

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

FORM TWO MATHEMATICS

END OF YEAR EXAMS - 20

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)

$$\begin{aligned} A \cdot S \cdot f &= \frac{36}{49} = \\ L \cdot S \cdot f &= \sqrt{A \cdot S \cdot f} \\ &= \sqrt{\frac{36}{49}} \\ &= \frac{6}{7} \end{aligned}$$

$$\begin{aligned} V \cdot S \cdot f &= (L \cdot S \cdot f)^3 \\ &= \left(\frac{6}{7}\right)^3 \\ &= \frac{216}{343} \end{aligned}$$

$$\frac{343}{216} \times 20.2 = 32.0768\text{cm}^3$$

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

$$\frac{5467 \times 0.3278}{\sqrt{0.0894}}$$

No	Std form	Log
5467	5.467×10^3	3.7377
0.3278	3.278×10^{-1}	1.5156
		3.2533
0.0894	8.94×10^{-2}	2.9513
		5
		2.9513 + 5
		= 7.9513
3552	3.552×10^3	3.5507

$$\begin{aligned} &3.2533 \\ &- 1.7026 \\ &\hline &3.5507 \end{aligned}$$

3. Simplify the expression below (3 mks)

$$\begin{aligned} \frac{6b+2ab-3a-a^2}{3a+2ab-6b-a^2} \\ N = \frac{6b+2ab-3a-a^2}{3a+2ab-6b-a^2} \\ \frac{2b(3+a)-a(3+a)}{(2b-a)(3+a)} \end{aligned}$$

$$\begin{aligned} D = \frac{3a-a^2+2ab-6b}{(a+2b)(3-a)} \\ \frac{a(3-a)+2b(a-3)}{(a+2b)(3-a)} \end{aligned}$$

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

$$\begin{aligned} \frac{3a-6b-a^2+2ab}{3(a-2b)-a(a-2b)} \\ \frac{(3-a)(a-2b)}{(3-a)(a-2b)} \end{aligned}$$

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

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

$$\frac{-3+a}{3-a}$$

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

$$\begin{aligned} 4^{3y-4x} &= 4^3 \\ 3y-4x &= 3 \\ 3y &= 3+4x \\ 3y &= 3^{1+4x} \\ y &= 1+4x \\ 3y-4x &= 3 \end{aligned}$$

$$\begin{aligned} y &= 2x \\ 3(2x) - 4x &= 3 \\ 6x - 4x &= 3 \\ 2x &= 3 \\ x &= 1.5 \\ y &= 2(1.5) \end{aligned}$$

$$y = 0$$

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)

$$3h + 5x - 2y = 0$$

$$y + tx + 3 = 0$$

$$y = -tx - 3$$

$$G_1 = -t = G_2$$

$$2y = 3h + 5x$$

$$y = \frac{3}{2}h + \frac{5}{2}x$$

$$\begin{aligned} \frac{y-17}{x-5} &= -t \\ y-17 &= \\ 3h+5x-2y &= 0 \\ 3h+25-34 &= 0 \\ 3h &= 9 \\ h &= 3 \end{aligned}$$

$$2y - 5x - 3 = 0$$

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

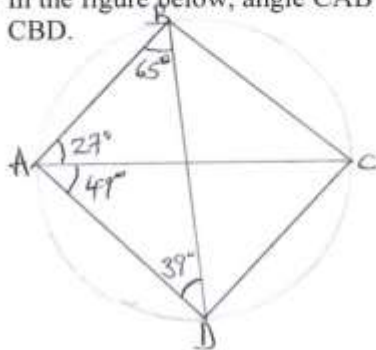
$$m_1 = \frac{5}{2}$$

$$m_1 = m_2$$

$$-t = \frac{5}{2}$$

$$t = -\frac{5}{2}$$

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



$$\begin{aligned} 180^\circ - (27^\circ + 65^\circ + 39^\circ) &= \\ &= 49^\circ \end{aligned}$$

$$CBD = 49^\circ \text{ } \angle \text{ subtended by the same chord } CD$$

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

$$\begin{aligned} \text{Volume of Salt} &= \frac{2.2 \times 800 \text{ g}}{2.2} \\ &= 1760 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Volume of Sand} &= \frac{3.2 \times 1500 \text{ g}}{3.2} \\ &= 4800 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Total Vol.} &= 4800 + 1760 \\ &= 6560 \text{ cm}^3 \end{aligned}$$

$$\text{Density} = \frac{\text{Total mass}}{\text{Total Volume}}$$

$$= \frac{2300 \text{ g}}{6560 \text{ cm}^3}$$

$$= 0.3506 \text{ g/cm}^3$$

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

$$\begin{aligned} \text{Vol. of sphere} &= 29.4 - 25.2 \\ &= 4.2 \text{ cm}^3 \end{aligned}$$

