22}{7})$
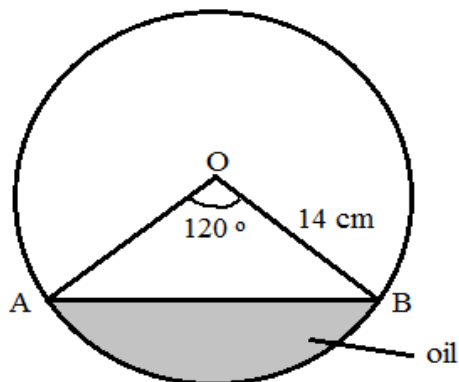
Calculate to 2 d.p:
i)   The length of chord AB.   (2 marks)
ii) The area of segment ACB.   (3 marks)
iii) The volume of oil in the tank in m³.   (2 marks)
iv) The area of the tank in contact with the oil in cm².   (3 marks)

19. A bus travels from Nairobi to Kisumu a distance of 320 km at a speed of x km/hr. If the speed is reduced by 20km/hr the bus would take 48 minutes more.
    (a) Form an equation to represent the given information and hence find the speed of the bus (5mks)
    (b) Determine the time taken by the bus for the whole journey   (1mk)
   (c) Another car left Kisumu at 8.00 a.m. and travelled along the same road to Nairobi at an average speed of 80km/h. If the bus left Nairobi at 9.00 a.m, determine the time when the vehicles met.   (4mks)
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20. Four towns P, R, T and S are such that R is 80km directly to the north of P and T is on a bearing of 290° from P at a distance of 65km. S is on a bearing of 330° from T and a distance of 30 km. Using a scale of 1cm to represent 10km, make an accurate scale drawing to show the relative position of the towns.   (3mks
    Find:
    (a) The distance and the bearing of R from T   (3mks)
    (b) The distance and the bearing of S from R   (3mks)
    (c) The bearing of P from S   (1mk)

21. a) Triangle ABC has the vertices $A(-2, -2), B(-2, -5)$ and $C(-5, -4)$. Draw ΔABC on the graph paper provided.   (1 mark)
    b) $\Delta A'B'C'$ is the image of ΔABC under reflection in the line $x + y = 0$. Draw triangle $A'B'C'$ on the same axes and state its coordinates.   (3 marks)
    a) $\Delta A''B''C''$ is the image of $\Delta A'B'C'$ under a positive quarter turn about the origin. Draw $\Delta A''B''C''$ on the same axes and state its coordinates.   (3 marks)
    b) $\Delta A'''B'''C'''$ is the image of $\Delta A''B''C''$ under an enlargement centre $(0,0)$ and scale factor -1. Draw $\Delta A'''B'''C'''$ and state its coordinates.   (3 marks)

22. The figure below represents a model of a solid structure in the shape of a frustrum of a cone with a hemispherical top. The diameter of the hemispherical part and the top of the frustrum is 70cm. The frustrum has a base diameter of 28cm and slant height of 60cm.
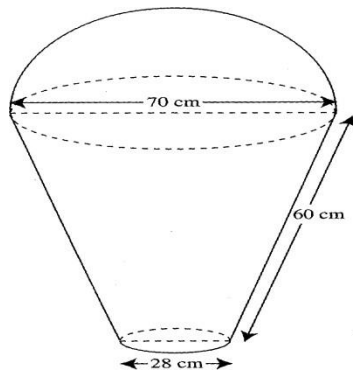
Calculate:
(a) The area of the hemispherical surface. (2mks)
(b) The slant height of the cone from which the frustrum was cut. (2mks)
(c) The curved surface area of the frustrum. (2mks)
(d) The area of the base. (2mks)
(e) The total surface area of the model. (2mks)

23. Fifty three seedlings were uprooted from a nursery and their heights measured to the nearest centimeter and recorded in the given table.

Height (cm)	Frequency
13 -15	4
16- 18	7
19 – 21	11
22 – 24	15
25 – 27	6
28 – 30	5
31 – 33	2

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Calculate:
(a) (i) The mean height of the seedlings (3mks)
   (ii) The median height of the seedlings (3mks)
(b) Draw a histogram and hence a frequency polygon to represent the above data (4mks)

24. In the figure below PQRS is a cyclic quadrilateral. Given that TPX is a tangent at P and O is the centre of the circle. RQX is a straight line with angle RPQ = 50⁰, and angle PRS = 25⁰.
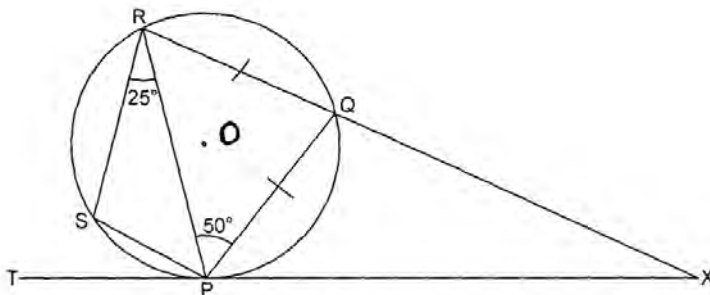
Giving reasons in each case, find:
a)   Angle PRQ (2mks)
b)   Angle PSR. (2mks)
c)   Angle PXQ (2mks)
d)   Angle TPS (2mks)
e)   Angle POS (2mks)

ACK NAMBALE DIOCESE EXAM
121/2
MATHEMATICS (ALT A)-PAPER 2

SECTION I (50MARKS)
*Answer **ALL** the questions in this section in the spaces provided.*

1. Use logarithm tables to evaluate $\sqrt[3]{\dfrac{0.4239 \times 149.6}{\log 6}}$ (3 marks)

2. Without using a calculator or mathematical table evaluate $\dfrac{2\tan 60^0}{\sin 45^0 - \cos 30^0}$ leaving your answer in simplified form. (3 marks)

3. Expand $(1 + \dfrac{1}{2}x)^{10}$ up to the term in x^3 in ascending powers of x .Hence find the value of $(1.005)^{10}$ correct to four decimal places. (3 marks)

4. Solve for x in the equation
   $2\log_{10}x + \log_{10}5 = 1 + 2\log_{10}4$ (3marks)

5. In the figure below OS is the radius of a circle centre O. Chords SQ and TU are extended to meet at P and OR is perpendicular to QS at R. OS = 61 cm, PU = 50 cm, UT = 40 and PQ = 30cm.

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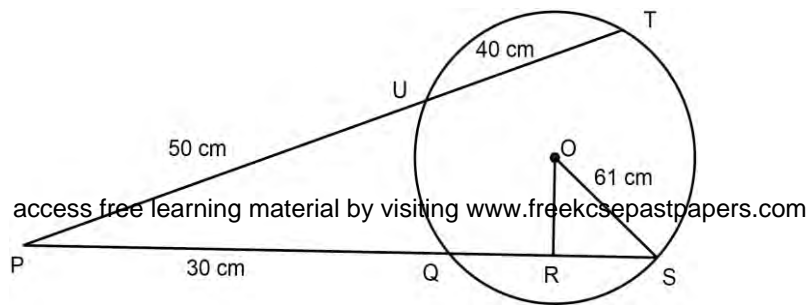
   Calculate the length of
   a) QS (2 marks)
   b) OR to 2 decimal places (2 mark)
6. Simplify as far as possible leaving your answer in surd form (3marks)
   $$\frac{1}{\sqrt{14} - 2\sqrt{3}} - \frac{1}{\sqrt{14} + 2\sqrt{3}}$$

7. In the figure below angle A=68^0, B= 39^0, BC= 8.4cm and CN is the bisector of angle ACB. Calculate the length CN to 1decimal place. (3 marks)

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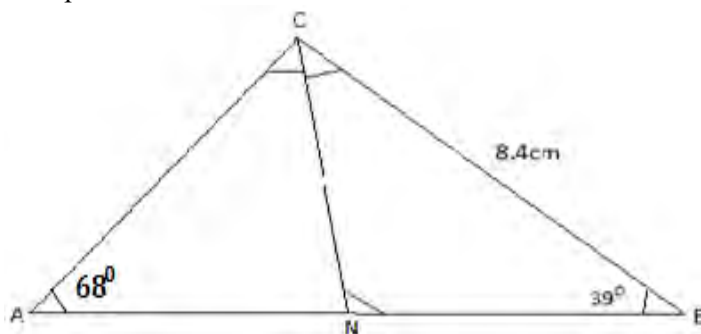8. Given that the matrix $\begin{pmatrix} x & -3 \\ 0 & x-1 \end{pmatrix}$ is a singular matrix, find the values of x.   (3marks)

