NAME: ....Marking Scheme..... ADM NO: F2:.....CLASS: Maths.:

**FORM TWO MATHEMATICS**
**END OF YEAR EXAMS – 20[redacted]**
**TIME: 2 HOURS**

**Attempt all the questions in the spaces provided.**

1. Two spheres have surface areas of 36cm$^2$ and 49cm$^2$. If the volume of the smaller sphere is 20.2cm$^3$ calculate the volume of the larger one. (3 mks)

$A \cdot S \cdot f = \frac{36}{49}$

$L \cdot S \cdot f = \sqrt{A \cdot S \cdot f}$

$= \sqrt{\frac{36}{49}}$ ✓ (1)

$= \frac{6}{7}$

$V \cdot S \cdot f = (L \cdot S \cdot f)^3$

$= \left(\frac{6}{7}\right)^3$ ✓ (1)

$= \frac{216}{343}$

$\frac{343}{216} \times 20.2 = 32.0768 cm^3$ ✓ (1)

2. Using mathematical tables, evaluate: (4 mks)

$$\frac{5467 \times 0.3278}{\sqrt[5]{0.0894}}$$

| No | Std form | Log |
|---|---|---|
| 5467 | $5.467 \times 10^3$ | 3.7377 |
| 0.3278 | $3.278 \times 10^{-1}$ | $\bar{1}.5156$ |
| | | 3.2533 |
| 0.0894 | $8.94 \times 10^{-2}$ | $\bar{2}.9513 \div 5$ |
| | | $= \bar{1}.7026$ ✓ (1) |
| 3552 ✓ (1) | $\leftarrow 3.552 \times 10^3$ | $\leftarrow 3.5507$ |

$3.2533 - \bar{1}.7026 = 3.5507$ ✓ (1)

3. Simplify the expression below (3 mks)

$$\frac{6b + 2ab - 3a - a^2}{3a + 2ab - 6b - a^2}$$

$N = 6b + 2ab - 3a - a^2$

$2b(3+a) - a(3+a)$

$(2b-a)(3+a)$ ✓ (1)

$D = 3a - a^2 + 2ab - 6b$

$a(3-a) + 2b(a-3)$

$(a+2b)(3-a)$ ✓ (1)

$\frac{N}{D} = \frac{(2b-a)(3+a)}{(a+2b)(3-a)}$

$3a - 6b - a^2 + 2ab$

$3(a-2b) - a(a-2b)$ ✓ (1)

$(3-a)(a-2b)$

$\frac{N}{D} = \frac{(2b-a)(3+a)}{(3-a)(a-2b)}$

$\frac{-1(2b-a)(3+a)}{(3-a)(a-2b)}$

$= \frac{-3+a}{3-a}$ ✓ (1)

4. If $4^{3y-4x} = 64$ and $3^y \div 9^x = 1$, solve for x and Y. (3 mks)

$4^{3y-4x} = 4^3$

$3y - 4x = 3$ ✓ (1)

$3^y \div 3^{2x} = 3^0$

$y - 2x = 0$

$3y - 4x = 3 \quad \ldots (6)$

$y - 2x = 0 \quad \ldots (5)$

$y = 2x$

$3(2x) - 4x = 3$

$6x - 4x = 3$ ✓ (1)

$2x = 3$

$x = 3$

$y = 2(3)$

$y = 6$ ✓ (1)

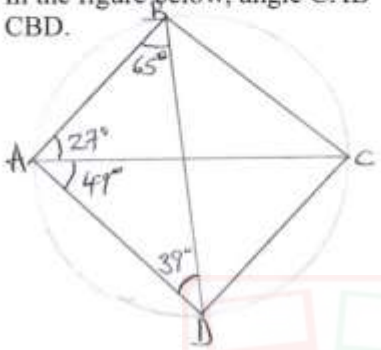
5. Find the values of h and t if the line whose equation is $3h + 5x - 2y = 0$ passes through the point (5, 17) and is parallel to the line $y + tx + 3 = 0$. (3 mks)

