Name .... F_2 Scheme. .... Admission No. _____

School...

MATHEMATICS PAPER

OCTOBER 2022

2 ½ HOURS

URANGA MATHEMATICS ASSOCIATION

FORM TWO JOINT 2022

INSTRUCTIONS TO DANDIDATES

1. Write your name,admission number and school.
2. The paper contains two sections: Section I and II
3. Answer ALL questions in section I and ONLY FIVE questions from section II.
4. All working and answers must be written on the question paper in the spaces provided below each question.
5. Marks may be awarded for correct working even if the answer is wrong.
6. Negligence and slovenly work will be penalized.
7. Non-programmable silent electronic calculators and mathematical tables are allowed for use.
8. This paper consists of 15printed pages. Candidates should check to ensure that all pages are printed as indicated and no questions are missing

FOR EXAMINER'S USE ONLY

SECTION 1

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

GRAND TOTAL

SECTION II

17	18	19	20	21	22	23	24	TOTAL

SECTION 1 (50 Marks)
Answer ALL questions from this section

1. Evaluate: $\dfrac{\frac{1}{2} \text{ of } 18 \div -3 + 2\frac{1}{2} \times \frac{3}{-5}}{\frac{1}{2} + 3\frac{3}{4} \div \frac{3}{4}}$ BODMAS   (3 marks)

Numerator:

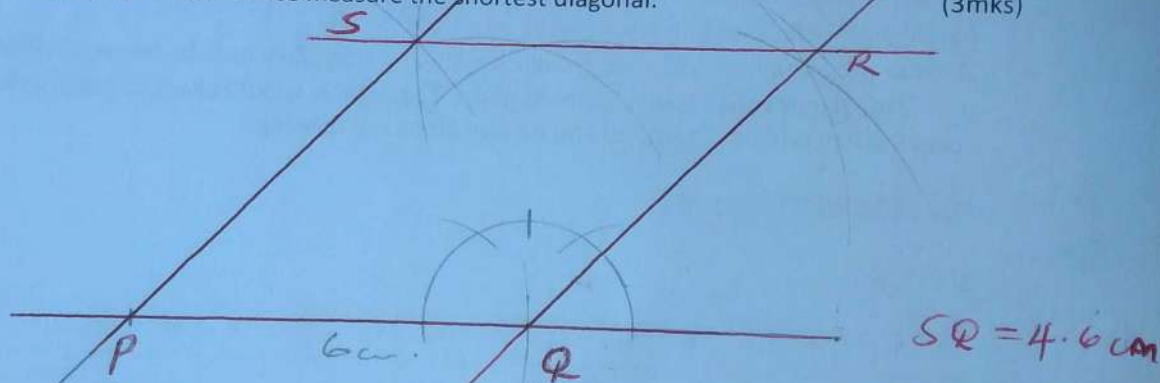$9 \div -3 + \frac{5}{2} \times \frac{3}{-5}$

$-3 + -1\frac{1}{2}$

$-\frac{9}{2}$

Denominator:

$\frac{1}{2} + \frac{15}{4} \times \frac{4}{3}^1$

$\frac{1}{2} + 5 = 5\frac{1}{2}$.

Combine N & D

$-\frac{9}{2} \div \frac{11}{2}$.

$-\frac{9}{2} \times \frac{2}{11}$.

$-\frac{9}{11}$

2. Using a ruler and a pair of compasses **only**, construct a rhombus PQRS such that PQ = 6 cm and angle PQR = 135^0 hence measure the shortest diagonal.   (3mks)

$SQ = 4.6$ cm

3. Solve the following inequalities and represent the solution on a number line and hence state the integral values of x

$7x - 4 \le 9x + 2 < 3x + 14$ (4 marks)
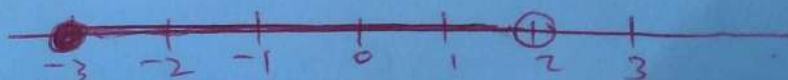
$7x - 4 \le 9x + 2$

