SECTION I (50 MARKS)

Answer all questions in this section

1. Evaluate without using tables or calculator: $\frac{-2(-3^2 + 5) - 12 \div 3 \text{ of } 4\times(-2)^2}{5^{-1} - 12 \div 10 + 6}$ correct to 3 decimal places (3 marks)

$N = -2(-9+5) - 12 \div 3 \times 4 + 4$

$= -2(-4) - 1 \times 4$

$= 8 - 4$ M1

$= 4$

$D = \frac{1}{5} - \frac{6}{5} + 6$

$= 6\frac{1}{5} - \frac{6}{5}$

$= 5$ M1

$\frac{N}{D} = \frac{4}{5} = 0.800$ A1

2. Two of the exterior angles of a polygon are each 63^0. The remaining exterior angles are each 26^0. Determine the number of sides of the polygon and hence the name. (3 marks)

Sum of interior angles $= 360^\circ$

$(2\times 63) + (n-2)26 = 360$ M1

$126 + 26n - 52 = 360$ B1

$26n = 286$

$n = 11$ A1

Hendecagon. B1

3. Koech and Kigen began a 10000 m race together at the starting line. Koech and Kigen took 36 seconds and 48 seconds respectively to run a 400 m lap. The two athletes were together again at the starting line after some time. Determine the number of laps that Kigen had to run to complete the race after they were together. (3 marks)

L.C.M of 36, 48, 66

2	36	48
2	18	24
2	9	12
2	9	6
3	9	3
3	3	1
	1	1

$2^4 \times 3^2 = 144$ B1

laps completed by Kigen $= \left(\frac{144}{48}\right)$

$= 3$

No. of laps in 10000 m race B1

$= \left(\frac{10,000}{400}\right)$

$= 25$

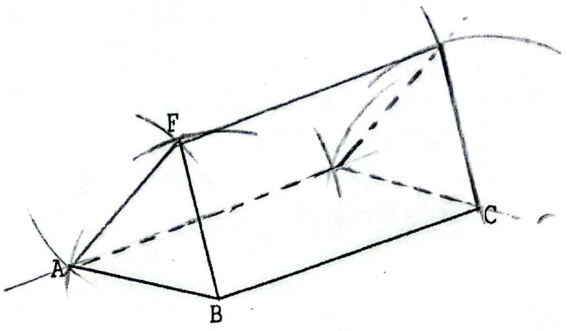
No. of laps Kigen had to run

$= (25 - 3)$ B1

$= 22$

4. In the figure below ABF is a uniform cross section of a solid. AB, BC and BF are some of the visible edges of the solid. Complete the sketch showing the hidden edges with broken lines.

(3 marks)



- Construction – B1
- Broken line – B1
- Complete Fig – B1

03

5. A Kenyan bank bought and sold Japanese Yen when the rate are as shown below.

	Buying (Ksh)	Selling (Ksh)
100 Japanese Yen	84.00	85.50

A Kenyan businessman travelled to Japan and converted Ksh. 1 613 760 to Japanese Yen. He spends 75% of the amount and then converted the balance into Kenyan shillings at the bank when buying rate increased by 1.4% and selling rate increased by 1.3%. Calculate the amount of money in Kenyan shilling that he received.

(3 marks)

