SEC I: (50 marks)

Answer all questions in this section

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

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

$= \frac{-52}{-3-10} - \frac{4(-12)}{8}$

$= \frac{-52}{-13} - \frac{-48}{8}$ ✓M1

$= 4 - -6$ ✓M1

$= 10$ ✓A1

Alt.

$\frac{52}{13} + \frac{48}{8}$ ✓M1

$= \frac{1040}{104}$ ✓M1

$= 10$ ✓A1

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)

2	234	270	324
3	117	135	162
3	39	45	54
	13	15	18

✓M1

G.C.D $= 2\times3\times3$

$= 18$ ✓A1

$\frac{234}{18} + \frac{270}{18} + \frac{324}{18}$

$= 13 + 15 + 18$

$= 46$ pieces ✓B1

3. A point P has the coordinates (1, 2, 3). If $\mathbf{PQ} = 5\mathbf{i} + \mathbf{j} + 2\mathbf{k}$, find.

(a) the coordinates of point Q. (2mks)

$\begin{pmatrix} x \\ y \\ z \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 1 \\ 2 \end{pmatrix}$ ✓M1

$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 6 \\ 3 \\ 5 \end{pmatrix}$

$\therefore Q(6, 3, 5)$ ✓A1

(b) the modulus of **PQ**. (1mk)

$|\overrightarrow{PQ}| = \sqrt{5^2+1^2+2^2}$

$= \sqrt{30}$

$= 5.477$ units ✓B1

4. The size of an interior 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)

$x + 3.5x = 180°$ ✓M1

$4.5x = 180$

$x = 40°$ ✓A1

$n = \frac{360}{40} = 9$ sides ✓B1

Sum $= 180(9-2)$

$= 1260°$ ✓B1

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

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

$\sqrt{72.35 \times 10^{-2}}$

$= 8.5058 \times 10^{-1}$

$= 0.85058$ ✓M1

$\frac{1}{8.5058 \times 10^{-1}} - \frac{1}{1.056 \times 10^{1}}$

$= (0.1175 \times 10) - (0.9469 \times 10^{-1})$ ✓M1

$= 1.175 - 0.09469$

$= 1.08031$ ✓A1

6. Solve for x and y in the following equations (4mks)

$2^x + 3^y = 59$

$2^{x+3} - 3^{y+2} = 13$

Let $2^x = a$, $3^y = b$.

$a + b = 59$ —(i)

$8a - 9b = 13$ —(ii) ✓M1

$8a + 8b = 472$

$8a - 9b = 13$ —

$17b = 459$

$b = 27$, $a = 32$ ✓M1

$\Rightarrow 2^x = 2^5$

$\therefore x = 5$ ✓B1

$3^y = 3^3$

$y = 3$ ✓B1

7. Solve the inequalities and represent the solution on number line. (3mks)

$3x - 9 < 5x + 3 \leq 2x - 6$

$3x - 9 < 5x + 3$

$-2x < 12$

$x > -6$ ✓B1

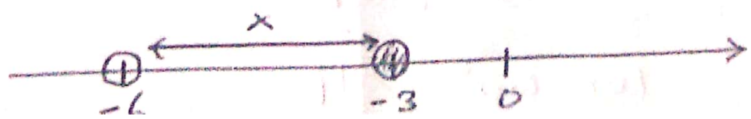
or $-6 < x$

$5x + 3 \leq 2x - 6$

$3x \leq -9$

$x \leq -3$ ✓B1

$-6 < x \leq -3$



✓B1

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)

50000×130.10 ✓M1

$=$ Ksh. 6505000

$\frac{20}{100} \times 6505000$

$= \frac{1301000}{9.58}$ ✓M1

$= 135804$ Rand ✓A1

9. Simplify the expression

$$\frac{2x^2-3xy-2y^2}{4x^2-y^2}$$

(3mks)

$= \frac{2x^2-4xy+xy-2y^2}{(2x+y)(2x-y)}$

$= \frac{(x-2y)\cancel{(2x+y)}}{\cancel{(2x+y)}(2x-y)}$

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

M1 ✓ numerator factorized

M1 ✓ denominator factorized

A1 ✓ – C.A.O.