$-2x \le 6$

$x \ge -3$ - - - +
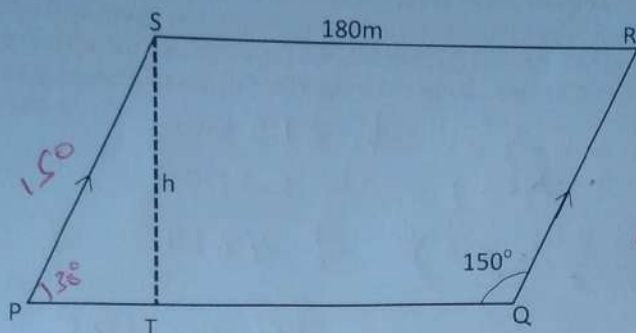
$9x + 2 < 3x + 14$

$6x < 12$

$x < 2$ or $2 > x$.

$2 > x \ge -3$

Integral values $= -3, -2, -1, 0$ & 1

4. The figure PQRS is a piece of land. QR is parallel to PS, RS=180m, QR=150m and angle PQR=150°. Calculate the area of the land in hectares.

(3 marks)

$\sin 30 = \dfrac{h}{150}$

$h = 150 \sin 30$

$Area = 150 \sin 30 \times 180$

$= 13500 m^2$

$\dfrac{13500}{10000}$

$1.35 ha.$

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

$$\dfrac{81^{2x} \times 27^x}{9^x} = 729$$

$3^{8x} \times 3^{3x} = 3^6 \times 3^{2x}$

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

$\dfrac{9x}{9} = \dfrac{6}{9}$

$x = \dfrac{2}{3}$

6. It would take 15men 8days to dig a trench of 240m long. Find how many ^more days it would take 18men to dig a trench 360meters long working at the same rate. (3 marks)

Men.	Trench	Days.
15	240	8
18	360	

$\dfrac{15 \times 8}{18} \times \dfrac{360}{240}$

$= 10 days.$

$10 - 8$

$= 2$ more days.

7. Mr. Waweru needs to import a car from Japan where cost is USD 5000 outside Kenya. He intends to buy the car through an agent who deals in Japanese yen. The agent will charge him 20% commission on the price of the car and further 80,325 Japanese yen for shipment of the car. How much Kenya shillings will he need to send to the agent to obtain the car given that? 1USD = 105.00 yen and 1USD = KSh. 63.00   (3 marks)

$$\text{Cost of Car} = (5000 \times 63) = \text{Sh } 315\,000$$

$$\text{Commission} = \left(\frac{20}{100} \times 5000 \times 63\right) = \text{Sh } 63\,000$$

$$\text{Shipment Fee} = \left(\frac{80\,325}{105} \times 63\right) = \text{Sh } 48\,195. \; +$$

$$\text{Sh. } 426\,195.$$

8. Use tables of reciprocals only to find the value of

$$\frac{5}{0.0829} - \frac{14}{0.581} \qquad\qquad \text{(3 marks)}$$

$$5\left(\frac{1}{8.29 \times 10^{-2}}\right) - 14\left(\frac{1}{5.81 \times 10^{-1}}\right)$$

$$5\left(0.1209 \times 10^{2}\right) - 14\left(0.1721 \times 10^{1}\right).$$
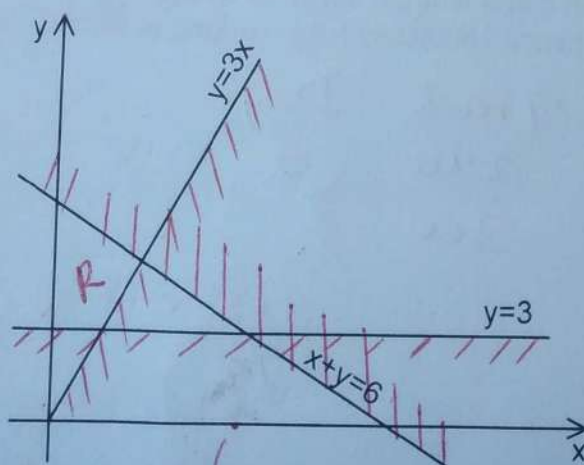
$$5(12.09) - 14(1.721) \qquad 36.356.$$

9. The diagram below shows the graph of y=3, y=3x and x + y = 0. By shading the unwanted region, determine and label the region which satisfies the following inequalities: (3 marks)

