

'O' Level E.Math

Predicted Question Types for
2025 'O' Level E.Math Paper 2

Predicted 2025 O Level EM P2 Topics

Question types that are **VERY LIKELY** to come out, split into 2 sections:

Section 1: Heavy-weightage questions

1. Trigonometry – Bearings, Sine Rule, Cosine Rule, Angle of Elevation / Depression
2. Matrices
3. Vectors – Given unknown vectors, proving collinear points / parallel vectors
4. Ratio of Area of Triangles [e.g. Find the ratio of $\frac{\text{Area of } \triangle ABC}{\text{Area of } \triangle ABD}$.]
5. Mensuration – Area and Volume of Cylinders, Prisms, Pyramids, Cones, Spheres
6. Graphical Solutions – Plot points, sketching graph, drawing tangent,
[“suitable straight line” concept might come out again here]
7. Coordinate Geometry
8. Arc Sector Segment in Radian Measure
9. Number Patterns

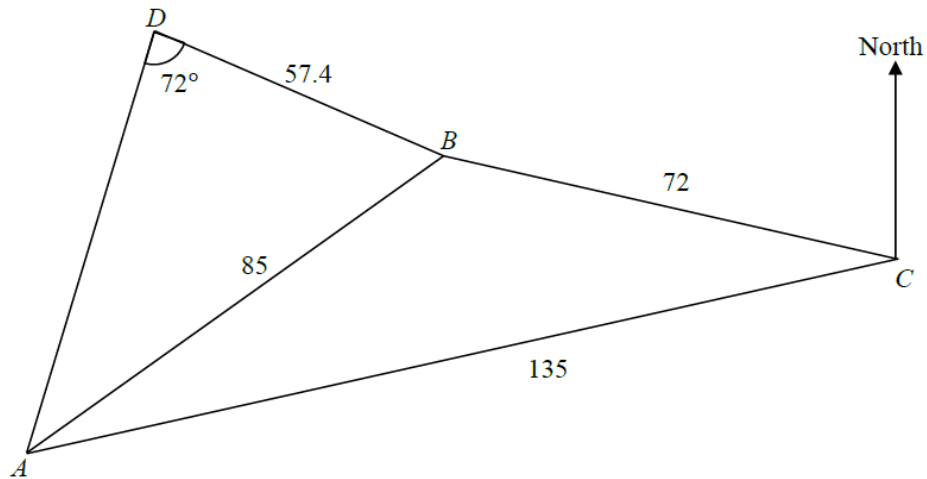
Section 2: Lighter-weightage questions

1. Standard Algebra Questions, $a^2 - b^2 = (a + b)(a - b)$, Simultaneous Equations
2. Direct and Inverse Proportion
3. Map Scales
4. Finance: Exchange Rate, Hire Purchase, Compound Interest
5. Sets and Venn Diagrams
6. Polygons
7. Graphs of Functions [e.g. $y = \frac{1}{x}$, $y = 3(4)^x$]

Question types that **MAY OR MAY NOT** come out

1. Statistical Data Analysis – Median, IQR, Percentile
2. Properties of Circles
3. Algebraic Contextual + Quadratic Formula
4. Proving similar / congruent triangles

Question 1 – Applications of Trigonometry [2023/FFMS/4E/Prelim/II/8]



ABC and ADB are two triangular plots of land.

$AB = 85$ m, $BC = 72$ m, $AC = 135$ m and $BD = 57.4$ m.

The bearing of B from C is 290° and angle $ADB = 72^\circ$.

(a) Find the bearing of A from B .

$$(a) \angle BCN_1 = 360^\circ - 290^\circ \text{ (Ext. \(\angle\))} \\ = 70^\circ$$

$$\angle N_2BC = 180^\circ - 70^\circ \text{ (Int. \(\angle\))} \\ = 110^\circ$$

By Cosine Rule,

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\Rightarrow \angle ABC = \cos^{-1} \left(\frac{85^2 + 72^2 - 135^2}{2(85)(72)} \right) \\ = 118.369^\circ$$

$$\therefore \text{Bearing} = 118.369^\circ + 110^\circ \\ = 228.369^\circ \\ = \underline{\underline{228.4^\circ \text{ (dp)}}}$$

Answer **228.4** $^\circ$ [4]

[Turn Over]

- (b) The plot of land ADB is to be filled with top soil. Calculate the area to be filled with top soil. [4]

By Sine Rule,

$$\frac{\sin \angle DAB}{57.4} = \frac{\sin 72^\circ}{85}$$

$$\angle DAB = \sin^{-1} \left(\frac{57.4 \sin 72^\circ}{85} \right)$$

$$= 39.959^\circ$$

$$\angle DBA = 180^\circ - 72^\circ - 39.959^\circ \text{ (L sum in } \triangle)$$

$$= 68.041^\circ$$

$$\text{Area of } \triangle ADB = \frac{1}{2} (57.4)(85) \sin 68.041^\circ$$

$$= 2162.518$$

$$= \underline{\underline{2260 \text{ m}^2}} \text{ (3sf)}$$

Answer **2260** m^2 [4]