10. The volumes of two similar cans are $125cm^3$ and $216cm^3$ respectively. If the base area of the smaller can is $75cm^2$, find the base area of the larger can. (3 marks)

l.s.f $= \sqrt[3]{\frac{125}{216}} = \frac{5}{6}$

a.s.f $= \left(\frac{5}{6}\right)^2 = \frac{25}{36}$ ✓M1

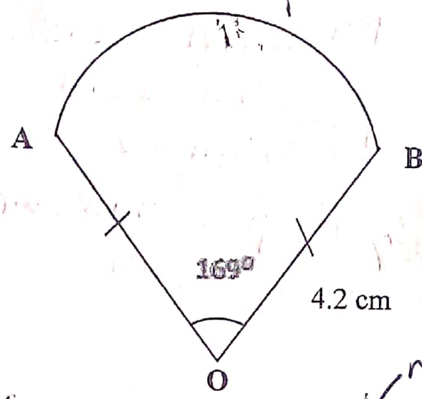
$\Rightarrow \frac{36}{25} \times 75$ ✓M1

$= 108\ cm^2$ ✓A1

(b) Henc

2
x

11. Find the perimeter of the figure below to 4 s.f. (Take $\pi = \frac{22}{7}$). (3 marks)



$P = \left(\frac{169}{360} \times 2 \times \frac{22}{7} \times 4.2\right) + 4.2 + 4.2$ ✓M1 ✓M1

$= 12.39 + 8.4$

$= 20.79$ cm. ✓A1

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)

M	H	D
30	10	14
40	7	?

$= \frac{30}{40} \times \frac{10}{7} \times 14$ ✓M1 ✓M1

$= 15$ days. ✓A1

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 (Take $\pi = \frac{22}{7}$). (3 mks)

$2 \times \frac{22}{7} \times 21 \times h = 1980$ ✓M1

$h = 15cm$

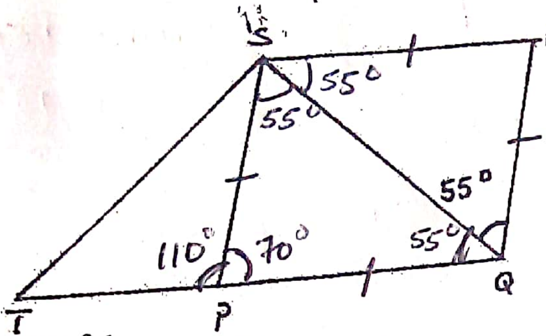
Volume $= \frac{22}{7} \times 21^2 \times 15$ ✓M1

$= 20790 \ cm^3$

$= 20.79 L$

$\simeq 20.8 L$ ✓A1

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



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

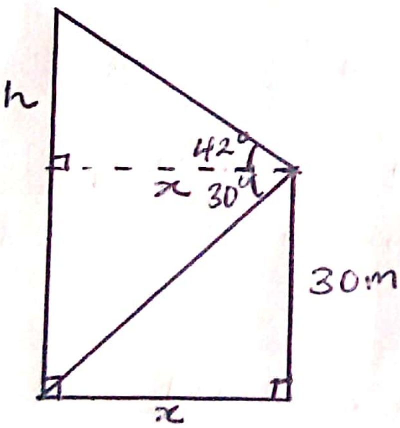
∠TPS = 110° ✓B1

∠STQ = 180 − (110 + 35)

= 35° ✓B1

∠TSP = 35° ✓B1

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)



$\tan 30° = \frac{30}{x}$ ✓M1

$x = \frac{30}{\tan 30} = 51.96m$

$h = 51.96 \tan 42°$ ✓M1

$= 46.78m$

Height of aircraft

$= 30 + 46.78$

$= 76.78m \approx 77m$ ✓A1

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)

$\frac{98}{100} \times 385000$

= sh. 377300

$\frac{3}{100} \times 150000$ ✓M1

= sh. 4500

$\frac{4.5}{100} \times 277300$ ✓M1

= sh. 10228.50

Total = 4500 + 10228.50

= sh. 14728.50 ✓A1

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(b) He

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)

Gradient $= \frac{4-2}{3-5} = -1$ ✓M1

$\Rightarrow \frac{y-2}{x-5} = -1$ ✓M1

$y-2 = -x+5$

$\therefore x+y-7=0$ ✓A1 // $-x-y+7=0$.