Amount in Yen $= \left(\frac{100 \times 1,613,760}{85.50}\right)$ – M1

$= 1,887,438.60$

Balance $= (1,887,438.60 - 1,613,760)$

$= 273,678.60$

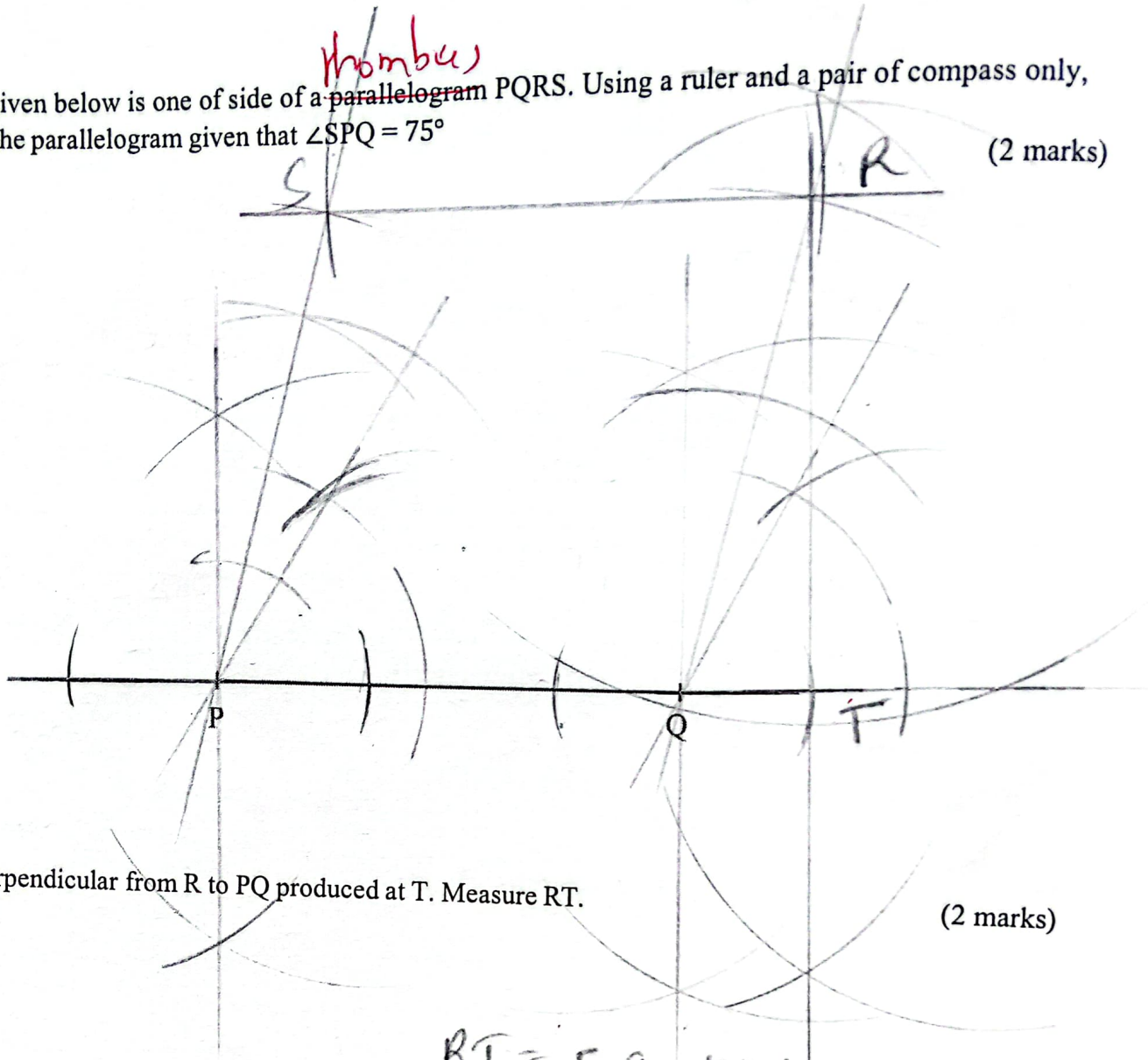
New buying rate $= (84 \times 1.04)$ – M1

$= 85.176$

Amount in Kshs $= \left(\frac{100 \times 273,678.60}{85.176}\right)$

$= 321,309.50$ – A1

(a) Line PQ given below is one of side of a ~~parallelogram~~ rhombus PQRS. Using a ruler and a pair of compass only, construct the parallelogram given that $\angle SPQ = 75°$ (2 marks)



(b) Drop a perpendicular from R to PQ produced at T. Measure RT. (2 marks)

RT = 5.9 ± 0.1 cm.

Constructing ∠SPQ - B1
Complete - PQRS - B1
⊥ from R to PQ - B1
RT - 5.9 ± 0.1 - B1

7. Six tractors each working 8 hours a day can plough a field in 5 days. Calculate the number of days that four tractors working 10 hours a day would take to plough the field. (3 marks)

T	H	D
6	8	5
4	10	

$= \left(\frac{6}{4} \times \frac{8}{10} \times 5\right)$ M1 M1

$= 6$ days A1

8. Rina has several buses, each with a driver and a conductor. All her drivers earn the same wage and all conductors earning are also equal. Any three drivers and four conductors earn a total of Ksh. 7 500 per day and the difference in driver's earning and conductor's earning per day is Kshs. 400. Calculate the daily wage of a driver. (3 marks)

Let driver be d, conductor $= C$ A1 for c & d.

$3d + 4C = 7500$

$d - C = 400$ M1

$3d - 4C = 7500$ M1

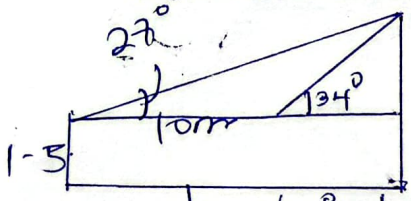
$3d - 4C = 1200$

$7C = 6300$

$C = 900$ A1

$d = 1300$

9. From a point Mary notices that the angle of elevation of the top of a tree is 28^0, she then walks 10m towards the tree and finds that the angle of elevation of the top of the tree is now 34^0. Calculate the height of the tree to 1 d.p given that Mary is 1.5m tall.



