MATHEMATICS
FORM 3
PAPER 1
END TERM 2 2025
MARKING SCHEME

SECTION I(50marks)

Answer all the questions in this section

1.Evaluate: (3mks)

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

$\frac{5}{2} \times \frac{7}{4} - \frac{21}{4}$

$\frac{35}{8} - \frac{21}{4}$

$\frac{35-42}{8}$

Denominator.

$\frac{5}{4} - \frac{11}{4} = \frac{-3}{2}$

$2\left(\frac{-3}{2}\right) = -3$

$1\frac{2}{5} + -3$

$= \frac{7}{5} - 3$

[redacted] $= \frac{-8}{5}$

$= \frac{-7}{8} \times \frac{-5}{8}$

$= \frac{35}{64}$

2. A piece of rectangular plot measuring 27m by 16m is to be divided into smaller rectangular units leaving no remainder. Calculate the highest number of smaller units whose dimensions are each greater than 1m that can be obtained from the plot. (3marks)

$27 = 3 \times 3 \times 3$

$16 = 2 \times 2 \times 2 \times 2$

Dimension of the smaller unit $= 3 \times 2 = 6$

Number of smaller unit

$= \frac{27 \times 16}{3 \times 2}$

$= 72$ units

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

$x = 1.313313313$

$1000x = 1313.313313313$

$- \quad x = \quad 1.313313313$

$\frac{999x}{999} \quad \frac{1312}{999}$

$x = \frac{1312}{999}$

$= 1\frac{313}{999}$

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

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

$$\left(\frac{95.75 \times 0.85}{5.758}\right)^{2/3}$$

No	std form	log
95.75	9.575×10^{1}	1.9811
0.85	8.5×10^{-1}	$\bar{1}.9294$
		1.9105
5.758	5.758×10^{0}	0.7603
		1.1502

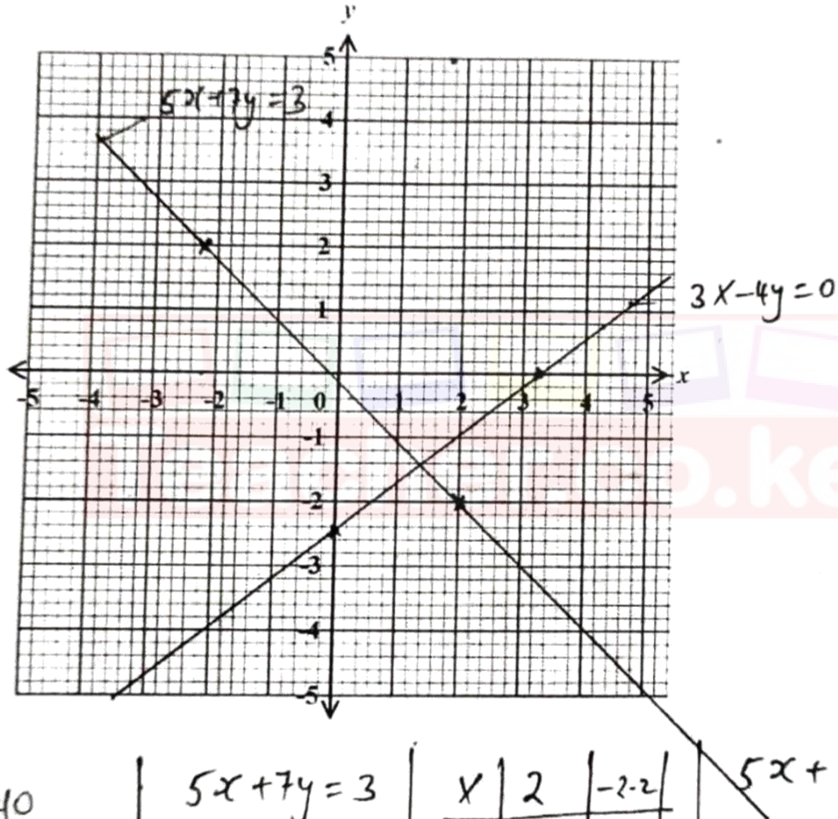
$$\left(\frac{1.1502}{3}\right)2 = 0.7668$$