(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)

$m_1 m_2 = -1 \Rightarrow m_2 = 1$ ✓M1

$\frac{y-3}{x-0} = 1$ ✓M1

$y-3 = x$

$\therefore y = x+3$ ✓A1

(ii) Determine the point of intersection between L_1 and L_2. (3 marks)

$x+y-7=0$ —(i)

$y = x+3$ —(ii)

$\Rightarrow x+x+3-7=0$ ✓M1

$\left.\begin{array}{l} x=2 \\ y=5 \end{array}\right\}$ ✓A1

$\therefore$ point is (2, 5) ✓B1

(c) Another line L_3 is parallel to L_1 and passes through R. Find the x – intercept of L_3. (2 marks)

$m = -1$

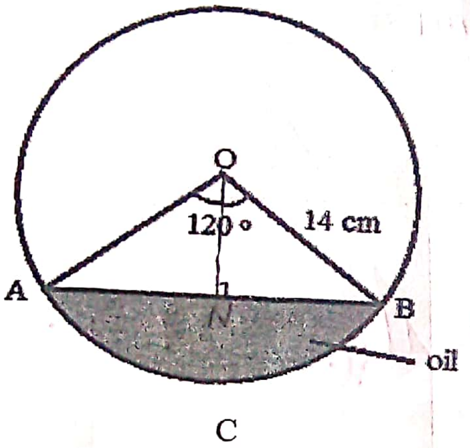
$\frac{y-3}{x-0} = -1$ ✓M1

$y-3 = -x$

$y = -x+3$

$\therefore$ x-intercept; $x = 3$ ✓A1

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 $\angle AOB = 120°$. ($\pi = \frac{22}{7}$)



Calculate to 2 d.p:

i) The length of chord AB. (2 marks)

$\sin 60° = \frac{NB}{14}$ ✓M1

$NB = 12.12$ cm

$\therefore AB = 2 \times 12.12 = 24.24$ cm ✓A1

ALT:

$\frac{NB}{\sin 60} = \frac{14}{\sin 90}$ ✓M1

$NB = 12.12$ cm

$\therefore AB = 24.24$ cm ✓A1

ii) The area of segment ACB. (3 marks)

$\frac{120}{360} \times \frac{22}{7} \times 14^2 - \frac{1}{2} \times 14^2 \sin 120°$ ✓M1 ✓M1

$205.33 - 84.87$

$= 120.46$ cm^2 ✓A1

iii) The volume of oil in the tank in m^3. (2 marks)

$\frac{120.46 \times 400}{1000\,000}$ ✓M1

$= 0.05$ m^3 ✓A1

iv) The area of the tank in contact with the oil in cm^2. (3 marks)

$\frac{120}{360} \times 2 \times \frac{22}{7} \times 14 \times 400$ ✓M1 $+ 2 \times 120.46$ ✓M1

$= 11733.33 + 240.92$

$= 11974.25$ cm^2 ✓A1

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)

$$\frac{320}{x-20} - \frac{320}{x} = \frac{4}{5} \quad \checkmark M1$$

$$1600x - 1600x + 32000 = 4x^2 - 80x$$

$$4x^2 - 80x - 32000 = 0 \quad \checkmark M1$$

$$x^2 - 20x - 8000 = 0$$

$$x^2 - 100x + 80x - 8000 = 0$$

$$x(x-100) + 80(x-100) = 0$$

$$(x-100)(x+80) = 0 \quad \checkmark M1$$

$$x = 100 \quad , \quad x = -80 \text{ (ignore)} \quad \checkmark A1$$

$$\Rightarrow x = 100 \text{ Km/h} \quad \checkmark B1$$

(b) Determine the time taken by the bus for the whole journey (1mk)

$$\frac{320}{100} = 3.2 \text{ hrs} \quad \checkmark B1$$

or 3h 12 min.

