KASSU JOINT EVALUTION TEST (J.E.T)

Kenya certificate of secondary education (KCSE)

121/1 - MATHEMATICS - Paper 1

ALT A

June. 2022 - $2\frac{1}{2}$hours

Name....Marking Scheme....class........... Adm......

Signature.......................date..........

Instructions to candidates

- *Write your name, admission number and class in the spaces provided above.*
- *Sign and write the date of examination in the spaces provided above.*
- *You are reminded of the necessity of* ***orderly presentation*** *in your answers.*
- *The paper contains* ***TWO*** *sections:* ***Section I*** *and* ***Section II.***
- *Answer* ***ALL*** *the questions in* ***Section I*** *and any* ***five*** *questions from* ***Section II***
- *All answers and working must be written on the question paper in the spaces provided below each question.*
- ***Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.***
- *Marks may be given for correct working even if the answer is wrong.*
- *Non – programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.*

For Examiner's use only.

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section II

17	18	19	20	21	22	23	24	Total

Grand Total	

SECTION I (50 MARKS)

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

1. An aircraft Company bought eight aircrafts for eighteen billion, nine hundred and seventy-five million, twenty-eight thousand, two hundred and forty.

(a) Write the total cost of the eight aircrafts in figures. (1mark)

18,975,028,240 B_1

(b) Calculate the cost of each aircraft. (2marks)

$$\frac{18,975,028,240}{8} \quad M_1$$

$= 2,371,878,530$ A_1

2. Solve for x in the equation $\frac{3}{x+1} + \frac{2}{x+5} = \frac{1}{x-2}$ (4mks)

$$\frac{3x+15+2x+2}{(x+1)(x+5)} = \frac{1}{x-2} \quad M_1$$

$(x-2)(5x+17) = (x+1)(x+5)$

$5x^2+17x-10x+34 = x^2+6x+5$ M_1

$4x^2+x-39=0$

$$\frac{-1 \pm \sqrt{1+16\times39}}{8} \quad M_1$$

$= 3$ or -3.25 A_1 Both

3. (a)The number 16200 is given as $2^x \times 3^y \times 5^z$. Find the value of $x+y+z$ (2marks)

$16200 = 2^3 \times 3^4 \times 5^2$

$x=3$

$y=4$

$z=2$

$3+4+2 = 9$ B_1

(b). When another number N is multiplied by 16200, a perfect cube is obtained. Find the least value of N (2marks)

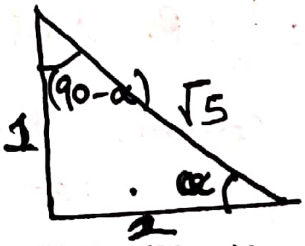
$2^3 \times 3^4 \times 5^2$

$2^0 \times 3^2 \times 5^1 = 45$ B_1

B_1

4. Given that $\sin \propto° = \frac{1}{\sqrt{5}}$ where a is an acute angle find, without using Mathematical tables

(a) Cos ∝ ° in the form of $a\sqrt{b}$, where a and b are rational numbers (2marks)



$\cos \alpha = \frac{2}{\sqrt{5}}$ M1 ✓

$= \frac{2\sqrt{5}}{5}$ ✓ A1

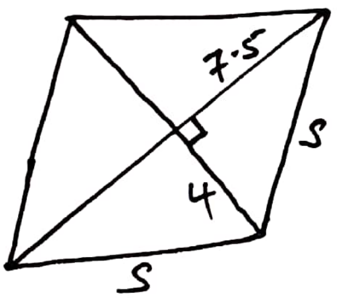
(b) $Tan\ (90{-}\propto)°$ 2marks

$\tan(90-\alpha) = \frac{2}{1}$ B1 ✓

✓

$= 2$ B1

5. The area of a rhombus is 60 cm^2. If the shorter diagonal is 8 cm. Find the perimeter of the rhombus. (4 marks)



$A = \frac{1}{2} D \times d$

$60 = \frac{1}{2} \times 8 \times D$

$\frac{120}{8} = D$

$D = 15cm$ ✓

$7.5^2 + 4^2 = s^2$

$72.25 = s^2$ ✓

$s = 8.5 cm$

$P = 4s$

$= 4 \times 8.5$ ✓

$= 34 cm$ ✓

6. A 63kg metal of density 7,000 kg/m^3 is moulded into a rectangular pipe with external dimensions of 12cm by 15cm and internal dimensions of 10cm by 12cm. Calculate the length of the pipe in meters. (2marks) (3marks)