$$5.845 \times 10^{0} = \underline{5.845}$$

5. Using the grid provided below, solve the simultaneous equation (3 marks)

$3x - 4y = 10$

$5x + 7y = 3$



$3x - 4y = 10$

x	0	3.3
y	-2.5	0

$5x + 7y = 3$

x	0	0.6
y	0.4	0

x	2	-2.2
y	-1	2

$10 + 7y = 3$

$\frac{7y}{7} = \frac{-7}{7}$

$y = -1$

$5x + 7y = 3$

$5x + 14 = 3$

$\frac{5x}{5} = \frac{-11}{5}$

$x = -2.2$

$x = 1.4$

$y = \underline{-1.4}$

let $c(x,y)$

$2\left[\binom{3}{1}-\binom{x}{y}\right] = \binom{3}{7}-\binom{x}{y}$ Centre $= (3,3)$

6. Under an enlargement, the image of the points $A(3,1)$ and $B(1,2)$ are $A'(3,7)$ and $B'(7,5)$. Find the centre and scale factor of enlargement. (4 marks)

$AB = B - A$

$= \binom{1}{2} - \binom{3}{1}$

$= \binom{-2}{1}$

$|AB| = \sqrt{(-2)^2 + (1)^2}$

$\sqrt{4+1}$

$= \sqrt{5}$

$A'B' = B' - A'$

$= \binom{7}{5} - \binom{3}{7}$

$= \binom{4}{-2}$

$|A'B'| = \sqrt{(4)^2 + (-2)^2}$

$= 16 + 4$

$= \sqrt{20}$

$\frac{A'B'}{AB} = \frac{\sqrt{20}}{\sqrt{5}}$

$= \sqrt{4}$

$= 2$

$S.F =$

7. A Kenyan businessman intended to buy goods worth US dollar 20,000 from South Africa. Calculate the value of the goods to the nearest south Africa (S.A) Rand given that 1 US dollar = Ksh 101.9378 and 1 S.A Rand = Ksh 7.6326. (3marks)

1 USD = Ksh 101.9378

20,000 USD = x

= Ksh 2038756

1 S.R = 7.6326

$\frac{2038756}{7.6326}$

= 267111.6

= 267111. SR

8. Solve for x in the following equation. (3marks)

$4^x(8^{x-1}) = \frac{\sin 45^0}{\cos 45^0}$

$\frac{4^x(8^{x-1})}{4^x} = \frac{1}{4^x}$

$8^{x-1} = \frac{1}{4^x}$

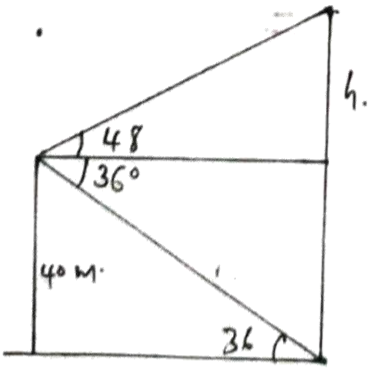
$2^{3(x-1)} = 2^{-2x}$

$3x - 3 = -2x$

$\frac{5x}{5} = \frac{3}{5}$

$x = 3/5$

9. From a viewing tower 40 metres above the ground, the angle of depression of an object on the ground is 36° and the angle of elevation of an aircraft vertically above the object is 48°. Calculate the height of the aircraft above the objet on the ground. (3marks)



$\tan 36 = \frac{40}{x}$

$x = \frac{40}{\tan 36}$

$= 55.06$ m.

$\tan 48 = \frac{h}{55.06}$

$h = 61.15$ m.

$= 61.15 + 40$

$= 101.15$ m

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

$\frac{2x^2}{2}+\frac{3x}{2}=\frac{5}{2}$

$x^2+\frac{3}{2}x=2.5$

$x^2+\frac{3}{2}x+\left(\frac{3}{2\cdot2}\right)^2=2.5+\left(\frac{3}{4}\right)^2$

$\left(x+\frac{3}{4}\right)^2=3.0625$

$x+\frac{3}{4}=\pm1.75$

$x+0.75=\pm1.75$

$x=+1.75-0.75$

$=1.$

$x+0.75=-1.75$

$x=-2.5$

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

$\Sigma fx = 20\times5=100$

1st three $=16\times3=48$

Diff $=100-48$

$=\underline{\underline{52}}$

let 4th be x

5th $=x+8$

$x+x+8=52$

$\frac{2x}{2}=\frac{44}{2}$

$x=22$

5th $=22+8$

$=\underline{\underline{30}}$

12.Simplify the expression $\frac{12x^2+ax-6a^2}{9x^2-4a^2}$ (2mks)