9. Make x the subject of the equation   (3 marks)

$$\frac{t}{s} = \frac{b}{\sqrt{x-4}}$$

10. The equation of the circle is given by $x^2 + y^2 + 8x -2y -1 = 0$. Determine the radius and the centre of the circle.   (4marks)

11. A coffee blender mixes 6 parts of type A with 4 parts of type B. if type A cost him sh. 24 per kg and type B cost him sh. 22 per kg, at what price per kg should he sell the mixture in order to make 5% profit. Give your answer to 2 decimal places   (3marks)

12. Musau invested a sum of money which earned him 10% compound interest in the first year. In the second year, the investment earned him 20% compound interest and in the third year, it earned him 25% compound interest. At the end of the three years, the investment was worth sh. 11,550,000. What sum did he invest.   (3marks)

13. Line AB is 8cm long. On the same side of line AB draw the locus of point P such that the area of triangle APB is 12cm^2 and angle APB=90^0 (3marks)

14. In a class of 20 students, there are 12 boys and 8 girls. If two students from the class are chosen at random to go to trip, what is the probability that both of them are boys   (3marks)

15. After transformation T represented by the matrix $\begin{pmatrix} 2 & 1 \\ 0 & 1 \end{pmatrix}$, the triangle ABC was mapped onto triangle $A_1B_1C_1$ where A_1,B_1,C_1 had coordinates (2,0), (4,0) and (4,6) respectively. Determine the coordinates A, B, and C (3marks)

16. The length and breadth of a rectangular floor were measured and found to be 4.1m and 2.2m respectively. If a possible error of 0.01m was made in each of the measurements; find the:
   (a) Maximum and minimum possible area of the floor   (2marks)
   (b) Maximum wastage in the carpet ordered to cover the whole floor.   (1mark)

SECTION II (50 MARKS)
Answer ANY FIVE questions only in this section
17. complete the table below, giving the values correct to 2 decimal places   (2mks)

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
Cos 2X^0	1.00	0.87		0.00	-0.5		-1.00		-0.5	0.00	0.50	0.87	1.00
Sin (X^0+30^0)	0.50	0.71	0.87	0.97	1.00		0.87	0.71	0.50		0.00		-0.50

   (ii) Using the grid provided draw on the same axes the graph of y=cos 2X^0 and y=sin(X^0+30^0) for $0^0 \le X \le 180^0$.   (4mks)
   (iii) Find the period of the curve y=cos 2x^0 (1mk)
   (iv) Using the graph, estimate the solutions to the equations;
       (a) sin(X^0+30^0)=cos 2X^0 (1mk)
       (b) Cos 2X^0=0.5   (1mk)
18. A Quantity P varies partly as the square of m and partly as n. When p= 3.8, m = 2 and n = -3, When p = - 0.2, m = 3 and n= 2.
   a) Find
       i) The equation that connects p, m and n   (4marks)
       ii) The value of p when m = 10 and n = 4   (1mark)
   b) Express m in terms of p and n   (2marks)
   c) If P and n are each increased by 10%, find the percentage increase in m correct to 2 decimal place.   (3marks)

19. The 5th term of an AP is 16 and the 12th term is 37.
    Find;
    i) The first term and the common difference (3 marks)
    ii) The sum of the first 21 terms (2 marks)
    b) The second, fourth and the seventh term of an AP are the first 3 consecutive terms of a GP. If the common difference of the AP is 2.
    Find:
    c) The common ratio of the GP (3 marks)
    d) The sum of the first 8 terms of the GP (2 marks)

20. The table below shows the rates of taxation in a certain year.

Income in K£ pa	Rate in Ksh per K£
1 – 3900	2
3901 – 7800	3
7801 – 11700	4
11701 – 15600	5
15601 – 19500	7
Above 19500	9

In that period, Juma was earning a basic salary of sh. 21,000 per month. In addition, he was entitled to a house allowance of sh. 9000 p.m. and a personal relief of ksh.1056 p.m He also has an insurance scheme for which he pays a monthly premium of sh. 2000. He is entitled to a relief on premium at 15% of the premium paid.
    (a) Calculate how much income tax Juma paid per month. (7mks).
    (b) Juma's other deductions per month were cooperative society contributions of sh. 2000 and a loan repayment of sh. 2500. Calculate his net salary per month. (3mks)

21. A cupboard has 7 white cups and 5 brown ones all identical in size and shape. There was a blackout in the town and Mrs. Kamau had to select three cups, one after the other without replacing the previous one.
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    (a) Draw a tree diagram for the information. (2mks)
    (b) Calculate the probability that she chooses.
        (i) Two white cups and one brown cup. (2mks)
        (ii) Two brown cups and one white cup. (2mks)
        (iii) At least one white cup. (2mks)
        (iv) Three cups of the same colour. (2mks)

22. The 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 (4mks)
        (ii) the standard deviation of the distribution (3mks
    (b) Calculate the quartile deviation (3mks)

23. The position of town A and B on the earth's surface are (36^{0}N, 49^{0}E) and (36^{0}N, 131^{0}W) respectively.
    (a) Find the difference in longitude between town A and town B (2marks)
    (b) Given that the radius of the earth is 6370km, calculate the distance between town A and B along;
        (i) Parallel of longitude (2marks)
        (ii) A great circle (3marks)
    (c) Another town C is 840km east of town B and on the same latitude as town A and B. find the longitude of town C (3marks)

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

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

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

(c) The profits were as follows;
Type A: sh. 600 per shirt
Type B: sh. 400 per shirt

(i) Use the graph to determine the number shirts of each type that he should make to maximize the profit
(1mark)

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

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GATUNDU SOUTH SUB COUNTY TRIAL EXAMINATIONS 2021
MATHEMATICS 121/1
PAPER 1
DECEMBER 2021

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

1. Evaluate without using a calculator: (3 marks)
$$\frac{-12 \div (-3) \times 4 - (-15)}{-5 \times 6 \div 2 + (-5)}$$

2. Mbogo and wanjiku stand on opposite sides of a vertical tower 60m high. The angle of elevation of the top of the tower from Mbogo and Wanjiku are 75^0 and 65^0 respectively. Calculate the distance between Mbogo and Wanjiku. (3 marks)

3. Find the integral values of the inequalities $x \le 2x + 7 \le {}^{-1}/_3x + 14$ hence represent the solution on a number line. (3mks)

4. The position vectors of A and B are given as $\mathbf{a} = 2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$ and $\mathbf{b} = -2\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ respectively.
   Find to 2 decimal places, the length of vector **AB**. (3 Marks)

5. 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) (3 marks)

6. A salesman is paid a salary of sh. 25,000. He gets a commission of 3.5% on sales above sh. 100,000 and an additional 1.5% if the sales exceed sh. 500,000. In the month of December the salesman received earnings totaling sh. 61,500. Calculate the total sales he made that month. (3 marks)

7. Express 1.26565…. as a fraction in the simplest form. (3 marks)

8. The sum of interior angles of a regular polygon is twelve times its exterior angle. Find the number of sides of the polygon and na̶ṁ̶e̶ t̶h̶e̶ p̶o̶l̶y̶g̶o̶n̶. access free learning material by visiting www.freekcsepastpapers.com (4 marks)

9. Elsie bought 4 newspapers and 3 magazines at a total cost of sh. 425. If she had bought 2 newspapers more and 1 magazine less, she would have spent sh. 25 less. Find the cost of 1 newspaper and 1 magazine. (3 marks)

10. A woman is now five times as old as her son. In five years time she will be three times as her son. Find their present ages. 3mks

11. The diagram below represents a cylindrical water bucket with a top diameter of 70cm and a bottom diameter of 56 cm. The water bucket is in the shape of a frustum of height 40 cm.
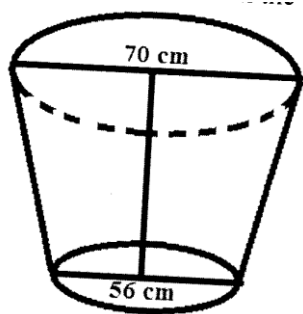
Calculate the volume of the water bucket. (4 marks)