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

$$4.2 = \frac{4}{3} \times \frac{22}{7} \times r^3$$

$$4.2 = \frac{88}{21} r^3$$

$$4.2 \times \frac{21}{88} = r^3$$

$$r^3 = 1.00$$

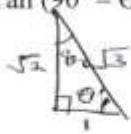
$$r = \sqrt[3]{1.00}$$

$$r = 1 \text{ cm}$$

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

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

(1 mk)



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

(b) $\sin \theta$ in the form $\frac{\sqrt{a}}{\sqrt{b}}$ where a and b are integers.

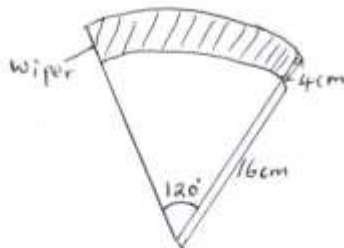
(2 mks)

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

$$\sin \theta = \frac{\sqrt{2}}{\sqrt{3}} \quad \checkmark \textcircled{2}$$

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)



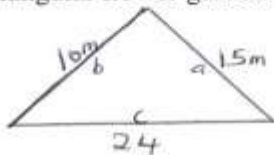
$$A = \frac{120}{360} \times \frac{22}{7} \times 20 \times 20 = 419.05 \text{ cm}^2 \quad \checkmark \textcircled{1}$$

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

$$\text{A shaded region} = 419.05 - 268.19 = 150.86 \text{ cm}^2 \quad \checkmark \textcircled{1}$$

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

(3 mks)



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

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

$$A = \sqrt{24.5 \times 14.5 \times 9.5 \times 1.5} \quad \checkmark \textcircled{1}$$

$$A = \sqrt{1687.4375}$$

$$= 41.078 \text{ cm}^2 \quad \checkmark \textcircled{1}$$

12. Triangle OAB is such that $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$. 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 a and b. (3 mks)



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

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

$$\vec{AB} = -\mathbf{a} + \mathbf{b}$$

$$= \mathbf{b} - \mathbf{a}$$

$$\vec{CO} = -\frac{1}{2}\mathbf{b}$$

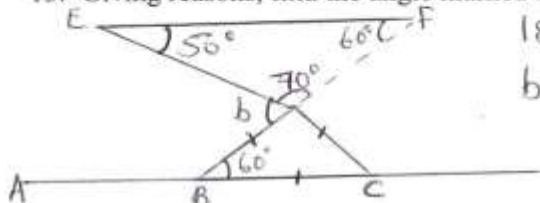
$$\vec{CD} = -\frac{1}{2}\mathbf{b} + \mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a})$$

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

$$\vec{CD} = \frac{1}{2}\mathbf{a} \quad \checkmark \textcircled{1}$$

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

(3 mks)



$$180^\circ - 110^\circ = 70^\circ \quad \checkmark \textcircled{1} \quad (\text{Angles of a } \Delta \text{ add up to } 180^\circ)$$

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

$$= 110^\circ \quad \checkmark \textcircled{1} \quad (\text{Ls on a straight line add up to } 180^\circ)$$

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)

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

$$\text{Median class} = 2.0 - 2.4$$

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

(4 mks)

Height	f	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
$\Sigma f = 20$		$\Sigma fx = 43.6$	

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{43.6}{20} = 2.18 \text{ cm}$$

(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 $+90^\circ$ about origin. State the co-ordinates of A''B''C''. (3 mks)