$3h+5x-2y=0$
$y+tx+3=0$
$y=-tx-3$
$G_1 = -t = G_2$
$2y = 3h + 5x$
$y = \frac{3}{2}h + \frac{5}{2}x$

$\frac{y-17}{x-5} = -t$
$y-17 = -tx+5t$
$3h+5x-2y=0$
$3h+25-34=0$
$3h=9$
$h=3$ ✓ (1)

$2y-5x-3=0$
$y=\frac{5x}{2}+\frac{3}{2}$
$m_1 = \frac{5}{2}$ ✓ (1)
$m_1 = m_2$
$-t = \frac{5}{2}$
$t = -\frac{5}{2}$ ✓ (1)

6. In the figure below, angle CAB = 27°, angle ABD = 65° and angle DB = 39°. Find the size of angle CBD. (3 mks)




$180° - (27° + 65° + 39°)$ (1)
$= 49°$ (1)
CBD = 49° ∠s subtended by the same chord CD (1)

7. Common salt has a density of 2.2g/cm$^3$ while sand has a density of 3.2g/cm3. If 0.8kg of salt is mixed with 1.5kg of sand, find the density of the mixture. (3 mks)

Volume of Salt $= 2.2 \times 800g$
$= 1760cm^3$
Volume of Sand $= 3.2 \times 1500g$
$= 4800cm^3$
Total Vol. $= 4800 + 1760$
$= 6560cm^3$ ✓ (1)

Density $= \frac{\text{Total mass}}{\text{Total Volume}}$
$= \frac{2300g}{6560cm^3}$ ✓ (1)
$= 0.3506g/cm^3$ ✓ (1)

8. The volume of water in a measuring cylinder is 25.2cm$^3$. After a solid metal sphere is immersed into it, the measuring cylinder reads 29.4cm$^3$. Calculate the radius of the sphere. (3 mks)

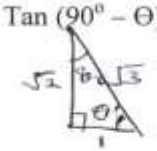
Vol. of sphere $= 29.4 - 25.2$
$= 4.2cm^3$
$V = \frac{4}{3}\pi r^3$
$4.2 = \frac{4}{3} \times \frac{22}{7} \times r^3$ ✓ (1)

$4.2 = \frac{88}{21} r^3$
$4.2 \times \frac{21}{88} = r^3$
$r^3 = 1.00$ (1)

$r = \sqrt[3]{1.00}$
$r = 1cm$ ✓ (1)

9. $\cos\theta = \frac{1}{\sqrt{3}}$ where $\theta$ is an acute angle. Without using mathematical tables, find;

(a) Tan $(90^\circ - \theta)$ (1 mk)




$\tan(90^\circ - \theta)$

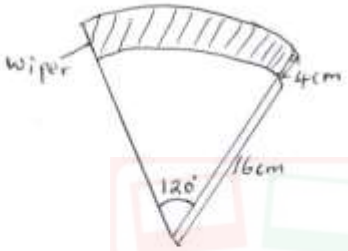
$\tan(90^\circ - \theta) = \frac{1}{\sqrt{2}}$ ✓1

(b) Sin θ in the form $\frac{\sqrt{a}}{\sqrt{b}}$ where a and b are integers. (2 mks)

$\sin\theta = \frac{OPP}{HYP} = \frac{\sqrt{2}}{\sqrt{3}}$

$\sin\theta = \frac{\sqrt{2}}{\sqrt{3}}$ ✓2

10. The shaded region in the figure below shows the area swept out on a flat windscreen by a wiper. Calculate the area of this region. (3 mks)



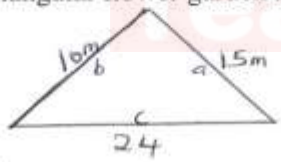

$A = \frac{120}{360} \times \frac{22}{7} \times 20 \times 20 = 419.05\text{cm}^2$ ✓1