12. Without using mathematical tables or calculation, evaluate: (3mks)

$$27^{\frac{2}{3}} + \left(\frac{81}{16}\right)^{-\frac{1}{4}}$$

13. An exchange bank in Kenya buys and sells foreign currencies as is shown in the table **below**;

|	Buying price (Ksh)	Selling price (Ksh)
1 US dollar	89.42	90.83
1 Sterling pound	133.45	136.78

An American tourist came to Kenya from New-York with 15,000 US dollars. He converted the whole amount into Ksh. and then spent Ksh.650,000. He then converted the remaining money into sterling pounds. Calculate to the nearest pounds the amount of money he remained with. (3 marks)

14. Simplify fully the expression (3mks)

$$\frac{6x^2 - 9xy - 6y^2}{8x^2 - 2y^2}$$

15. Jane spends 1/8 of her monthly salary on school fees and a third of the remainder on rent .She spends 3/4 of what remains after paying school fees and rent on food. If she is left with Ksh.1470, calculate her monthly salary. (3mks)

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

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Time (seconds)
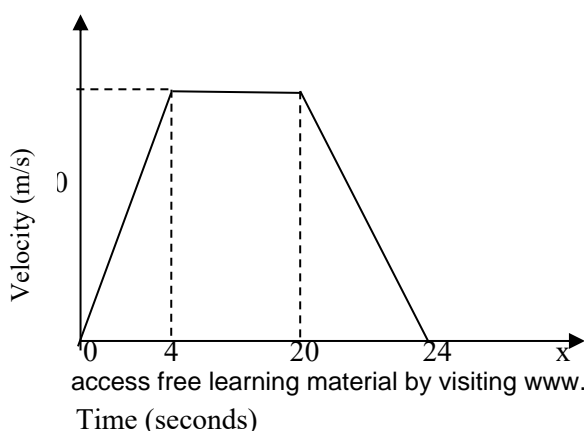
(a) Find the total distance traveled by the car. (2mks
(b) Find the deceleration of the car (1mks)

SECTION II
Answer any FIVE questions from this section

17. The figure below shows a sketch of a curve $y = 3x^2 - 5x + 8$ from $x = -4$ to $x = +2$
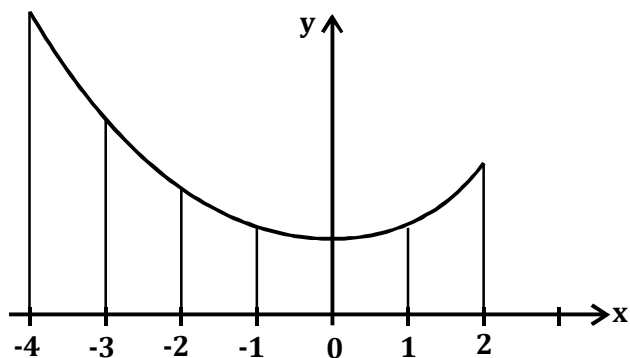
a) Use the mid ordinate rule with 6 strips to estimate the area between the curve, the x-axis and line x=-4 and x = +2 (4 mks)
b) Use integration to find the exact are in (a) above. (3 mks)
c) Calculate to 4s.f the percentage error in area estimated by the mid ordinate rule. (3 mks)

18. A group of people planned to contribute equally toward water project which needed Ksh. 2,000,000 to complete. However, 40 members of the group withdraw from the project. As a result each of the remaining members were to contribute Ksh. 2500 more.

(a) If the original number of people was X, write an expression of how much each was originally going to contribute. (1 mk)

(b) Write down an expression of how much each contributed after the 40 members pulled out. (1 mks)

(c) Calculate how much each member contributed. (3 mks)

(d) Forty five percent of the value of the project was funded by the constituency development fund(CDF), Calculate the amount of the contribution that would be made by each of the remaining members (3mks)

(e) Members contribution were in terms of labour provided and money contributed. If the rate of the value of labour to the money contribution was 6:9, Calculate the total amount of money contributed by the members (2mks)

19. In the figure below OAB is a triangle in which M divides OA in the ratio 2:3 and N divides OB in the ratio 4:1. AN and BM intersects at X.
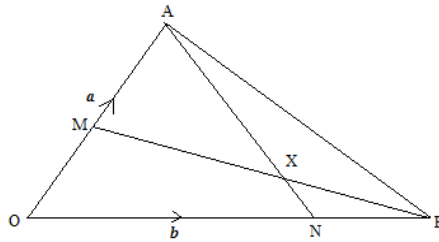
a) Given that $OA = a$ and $OB = b$ express in terms of a and b.

   i) **AN** (1 mk

   ii) **BM** (1mk)

   iii) **AB** (1mk)

b) If $AX = sAN$ and $BX = tBM$ where s and t are constants

   i) Write two expressing for **OX** in terms of a, b, s and t. (2mks)

   ii) Find the value of s and t, and hence express **OX** in terms of a and b. (5marks)

20. The diagram below shows a solid triangular prism whose dimensions are as shown.
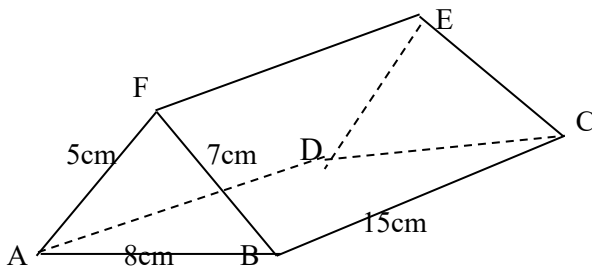
Calculate to one decimal place;

(i) (a) The total surface area of the prism. (3 mks)

   (b) The volume of the prism. (2 mks)

   (c) The size of the angle between the planes ADEF and ABCD. (3 mks)

(ii) If the prism was to be melted down to form solid spheres of radius 2cm, how Many full such spheres would be made. (2 mks)

21. Four towns **W, A, N** and **G** are such that **W** 16km from **A** on a bearing of 158°, **N** is to the west of **A** and 20km away while **G** is to the South of **N** and on a bearing of 240° from **W**.

(a) Using a scale of 1:400,000 draw a scale diagram showing the relative positions of the four schools. (5mks)

(b) Using your diagram determine the distance and bearing of **G** from **A** (2mks)

(c) Using your diagram determine:

   i) the bearing of **G** from **A** (2mks)

    ii)   the distance from G to A   (1mark)

    iii) the distance from G to W.   (1mark)

    iv) The distance from N to G.   (1mark)

22. A trader bought 2 cows and 9 goats for a total of Ksh. 98,200. If she had bought 3 cows and 4 goats, she would have spent Ksh. 2, 200 less.

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

 (b) Use the matrix method to determine the cost of a cow and that of a goat.   (4ks)

 (c) The trader later sold the animals she had bought making a profit of 30% per cow and 40% per goat.

    i)   Calculate the total amount of money she received.   (2mks)

    ii)   Determine corrects to 4 significant figures the percentage profit the trader made from the sale of animals.   (2mks)

23. Draw the graph of $y = -2x^2 - 7x + 4$ for the range $-5 \leq x \leq 1$ (5mks)

    Use a scale of 1cm for 1 unit along the x-axis and 1cm for 2 units along the y-axis

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

 (a) Maximum value of y   (1mks)

 (b) Roots of $-2x^2 - 7x + 4 = 0$ (2mks)

 (c) Solutions to the equations below using the graphing.