(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)

In 1 hour; $x = 80 \times 1$

$= 80$ km ✓M1

R.D $= 320 - 80$

$= 240$ km

R.S $= 100 + 80 = 180$ km/h ✓M1

Time taken $= \frac{240}{180}$ ✓M1 $= 1\frac{1}{3}$h

meeting time $= 9.00$ a.m

$+ \quad 1.20$

$= 10.20$ a.m ✓A1

Alt.

$320 - 80 = 240$ km.

$$\frac{240 - x}{100} = \frac{x}{80} \quad \checkmark M1$$

$$100x = 19200 - 80x$$

$$180x = 19200$$

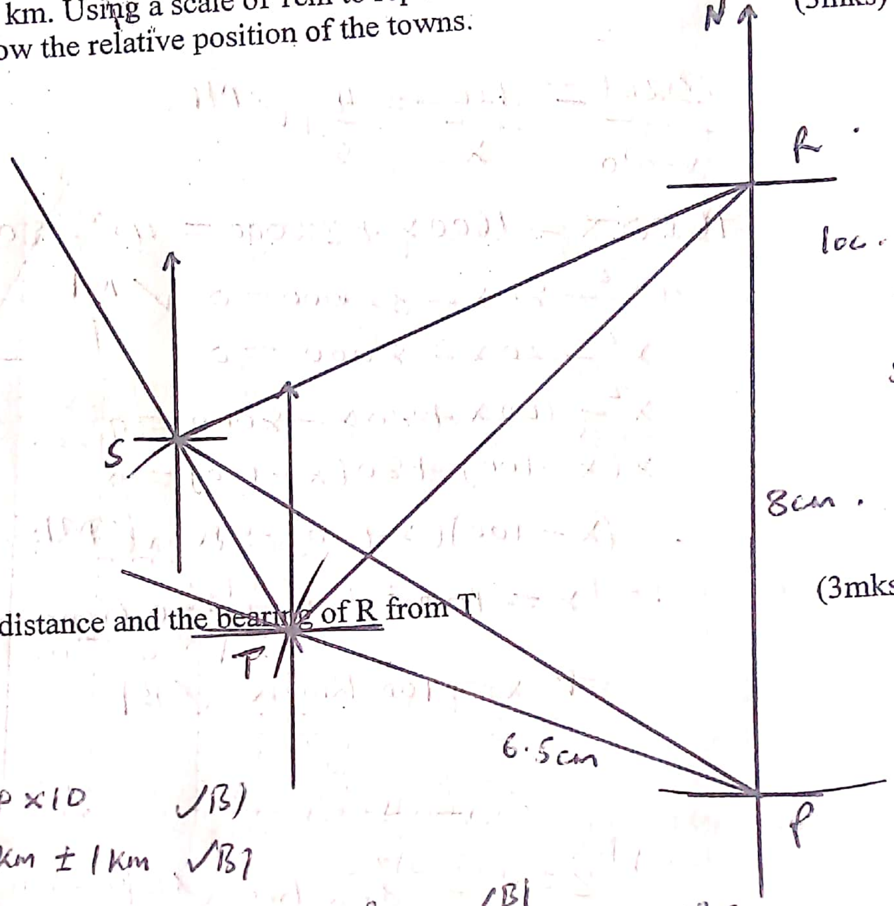
$$x = 106.67 \text{ Km} \quad \checkmark A1$$

$$T.T = \frac{106.67}{80} \quad \checkmark M1$$

$$= 1\frac{1}{3} \text{hr} \quad \checkmark A1$$

$\Rightarrow$ meeting time $= 10.20$ am

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)



loc. R ✓B1
T ✓B1
S ✓B1

Find:

(a) The distance and the bearing of R from T (3mks)

RT = 8.4 × 10 ✓B1
≈ 84 Km ± 1 Km ✓B1

Bearing of R from T = 045° ± 1° ✓B1 OR N 45° E.