$A = \frac{120}{360} \times \frac{22}{7} \times 16 \times 16 = 268.19\text{cm}^2$ ✓1

$A_{\text{shaded region}} = 419.05 - 268.19$

$= 150.86\text{cm}^2$ ✓1

11. A triangular flower garden measures 10m, 15m and 24m. Find the area of the garden. (3 mks)




$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$

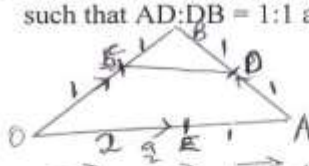
$s = \frac{1}{2}(10+15+24) = 24.5$ ✓1

$A = \sqrt{24.5 \times 14.5 \times 0.5 \times 9.5}$ ✓1

$A = \sqrt{1687.4375}$

$= 41.078\text{cm}^2$ ✓1

12. Triangle OAB is such that $\overrightarrow{OA} = \underset{\sim}{a}$ and $\overrightarrow{OB} = \underset{\sim}{b}$. C lies on OB such that OC:CB = 1:1. D lies on AB such that AD:DB = 1:1 and E lies on OA such that OE:EA = 3:1. Find CD in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$. (3 mks)




$\overrightarrow{CD} = \overrightarrow{CO} + \overrightarrow{OA} + \overrightarrow{AD}$

$\overrightarrow{AD} = \frac{1}{2}(\overrightarrow{AB})$ ✓1

OA:AE

$\overrightarrow{AB} = -\underset{\sim}{a} + \underset{\sim}{b}$

$= \underset{\sim}{b} - \underset{\sim}{a}$

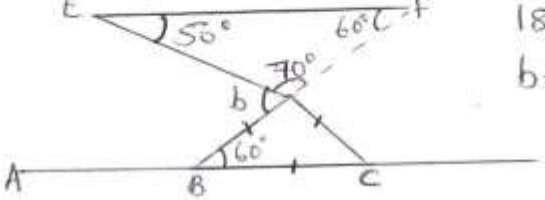
$\overrightarrow{CO} = -\frac{1}{2}\underset{\sim}{b}$

$\overrightarrow{CD} = -\frac{1}{2}\underset{\sim}{b} + \underset{\sim}{a} + \frac{1}{2}(\underset{\sim}{b} - \underset{\sim}{a})$ ✓1

$= -\frac{1}{2}\underset{\sim}{b} + \underset{\sim}{a} + \frac{1}{2}\underset{\sim}{b} - \frac{1}{2}\underset{\sim}{a}$

$\overrightarrow{CD} = \frac{1}{2}\underset{\sim}{a}$ ✓1

13. Giving reasons, find the angle marked b, given that EF is parallel to AC. (3 mks)




$180^\circ - 110^\circ = 70^\circ$ (Angles of a Δ add up to $180^\circ$) ✓1

$b = 180^\circ - 70^\circ$

$= 110^\circ$ (∠s on a straight line add up to $180^\circ$) ✓1

## SECTION B: (30 MARKS)

**Answer any three questions in this section.**

14. The height (in cm) of some seedlings in a nursery are recorded in the table below.

| Height (cm) | 1.0 – 1.4 | 1.5 – 1.9 | 2.0 – 2.4 | 2.5 – 2.9 |
|---|---|---|---|---|
| No. of seedlings | 2 | 6 | 4 | 8 |
| C.F | 2 | 8 | 12 | 20 |

(a) State the median class (1 mk)

Median = $\frac{n}{2} = \frac{20}{2} = 10$

Median class = 2.0 – 2.4

(b) Calculate the mean height of the seedlings in the nursery. (4 mks)

| Height | f | x | fx |
|---|---|---|---|
| 1.0 – 1.4 | 2 | 1.2 | 2.4 |
| 1.5 – 1.9 | 6 | 1.8 | 10.8 |
| 2.0 – 2.4 | 4 | 2.2 | 8.8 |
| 2.5 – 2.9 | 8 | 2.7 | 21.6 |
| | $\Sigma f = 20$ | | $\Sigma fx = 43.6$ |

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

$= \frac{43.6}{20}$

$= 2.18$ cm.