$V = \frac{m}{\rho}$

$= \frac{63}{7000}$

$= 9000 cm^3$ ✓

$A_{CSA} = (12 \times 15) - (10 \times 12)$

$= 180 - 120$

$= 60 cm^2$

$V = A_{CSA} \times L$

$\frac{60 \times l}{60} = \frac{9000}{60}$

$l = 150 cm$

$= 1.5m$

7. The position vectors of the points P, Q and R are $\begin{pmatrix}-3\\-1\end{pmatrix}$, $\begin{pmatrix}\frac{1}{2}\\-2\end{pmatrix}$ and $\begin{pmatrix}4\\-3\end{pmatrix}$ respectively. Show that P, Q and R are collinear (3marks)

$PR = \begin{pmatrix}4\\-3\end{pmatrix} - \begin{pmatrix}-3\\-1\end{pmatrix}$

$= \begin{pmatrix}7\\-2\end{pmatrix}$

$PQ = \begin{pmatrix}0.5\\-2\end{pmatrix} - \begin{bmatrix}-3\\-1\end{bmatrix}$

$= \begin{pmatrix}3.5\\-1\end{pmatrix}$

$PQ = hPR$

$\begin{bmatrix}3.5\\-1\end{bmatrix} = h\begin{bmatrix}7\\-2\end{bmatrix}$

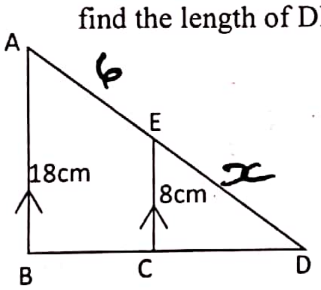
$h = \frac{1}{2}$

$PQ = \frac{1}{2}PR$ and

P is common pt

Hence Collinear

8. In the triangle ABD, BA is parallel, to CE, given that BA= 18cm, CE = 8cm and AE = 6cm, find the length of DE (3marks)



Let DE be x

$\frac{18}{8} = \frac{6+x}{x}$

$18x = \cancel{4}8 + 8x$

$10x = 48$

$x = 4.8\text{cm}$

9. Given the equation $\frac{9^{4x}}{3^{2x}} = \frac{1}{9^{-4}}$, solve for x to its simplest form. (3 marks)

$[3^2]^{4x} \div 3^{2x} = 1 \div [3^2]^{-4}$

$3^{8x-2x} = 3^{0-(-8)}$

$6x = 8$

$x = \frac{4}{3}$

$x = 1\frac{1}{3}$.

10. A Kenyan company received M US Dollars. The money was converted into Kenyan shillings in a bank which buys and sells foreign currencies.

	Buying (in Ksh.)	Selling (in Ksh.)
1Sterling Pound	145.78	146.64
US Dollar	110.66	110.86

If the company received Ksh. 15,132, 000, calculate the amount M, received in US Dollars. (2marks)

$\frac{15,132,000}{110.66}$ ✓ M_1 = 136,743.1773 US \$ ✓A_1

11. Two interior angles of an irregular n sided polygon is 117 each. The remaining exterior angles are 39^0 each. Calculate the number of sides of the polygon (3marks)

$180 - 117 = 63°$

$63 \times 2 = 126°$ ✓M_1

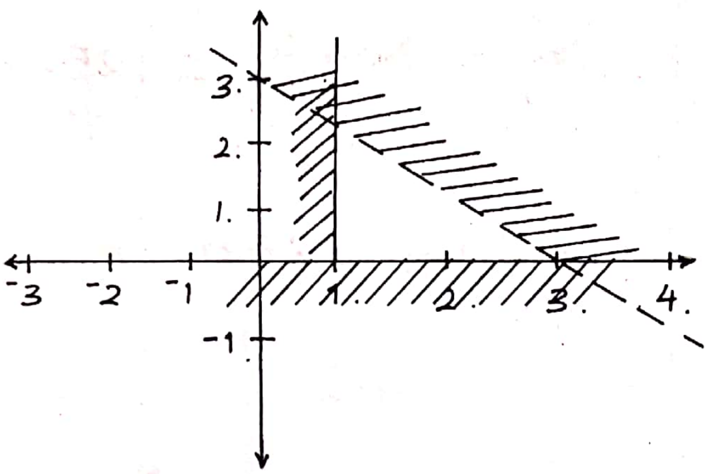
$126 + 39(n-2) = 360$ ✓M_1

$\frac{39(n-2)}{39} = \frac{234}{39}$

$n - 2 = 6$

$n = 8$ sides. ✓A_1

12. Determine the inequalities that represent and satisfies the unshaded region (3marks)



$x \geq 1$ ✓ B_1

$y \geq 0$ ✓ B_1

$y + x < 3$ ✓ B_1

5

14. There are two grades of rice, grade A and Grade B. Grade A costs Sh 80 per Kg while Grade B costs Sh 60 per Kg. In what ratio must the two be mixed in order to produce a blend costing Sh 75 per Kg. (3marks)