(b) The distance and the bearing of S from R (3mks)

8.2 × 10 ✓B1
= 82 km. ✓B1

247° ✓B1 OR S 67° W. ✓B1

(c) The bearing of P from S (1mk)

124° ✓B1

or

S 56° E ✓B1

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)

ΔABC drawn ✓B1

Line $x+y=0$ drawn ✓B1

$\Delta A'B'C'$ plotted ✓B1

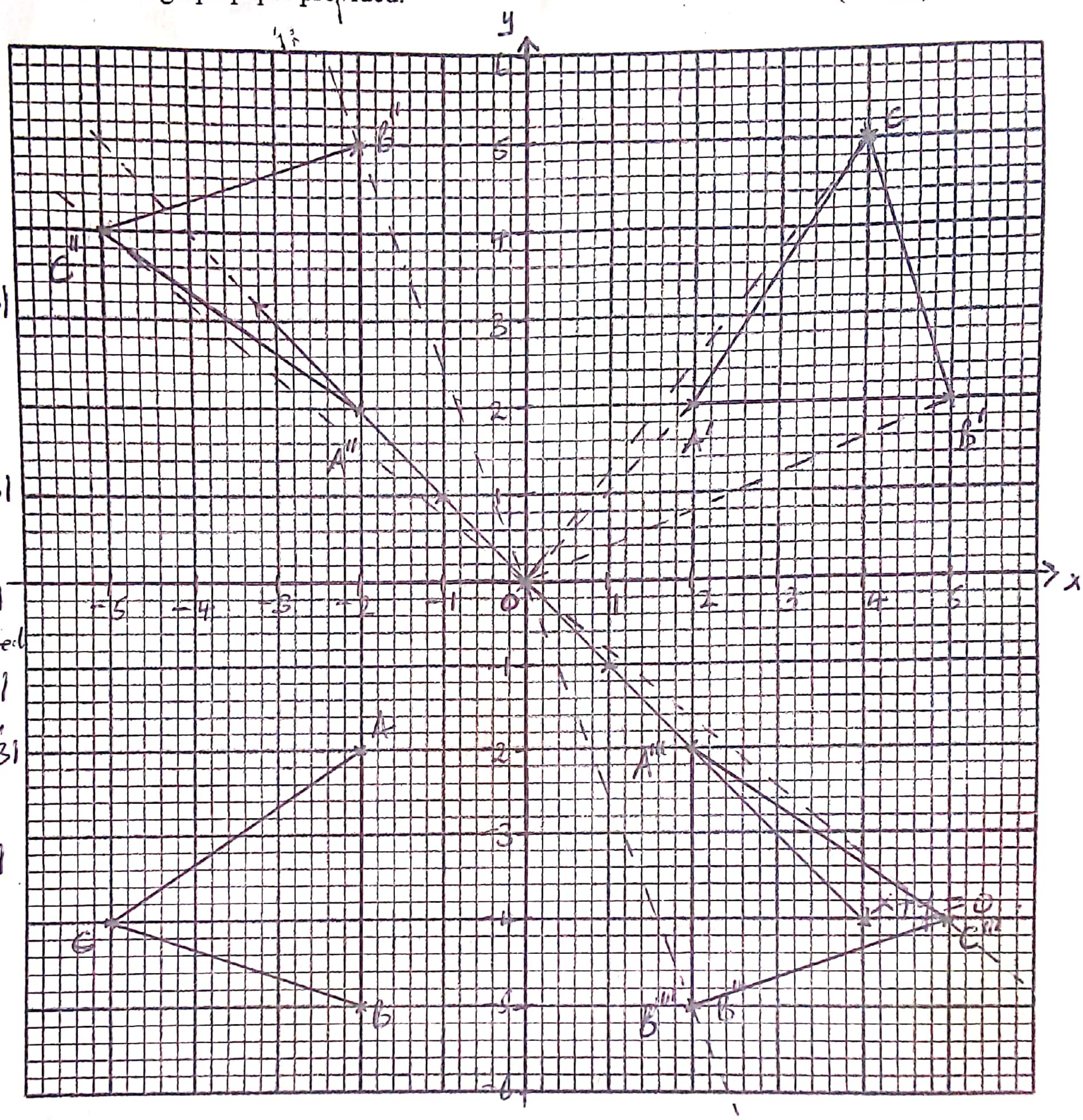
~~$\Delta A''B''C''$~~

A'', B'', C'' plotted ✓B1

$\Delta A''B''C''$ completed ✓B1

A''', B''', C''' plotted correctly ✓B1

$\Delta A'''B'''C'''$ completed ✓B1



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)