$\left.\begin{array}{l}p=-72\\ s=1\end{array}\right\}$ 8 and

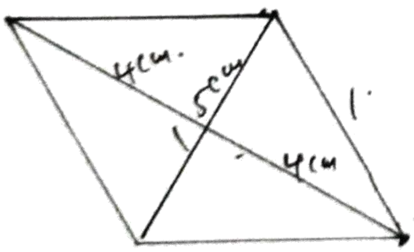
$\frac{12x^2-8ax+9ax-6a^2}{(3x+2a)(3x-2a)}$

$4x(3x-2a)+3(3ax-2a)$

$\frac{(4x+3)(\cancel{3x-2a})\;3ax-2a}{(3x+2a)\;(\cancel{3x-2a})}$

$\frac{(4x+3)(3ax-2a)}{(3x+2a)}$

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



$A=60cm^2$

$A=\frac{1}{2}bh\times2.$

$60=\frac{1}{2}\times15\times h\times2$

$\frac{15h}{15}=\frac{60}{15}$

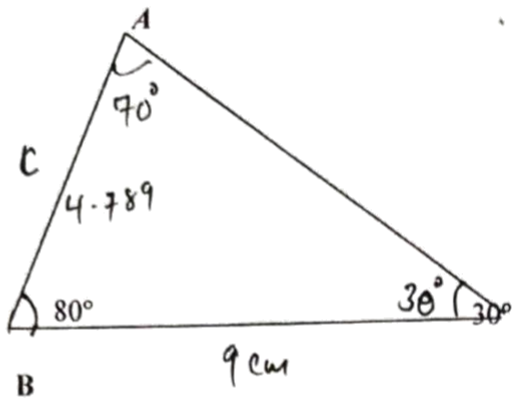
$h=4cm$

$l=\sqrt{7.5^2+4^2}$

$=8.5cm\times4$

$=\underline{\underline{34cm}}$

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



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

$\frac{9}{\sin 70} = \frac{c}{\sin 30}$

$c = \frac{9 \sin 30}{\sin 70}$

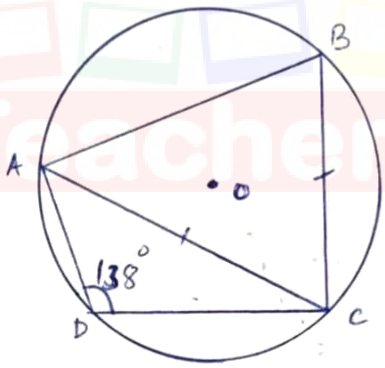
$= 4.789$

$A = \frac{1}{2} ba \sin \theta$

$= \frac{1}{2} \times 9 \times 4.789 \sin 80$

$= \underline{\underline{21.22 \text{ cm}^2}}$

16. In the circle below, O is the centre, angle ADC = 138°. Chord BC = AC.



Calculate the size of;

i) Angle ~~ABD~~ ABC 42. opposite angles of cyclic quadrilateral (2marks)

(ii) Angle ~~ADB~~ ACB 96° Sum of angles of triangle ABC add up to 180° (1mark)

ii) ~~Angle ADB~~ (1mark)