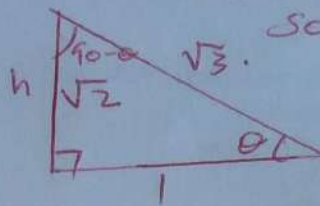$$y \geq 3$$

$$y \geq 3x$$

$$x + y \leq 6$$

10. $\cos \theta = \dfrac{1}{\sqrt{3}}$ where θ is an acute angle. Without using mathematical tables or calculator, find:

(a) $\sin \theta$ (2 marks)

SOHCAHTOA

$h^2 + 1^2 = (\sqrt{3})^2$

$h^2 = 3 - 1$

$h = \sqrt{2}$

$\sin \theta = \dfrac{\sqrt{2}}{\sqrt{3}}$

(b) $\tan(90 - \theta)$ (1 mark)

$\tan(90 - \theta) = \dfrac{1}{\sqrt{2}}$

11. Wafula uses $^1/_6$ of his land for planting maize, $^1/_{12}$ for beans and $^4/_9$ of the remainder for grazing. He still has 10 hectares of unused land. Find the size of Wafula's land.   (3mks)

Maize $= \dfrac{1}{6}$

Beans $= \dfrac{1}{12}$

Remainder $= 1 - \left(\dfrac{1}{6} + \dfrac{1}{12}\right) = \dfrac{3}{4}$

Grazing $= \dfrac{4}{9} \times \dfrac{3}{4} = \dfrac{1}{3}$

Total used land $= \dfrac{1}{3} + \dfrac{1}{6} + \dfrac{1}{12} = \dfrac{7}{12}$

Unused land $= \dfrac{5}{12} = 10\,ha$

$1 = ?$

$\dfrac{10 \times 12}{5}$

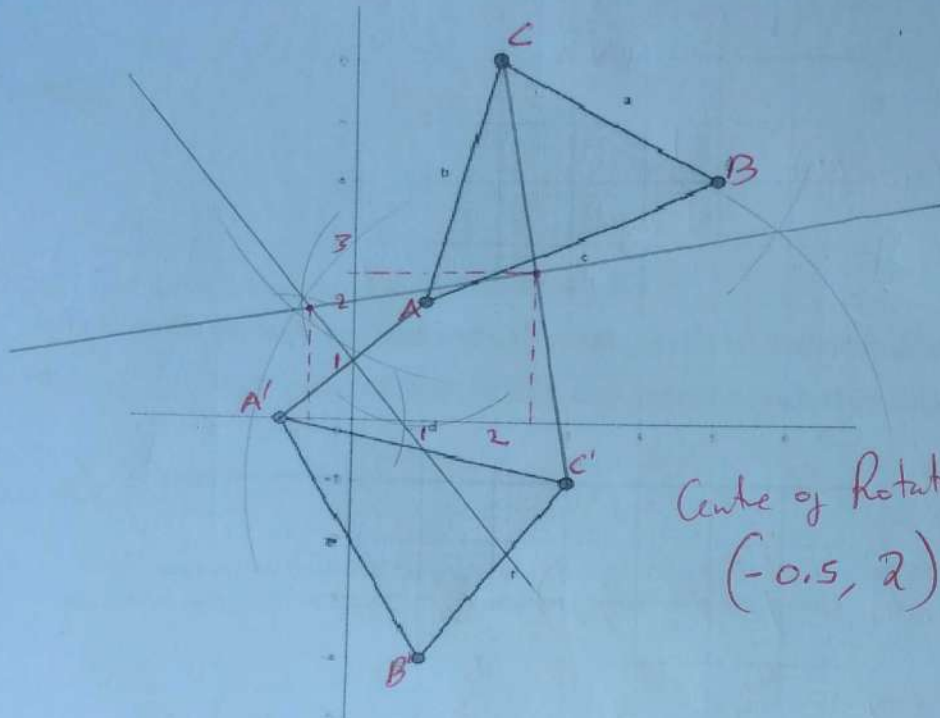$\underline{\underline{24\,ha.}}$

12. The figure below shows triangle ABC and its image A'B'C' after a clockwise rotation. Find by construction

a) The centre of rotation

(3 marks)

b) The angle of rotation

(1 mark)

Centre of Rotation $\left(\cancel{2.5, 7.5} \right)$

$(-0.5, 2)$.