       (i) $-2x^2 - 7x + 4 = -3$ (2mks)

24. The figure below shows two intersecting circles with centres A and C, of radius 5cm and 8cm respectively. The common chord EF = 6c

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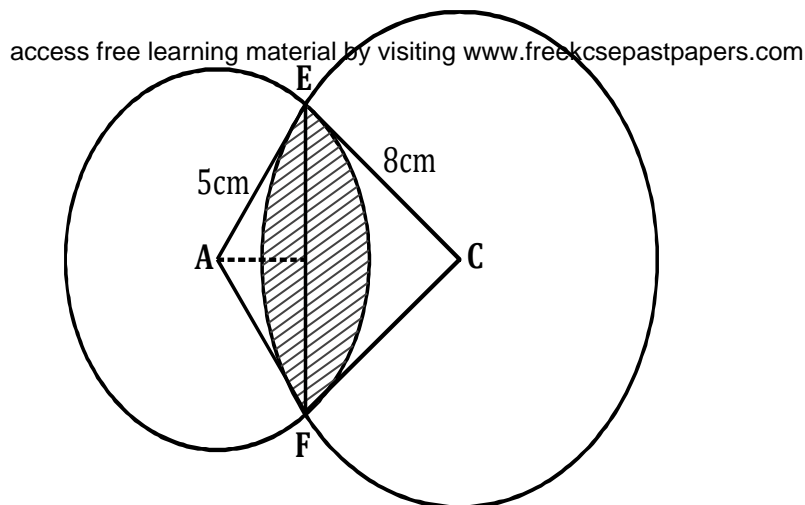
Calculate

a) Angle EAF   (2 marks)

b) Angle ECF   (2 marks)

c) Calculate the common area between the two intersecting circles.   (6 marks)

GATUNDU SOUTH SUB-COUNTY EXAMINATIONS
121/2
MATHEMATICS PAPER TWO

SECTION I (50Mks)
Attempt ALL Questions from this section

1. Use logarithms to evaluate: (4marks)

$$\sqrt[3]{\frac{(0.0246)^2 \times 142}{0.02 \times 1.14}}$$

2. Make x the subject of the formula   3mks

$$P = \sqrt{\frac{x + 2w}{4x + 3R}}$$

3. Expand $(1 + 2x)^7$ up to x^3, hence use the expansion to estimate the value of $(1.02)^7$ correct to four decimal places.   3mks

4. Simplify $\frac{\sqrt{7}}{3 - \sqrt{7}}$ (2 marks)

5. Draw line MN= 8cm. On one side of MN, draw the locus of a point P such that the area of triangle MPN is $12cm^2$. On the locus of P, locate two points T and R such that $< MTN = <MRN = 90^0$.   4mks

6. Given x = 13.4cm and y=4.3cm. calculate the percentage error in $^x/_y$ correct to 4 d.   3mks

7.   Tap A can fill a bath in 4min. Tap B can fill the same bath in 6 min and tap C can empty the bath in 8min. Calculate how long it would take to fill the bath if all the taps were left running.   (3marks

8. In the figure below QT is a tangent to a circle at Q. PXRT and QXS are straight lines. PX = 6cm, RT = 8cm, QX= 4.8CM   access free learning material by visiting www.freekcsepastpapers.com
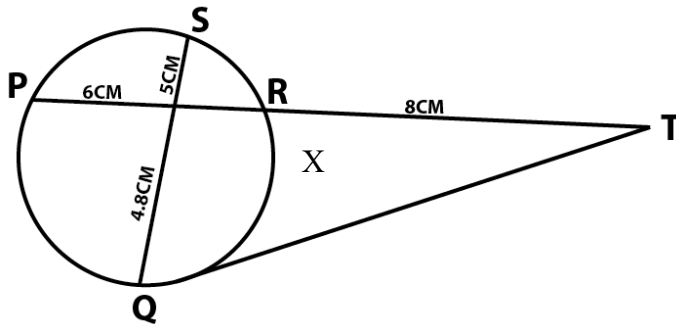
Find the length of
  a. XR   2mks
  b. QT   2mks

9. The length and width of a rectangle are (3x -12) cm and (x - 4) cm respectively. If its area is 108 cm^2, determine its perimeter.   (3 marks

10. A circle whose equation is $(x -1)^2 + (y – k)^2 = 10$ passed through point (2, 5). Find the coordinates of the two possible centres of the circle.   3mks

11. Find the value of x given that $log\ (x + 24) – 2\ log\ 3\ =\ log\ (9 – 2x).$ (3 marks)

12. Use reciprocal tables to find the value of f given that $\frac{1}{f} = \frac{1}{11} + \frac{2}{13}$ (3marks)

13. A container of height 90cm has a capacity of 4.5L. What is the height of a similar container of volume 9cm³.   3mks

14. Akili bought maize and beans from a wholesaler. She then mixed the maize and beans in the ratio 4:3. She bought the maize at Ksh 21 per kg and the beans 42 per kg. If she was to make a profit of30%. What should be the selling price of 1 kg of the mixture (3 marks)

15. Solve for θ given that θ is acute and sin $(3\theta - 50^\circ)$ – Cos $(20 + 10^\circ) = 0$ 3mks

16. The points P, Q, R and S have position vectors 2**p**, 3**p**, **r** and 3**r** respectively, relative to an origin O. A point T divides **PS** internally in the ratio 1:6. Show that the points Q, T, and R lie on a straight line.   (4 marks)

SECTION II (50mrks)
Attempt any FIVE questions from this section

17. In a retail shop, the marked price of a computer is Ksh 40,000. Kyoto bought it on hire purchase terms at Ksh 56,000. He paid a deposit of 25% of the hire purchase price and cleared the balance by equal monthly installments of Kshs 2625.
a. Calculate the number of installments he paid   (3marks)
b. Had Kyoto bought the computer on cash terms he would have been allowed a discount of 12 ½ % on marked price.
    i.   Calculate the cash price of the computer   (2 marks)
    ii.   Expressthe difference between the cash price and the hire purchase price as a percentage of the cash price.
                                                                                      (2 marks)
    iii. If a simple interest was charged on the hire purchase price, determine the interest rate p.a.   (3 marks)

18. The product of the first three terms of a geometric progression is 64. If the first term is a and the common ratio is r.
    (a) Express r in terms of a   3mks
    (b) Given that the sum of the three terms is 14,
        (i)   Calculate the values of a and r and hence write down two possible sequences each up to the 4th term.   5mks
        (ii) Find the product of the 50th terms of the two sequences   2mks

19. The table below shows income tax rates for certain year.

Monthly income in Kenya Shillings (Kshs)	Tax rate in each shillings
0 – 10164	10%
10165 – 19740	15%
19740 – 29316	20%
29317 – 38892	25%
Over 38892	30%

A tax relief of Kshs. 1162 per month was allowed. In a certain month of the year, an employee's taxable income in the fifth band was Ksh. 2108.
(a) Calculate
    i)   Employees total income in that month   2mks
    ii)   The tax payable by the employee in that month.   5mks

(b) The employee's income includes a house allowance of Ksh. 15,000 per month. The employees contributed 5% basic salary to a cooperative. Calculate the employee net pay for that month.   3mks

20. In an agriculture research centre, the lengths of a sample of 50 maize cobs were measured and recorded as shown in the frequency distribution table below

Length in cm	Number of cobs	
8-10	4	
11-13	7	
14-16	11	
17-19	15	
20-22	8	
23-25	5	

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Using an assumed mean of 18, Calculate;
- a. The mean (2 marks)
- b. The standard deviation (3 marks)
- c) On the grid provided draw a cumulative frequency graph for the data (3 marks)
- d) Use the graph to determine the median. (2 marks)

21. The probability of three darts players Akinyi, Kamau, and Jimna hitting the bulls eye are 0.3, 0.7and 0.5 respectively.
    - a) With the aid of a tree diagram; (2 marks)
    - b) Find the probability that:
    - i) Only Akinyi hits the bulls eye (1 mark)
    - ii) All hit the bull's eye (2 marks)
    - iii) Only one of them hit the bull's eye (2 marks)
    - iv) At most one missed the bull's eye (3 marks)

22. a) Complete the table below   2mks

X	0	30º	60º	90º	120º	150º	180º	210º	240º	270º	300º	330º	360º
- Cos x	-1		-0.5		0.5	0.87		0.87			-0.5	0.87	
Sin(x-30º)		0.0	0.5			0.87	0.5		-0.5			-0.87	-0.5

- b) Draw the graphs of y=sin(x-30) and y=-Cos x on the same axes, for 0º≤x≤360º (5mks
- c) Use your graph to solve the equation sin(x - 30º) + Cos x = 0 (3mks)

23. The cost c of producing n items varies directly as n and partly as the inverse of n to produce two items it costs Ksh. 135 and to produce three items it costs Ksh. 140. Calculate
    - a) The constant of proportionality and hence write the equation connecting c and n. 5mks
    - b) The cost of producing 10 items 2mks
    - c) The number of items produced at a cost of Ksh. 756. 3mks