(c) On the grid provided, draw a histogram and a frequency polygon to represent the information. (5 mks)

15. On the graph paper provided, plot the triangle whose co-ordinates are A(1, 3) B(2, 1) and C(3, 4). (1 mk)

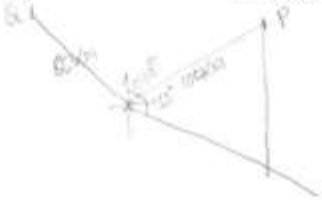
(a) On the same grid, draw;

(i) A'B'C' the image of ABC under an enlargement, centre (0,0), scale factor -1 and state its co-ordinates. (3 mks)

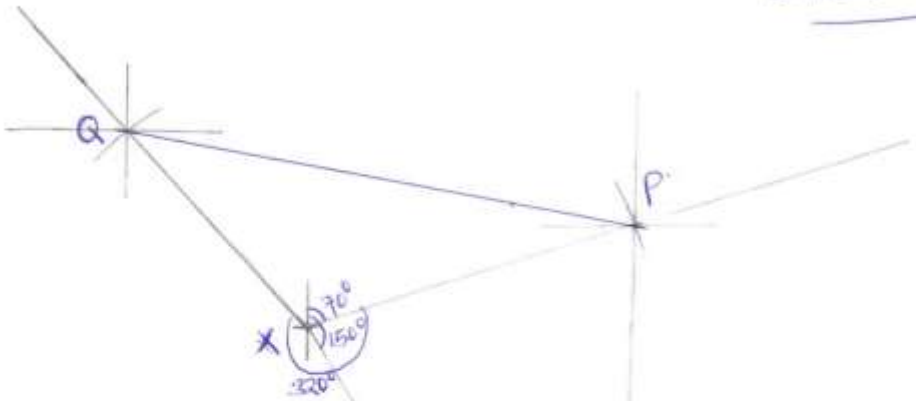
(ii) A"B"C" the image of A'B'C' under a rotation of +90° about origin. State the co-ordinates of A"B"C". (3 mks)

16. Three warships P,Q and R leave port X at 9.00 a.m. Ship P sails at a steady speed on a bearing of 070°, 100km from port X while ship Q sails on a bearing of 320°, 80km from port X. Ship R is on a bearing of 150° from port X and due south of ship P.

(a) Construct a scale drawing to show the position of P, Q, R and X. (4 mks)



Scale 1cm rep 20km .




(b) Use the scale drawing to determine:

(i) The distance and bearing of ship P from ship Q. (2 mks)

= 7.5cm x 20

Dist = 150Km ±2

Bearing = 100°

(ii) The distance of ship R from port X. (2 mks)