13. Mutua bought 8 pairs of trousers and six shirts at Sh. 4160. Had he bought twice as many shirts and half as many trousers, he would have saved Sh. 160. Find the cost of each item.

(3 marks)

$$8t + 6s = 4160 \times 2$$
$$- \quad 16t + 3s = 4000 \times 1$$
$$\overline{\qquad\qquad\qquad}$$
$$9s = \frac{4320}{9}$$
$$\frac{}{9}$$
$$\text{Shirt} = Sh\ 480$$

$$16t + 1440 = 4000$$
$$16t = 2560$$
$$\frac{16t}{16} = \frac{2560}{16}$$
$$t = 160$$

Cost of Shirt = Sh 480
Trouser = Sh 160.

14. Two containers have base area of 750cm² and 120cm² respectively. Calculate the volume of the larger container in litres given that the volume of the smaller container is 400cm³. **(3 marks)**

$$A.S.F = \frac{750}{120} = \frac{25}{4}$$

$$L.S.F = \frac{5}{2}$$
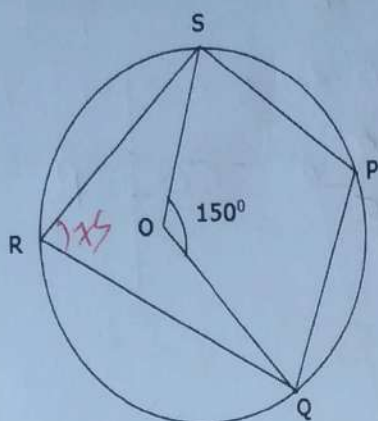
$$V.S.F = \left(\frac{5}{2}\right)^3 = \frac{125}{8}$$

$$\frac{125}{8} = \frac{V_{Large}}{400}$$

$$V_{Large} = 6250 \, cm^3$$

$$Volume \ in \ Litres = \frac{6250}{1000}$$

$$6.25 \, Lths$$

15. PQRS is a cyclic quadrilateral and O is the center of the circle. Angle QOS = 150⁰.

Find the size of:

(a) Angle QPS **(2 marks)**

$$\angle QRS = 75°$$

$$75 + \angle QPS = 180°$$

$$\angle QPS = 105°$$

(b) Angle QRS **(1 marks)**

$$\angle QRS = 75°$$

16. Simplify the following expression. **(3 marks)**

$$\frac{x-3}{x+3} - \frac{3x-9}{x^2-9}$$

$$\frac{(x-3)(x-3) - (3x-9)}{(x-3)(x+3)}$$

$$\frac{(x-3)(x-3)}{(x-3)(x+3)} - \frac{3(x-3)}{(x-3)(x+3)}$$

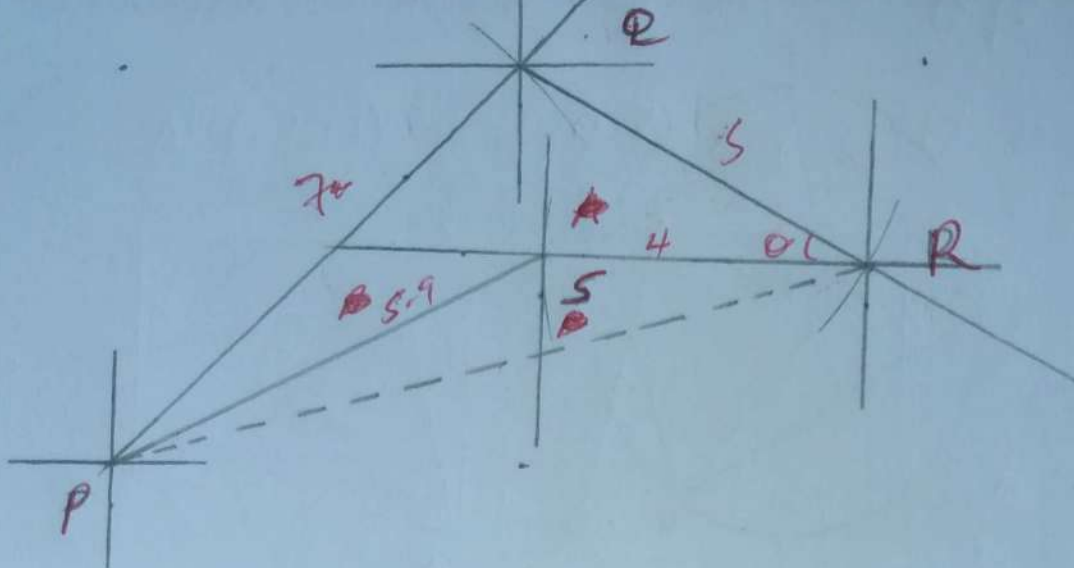$$\frac{x-3}{x+3} - \frac{3}{x+3} = \frac{(x-3)-3}{(x+3)}$$