$\frac{80A+60B}{A+B} = 75$ ✓M1

$80A - 75A = 75B - 60B$

$5A = 15B$ ✓M1

$\frac{A}{B} = \frac{15}{5} = \frac{3}{1}$

$A:B = 3:1$ A1

15. One of the three vertices of triangle ABC is A (2,-3). Point A is mapped onto A' (-4, 7) under a reflection on mirror line *M*. find the equation of the mirror-line *M* (3marks)

Midpoint; $\left(\frac{2-4}{2}, \frac{-3+7}{2}\right)$

$= (-1, 2)$ ✓M1

$m_1 = \frac{7+3}{-4-2} = \frac{10}{-6}$

$m_2 = \frac{3}{5}$. ✓

$y = mx + c$

$-3 = \frac{3}{5}(2) + c$

$-3 - \frac{6}{5} = c = -\frac{21}{5}$

$5y - 3x + 21 = 0$ ✓

$y = \frac{3}{5}x - \frac{21}{5}$

16. A camp has enough food ration to last 10,000 refugees for 35 days. After 5 days, 2500 more refugees arrived in the camp. If all are now put on a half ration, how much longer will the food last? (3 marks)

$1\text{ Day} = \frac{10,000}{35}$

$5\text{ days} = \frac{10,000}{35} \times 5$

$= \frac{10,000}{7}$

Remainde $= 8571\frac{3}{7}$ ✓

After new 2500 refugees

$1\text{ Day} = \frac{12500}{35 \div \frac{1}{2}} = \frac{12500}{70}$ ✓

$\frac{12500}{70}x = 8571\frac{3}{7}$

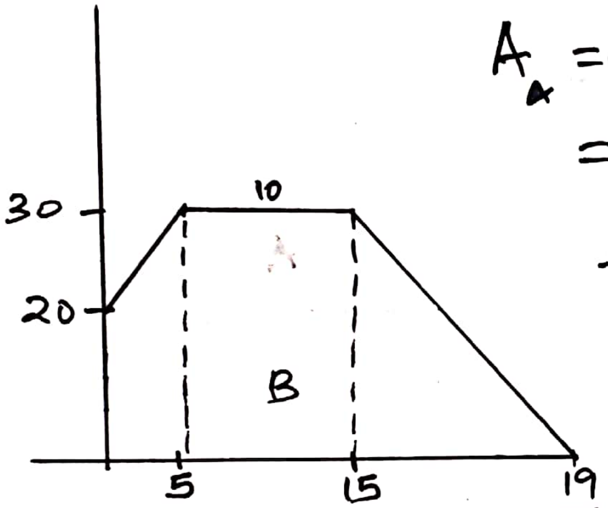
$x = 48$

$48 - 35 = \underline{13\text{ days}}$ ✓

SECTION II (50 marks)

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

17. a). A particle moving at 20 m/s accelerates to 30 m/s in 5 seconds then travels at this speed for 10 seconds before decelerating to rest in 4 seconds. Draw a velocity –time graph and use it to calculate the distance covered by the particle in 19 seconds. (3 marks)



$A_A = \left(\frac{1}{2} \times 4 \times 30\right) + \frac{1}{2}(30+20)5 + 10 \times 30$

$= 60 + 125 + 300$

$= 485m$

Area = Distance

40M ✓

b). A train 100 m long travelling at $72 km/h$ overtakes another train travelling in the same same direction at $56 km/hr$ and passes it completely in 54 seconds. Find the length of the second train. (4 marks)

$RS = 72 - 56$

$= 16 Km/h$

$T = 54s$

$D = S \times T$

$= 16 \times \frac{5}{18} \times 54$

$16 \times 5 \times 3 = 240m$

$T_1 = 100m$

$T_2 = 240 - 100$

$= 140m$

ii). Find the time (how long) they would have taken to pass each other if they had been travelling at these speeds in opposite directions. (3 marks)

$RS = 56 + 72$

$= 128 Km/h$

$D = 240 m$

$t = D/Rs$

$= \frac{240 \times \frac{1}{1000}}{128}$

$= 6.75$ Seconds

18. (a) Find the inverse of the matrix A , given that A is $\begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix}$

Det = 8 − 9 = −1

Inv = $-1\begin{pmatrix} 4 & -3 \\ -3 & 2 \end{pmatrix}$

$= \begin{bmatrix} -4 & 3 \\ 3 & -2 \end{bmatrix}$

(b) Jane bought 200 bags of sugar and 300 bags of rice for a total cost of shs. 850,000. Peter bought 120 bags of rice and 90 bags of sugar for a total cost of shs. 360,000. If the price of a bag of sugar is shs. x and that of rice is shs. y.