6. Solve the inequality and represent the solution on a number line. (3 marks)

$6 - 4x \geq x < \frac{4x+10}{3}$

$6 - 4x \geq x$

$\frac{6}{5} \geq \frac{5x}{5}$

$x \leq 1.2$

$x < \frac{4x+10}{3}$

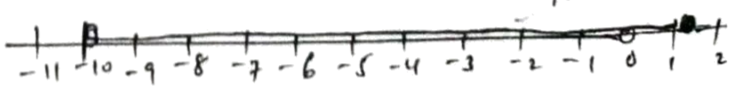
$3x < 4x + 10$

$-10 < x$

$x > -10$

$\frac{-x}{-1} < \frac{10}{-1}$

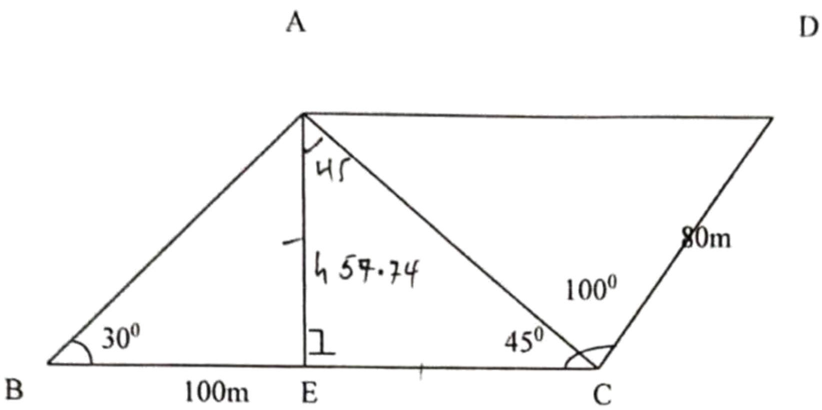
$x > -10$



SECTION II (50marks)

Answer 5 questions only in this section

17. The figure below represents a quadrilateral piece of land ABCD divided into three triangular plots. The lengths BE and CD are 100m and 80m respectively. Angle ABE = 30^0, ACE = 45^0 and ACD = 100^0.



(a) Find to four significant figures:

(i) The length of AE. (2mks)

$\tan 30 = \frac{AE}{100}$

$AE = 100 \tan 30$

$= 57.74 m$

(ii) The length of AD. (2mks)

$AC = \sqrt{57.74^2 + 57.74^2}$

$= 81.66$

(iii) The perimeter of the piece of land. (3mks)

$AD^2 = 81.66^2 + 80^2 - 2 \times 81.66 \times 80 \cos 100$

$= 123.84$

(iii) $\sqrt{100^2 + 57.74^2}$

$= \sqrt{10,000 + 3333.9}$

$= 115.5$

$P = 115.5 + 123.8 + 80 + 57.74 + 100$

$= 477.1 m$

(ii) The plots are to be fenced with five strands of barbed wire leaving an entrance of 2.8m wide to each plot. The type of barbed wire to be used is sold in rolls of lengths 480m. Calculate the number of rolls of barbed wire that must be bought to complete the fencing of the plots.(3mks)

$= \frac{477.1}{2.8 \times 3} = 468.7$

five strands $= 468.7 \times 5 = 23343.5$

$= \frac{23343.5}{480} = 4.882$

$= 5$ rolls

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

a) If Mr.Makori bought an orange at Kshs x, write down and simplify an expression for the total number of oranges bought by the two in the week. (3marks)

Before discount $= \frac{45}{x}$

After discount $= \frac{45}{x-3/4}$

b) If Mrs.Makori bought 2 oranges more than her husband, find how much each spent on an orange. (5 marks)

$x(x-0.75)\frac{45}{x-\frac{3}{4}} - \frac{45}{x} = 2.[x(x-0.75)]$

$45x - 45x + 33.75 = 2[x^2 - 0.75x]$

$33.75 = 2x^2 - 1.5x$

$2x^2 - 1.5x - 33.75 = 0$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-(1.5) \pm \sqrt{(-1.5)^2 - 4 \times 2 \times -33.75}}{4}$

$= \frac{1.5 \pm \sqrt{2.25 + 270}}{4} = \frac{1.5 + 16.5}{4}$

$= \underline{4.5}$

c) Find the number of oranges bought by the two. (2 marks)

Makori $= \frac{45}{4.5} = 10$

Mr Makori $= \frac{45}{4.5 - 0.75}$

$= 12.$

Total Oranges $= 10 + 12$

$= 22$ Oranges

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

a) Find the coordinates of A (3 marks)

$2y - 3x = 6$

$3(3y + x = 20)$

$2y - 3x = 6$

$9y + 3x = 60$

$\frac{11y}{11} = \frac{66}{11}$

$y = 6$

$2(6) - 3x = 6$

$-3x = 6 - 12$

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

$x = 2$

$(x, y) = (2, 6)$

b) A third line L_3 is perpendicular to L_2 at point A. Find the equation of L_3 in the form $y = mx + c$, where m and c are constants. (3 marks)