$\tan 28° = \frac{h}{x+10}$, $\tan 34 = \frac{h}{x}$

$\frac{(x+10)\tan 28°}{\tan 34°} = x$ M1

$(x+10)0.7883 = x$

$x = 37.235$

@KASSU-JET EXAMS.

$h = (37.235 \times \tan 34)$ (3 m.) M1

$= 25.11532$

$= (25.12 + 1.5)$

$= 26.62$

$= 26.6$ m. A1

(3marks)

10. Under an enlargement with scale factor -1.5, the point R (2, -8) is mapped onto R' (10,5). By calculation, determine the coordinates of the center of enlargement.

(3marks)

$O(a,b)$ $R(2,-8)$ $R'(10,5)$

$\vec{OR} = \begin{pmatrix}2\\-8\end{pmatrix} - \begin{pmatrix}a\\b\end{pmatrix}$ $\vec{OR'} = \begin{pmatrix}10\\5\end{pmatrix} - \begin{pmatrix}a\\b\end{pmatrix}$

$-1.5\left[\begin{pmatrix}2\\-8\end{pmatrix} - \begin{pmatrix}a\\b\end{pmatrix}\right] = \left[\begin{pmatrix}10\\5\end{pmatrix} - \begin{pmatrix}a\\b\end{pmatrix}\right]$ M1

$-3 + 1.5a = 10 - a$.

$2.5a = 13$, $a = 5.2$

$12 + 1.5b = 5 - b$ M1

$2.5b = -7$

$b = -2.8$

$(5.2, -2.8)$ A1

11. Use tables of squares, square roots and Reciprocal to find the value of x if its given that

$$x = \frac{2}{\sqrt{0.4278}} + \frac{1}{6.04^2}$$

(4marks)

42.78×10^{-2}

$= 6.5406 \times 10^{-1}$

$= 0.65406$ M1

$2 \times \frac{1}{0.6541} = (2 \times 1.5288)$

$= 3.0576$

$6.04^2 = 36.4816$ M1

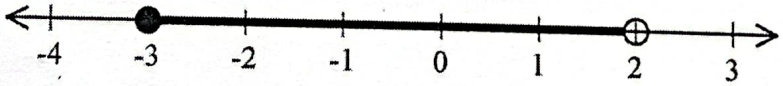
$3.648 \times 10^{-1} = 0.274 \times 10^{-1}$.

$= 0.02741$.

$= (3.0576 + 0.02741)$ M1

$= 3.085$. A1

12. The number line below represents the solution for some given inequalities



Form the two inequalities represented above and write them as a compound statement

(3 marks)

$-3 \leq x$ B1

$x < 2$. B1

$-3 \leq x < 2$. B1

13. The coordinate of A (-2,5) and B(x, 0), calculate the value of x if the magnitude of AB is 13 units (3 marks)

$AB = \begin{pmatrix} x \\ 0 \end{pmatrix} - \begin{pmatrix} -2 \\ 5 \end{pmatrix}$

$= \begin{pmatrix} x+2 \\ -5 \end{pmatrix}$ M1

$(x+2)^2 + (-5)^2 = (13)^2$ M1

$(x+2)^2 = 169 - 25$

$x+2 = \sqrt{144}$

$x = -2 \pm 12$, $x = 10$ A1 + Two values must be written

14. Simplify completely $\left[\frac{(m+5n)^2+(m-5n)^2}{3m^2+75n^2}\right]^{-1}$ (3 marks)

$= \frac{3m^2+75n^2}{(m+5n)^2+(m-5n)^2}$ M1

$= \frac{3[m^2+25n^2]}{m^2+10mn+25n^2+m^2-10mn+25n^2}$ M1

$= \frac{3[m^2+25n^2]}{2[m^2+25n^2]} = \frac{3}{2}$.

$= 1\frac{1}{2}$. A1

15. Calculate the values of x and a in the equation $\frac{4^{2x}-2^{2x}}{2^{2x}-2^x} = 20$ (3 marks)

$\frac{2^{2(2x)} - 2^{2x}}{2^{2x} - 2^x} = 20$

$\frac{y^4 - y^2}{y^2 - y} = 20$

$\frac{(y^2+y)(y^2-y)}{(y^2-y)} = 20$ M1

$y^2 + y = 20$.