$A'(2,2)$, $B'(5,2)$, $C'(4,5)$. B1

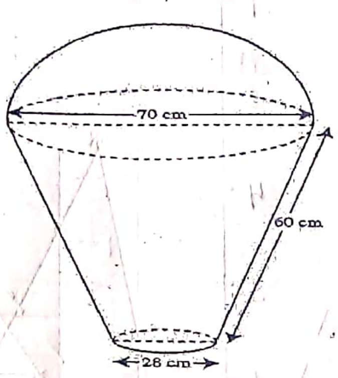
a) $\Delta A''B''C''$ is the image of $\Delta A'B'C'$ under a positive quarter turn about the origin. Draw $\Delta A''B''C''$ on the same axes and state its coordinates. (3 marks)

$A''(-2,2)$, $B''(-2,5)$, $C''(-5,4)$. B1

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)

$A'''(2,-2)$, $B'''(2,-5)$, $C'''(5,-4)$. B1

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)

$2 \times \frac{22}{7} \times 35^2$ ✓M1

$= 7700\ cm^2$ ✓A1

(b) The slant height of the cone from which the frustrum was cut. (2mks)

$\frac{l}{l+60} = \frac{28}{70}$ ✓M1

$70l = 28l + 1680$

$l = 40cm$

$\Rightarrow L = 40 + 60$

$= 100cm$ ✓A1

(c) The curved surface area of the frustrum. (2mks)

$\frac{22}{7} \times 35 \times 100 - \frac{22}{7} \times 14 \times 40$ ✓M1

$= 11000 - \cancel{12320}$ 1760

$= 9240\ cm^2$ ✓A1

(d) The area of the base. (2mks)

$\frac{22}{7} \times 14^2$ ✓M1

$= 616\ cm^2$ ✓A1

(e) The total surface area of the model. (2mks)

$= 7700 + 9240 + 616$ ✓M1

$= 17556\ cm^2$ ✓A1

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

Height (cm)	Frequency f	x	fx	c.f
13 -15	4	14	56	4
16- 18	7	17	119	11
19 – 21	11	20	220	22
22 – 24	15	23	345	37
25 – 27	6	26	156	43
28 – 30	5	29	145	48
31 – 33	2	32	64	50
			$\Sigma fx = 1105$	

B1 – for fx.
B1 – c.f.

Calculate:

(a) (i) The mean height of the seedlings (3mks)