$L_2 = 3y + x = 20$

$\frac{3y}{3} = \frac{-x}{3} + \frac{20}{3}$

$y = -\frac{1}{3}x + \frac{20}{3}$

$M_1 = -\frac{1}{3}$

$M_2 = 3$ $(x, y)\ (2, 6)$

$\frac{y-6}{x-2} = 3$

$y - 6 = 3(x-2)$

$y - 6 = 3x - 6$

$y = 3x - 6 + 6$

$y = 3x$

c) Another line L4 is parallel to L_1 and passes through (-2, 3). Find the x and y intercepts of L_4 (4mks)

$2y - 3x = 6$

$\frac{2y}{2} = \frac{3x}{2} + \frac{6}{2}$

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

$M_1 = \frac{3}{2}$

$M_2 = \frac{3}{2}$

$(x, y)\ (-2, 3)\ \frac{3}{2}$

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

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

$2y - 6 = 3x + 6$

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

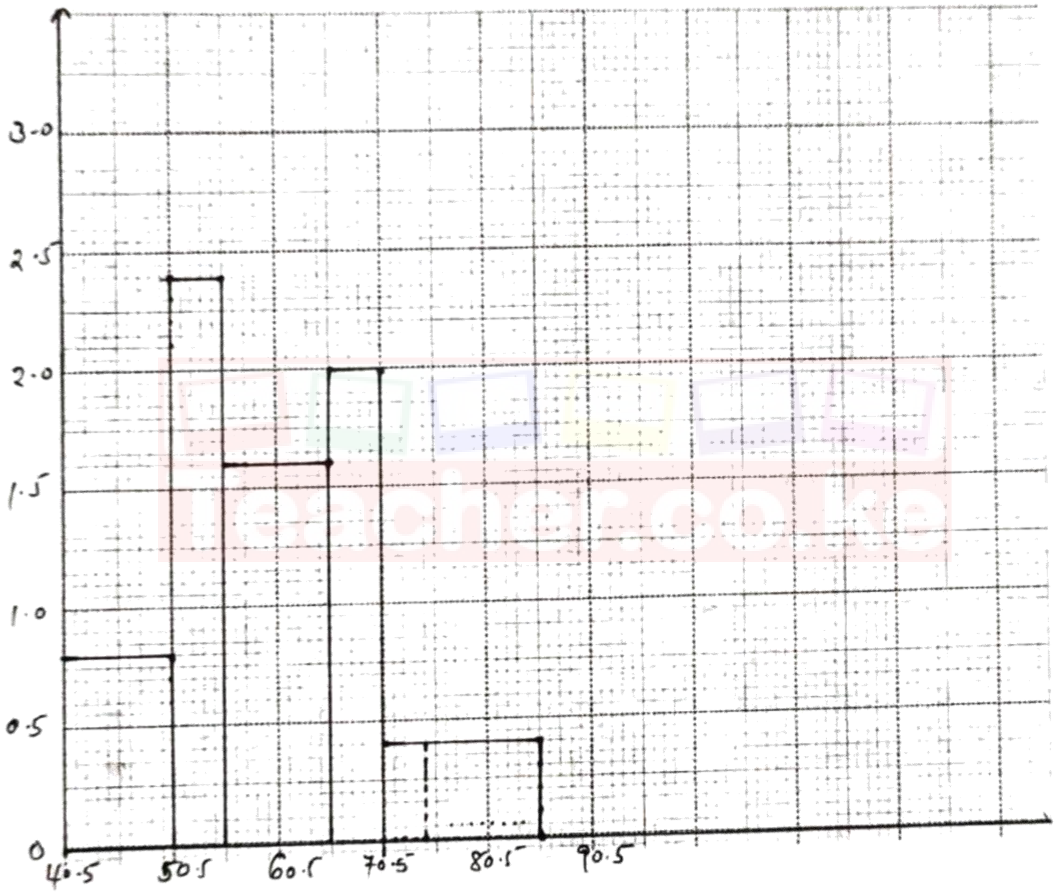
$y = \frac{3}{2}x$.