$y^2 + 5y - 4y - 20 = 0$

$y(y+5) - 4(y+5) = 0$ M1

$(y-4)(y+5) = 0$

$y = 4, \quad y = -5, \quad y = 0$

$2^{2x} = 2^2$.

$2x = 2$. A1 ~~, $x = 0$~~

16. Find the equation of the normal to the curve $y = x^3 + 2x^2 - 4x$ when x = -1 (3 marks)

$\frac{dy}{dx} = 3x^2 + 4x - 4$

$m_1 = 3 - 4 - 4$

$= -5$

$-5 \times m_2 = -1, \quad m_2 = \frac{1}{5}$

$\frac{y-5}{x+1} = \frac{1}{5}$

$5y - 25 = x + 1$

$5y = x + 26$

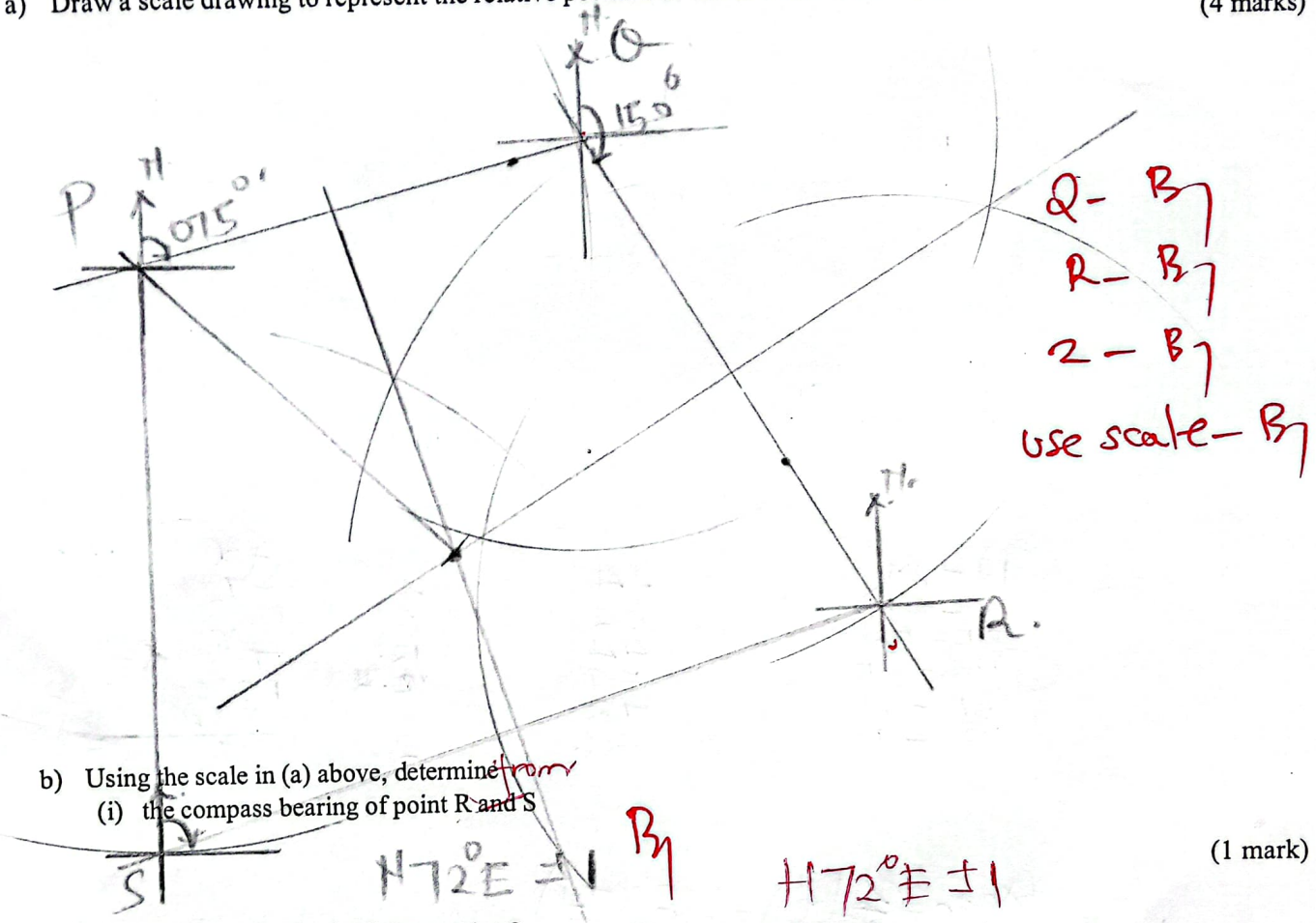
$y = \frac{x}{5} + \frac{26}{5}$

SECTION II (50 MARKS)