24. A tailor spends 6 hours to make a shirt and 4 hours to make a dress. It takes the tailor at least 240 hours to make x shirts and y dresses. The labour cost of making sa shirt is sh. 60 and that of a dress is sh. 70. The total labour cost should not exceed sh 4200. The tailor must make at least 20 shirts and more than 16 dresses.
    - a) Write down four inequalities representing the information above (3mks)
    - b) Represent the inequalities in (a) above in a graph (4mks)
    - c) If the tailor makes a profit of sh 140 on shirt and sh 180 on a dress, use the graph in (b) above to determine the maximum profit that the tailor can make (3mks)

BUTULA-SUB COUNTY JOINT 2021
121/1
MATHEMATICS PAPER 1
DECEMBER, 2021

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)


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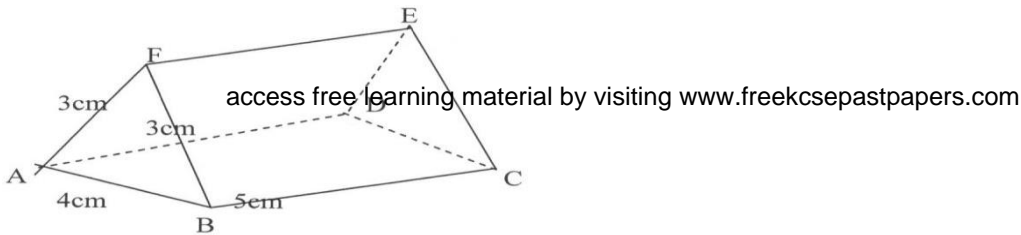
5. Solve for y in the equation. $8^{y+1}-2^{3y+1}=48$ (3marks)

6. Simplify the expression; $\dfrac{12x^2+ax-6a^2}{9x^2-4a^2}$ (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 = 100⁰. Calculate to the decimal places the length of AC. (3marks)

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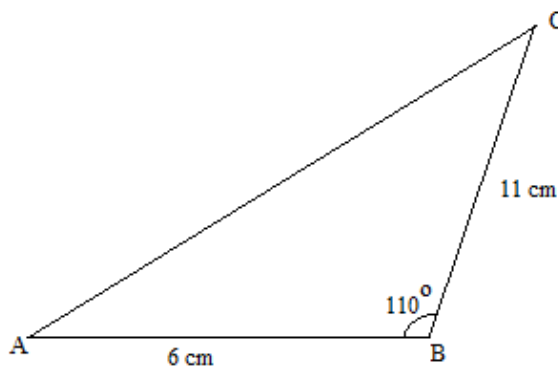
9. A football match between Bercelona FC and Liverpoo FC started at 1500hrs. It lasted for the official 90 minutes with a half time break of 15 minutes. The referee added five extra minutes for injuries and other stoppages. Find the time the match ended. (3marks)

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 marks

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 marks)

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

16. Use tables of square roots and reciprocals to find the value of x. (3marks)
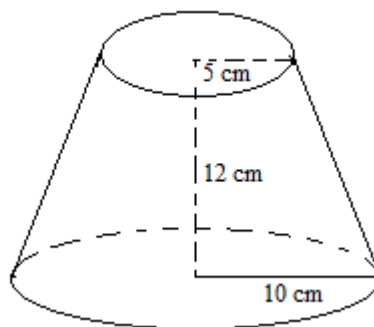
$$x = \sqrt{\frac{1}{15.36} + \frac{3}{1.302}}$$

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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
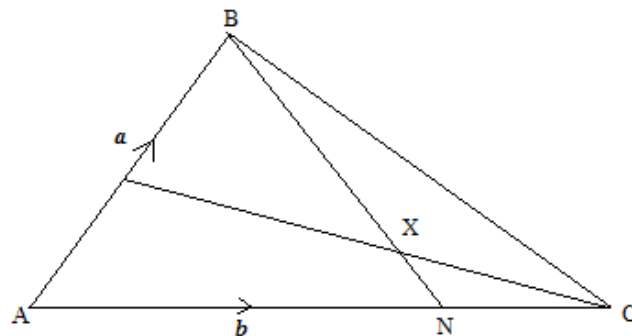

Find the:-

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. (3marks)

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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. (2marks)

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.   (4marks)
     ii)   Price per chair after discount.   (2marks)
     iii) The amount of money the school would have saved per chair if 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.   (2marks)
     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.

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   (4marks)

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

    (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 marks)

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

**BUTULA SUB – COUNTY JOINT EVALUATION EXAM**
121/2
MATHEMATICS PAPER 2
TERM 2, DECEMBER – 2021

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 $\frac{7}{9}$ 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 46°. Find angle CDN giving reasons.   (3 marks)
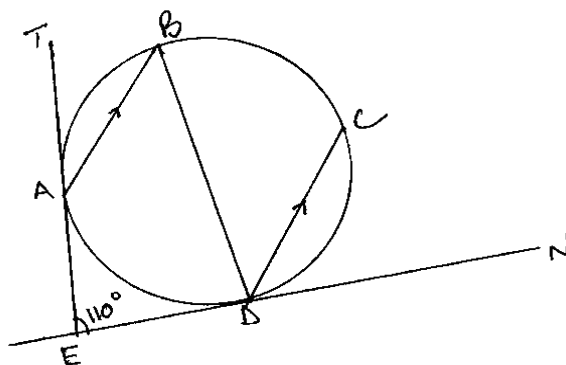
6. Use logarithm table to evaluate. (4marks)

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

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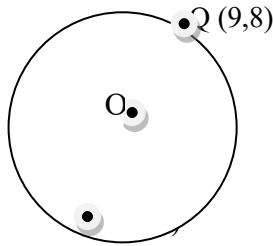
   (a) Write down in terms of X and Y the equation of the circle in the form:
       $ax^2 + by^2 + x + y + c = 0$ (2 marks
   (b) Find the equation of the tangent at Q in the form $ax + by + c = 0$ (2 marks)

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

   $$\frac{2 \tan 45^0\text{-}\tan 60^0}{4\tan45^0 \sin30^0\text{-}\sqrt{3}}$$ (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

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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

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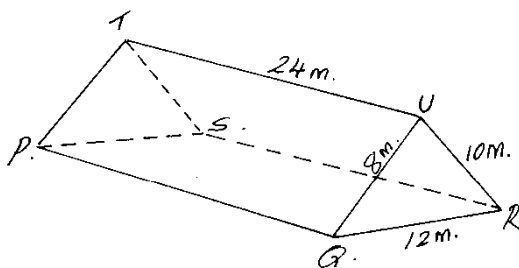
Calculate
(a) The angle between faces RSTU and PQRS (3marks)
(b) The space occupied by the roof (3marks)
(c) The angle between the plane QTR and PQRS (4marks)

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

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)
(b) Use your graph to find values of x for which $3\cos x – 4 \sin (2x -10^0) = 0$. (2marks)
(c) 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 $\angle XYZ = 75°$ (3marks)
b) Measure   access free learning material by visiting www.freekcsepastpapers.com
   i) line XZ (1mark)
   ii) $\angle XZY$ (1mark)

c). 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)

BUTULA SUB COUNTY JOINT EXAMINATIONS
121/1
MATHEMATICS PAPER 1

KENYA HIGH
**121/1 MATHEMATICS**
FORM 4
PREMOCK JOINT EXAMS

1. Evaluate $\dfrac{-4\{(-4+-15\div5)+-3-4\div2\}}{84\div-7+3--5}$ (3 marks)

2. Simplify completely the expression: $\dfrac{6x^2y^2-20xy+16}{2x^2y^2-8}$ (3 marks)

3. Given that $\cos\theta = \dfrac{3}{5}$, find $\sin\theta - \tan(90^0 - \theta)$ without using tables or calculator. (2 marks)

4. Under an enlargement, the images of points A(3,1) and B(1,2) are A^1(3,7) and B^1(7,5). Without construction, find the centre and the scale factor of enlargement. (4 marks)

5. List all the integral values of x that satisfy the inequalities; (3 marks)
$$x - \frac{3}{2} \le 2x + 1 < 5$$

6. A bus travelling at an average speed of x km/h left station at 8.15 am. A car, travelling at an average speed of 80km/h left the same station at 9.00 am and caught up with the bus at 10.45 am. Find the value of x. (3 marks)