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

Mass (kg)	41-50 10	51-55 5	56-65 10	66-70 5	71-85 15
Frequency	8	12	16	10	6
Height of rectangle	0.8	2.4	1.6	2	0.4
cf	8	20	36	46	52.

a). Complete the table above to 1 decimal (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. $\frac{52}{2} = 26$ 56 - 65 (1 mark)

ii) Estimate the median mark (2 marks)

$\cancel{40}\ (10 \times 0.8) + (5 \times 2.4) + (x \times 1.6) = 26$

$20 + 1.6x = 26$ $\quad \frac{1.6x}{1.6} = \frac{6}{1.6}$ $\quad x = 3.75 + 55.5 = \cancel{6}\ 59.25$

iii) The percentage number of students with masses of at least 74kg. (2marks)

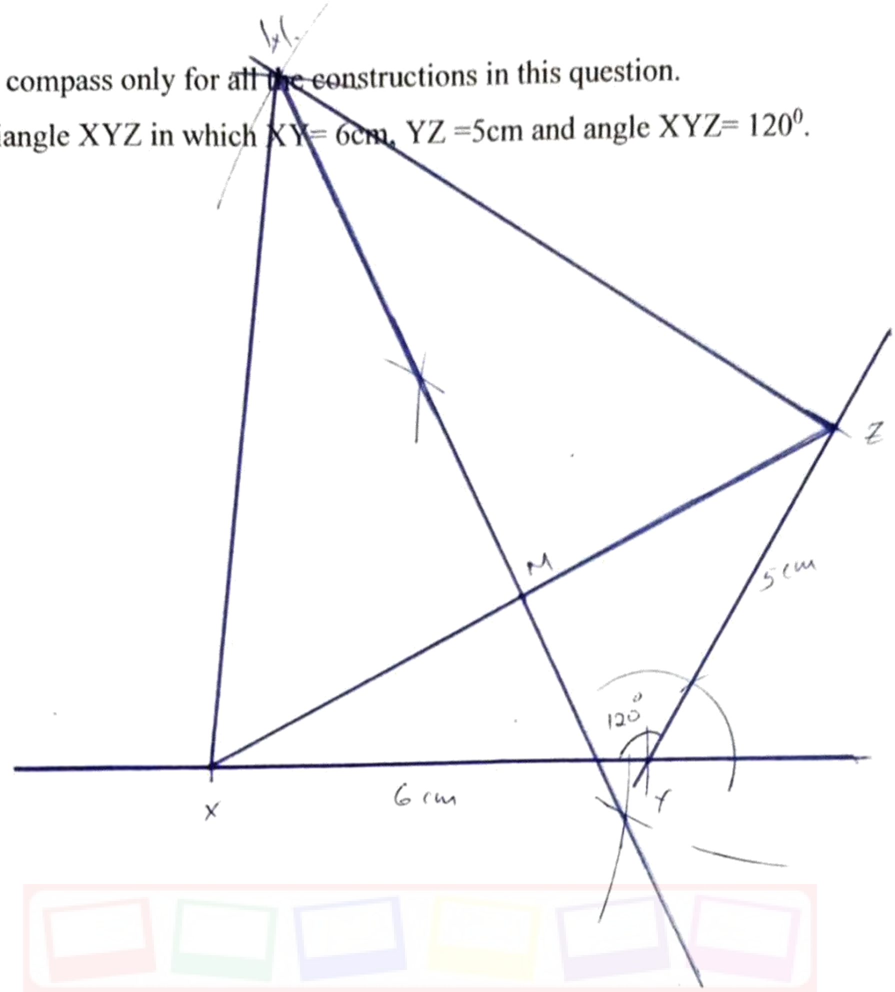
$\cancel{11 \times 0.4} = \cancel{44}$

$(85.5 - 74)0.4$

$\frac{4.6}{52} \times 100 = 8.846\%$

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

a) Construct a triangle XYZ in which XY= 6cm, YZ =5cm and angle XYZ= 120^0. (2marks)



b) Measure XZ and angle YXZ. (2 marks)

$XZ = 9.5\text{ cm} \pm 0.1$ $\quad \angle YXZ = 27^0 \pm 1^0$

c) Construct the perpendicular bisector of XZ and let it meet XZ at M. (1 mark)

d) Locate a point W on the opposite of XZ as Y and that XW = ZW and YW =9cm and hence complete triangle XZW. (2 marks)

e) Measure WM and hence calculate the area of triangle XZW. (3 marks)