*Answer any **FIVE** questions in this section*

17. During a surveying exercise to establish a housing of affordable houses units, a surveyor marked out four points P, Q, R and Z to represent an area to be left out for other social amenities. Point Q is 480m on a bearing of N75°E from P. Point R lie on a bearing of 150° at a distance 600m from Q. Z is directly south of P a distance of 640m.

a) Draw a scale drawing to represent the relative position of the area under survey (Scale: 1cm represent 8m). (4 marks)



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

(i) the compass bearing of point R and S (1 mark)

H72°E ±1 B1 H72°E ±1

(ii) the distance of point S from point Q (2 marks)

(11.2 ± 0.1) × 80 = 896km B1 = 89.6 km

c) An emergency water point is located within the area marked such that it is equal in distance from line QR and RS. Locate the water point and measure its distance from point P. (3 marks)

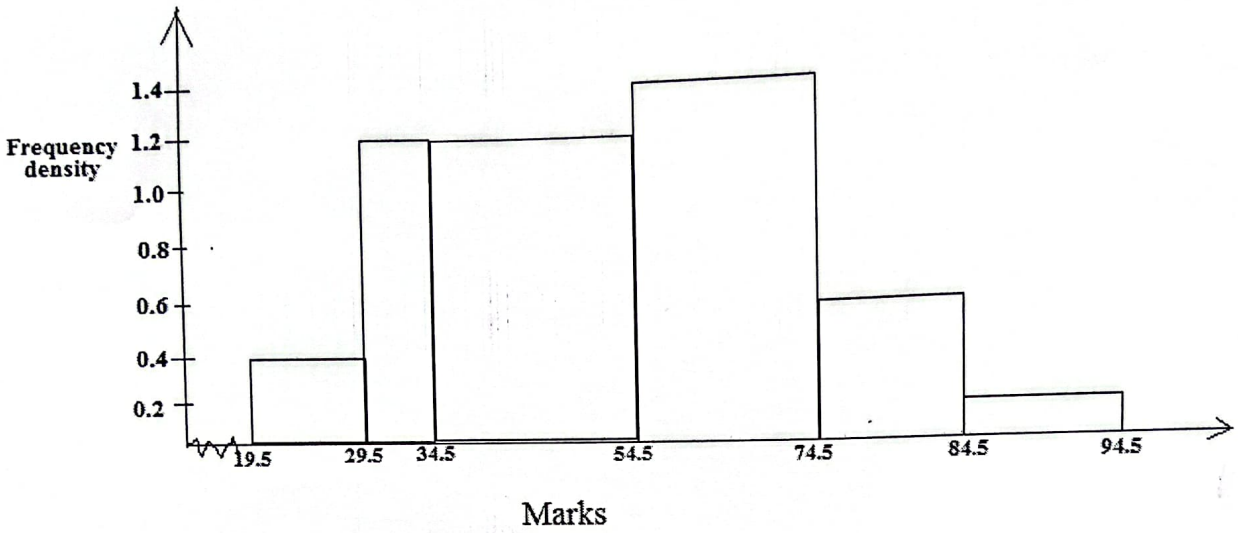
(5.5 ± 0.1) × 80 = 440km.

Bisecting QR & RS - B1

Locating point - B1

Distance from P - B1

18. The histogram below is drawn from marks obtained by students



(a) Use it to fill the table below

(4 marks)

Classes	Midpoint	Frequency	fx	c.f
20-29	24.5	4	98	4
30-34 B1	32 B1	6 B1	192	10
35-54 B1	44.5 B1	24 B1	1068	34
55-74	64.5	28 B1	1806	62
75-84	79.5	6	477	68
85-94	89.5	2	179	70

(4)

(b) Calculate the mean mark.

(3 marks)

$$\text{Mean} = \frac{\sum fx}{\sum f} = \left(\frac{3820}{70}\right) \text{M1}$$

$$= 54.57 \text{ A1}$$

(c) Calculate the median mark

(3 marks)

$$M = L + \left(\frac{\frac{N}{2} - C}{f}\right) \times i$$

$$= 54.5 + \left(\frac{35-34}{28}\right) \times 20 \text{ M1 M1}$$

$$= 55.2 \text{ A1}$$

19. (a) A Nissan travelling at a speed of 90 km/h left Nairobi for Nakuru at 9.00 a.m. Half an hour later, a bus left Nakuru for Nairobi at a speed of x km/h. The two vehicles met at a point 180 km from Nakuru at 11.00 am. Find the value of x

(4 marks)

Distance travelled by Nissan when bus arrived $= (90 \times \frac{1}{2}) = 45$ km

Distance covered from 9.30 to meeting point $= (90 \times 1.5)$ M1

$= 135$ km.