$$\frac{x-6}{x+3}$$

17. A village Q is 7 km from village P on a bearing of 045^0. Village R is 5 km from village Q on a bearing of 120^0 and village S is 4 km from village R on a bearing of 270^0.

a) Taking a scale of 1 m to represent 1 Km, locate the three villages.

(3 mks)

b) Use the scale drawing to find the:

i. Distance and bearing of the village R from village P.

Distance = 9.6 Km ± 0.1   (2 mks)

Bearing = 075^0 ± 1^0

ii. Distance and bearing of village P from village S.   (2 mks)

Distance 5.9 km ± 0.1

Bearing = 241^0

iii. Area of the polygon PQRS to the nearest 4 significant figures

~~(Hint: Divide the figure into two triangles)~~   (3 mks)

$\triangle PQR - \triangle PSR$.

$\left(\frac{1}{2} \times 7 \times 5 \sin 105 \right) - \left(\frac{1}{2} \times 5.9 \times 4 \sin 151 \right)$

$16.90 - 5.721$

$= 11.18 \text{ Km}^2$

18. A sector of angle 108⁰ is cut from a circle of radius 20 cm. It is folded to form a cone.

Calculate:

(a) The curved surface area of the cone.   (2 mks)

$$\frac{108}{360} \times \frac{22}{7} \times 20 \times 20$$

$$= 377.14 \ cm^2$$

(b) The base radius of the cone.   (2 mks)

$$\pi r L = 377.14$$
$$r = \frac{377.14 \times \frac{7}{22}}{20}$$
$$r = 6.0 cm$$

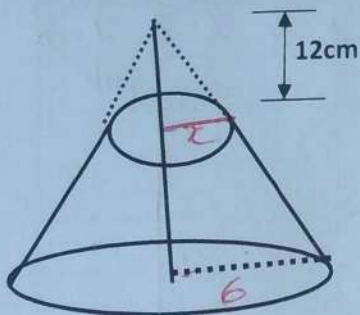(c) The vertical height of the cone.   (2 mks)

$$h^2 + 6^2 = 20^2$$
$$h^2 = 400 - 36$$
$$h^2 = \sqrt{364}$$
$$h = 19.08 \ cm$$

(d) If 12 cm of the cone is chopped off to form a frustrum as shown below.

12cm

6

Calculate the volume of the frustum formed.   (4 mks)

$$\frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$$

$$\frac{6}{r} = \frac{19.08}{12}$$

$$r = 3.774 \ cm$$

$$\left(\frac{1}{3} \times \frac{22}{7} \times 6 \times 6 \times 19.08\right) - \left(\frac{1}{3} \times \frac{22}{7} \times 3.774^2 \times 12\right)$$

$$719.59 - 179.06$$

$$= 540.53 \ cm^3$$

19. A kite ABCD has vertices at A(1,1), B(6,2), C(6,6) and D(2,6).

a) On the axes draw the image and state its coordinates;