= 9.1cm x 20

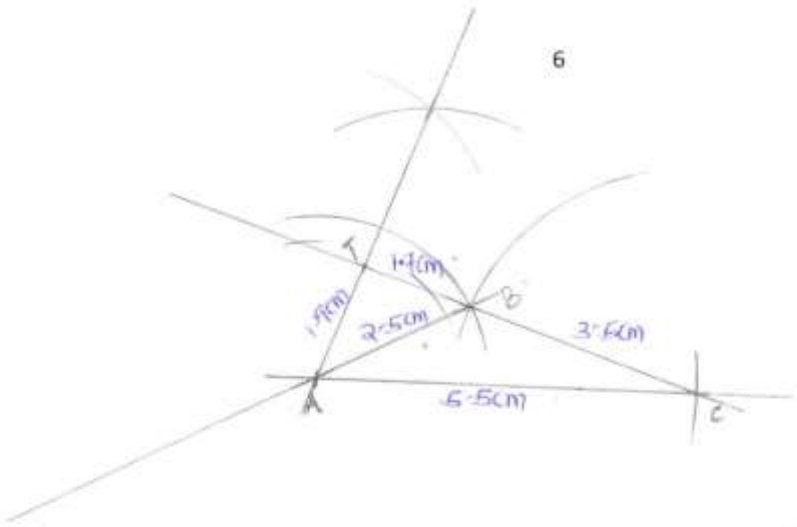
= 182Km ±2

(iii) The distance of ship R from ship P. (2 mks)

= 9.5 x 20

= 190Km ±2

17. (a) Use a ruler and a pair of compasses only to construct triangle ABC such that AB = 2.5cm, BC = 3.5cm and AC = 5.5cm. Measure < ABC. (3 mks)




$\angle ABC = 131^\circ \pm 0.1^\circ$

(b) Drop a perpendicular from A to a point T on CB produced. Measure the length AT. (3 mks)

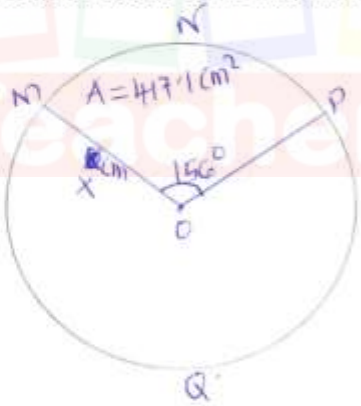
$AT = 1.9cm$

(c) With BT as the base, calculate the area of triangle ABT and triangle ACT. (4 mks)

$A(ABT) = \frac{1}{2} \times 1.9 \times 1.7$
$= 1.615 cm^2$ (2)

$A(ACT) = \frac{1}{2} \times 1.9 \times 5.2$
$= 4.94 cm^2$ (2)

18. The circle in figure below has a radius Xcm and centre O. Minor arc MNP subtends an angle of 156° at the centre of the circle. Sector MNP has an area of $417.1cm^2$




(a) Taking $\pi = \frac{22}{7}$, find x. (3 mks)

$A = \frac{\theta}{360} \times \pi x^2$ (1)

$417.1 = \frac{156}{360} \times \frac{22}{7} \times (x)^2$

$417.1 = 1.3619x^2$ (1)

$x^2 = 306.2622$

$x = 17.50cm$ (1)

(b) The major sector MQP is obtained from the circle and folded into a cone. Find:

(i) The radius of the cone's base. (2 mks)

length of major arc

$= \frac{204}{360} \times \frac{22}{7} \times 2 \times 17.5$ (1)

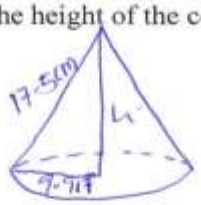
$= 62.333cm$

$C = 2\pi x$

$2 \times \frac{22}{7} \times x = 62.333$ (1)

$x = 9.9167 cm$

(ii) The height of the cone. (2 mks)




$h^2 = H^2 - b^2$ (1)

$h = \sqrt{(17.5)^2 - (9.917)^2}$ (1)