Distance btn two vehicles

$= 135 + 180$

$= 315$ km A1

Rel. Speed $= (x+90)$ km/h

Time taken for the two vehicles to meet $= 1\frac{1}{2}$ hrs

$1.5 = \frac{315}{x+90}$ — M1

$1.5x + 135 = 315$

$1.5x = 180$

$x = 120$ km/h. A1

(b) Given that the bus had a puncture that lasted 20 minutes to repair, determine which vehicle arrived at its destination first and by how long

(4 marks)

Time taken by bus $= \left(\frac{45+135}{120}\right)$ M1

1 hr 30 mins

Arrival time of bus in Nairobi $= 11.00 + 1\ 30 + 20$

$= 12.50$ pm A1

Arrival time of Nissan in Nakuru

$= \left(\frac{180}{90}\right) =$ M1 2 hrs

$11.00 + 2 = 1300$ hrs

Bus arrived earlier by 10 mins A1

(c) Find the distance between town A and B

(2 marks)

Distance AB $= (90 \times \frac{1}{2}) + (135 + 180)$ M1

$= (45 + 135 + 180)$

$= 360$ km A1

$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 2 & -\frac{5}{2} \\ -3 & 4 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ M1

20. (a) Given that $A^{-1} = \begin{pmatrix} 2 & \frac{-5}{2} \\ -3 & 4 \end{pmatrix}$, find matrix A (3 marks)

$2a + 12b = 4$
$-7.5a + 12b = 0$
$0.5a = 4$
$a = 8$

$64 - 12b = 4$
$-12b = -60$
$b = 5$ B1

$2c - 3d = 0 \times 4$
$-2.5c + 4d = 1 \times 3$
$3c - 12d = 0$
$-7.5c + 12d = 3$
$0.5c = 3$

$c = 6$
$12 - 3d = 0$
$-3d = -12$, $d = 4$

$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 8 & 5 \\ 6 & 4 \end{pmatrix}$ B1

(b) A student bought 16 exercise books and 10 pens at a total cost of Kshs. 1018. If she had bought 12 exercise books and 8 pens, she would have spent Kshs. 242 less.

(i) Form a matrix equation to represent the information above (2 marks)

$16b + 10p = 1018$ B1
$12b + 8p = 776$ B1

$\begin{pmatrix} 16 & 10 \\ 12 & 8 \end{pmatrix}\begin{pmatrix} b \\ p \end{pmatrix} = \begin{pmatrix} 1018 \\ 776 \end{pmatrix}$

(ii) Using the inverse of A in (a) above, determine the price of each item (4 marks)

$\begin{pmatrix} 2 & -2.5 \\ -3 & 4 \end{pmatrix}\begin{pmatrix} 16 & 10 \\ 12 & 8 \end{pmatrix}\begin{pmatrix} b \\ p \end{pmatrix} = \begin{pmatrix} 2 & -2.5 \\ -3 & 4 \end{pmatrix}\begin{pmatrix} 1018 \\ 776 \end{pmatrix}$ M1 M1 M1

book = 96 A1
pen = 50

(c) Find the total cost of 4 books and 5 pens by using matrices of orders 1×2 and 2×1 respectively (2 marks)

$\begin{pmatrix} 4 & 5 \end{pmatrix}\begin{pmatrix} 96 \\ 50 \end{pmatrix}$ M1
$= (4 \times 96) + (5 \times 50)$
$= 634$ A1

21. ABCD is a parallelogram with A(1,1) and C(8,10). The equation of AB is $4x - 5y = -1$ and the equation of BC is $5x - 2y = 20$. Determine

(a) The coordinates of M, where M is the point of intersection of the diagonals

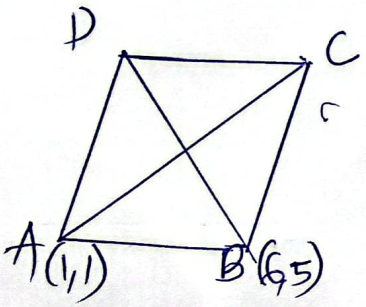
(2 marks)

$M\left(\frac{1+8}{2}, \frac{1+10}{2}\right)$ M1

$M(4.5, 5.5)$ A1

(b) The coordinates of the vertices of B and D

(6 marks)