   i) A'B'C'D' of ABCD under a rotation of 90^0 about the origin. (3 mks)
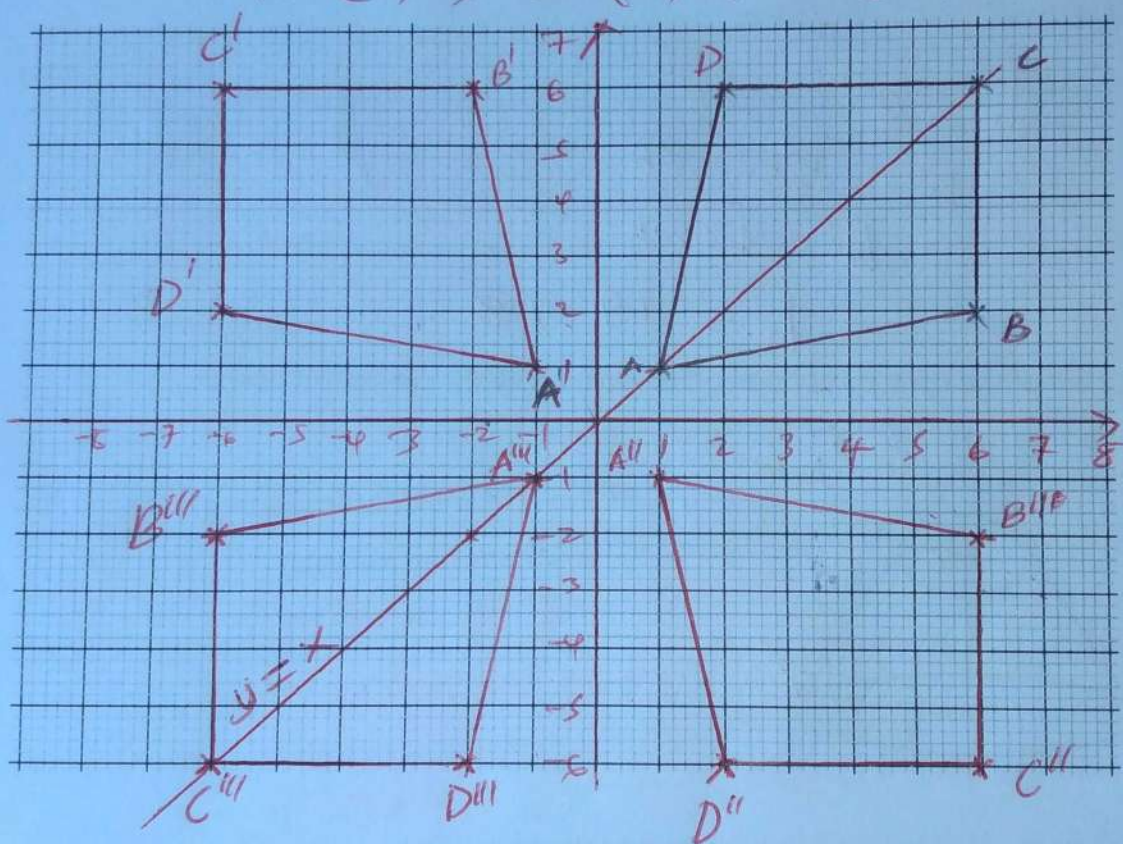
   $A'(-1, 1)$ $B'(-2,6)$ $C'(-6,6)$ $D'(-6,2)$

   ii) A''B''C''D'' of A'B'C'D' under a reflection in the line y=x. (3mrks)

   $A''(1,-1)$ $B''(6,-2)$ $C''(6,-6)$ $D''(2,-6)$

   iii) A'''B'''C'''D''' of A''B''C''D'' under a reflection in the line x=0. (2mks)

   $A'''(-1,-1)$ $B'''(-6,-2)$ $C'''(-6,-6)$ $D'''(-2,-6)$

b) Describe a single transformation that maps A"B"C"D onto ABCD. (2mks)

Reflection on the line. y=0

B

By

20. Marks scored by 100 students in a test were recorded as follows

Marks	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85-94
	6	14	24	14	x 22	10	6	4

(a) Determine the value of x. (2mks)

$$x = 100 - (6+14+24+14+10+6+4)$$
$$= 22$$

(b) State the modal class. (1mk)

$$35 - 44$$

(c) Calculate the median mark. (3mks)

$$\frac{1}{2} \times 100 = 50$$

$$44.5 + \frac{(50-44)10}{14}$$

$$= 48.79$$

(d) Calculate the mean mark (4mks)