$h = 14.419\ cm$

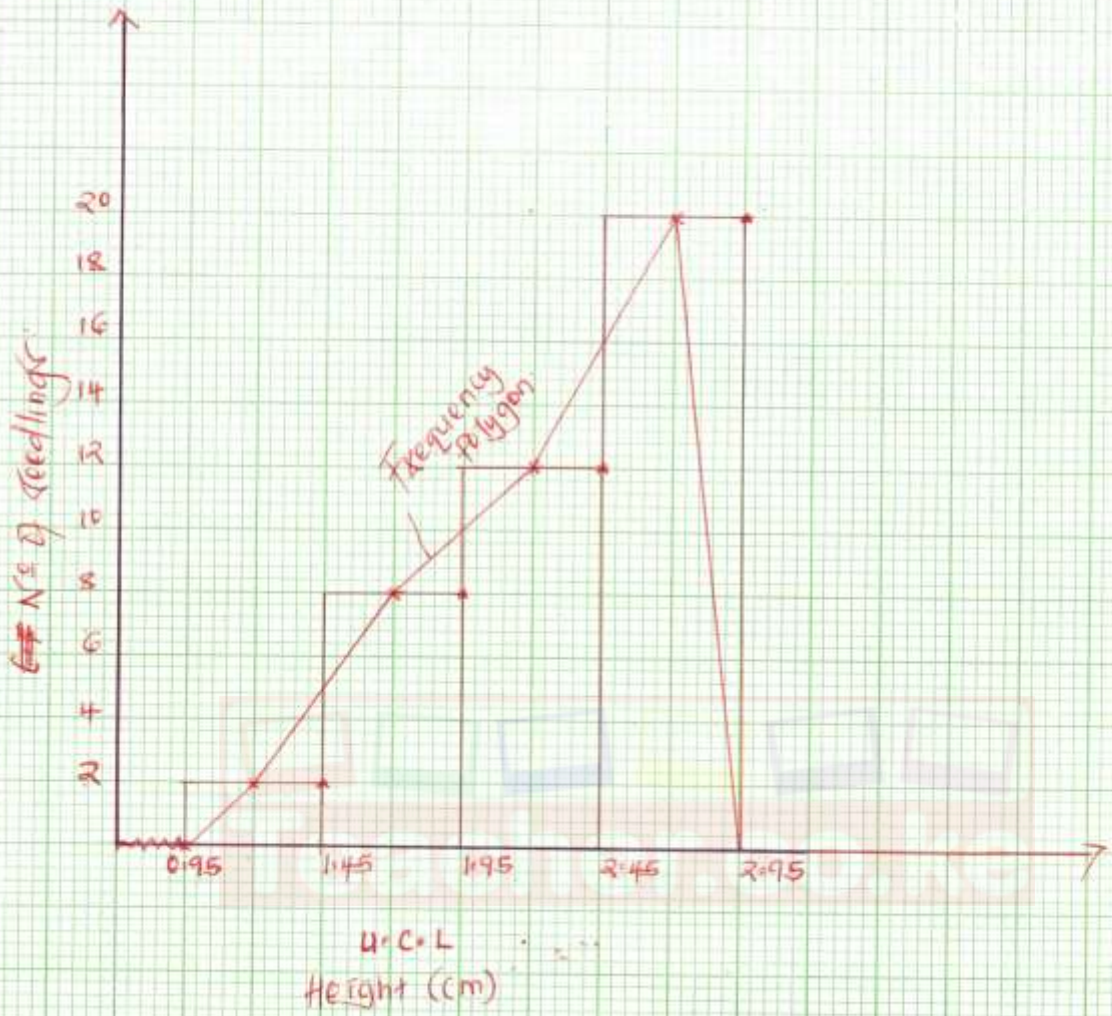
(iii) The surface area of the cone. (3 mks)