$4x - 5y = -1 \times 5$

$5x - 2y = 20 \times 4$ M1

$20x - 25y = -5$

$20x - 8y = 80$

$-17y = -85$

$y = 5$

$4x - 25 = -1$ M1

$4x = 24$

$x = 6$

$B(6, 5)$ A1

$\frac{x+6}{2} = 4.5$ M1

$x + 6 = 9$

$x = 3$

$\frac{y+5}{2} = 5.5$ M1

$y + 5 = 11$

$y = 6$

$D(3, 6)$ A1

(c) The length of AB correct to 3 significant figures

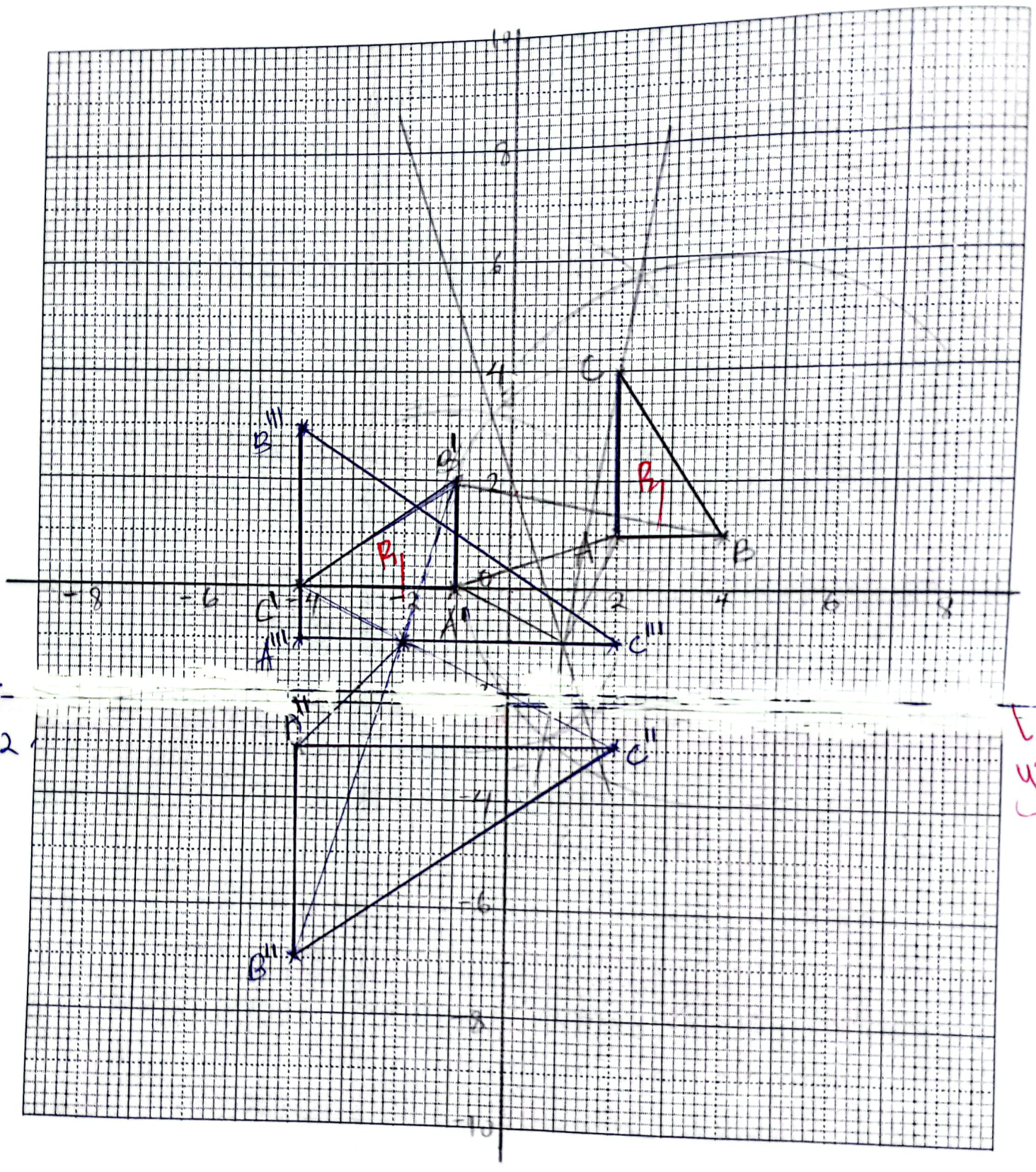
(2 marks)