7. The interior angle of a regular polygon with 3x sides exceeds the interior angle of another regular polygon having x sides by 40^0. Determine the value of x. (3 marks)

8. Use squares, cubes and reciprocals tables to evaluate, to 4 significant figures, the expression:
$$\frac{1}{\sqrt[3]{27.56}} + \frac{3}{(0.071)^2}$$ (3 marks)
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9. From a point 20m away on a level ground the angle of elevation to the bottom of the window is 27^0 and the angle of elevation of the top of the window is 32^0. Calculate the height of the window. (3 marks)

10. Solve for x in the equation: $5^{3y+3} + 5^{3y-1} = 125.2$ (4 marks)

11. Mr. Kanja, Miss Kanene and Mrs. Nyaga have to mark a form three mathematics contest for 160 students. They take 5 minutes, 4 minutes and 12 minutes respectively to mark a script. If they all start to mark at 9.00 am non-stop, determine the earliest time they will complete the marking. (4 marks)

12. Evaluate $4.\dot{4}\dot{1} - 0.\dot{2}\dot{1}$ (2 marks)

13. Two similar cylinders have diameter of 7cm and 21cm. If the larger cylinder has a volume of $6237cm^3$, find the heights of the two cylinders. (take $\pi = \dfrac{22}{7}$) (3 marks)

14. The cost of providing a commodity consists of transport, labour and raw materials in the ratio 8:4:12 respectively. If the transport cost increases by 12%, labour cost by 18% and raw materials by 40%, find the percentage increase of producing the new commodity. (3 marks)

15. Given that $4\boldsymbol{p} - 3\boldsymbol{q} = \begin{pmatrix} 10 \\ 5 \end{pmatrix}$ and $\boldsymbol{p} + 2\boldsymbol{q} = \begin{pmatrix} -14 \\ 15 \end{pmatrix}$, find value of **p** and **q** (4 marks)

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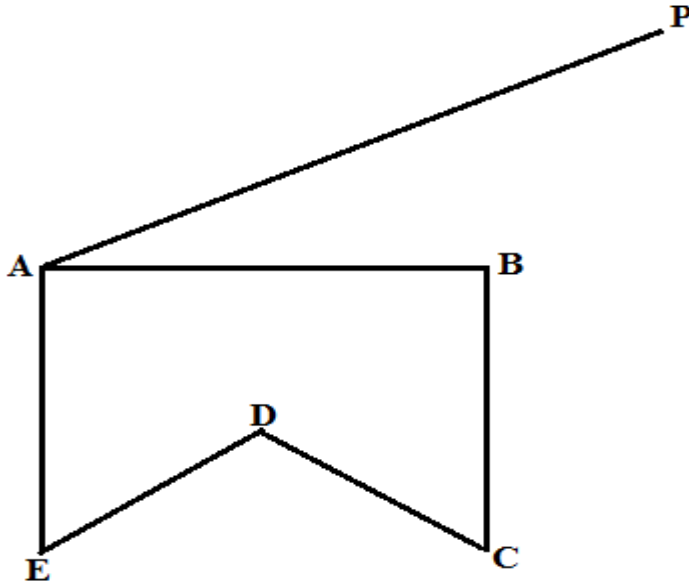

SECTION II (50 Marks)
Answer any five questions from this section in the spaces provided.

17. The figure below represents a sector of a circle radius r units. The area of the sector is 61.6 cm² and the length of the arc AB is one tenth of the circumference of the circle from which the sector was obtained. (Take $\pi = \frac{22}{7}$)
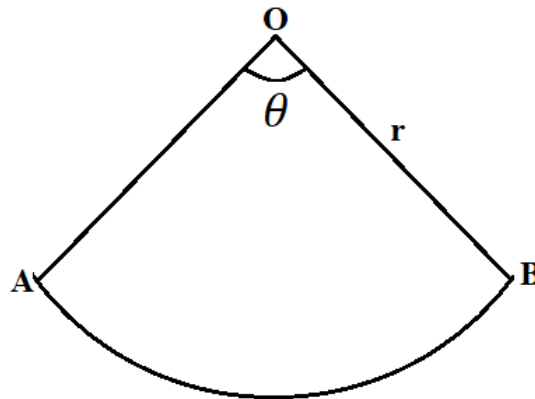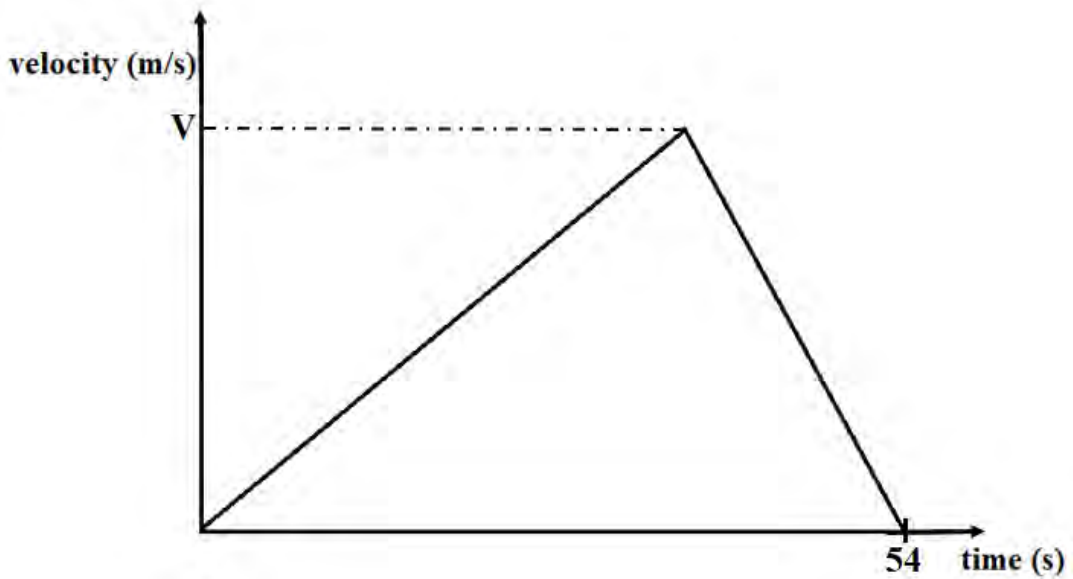

a) Calculate;
    i)   the angle θ subtended by the sector at the centre.   (2 marks)
    ii) The radius r of the circle.   (3 marks)
b) If the sector above is folded to form a cone;
    i)   Calculate the base radius of the cone.   (2 marks)
    ii) The volume of the cone.   (3 marks)

18. Two factories A and B produce both chocolate bars and eclairs. In factory A, it costs Kshs x and Kshs y to produce 1 kg of chocolate bars and 1 kg of eclares respectively. The cost of producing 1 kg of chocolate bars and 1 kg of eclairs in factory B increases by the ratio 6:5 and reduce by the ratio 4:5 respectively.
a) Given that it costs Kshs 460 000 to produce 1 tonne of chocolate bars and 800kg of eclares in factory A and Kshs 534 000 to produce the same quantities in factory B, form two simplified simultaneous equations representing this information.   (3 marks)
b) Use matrix method to find the cost of producing 1 kg of chocolate bars and 1 kg of eclaires in factory A.   (5 marks)