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

$3x + 4y = 12{,}000$

$2x + 3y = 8500$

(ii) Use matrix method to find the price of one bag of each item (3marks)

$2x + 3y = 8500$

$3x + 4y = 12{,}000$

$\begin{pmatrix} x \\ y \end{pmatrix} = \text{Inv}\begin{pmatrix} 8500 \\ 12000 \end{pmatrix}$

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -4 & 3 \\ 3 & -2 \end{pmatrix}\begin{pmatrix} 8500 \\ 12{,}000 \end{pmatrix}$

$x = -4(8500) + 3(12000)$

$y = 3(8500 - 2(12000)$

$x = 2000$

$y = 1500$

(c) Robert bought 225 bags of sugar and 360 bags of rice. He was given a total discount of shs. 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. (3marks)

$33{,}300 - [0.02 \text{ of } 360 \times 1500)$

$= 22{,}500$

$\frac{22500}{225 \times 2000} \times 100$

$= 0.05 \times 100$

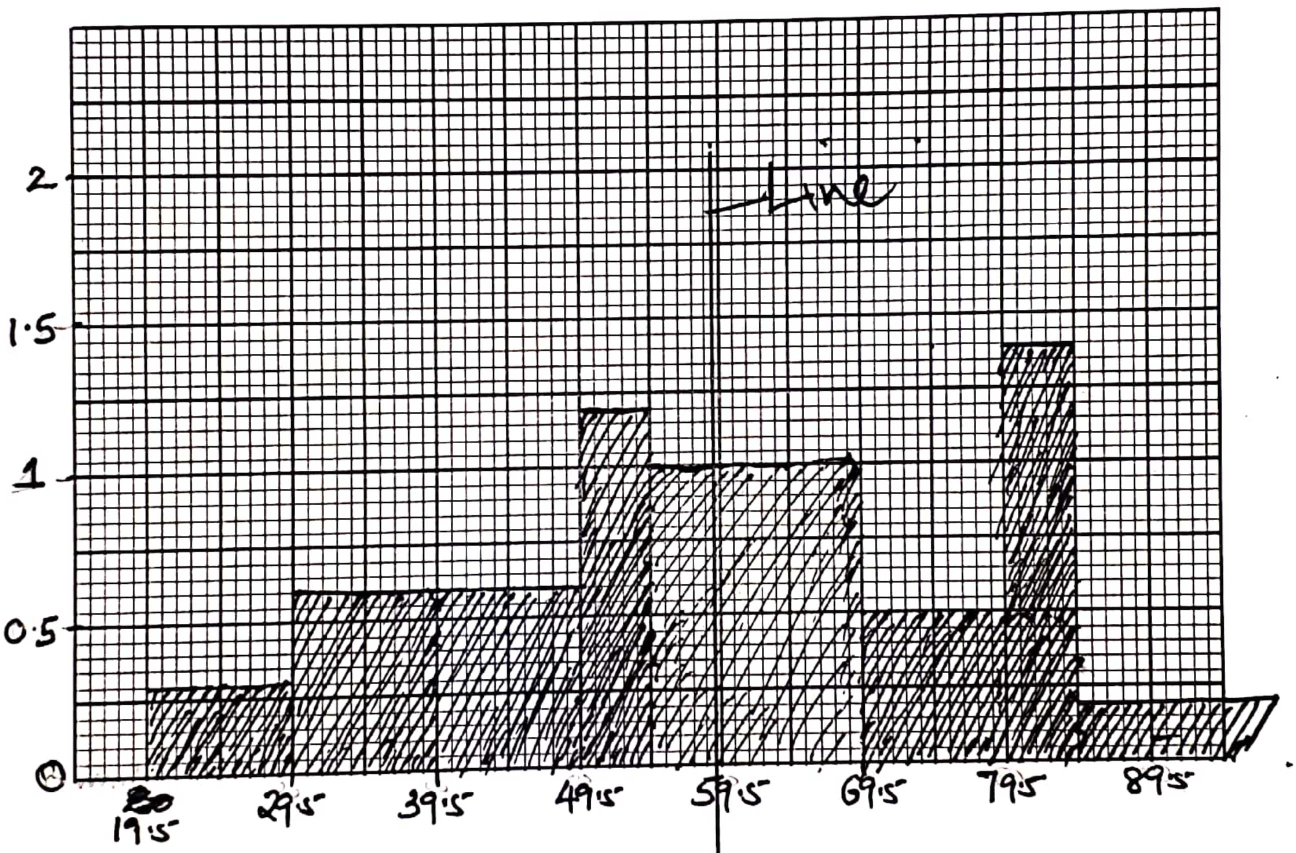
$= 5\%$

19. The table below shows scores for a form 4 class Math results in Ushindi School.

	3	15	21	36	41	48	51
Marks	20-29	30-49	50-54	55-69	70-79	80-84	85-99
No of Students	3	12	6	15	5	7	3
f.d	0.3	0.6	1.2	1	0.5	1.4	0.2

(a). Fill in the column for frequency density row on the table (2marks)

(b). Draw a histogram to represent the above data (3marks)