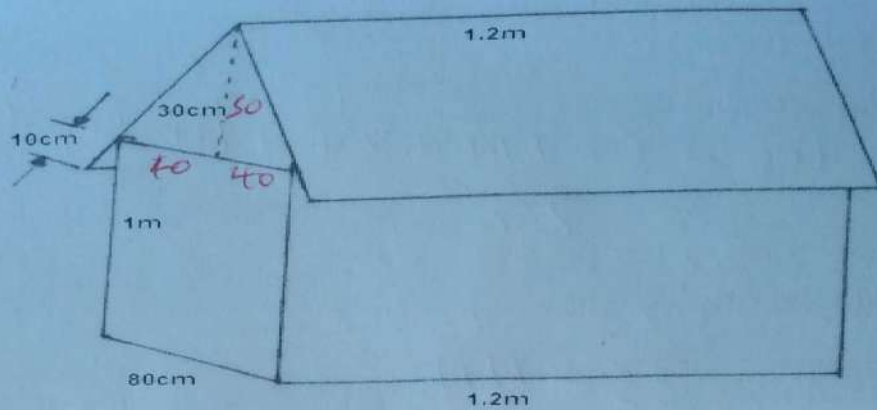| Class	f	x	fx	cf
15-24	6	19.5	117	6
25-34	14	29.5	413	20
35-44	24	39.5	948	44
45-54	14	49.5	693	58
55-64	22	59.5	1309	80
65-74	10	69.5	695	90
75-84	6	79.5	477	96
85-94	4	89.5	358	100

$$\Sigma f = 100 \qquad \Sigma fx = 5010$$

$$\bar{X} = \frac{\Sigma fx}{\Sigma f}$$

$$\frac{5010}{100}$$

$$50.1$$

21. The figure below shows a portable Kennel.

a) Calculate

   i) The total surface area of the walls and the floor. (2mks)

   $2\left(\frac{1}{2} \times 80 \times 50 + 80 \times 100\right) + (120 \times 80) + (120 \times 100) \times 2.$

   $20000 \quad + \quad 9600 \quad + \quad 24000$

   $53600\ cm^2$

   ii) The total area of the roof. (2mks)

   $40 \times 120 \times 2$

   $= 9600\ cm^2$

b) The cost of roofing is Ksh 500 per square meter and that of making walls and floor is Ksh 600 per m². Find the cost of making the Kennel. (2mks)

   $(5.36 \times 600) + (0.96 \times 500)$

   $3216 + 480$

   $= sh\ 3696$

c) Find the cost of roofing another Kennel whose dimensions are 50% more than those of the given Kennel. (2mks)

   $\frac{150}{100} \times 3696$

   $= 5544$

   OR $\frac{150}{100} \times \frac{53600}{10000} = 8.04\ m^2$ $\qquad 8.04 \times 600 = 4824$

   $\frac{150}{100} \times \frac{9600}{10000} = 1.44\ m^2$ $\qquad 1.44 \times 500 = 720$
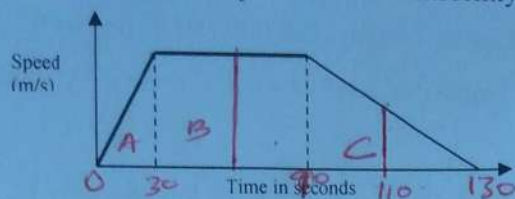
   $\underline{\qquad\qquad} \qquad 5544$

d) Calculate the volume of air inside the Kennel in cm³. (2mks)

   $\left(\frac{1}{2} \times 80 \times 50 + 80 \times 100\right) \times 120$

   10000×120

   $1\ 200\ 000\ cm^3$

22. The diagram below shows the speed-time graph for a bus travelling between two stations. The bus begins from rest and accelerates uniformly for 30 seconds. It then travels at a constant speed for 60 seconds and finally decelerates uniformly for 40 seconds.