$AB = \sqrt{(6-1)^2 + (5-1)^2}$ M1

$= \sqrt{(5)^2 + (4)^2}$

$= 6.40$ A1

22. $A^1(-1,0)$ $B^1(-1,2)$ and $C^1(-4,0)$ is the image of A(2,1), B(4,1) and



(a) Plot the two triangles on the grid provided (2 marks)

(b) By construction find the center and angle of rotation (3 marks)

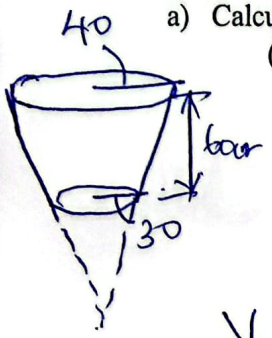
(c) A″B″ C″ is the image of $A^1B^1C^1$ under enlargement, center (-2,-1) and scale factor -2. Plot A″B″ C″and state its coordinates (3 marks)

(d) $A^{111}B^{111}C^{111}$ is the image of A″B″ C″ under reflection in the line $y + 2 = 0$. Plot $A^{111}B^{111}C^{111}$ on the same grid and state its coordinates (2 marks)

23. A bucket is in the shape of a frustum of a cone. The base radius of the bucket is 30 cm and it is filled with water to a height of 60 cm. The radius of the water level in the bucket is 40 cm. Taking π to be 3.142;

a) Calculate:

(i) The quantity of water in the bucket in litres. (3 marks)



$\frac{h}{h+60} = \frac{30}{40}$

$40h = 30h + 1800$

$10h = 1800$

$h = 180$

Vol. of small cone $= \frac{1}{3} \times 3.142 \times 30 \times 30 \times 180$

$= 169,668$

Vol. of big cone $= \frac{1}{3} \times 3.142 \times 40 \times 40 \times 240$

$= 402,176$

Vol. of water $= (402,176 - 169,668)$

$= 232,502$

$= 232.5$ litres

(ii) The surface area of the bucket in contact with water. (4 marks)

$l = \sqrt{30^2 + 180^2}$

$= 182.48$

$L = \sqrt{40^2 + 240^2}$

$= 243.31$

Curved S.A of big cone $= \pi RL$

$= 3.142 \times 40 \times 243.31$

$= 30,579.2 \text{ cm}^2$

Curved S.A of small cone $= (3.142 \times 30 \times 182.48)$

$= 17,200.56$

Curved Surface Area $= (30,579.2 + 17,200.56)$

$= 13,378.63$

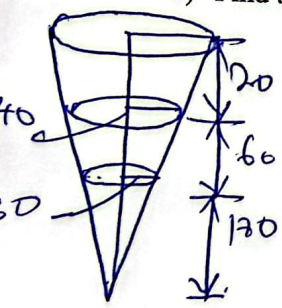
Bottom part $= 3.142 \times 30 \times 30$

$= 2827.43$

Total Surface Area in contact $= (2827.43 + 13,378.63)$

$= 16206.06 \text{ cm}^2$

b) Find the volume of water that if added into the bucket, would give a 20 cm rise in the water level. (3 marks)



$\frac{30}{R} = \frac{180}{260}$

$R = 43\frac{1}{3}$

Vol. of water added $= \frac{1}{3} \times 3.142 \times 43\frac{1}{3}^2 \times 260$

$= (511,311.407 - 402,176)$

$= 109,155.4074 \text{ cm}^3$

24. The displacement of a particle is given as $S = t^3 - 6t^2 + 9t + 50$ metres. Determine;

a) the displacement of the particle when $t = 2$ seconds. (2 marks)

$S = 2^3 - 6(4) + 9(2) + 50$ M1

$= 52$ A1

b) the velocity of the particle when $t = 4$ (2 marks)

$V = 3t^2 - 12t + 9$

$= 3(4) - 12(2) + 9$ m1

$= 9 m/s$ A1

c) the acceleration of the particle when $t = 5$. (2 marks)

$a = 6t - 12$

$= 30 - 12$ M1

$= 18 m/s$ A1

d) the time when the particle is at rest. (2 marks)

$3t^2 - 12t + 9 = 0$

$t^2 - 4t + 3 = 0$

$t^2 - t - 3t + 3 = 0$ M1

$t(t-1) - 3(t-1) = 0$

$(t-3)(t-1) = 0$

$t = 3, t = 1$ A1

e) the minimum velocity (2 marks)

$6t = 12$

$t = 2$

$V = 3(4) - 24 + 9$ M1

$= 12 - 24 + 9$

$= -3 m/s$ A1