(c). By using the histogram drawn above calculate the median of the data and indicate using a line where it lies in the histogram. (5marks)

$\frac{51}{2} = 25.5$

Median class = 55-69

$54.5 + \left[\frac{25.5 - 21}{15}\right] 15$

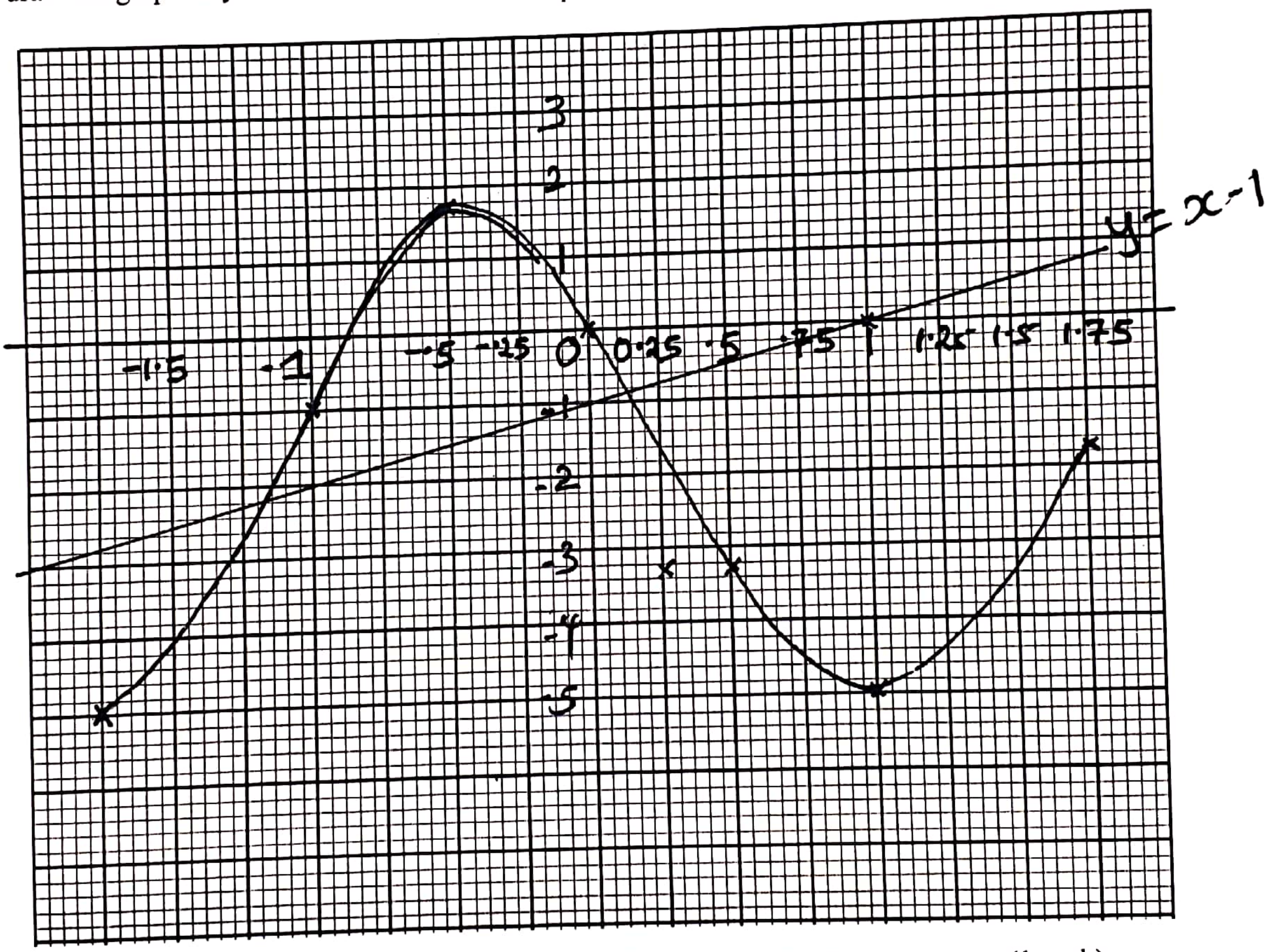
$54.5 + 4.5$

$= \underline{\underline{59}}$

20. (a). Complete the table below for the equation $y = 4x^3 - 3x^2 - 6x$ 2marks

x	$-1\frac{1}{4}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{3}{4}$
y	-5	-1	$1\frac{3}{4}$	0	$-3\frac{1}{4}$	-5	$-2\frac{1}{4}$	$1\frac{3}{4}$

b. Using a scale of 4 cm to represent 1 unit on the x axis and 2cm to represent 1 unit on the y-axis draw the graph of $y = 4x^3 - 3x^2 - 6x$ for $-1\frac{1}{4} \leq x \leq 1\frac{3}{4}$ on the grid provided 3marks



c). Use your graph to find the range of values of x for which $y \leq -3$ (1mark)