C.A $= \pi r^2 + \pi r L$

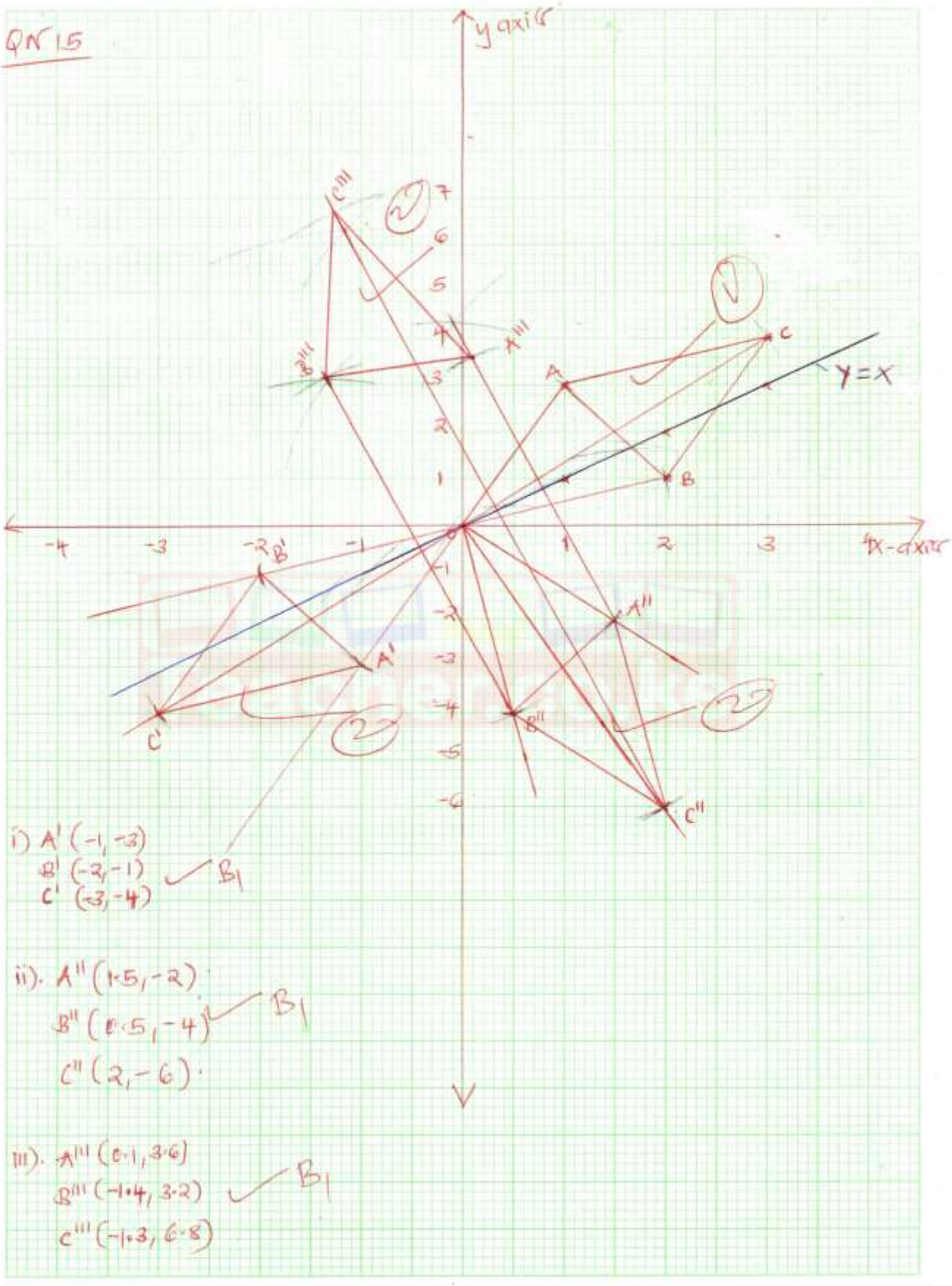
$= \left(\frac{22}{7} \times 9.917 \times 9.917\right) + \left(\frac{22}{7} \times 9.917 \times 17.5\right)$ .3

$= 854.5252\ cm^2$

Qn 14(c)



QN 15




i) A' (-1, -3)
B' (-2, -1) $B_1$
C' (-3, -4)

ii). A'' (1·5, -2)
B'' (0·5, -4) $B_1$
C'' (2, -6).

iii). A''' (0·1, 3·6)
B''' (-1·4, 3·2) $B_1$
C''' (-1·3, 6·8)