c) Find the cost of producing 100 kg of chocolate bars and 50 kg of eclaires in factory B. (2 marks)
19. The vertices of triangle ABC are A(6,2), B(8,2) and C(6,0).
   a) On the grid provided below, draw triangle ABC. (1 mark)
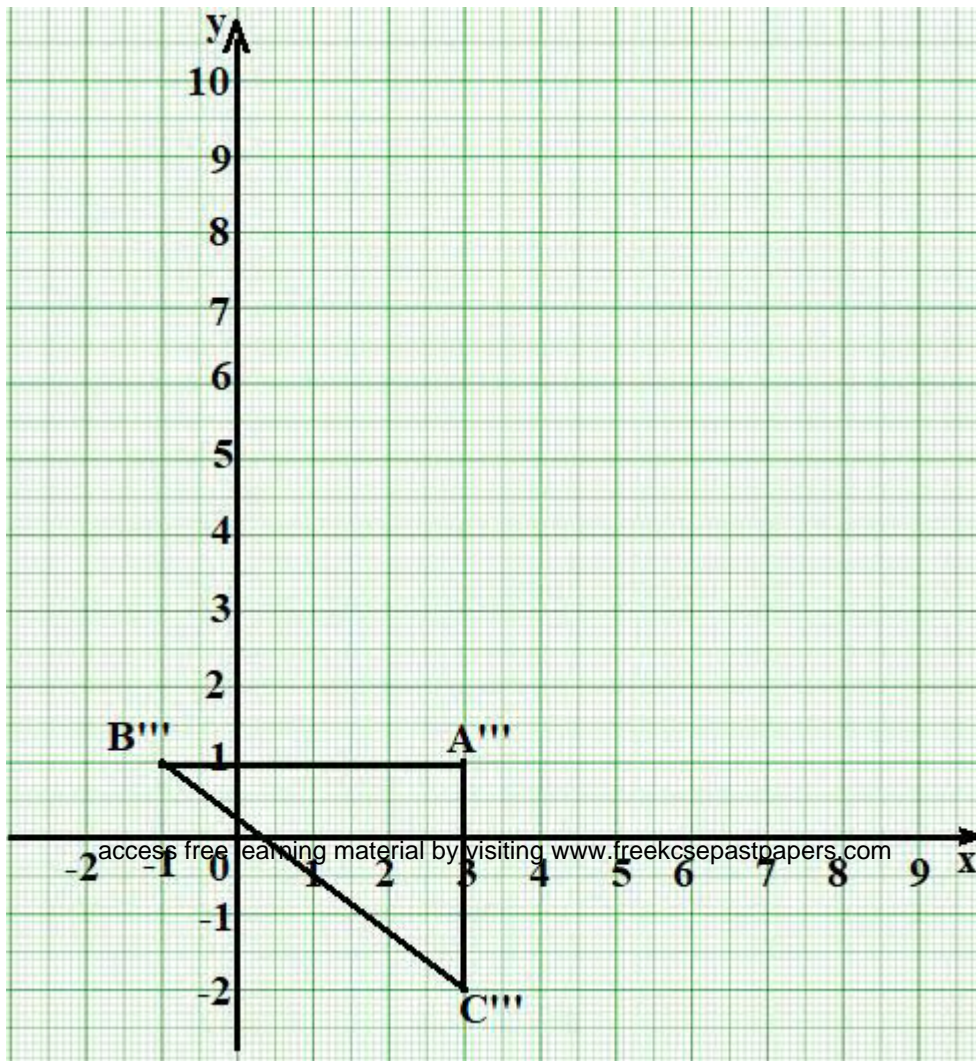
b) Triangle A'B'C' is the image of triangle ABC under a reflection in the line $y = x$. On the same grid draw triangle A'B'C' and state its coordinates (2 marks)
c) Triangle A"B"C" is the image of triangle A'B'C' under and enlargement scale factor 2 about the centre (-1,9). On the same grid, draw triangle A"B"C" and states its coordinates. (2 marks)
d) By construction, find and write down the co-ordinates of the centre and angle of rotation which can be used to rotate triangle A"B"C" onto triangle A'''B'''C''' shown on the grid above. (3 marks)
e) State any pair of triangles that are:
   i) Oppositely congruent. (1 mark)
   ii) Directly congruent. (1 mark)

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


a) If it covered a distance of 810 metres;
    i) Find the value of V. (2 marks)
    ii) Calculate its deceleration, given that its initial acceleration was $1\frac{2}{3}ms^{-2}$ (2 marks)

b) A bus left town X at 10.45 am and travelled toward town Y at an average speed of 60 km/h. A car left town X at 11.45 am on the same day and travelled along the same road toward Y at an average speed of 100km/h. The distance between town X and town Y is 500km.
    i) Determine the time of the day when the car overtook the bus. (3 marks)
    ii) Both vehicles continued towards town Y at their original speeds. Find how long the car had to wait in town Y before the bus arrived. (3 marks)

21. The masses to the nearest kilogram of some students were recorded in table below.

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

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

22. (a) a straight line L₁ whose equation is $9y - 6x = -6$ meets the x-axis at Z. Determine the coordinates of Z. (2 marks)

(b) A second line L₂ is perpendicular to L₁ at Z. Find the equation of L₂ in the form $ax + by = c$, where ,b and c
    are integers. (3 marks)

(c) a third line L₃ passes through the point (2,5) and is parallel to L₁. Find:
    i) The equation of L₃ in the form $ax + by = c$, where a, b and c are integers. (2 marks)
    ii) The coordinate of point R at which L₂ intersects L₃. (3 marks)

23. In the diagram below, the coordinates of points O, P and Q are (0,0), (2,8) and (12,8) respectively. A is a point on **OQ** such that 4**OA**=3**OQ**. Line **OP** produced to R is such as **OR**=5**OP**.
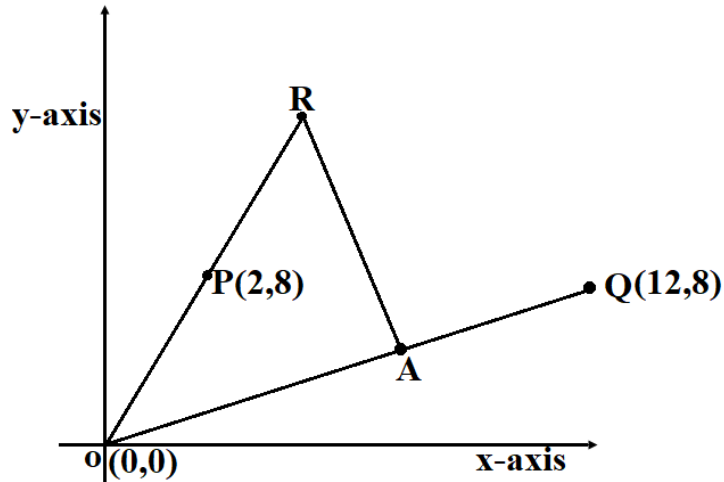
a) Find vector **RA**. (3 marks)
b) Given that point L is on **PQ** such that **PL**: **LQ**=12:5, find vector **RL**. (4 marks)
c) Show that R, L and A are collinear. (2 marks)
d) Find the ratio of **RL**:**LA**. (1 marks)

24. Five points, P, Q, R, V and T lie on the same plane. Point Q is 53km on the bearing of 055^0 of P. Point R lies 162^0 of Q at a distance of 58km. Given that point T is west of P and 114km from R and V is directly south of P and $S40^0E$ from T.
   a) Using a scale of 1:1,000,000, show the above information in a scale drawing. (3 marks)
   b) From the scale drawing determine:
      i) The distance in km of point V from R. (2 marks)
      ii) The bearing of V from Q. (2 marks)
      iii) Calculate the area enclosed by the points PQRVT in squares kilometers. (3 marks)

KENYA HIGH
121/2
MATHEMATICS PAPER 2
SEPTEMBER 2021

SECTION 1 (50 MARKS)

1. Evaluate using squares, cubes and reciprocal tables (4 marks)
$$\left[\frac{1}{\sqrt[3]{27.56}} + \frac{3}{(0.071)^2} \right]^{-2}$$

2. Make x the subject in $\dfrac{x^4 - 4}{x^2 - 2} = K$ (3 marks)

3. Ali deposited Ksh.100,000 in a financial institution that paid simple interest at the rate of 12.5% p.a. Mohamed deposited the same amount of money as Ali in another financial institution that paid compound interest. After 4 years, they had equal amounts of money. Determine the compound interest rate per annum to 1 decimal place. (3 marks)

4. Simplify (3 marks)
$$\left(\frac{a^3 - ab^2}{a^4 - b^4} \right)^{-1}$$

5. Expand $\left[1 - 2x\right]^4$, hence find the value of $\left[1.02\right]^4$ correct to 3 significant figures. (3 marks)

6. If $\sin x = 2b$ and $\cos x = 2b\sqrt{3}$, find the value of b (3 marks)

7. Find the relative error in $\dfrac{a + b}{c - d}$ given that $a = 77ml, b = 23ml,$
   $c = 36ml,$ and $d = 16ml.$ (3 marks)

8. Without using a calculator or mathematical tables, express
   $\dfrac{\sqrt{3}}{1 - \cos 30°}$ in surd form and simplify. access free learning material by visiting www.freekcsepastpapers.com (3 marks)