0·45 to 1·55 and -1·3 to -1·75.

d). Use your graph to solve the equation $4x^3 - 3x^2 - 6x = 0$ (2marks)

0 and - 0·85 .

e). By drawing a suitable straight-line graph on the same axes solve the equation

$-4x^3 + 3x^2 + 7x - 1 = 0$ (2marks)

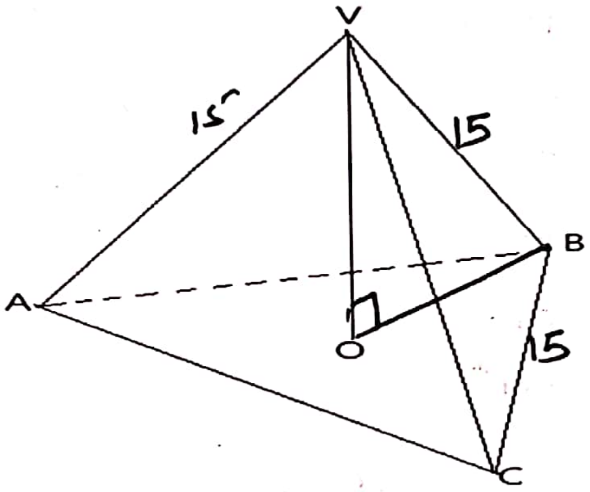
$4x^3 - 3x^2 - 6x + 0 = y$ +

$y = -1 + x$

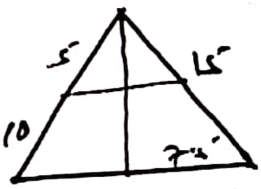
$y = x - 1$

$x = 0{\cdot}175$ and $1{\cdot}175$

21. The figure below shows a solid regular tetrahedron of side 15 cm. Point O is center of the base ABC



a). Calculate the perpendicular height VO of the pyramid to 1 decimal place. (3 marks)



$\frac{2}{3}\left(\sqrt{15^2 - 7.5^2}\right) = BO$

$= 8.66$

$15^2 - 8.66^2$

$\sqrt{225 - 75} = VO$

$= \underline{\underline{12.2\text{ cm}}}$

b). The tetrahedron is cut parallel to the base ABC forming a frustrum. The slant height of the frustrum is two-thirds the slant height of the pyramid. Calculate;

(i). The volume of the frustrum. (4 marks)

$V_T = \frac{1}{3} \times \frac{1}{2} \times 15^2 \sin 60 \times 12.2$

$= \cancel{113.654}$

396.206

$Vsf = 27 : 1$

$V_{S.T} = \frac{1}{27}\, 396.206$

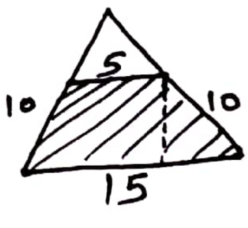
$= 14.67$

$V_f = 396.206 - 14.67$

$= \underline{\underline{381.53}}$

Acc. $\underline{\underline{383.016}}$ ✓✓

(ii). The surface area of the solid frustrum (3 marks)