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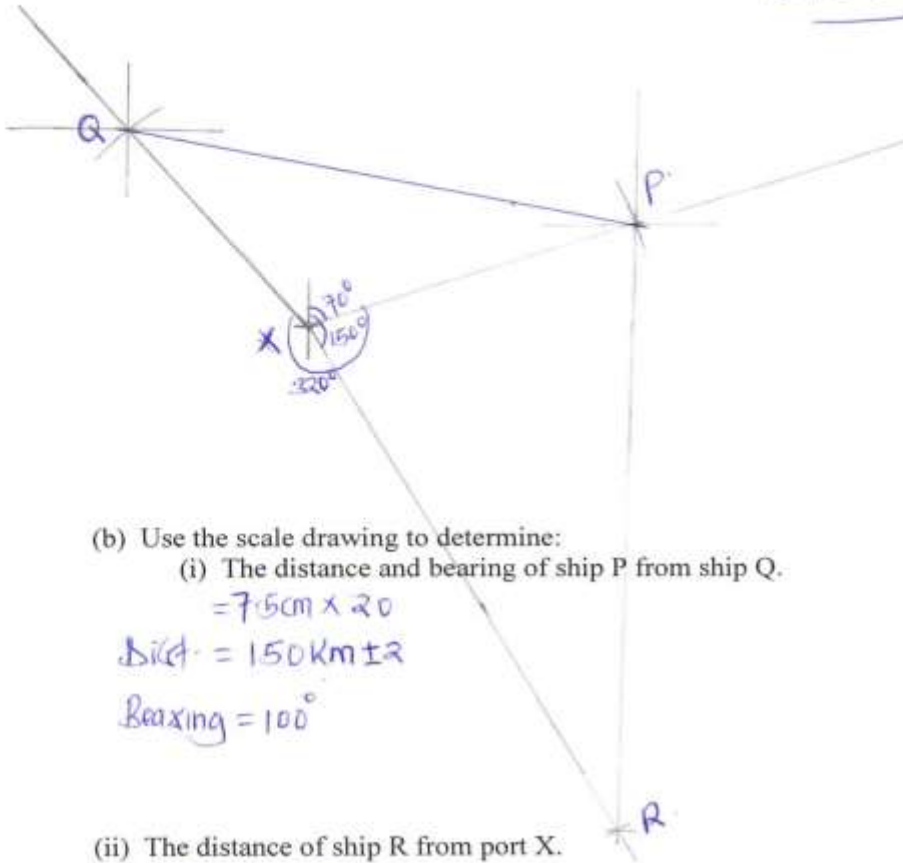
16. Three warships P, Q and R leave port X at 9.00 a.m. Ship P sails at a steady speed on a bearing of 070° , 100km from port X while ship Q sails on a bearing of 320° , 80km from port X. Ship R is on a bearing of 150° from port X and due south of ship P.

(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)

$$= 7.5 \text{ cm} \times 20$$

$$\text{Dist} = 150 \text{ km} \pm 2$$

$$\text{Bearing} = 100^\circ$$

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

$$= 9.1 \text{ cm} \times 20$$

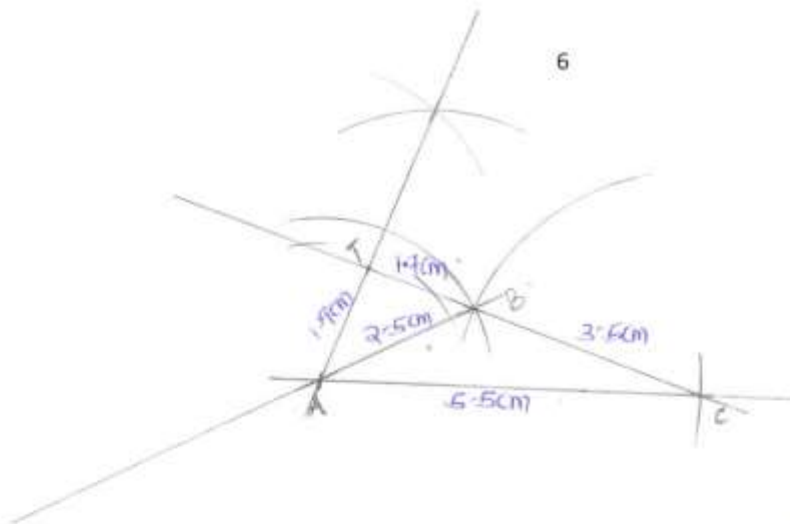
$$= 182 \text{ km} \pm 2$$

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

$$= 9.5 \times 20$$

$$= 190 \text{ km} \pm 2$$

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



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

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

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

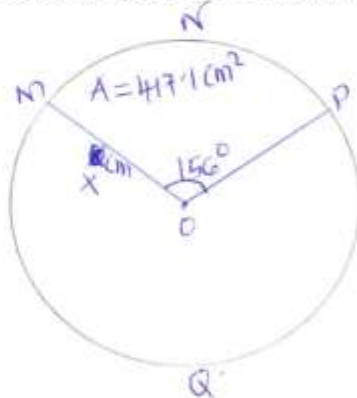
$$A(ABT) = \frac{1}{2} \times 1.9 \times 1.7$$

$$= 1.615 \text{ cm}^2$$

$$A(ACB) = \frac{1}{2} \times 1.9 \times 5.2$$

$$= 4.94 \text{ cm}^2$$

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



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

$$A = \frac{\theta}{360} \times \pi r^2$$

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

$$417.1 = 1.3619 x^2$$

$$x^2 = 306.2622$$

$$x = 17.50 \text{ cm}$$

- (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

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

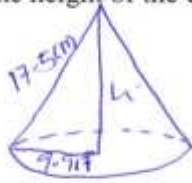
$$= 62.333 \text{ cm}$$

$$C = 2\pi r$$

$$2 \times \frac{22}{7} \times r = 62.333$$

$$r = 9.9167 \text{ cm}$$

(ii) The height of the cone.



$$h^2 = H^2 - b^2$$

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

$$h = 14.419 \text{ cm}$$

(2 mks)

(iii) The surface area of the cone.