9. The equation $3x^2 - 8px + 12 = 0$ has real roots.
   Find the value of P. (2 marks)

10. A construction company employs 200 artisans and craftsmen in the ratio 1:3 every week. An artisan is paid 2 ½ times as much as a crafts man. At the end of 3 weeks the company paid ksh 1485000 to those employees. Find how much each artisan and each craftsman is paid. (a working week has six days) (3 marks)

11. A dam containing 4158m³ of water is to be drained. A pump is connected to a pipe of radius 3.5cm and the machine operates for 8 hours per day. Water flows through the pipe at the rate of 1.5m per second. Find the number of days it takes to drain the dam. (4 marks)

12. Two brands of coffee Arabica and Robusta costs sh.4,700 and sh.4,200 per kilogram respectively. They are mixed to produce a blend that costs shs.4,600 per kilogram. Find the ratio of the mixture. (3 marks)

13. Under a transformation represented by a matrix $\begin{pmatrix} 5X & 2 \\ -3 & X \end{pmatrix}$, a triangle of area 10cm²
    is mapped onto a triangle whose area is 110cm². Find x (3 marks)

14. Find the distance between the centre 0 of a circle whose equation is
    $2x^2 + 2y^2 + 6x + 10y + 7 = 0$ and a point $B(-4,1)$. (3 marks)

15. Solve for x in the equation:
    $(\log_2 x)^2 + \log_2 8 = \log_2 x^4$ (4 marks)

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16. The figure below shows a circle inscribed in an isosceles triangle ABC. If Q, P and R are the points of contact between the triangle and the circle, O is the centre of the circle, $BO = 19.5cm$ and $BQ = 18cm$. Find the radius of the circle and hence the length of the minor arc PQ.

(3 marks)
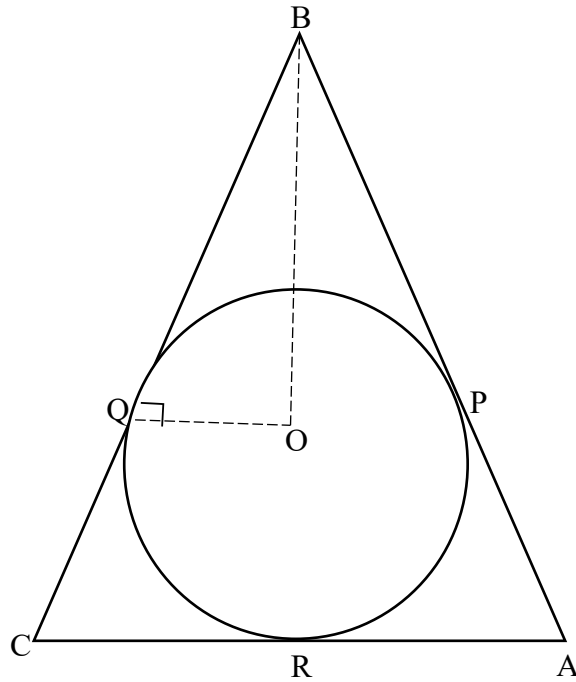
SECTION II (50 MARKS)
ANSWER ONLY FIVE QUESTIONS

17. (a) Mr. Mackey pays a tax of Kshs.5,800 per month according to the income tax table given below. He is married and entitled to a family relief of K€420p.a.

Taxable income	Rate (Ksh per K€)
(K€ p.a.)	
1 – 9,600	2
9,600 – 19,200	3
19,201 – 29,800	5
29,801 - 38,400	7
38,401 - 47,200	9
Over 47,200	10

Calculate Mackey's gross annual salary in K€   (6marks)

(b) The difference between compound interest and simple interest on Kshs.P over a duration of 36 months at the rate of 15% p.a. is Kshs.52,477.50. Calculate the value of P.   (4 marks)

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

X	-5	-4	-3	-2	-1	0	1	2
y			19			-5		

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

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

ii)   By drawing a suitable straight line on the graph, solve the equation
$$x^3 + 4x^2 - 5x - 5 = -4x - 1$$ (3 marks)

19. OPQ is a triangle in which OP=P and OQ=q. x is a point on OP such that OP:XP=5:2 and y is another point on PQ such that PY:YQ=1:2. Lines OY and XQ intersect at T.
(a) Express the following vectors in terms of P and q
(i) PQ (1 mark)
(ii) OY (1 mark)
(iii) OX (1 mark)
(b) If $OT = kOY$ and $QT = hQX$ express OT in two different ways. Hence or otherwise find the values of h and k. (6 marks)
(c) Determine the ratio OT:TY (1 mark)

20. If $\left(x - 1\frac{1}{8}\right)$, x and $\left(x + \frac{3}{2}\right)$ are the first three consecutive terms of a geometric progression;
(a) Determine the values of x and the common ratio. (4 marks)
(b) Calculate the sum of the first 6 terms of this progression. (3 marks)
(c) Another sequence has the terms
-13, -16, -19, ……………………………-310.
Find the sum of this sequence. (3 marks)

21. The figure below shows a belt passing round two pulleys of centres A and B.
The radius of the pulleys is 4cm and 6cm respectively and the distance   between the centres is 25cm.
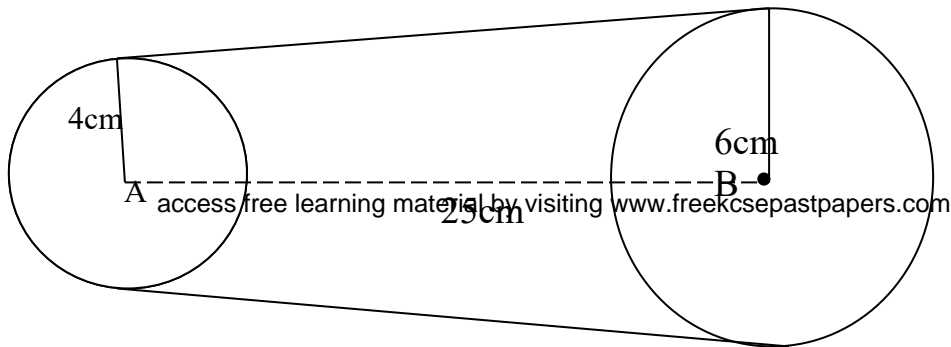
Calculate the length of the belt used for the pulley system. (10 marks)

22. The points P(2,1), Q(4,1) R(4,3) and S(3, 3) are coordinates of a quadrilateral.
(a) Plot the quadrilateral PQRS on the grid provided. (1 mark)
(b) Find the coordinates of P¹Q¹R¹S¹ the image of PQRS under the transformation represented by the matrix
$$M = \begin{pmatrix} 1 & 1 \\ 2 & 0 \end{pmatrix}$$ (2 marks)
(c) Draw and label P¹Q¹R¹S¹ on the same grid.
(d) Find the coordinates of P¹¹Q¹¹R¹¹S¹¹ on the image of P¹Q¹R¹S¹ under the transformation represented by the matrix $N = \begin{pmatrix} -2 & 1 \\ 0 & 1 \end{pmatrix}$ (2 marks)
(e) Draw and label P¹¹Q¹¹R¹¹S¹¹ on the same grid. (1 mark)
(f) Determine the matrix that maps PQRS directly onto P¹¹Q¹¹R¹¹S¹¹. (3 marks)

23. The table below shows the ages of people in years who attended a wedding ceremony.

Age in years	10-19	20-29	30-39	40-49	50-59	60-69	70-79
Frequency	2	4	4	8	6	3	2

(a) State the modal class   (1 mark)
(b) Using an assumed mean of 44.5 calculate
   (i)   The mean age   (3 marks)
   (ii) The standard deviation   (3 marks)
   (iii) The median age   (3 marks)

24. A supermarket is stocked with plates which come from two suppliers A and B. They are bought in the ratio 3:5 respectively, 10% of plates from A are defective and 6% of the plates from B are defective.

(a) A plate is chosen by a buyer at randon.
   Find the probability that
   i)   It is from A   (2 marks)
   ii)   It is from B and it is defective   (2 marks)
   iii) It is defective   (2 marks)
(b) Two plates are chosen at random. Find the probability that;
   i)   Both are defective   (2 marks)
   ii)   At least one is defective   (2 marks)

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