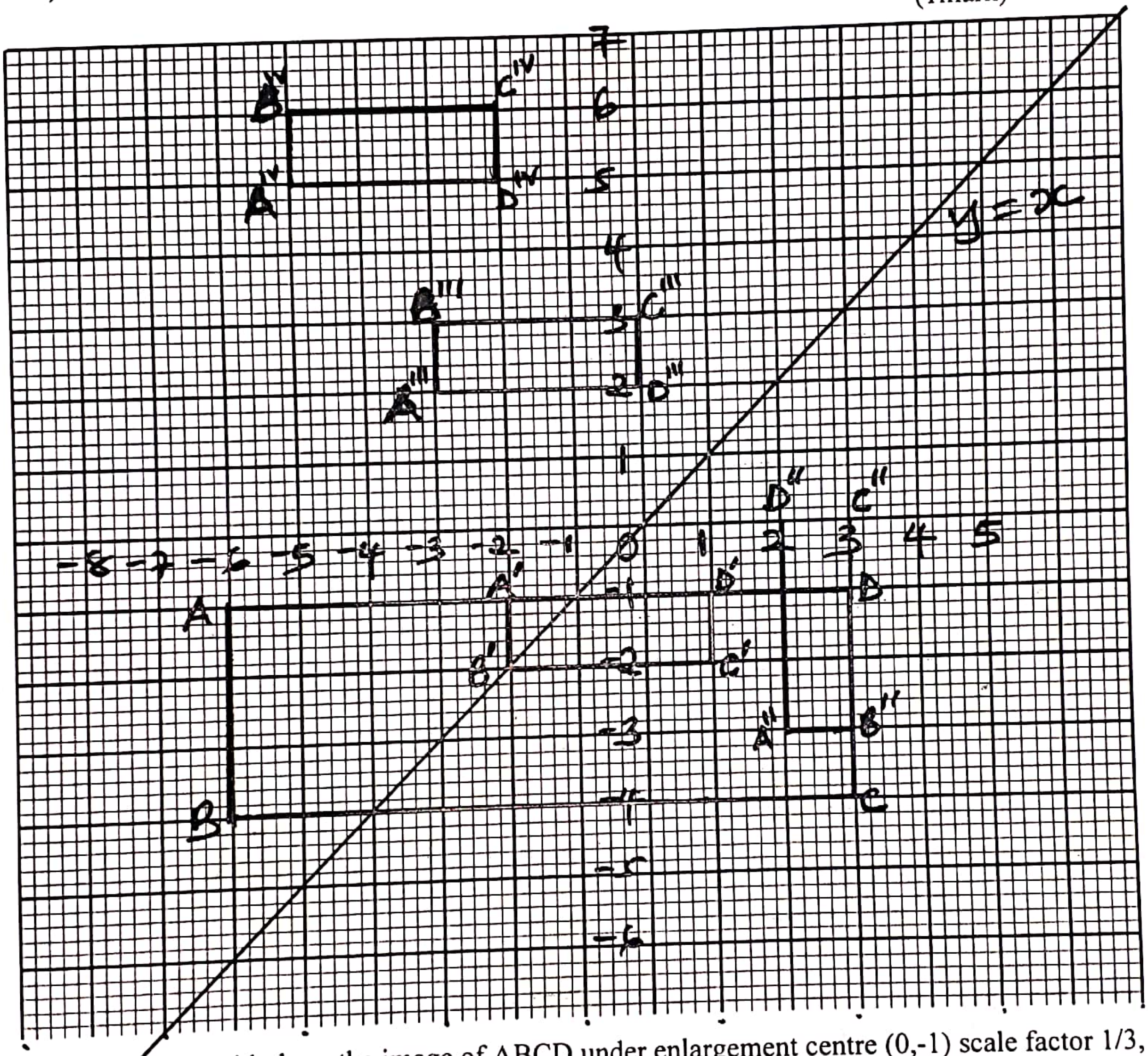


$\left[\frac{1}{2}(5+15)8.660\right]3$

$259.81 + \frac{1}{2} \times 15^2 \sin 60 + \frac{1}{2} \times 5^2 \sin 60$

$= \underline{\underline{368.1\text{ cm}^2}}$

22. a) Draw the quadrilateral with vertices at A(-6,-1) B(-6,-4) C(3,-4) and D(3,-1) (1mark)



(b) On the same grid, draw the image of ABCD under enlargement centre (0,-1) scale factor 1/3, label the image A'B'C'D'. (2marks)

(c) Draw A''B''C''D'' the image of A'B'C'D' under rotation of +90° about (1,0). (2marks)

(d) Draw A'''B'''C'''D''' the image of A''B''C''D'' under reflection in the line $y - x = 0$ 2marks

(e) Draw $A^{IV}B^{IV}C^{IV}D^{IV}$ the image of A'''B'''C'''D''' under translation $\begin{pmatrix}-2\\3\end{pmatrix}$ and write down its coordinates (3marks)

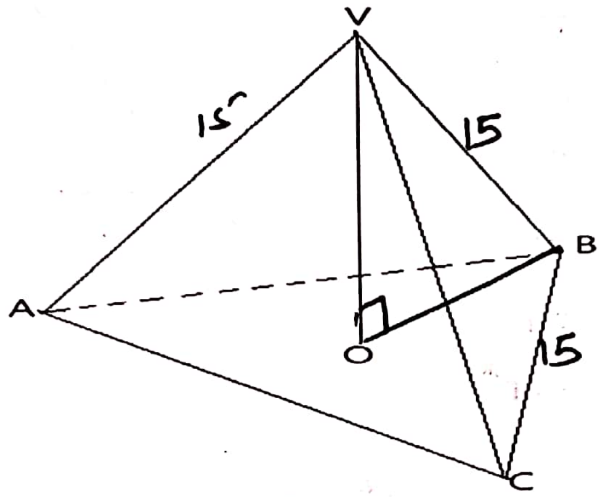
$A^{IV}(-5,5)$

$B^{IV}(-5,6)$

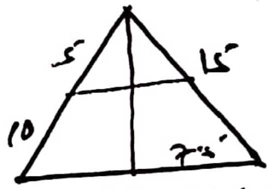
$C^{IV}(-2,6)$

$D^{IV}(-2,5)$.