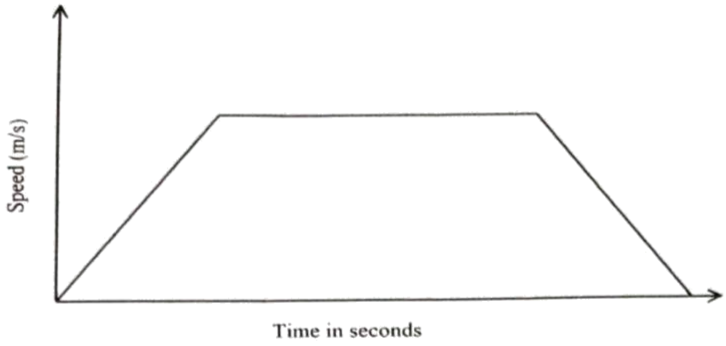
$WM = 7.6\text{cm}$

$A = \frac{1}{2}bh$

$= \frac{1}{2} \times 9.5 \times 7.6$

$= \underline{36.1\text{cm}^2}$

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



(a) Given that the distance between the two stations is 5225 m . Calculate

(i) Maximum speed in km/h attained by the bus. (3 marks)

$5525 = \frac{1}{2}h(325 + 150)$ $h = 22m$

$\frac{10450}{475} = \frac{475h}{475}$

(ii) The acceleration of the bus (2 marks)

$a = \frac{v-u}{t}$

$= \frac{22-0}{75}$

$= 0.2933\ m/s^2$

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

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

80km/h.

120km/h

NBI Car

$D = S \times T$

$= 80 \times \frac{1}{2} = 40km.$

$TT = \frac{D}{RS} = \frac{40\ km}{40\ km/h.}$

$= 1hour.$

$D = S \times T$

$= 120 \times 1$

$= 120\ km.$

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

$8:30 + 1\ 00 = 9:30$ am

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

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

$1s = \frac{\frac{22}{7} \times 8 \times 8 \times 24}{1000}$

$= \frac{4827.43}{1000}$

$= 4.82743 \times 3600$

$= 13729$ Litres

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

$1 \text{ day} = 17379 \times 14$

$= \frac{243302 \times 1}{320}$

$= 760.3$

Maximum = 760 Households.

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

$= 760 \times 280$

$= 212\,800$

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

760×350

$\frac{4827.43}{1000}$

$= \frac{266000}{4.8273}$

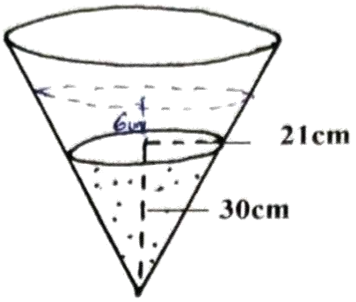
$= 55102$ sec

$= 15.3$ hours

$= 15.3 - 14$

$= 1.3$ hours

24. Consider the vessel below



a) Calculate the volume of water in the vessel. (Take π = 3.142) (2mks)

$V = \frac{1}{3} BAH$

$= \frac{1}{3} \times \frac{22}{7} \times 21 \times 21 \times 30$

$= \cancel{4410 cm^3} = 13860 cm^3$

$\frac{1}{3} \times 3.142 \times 21 \times 21 \times 30$

$= 13856.22 cm^3$

b) When a metallic hemisphere is completely submerged in the water, the level of the water rose by 6cm.

Calculate:

i) The radius of the new water surface. (2mks)

$\frac{36}{30} = \frac{R}{21}$

$R = \frac{36 \times 21}{30}$

$= 25.2 cm$

ii) The volume of the metallic hemisphere (to 2 d.p.) (3mks)

$V_{new} = \frac{1}{3} \times \frac{22}{7} \times 25.2 \times 25.2 \times 36$

$= 23950.08 cm^3$

$V_{sphere} = 23950.08 cm^3 - 13860 cm^3$

$= 10,090.08 cm^3$

$V = \frac{1}{3} \times 3.142 \times 25.2 \times 25.2 \times 36$

$= 23943.55$

$V_{sphere} = 23943.55 - 13856.22$

$= 10,087.3$

iii) The diameter of the hemisphere (to 1 d.p) (3 mks)

$10090.08 = \frac{4}{3} \pi r^3$

$r^3 = \frac{10090.08 \times 3}{4 \times 3.142}$

$r = \cancel{49.1} cm$ 13.4

$d = 26.8 cm$

$10087.3 = \frac{4}{3} \times 3.142 \times r^3$

$r^3 = \frac{10087.3 \times 3}{4 \times 3.142}$

$r = 13.4$

$d = 13.4 \times 2$

$= 26.8 cm$