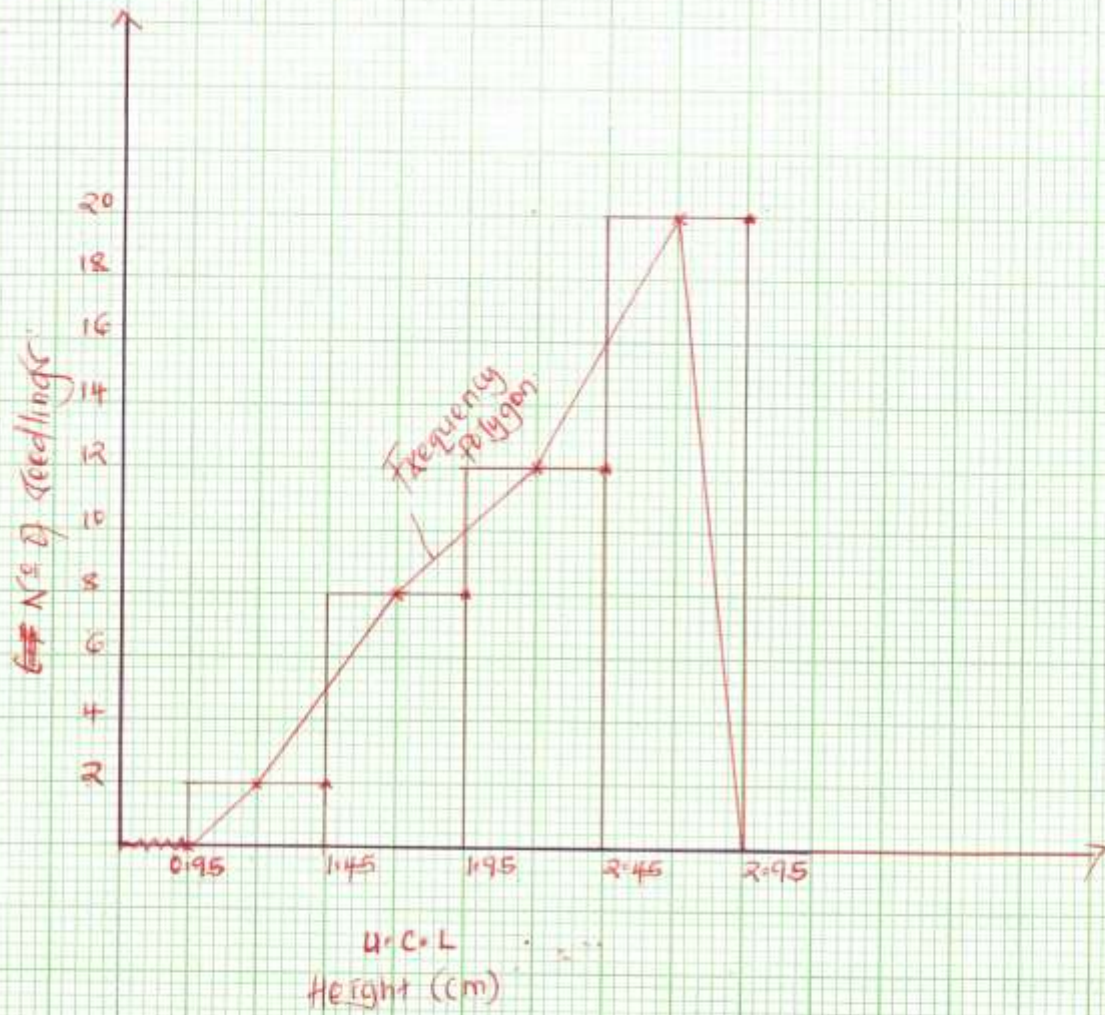
$$S.A = \pi r^2 + \pi r L$$

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

$$= 854.5252 \text{ cm}^2$$

(3 mks)

Q. N 14(c)



QN 15