$= \frac{1105}{50}$ ✓M1

$= 22.1$ cm ✓A1

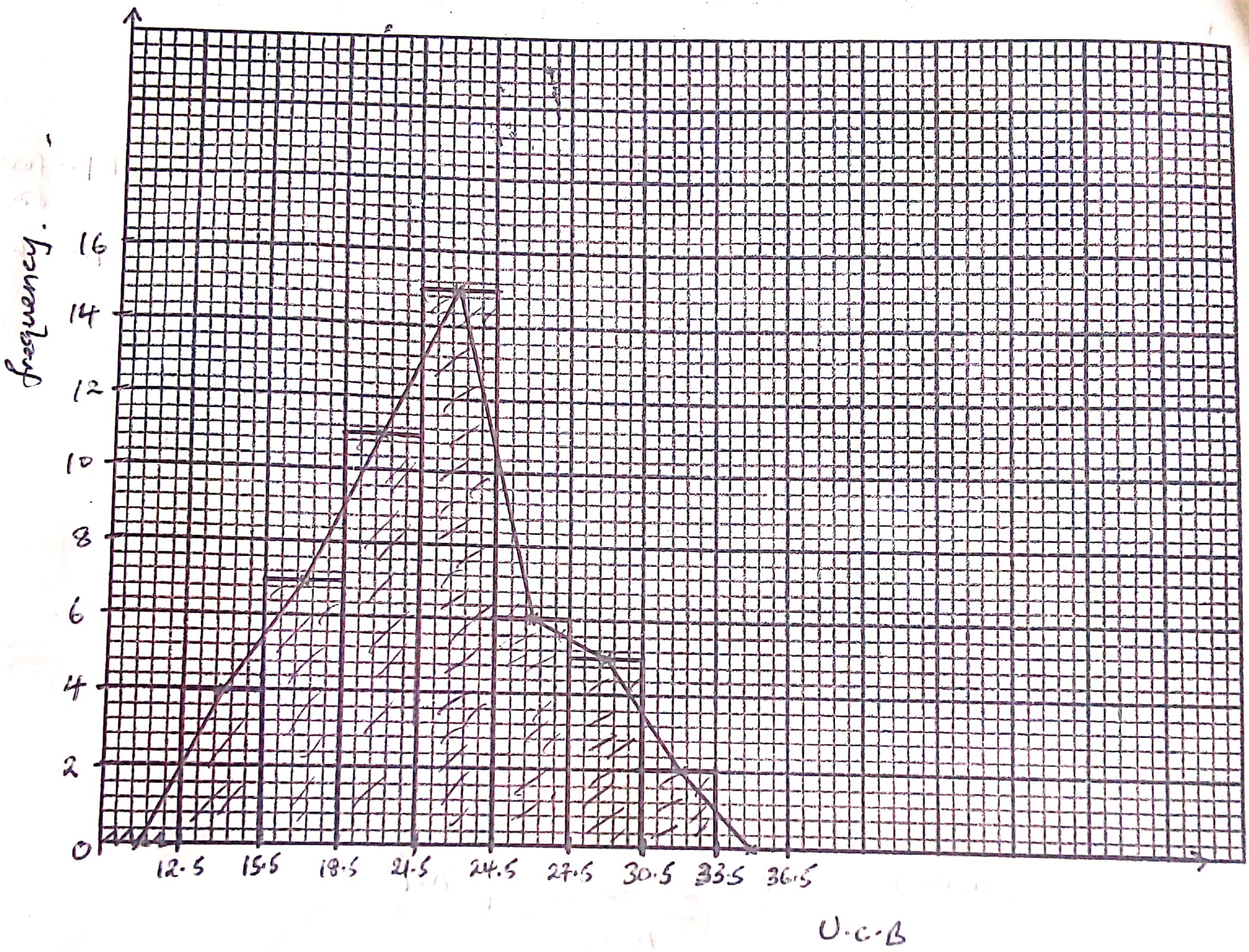
(ii) The median height of the seedlings (3mks)

median class : 22–24

median $= 21.5 + \left(\frac{25-22}{15}\right) \times 3$ ✓M1

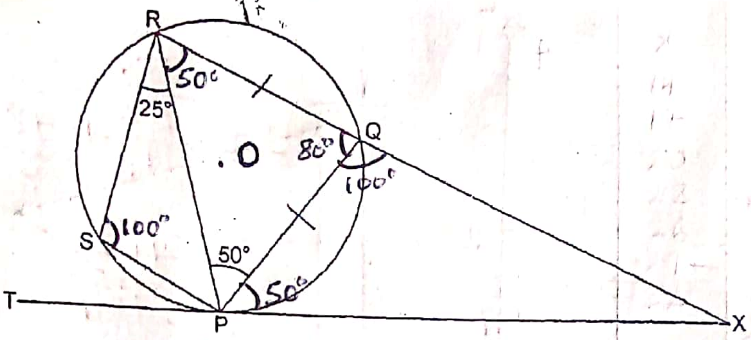
$= 22.1$ cm. ✓A1

(b) Draw a histogram and hence a frequency polygon to represent the above data (4mks)



frequency.
16
14
12
10
8
6
4
2
0
12.5
15.5
18.5
21.5
24.5
27.5
30.5
33.5
36.5
U.C.B

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 = 50^0, and angle PRS = 25^0.



Giving reasons in each case, find:

a) Angle PRQ (2mks)

50° ✓B1

Base angles of isosceles Δ are equal ✓B1

b) Angle PSR. (2mks)

100° ✓B1

opposite angles of a cyclic quadrilateral are ~~equal~~. supplementary. ✓B1

c) Angle PXQ (2mks)

$180-(100+50)$

$= 30^\circ$ ✓B1

angle sum of Δ add up to 180°. ✓B1

d) Angle TPS (2mks)

25° ✓B1

angle in the alternate segment. ✓B1

e) Angle POS (2mks)

50° ✓B1

angle at the centre is twice angle on circumference. ✓B1