21. The figure below shows a solid regular tetrahedron of side 15 cm. Point O is center of the base ABC



a). Calculate the perpendicular height VO of the pyramid to 1 decimal place. (3 marks)



$\frac{2}{3}\left(\sqrt{15^2-7.5^2}\right)=BO$

$=8.66$

$15^2-8.66^2$

$\sqrt{225-75}=VO$

$=\underline{\underline{12.2\text{ cm}}}$

b). The tetrahedron is cut parallel to the base ABC forming a frustrum. The slant height of the frustrum is two-thirds the slant height of the pyramid. Calculate;

(i). The volume of the frustrum. (4 marks)

$V_T=\frac{1}{3}\times\frac{1}{2}\times15^2\sin60\times12.2$

$=\cancel{113.654}$

396.206

$Vsf=27:1$

$V_{ST}=\frac{1}{27}\,396.206$

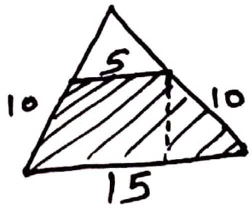
$=14.67$

$V_f=396.206-14.67$

$=\underline{\underline{381.53}}$

Acc. $\underline{\underline{383.016}}$ ✓✓

(ii). The surface area of the solid frustrum (3 marks)



$\left[\frac{1}{2}(5+15)8.660\right]3$

$259.81+\frac{1}{2}\times15^2\sin60+\frac{1}{2}\times5^2\sin60$

$=\underline{\underline{368.1\text{ cm}^2}}$

23. (a). The equation of a line L_1 is $7y - 5x - 20 = 0$ · Find the x-intercept of the equation (1mark)

$-5x = 20$

$x = \underline{\underline{-4}}$

b). Another line L_2 is perpendicular to L_1 and passes through (-5, 3). Find the equation of L_2. (3marks)

$m_1 = 5/7$

$m_2 = -\frac{7}{5}\ (-5, 3)$

$3 = -\frac{7}{\cancel{5}}(-\cancel{5}) + c$

$-4 = c$

$y = -\frac{7}{5}x - 4$

c). L_3 passes through (0,-3) and parallel to the line L_4 whose equation is $3y - 8x = 3$ find the equation of L_3. (3marks)

$m_1 = 8/3$

$m_2 = \frac{8}{3}\ (0, -3)$

$-3 = \frac{8}{3}(0) + c$

$-3 = c$

$y = \frac{8}{3}x - 3.$

d). Calculate the coordinates of point of intersection between the lines L_1 and L_3. (3marks)

$3y - 8x = -9$

$7y - 5x = 20$

$21y - 56x = -63$

$-\ 21y - 15x = 60$

$-41x = -123$

$x = 3$

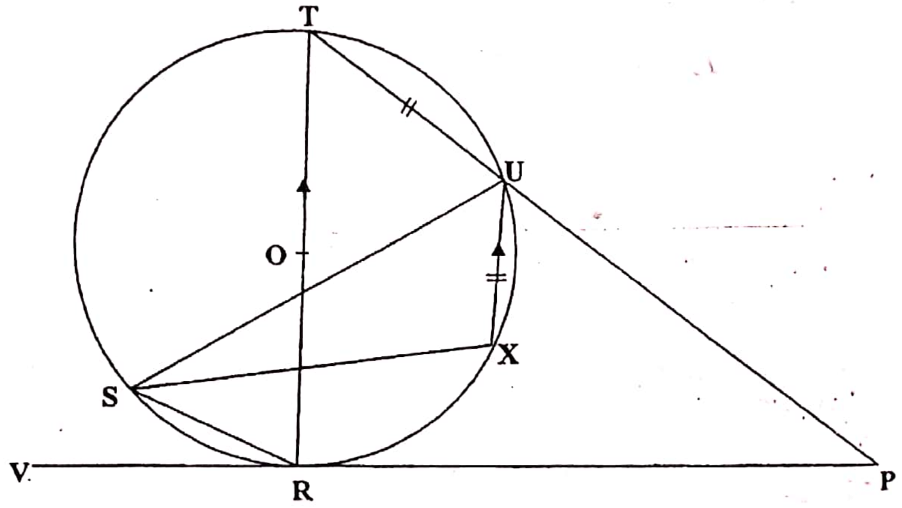
$3y - 8(3) = -9$

$3y = -9 + 24$

$y = 5.$

$\underline{\underline{(3, 5)}}$

24. In the figure below, O is the center of the circle TOR is the diameter and PRV is tangent to the circle at R.



Given that <SUR = 25^0, <URP = 60^0, TU = UX and that UX is parallel to the diameter; giving reasons calculate;

a) <TOU (2 marks)

60° – Sum of interior angles add to 180°

b) <XUP (2 marks)

60° – Vertically opposite angles are equal

c) <STR (2 marks)

25° – Same chord subtends equal angles at the circumference.

d) Reflex <SXU (2 marks)

95° – Opposite interior angles of a cyclic quadrilateral are equal.

e). <RPU (2marks)

30° – Angles of a triangle add to 180°