Given that the distance between the two stations in 2090m. Calculate

(a) The maximum speed, in km/h the bus attained

(3 Marks)

$$\frac{1}{2}h(a+b) = 2090.$$
$$\frac{1}{2}h(60+130) = 2090.$$
$$95h = 2090$$
$$h = 22\ m/s.$$
$$Speed = 22 \times \frac{10}{36}$$
$$6.111\ km/h.$$

(b) The acceleration

(2 Marks)

$$a = \frac{v-u}{t}.$$
$$\frac{22-0}{30}$$
$$0.7333\ m/s^2$$

* (c) The distance travelled during the last 40 seconds

(2 Marks)

$$\frac{1}{2}b \times h.$$
$$\frac{1}{2} \times 40 \times 22$$
$$= 440\ m$$

(d) The time the bus takes to travel the first half of the journey

(3 Marks)

$$\frac{1}{2} \times 2090 = 1045\ m.$$

First part of the journey $= \frac{1}{2} \times 30 \times 22 = 330.$

$$1045 - 330 = 715\ m.$$

$$22 \times x = 715.$$
$$x = \frac{715}{22}$$
$$x = 32.5\ seconds$$
$$Time = 32.5 + 30$$
$$= 62.5\ Seconds.$$

23. Nyongesa is a sales executive earning a salary of Kshs. 120,000 and a commission of 8% for the sales in excess of Kshs. 1,000,000. If in January he earned a total of Kshs. 480,000 in salaries and commission.

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

commission $= 480\,000 - 120000 = 360\,000$

Total sales $\left(\dfrac{100}{8} \times 360\,000\right) + 1\,000\,000$

$$Sh\ 5\,500\,000$$

(b) If the total sales in the month of February increased by 18% and in the month of March dropped by 30% respectively;

Calculate:-

(i) Nyongesa's commission in the month of February. (3 mks)

$\dfrac{118}{100} \times 5\,500\,000$

$= 6\,490\,000$

$6\,490\,000 - 1\,000\,000 = 5\,490\,000$

$\dfrac{8}{100} \times 5\,490\,000$

Commission $= 439\,200$

(ii) His total earning in the month of March. (3 mks)

Sales $= \dfrac{70}{100} \times 6\,490\,000$

$= 4\,543\,000$

Commission $\dfrac{8}{100} \times 3\,543\,000 = 283\,440$

Total Earning $= 283\,440 + 120\,000$

$= 403\,440$

24. a) Find the equation of a straight line passing through the point (3, 2) and (-3, 6) giving your in the form $\frac{x}{a}+\frac{y}{b}=1$ where a and b are constants. (4mks)

$$\text{gradient} = \frac{6-2}{-3-3} = \frac{4}{-6}$$

$$\frac{y-2}{x-3} = \frac{2}{-3}$$

$$-3(y-2) = 2(x-3)$$

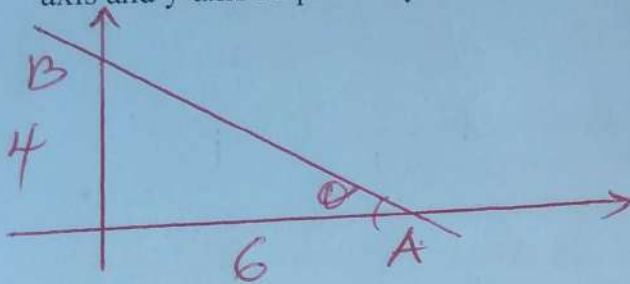$$-3y+6 = 2x-6$$

$$2x+3y = 12 \qquad \frac{x}{6}+\frac{y}{4}=1$$

b) State the coordinates of points A and B at which the line in (a) above crosses the x-axis and y-axis respectively. (2mks)

$$B = \frac{y}{4} = 1$$
$$y = 4$$
$$B(0,4)$$
$$A(6,0)$$

c) Using the information in (a) and (b) above, find the area of triangle AOB where O is the origin. (2mks)

$$\frac{1}{2} \times 6 \times 4$$

$$= 12 \text{ sq unit}$$

d) Find the acute angle the line in (a) above makes with the x-axis. (2mks)

$$\text{Tan}\,\theta = \frac{4}{6}$$

$$\theta = \text{Tan}^{-1}\frac{4}{6}$$

$$\theta = 33.69°$$