- (c) A 40 m antenna mast is installed vertically at point D . Find the largest angle of depression from the top of the mast to a point along the path AB . [3]

$$\sin 68.041^\circ = \frac{DF}{57.4}$$

$$DF = 57.4 \sin 68.041^\circ$$

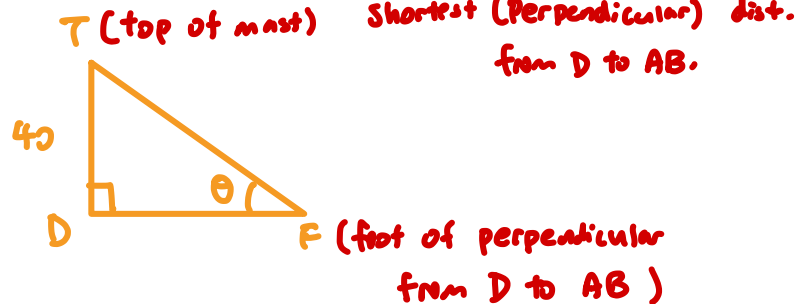
$$= 53.236$$

$$\tan \theta = \frac{40}{53.236}$$

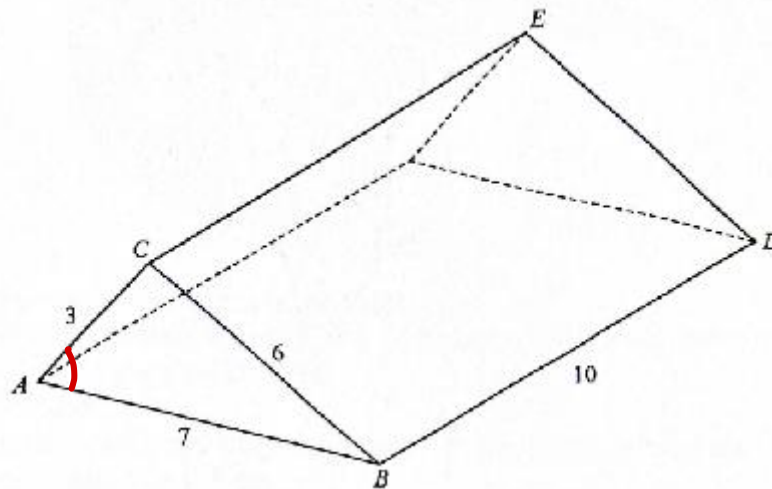
$$\theta = \tan^{-1} \left(\frac{40}{53.236} \right)$$

$$= 36.910^\circ$$

$$= \underline{\underline{36.9^\circ}} \text{ (1dp)}$$



Answer **36.9** $^\circ$ [3]

Question 2 – Trigonometry – 3D Solid + Angle of Elevation / Depression [N2016/II/8]

The diagram shows a solid triangular prism with three rectangular faces.

$AB = 7$ cm, $AC = 3$ cm, $BC = 6$ cm and $BD = 10$ cm.

- (a) Show that angle $BAC = 58.4^\circ$, correct to 1 decimal place.

Answer

$$\begin{aligned}\cos \angle BAC &= \frac{3^2 + 7^2 - 6^2}{2(3)(7)} \\ \angle BAC &= \cos^{-1}\left(\frac{11}{14}\right) \\ &= 58.412^\circ \\ &= \underline{\underline{58.4^\circ}} \quad (1dp) \quad (shown)\end{aligned}$$

[3]

- (b) Calculate the surface area of the prism.

$$\begin{aligned}\text{Total SA} &= 2 \times \text{Area of } \triangle ABC + 3 \times \text{Area of Rect.} \\ &= 2\left(\frac{1}{2}\right)(3)(7) \sin 58.4^\circ + (3)(10) + (6)(10) + (7)(10) \\ &= 177.88 \\ &= \underline{\underline{178 \text{ cm}^2}} \quad (3sf)\end{aligned}$$

Answer **178** cm^2 [3]

Final Set
110% $\Rightarrow$ 1.1115% $\Rightarrow$ 1.15

If the postage charges are increased by 10% for parcels and 15% for letters, and the postage charge for cards is decreased by 10%,

- (e) write down a 3×3 matrix **R** such that when multiplied to matrix **C** will give the revised postage charges.

$$\begin{pmatrix} 1.1 & 0 & 0 \\ 0 & 0.9 & 0 \\ 0 & 0 & 1.15 \end{pmatrix}$$

Answer **R** = [1]

- (f) Explain why **RN** is not possible.

$$\begin{matrix} \downarrow & \downarrow \\ 3 \times 3 & 2 \times 3 \end{matrix}$$

Answer ... Since the number of columns in matrix **R** (i.e. 3 columns) $\neq$ number of rows in matrix **N** (i.e. 2 rows), [1]
RN is not possible.

- (g) By matrix multiplication, find the new postage charges Peter and Jane each had to pay.

$$RC = \begin{pmatrix} 1.1 & 0 & 0 \\ 0 & 0.9 & 0 \\ 0 & 0 & 1.15 \end{pmatrix} \begin{pmatrix} 7 \\ 0.5 \\ 0.4 \end{pmatrix}$$

$$= \begin{pmatrix} 7.7 \\ 0.45 \\ 0.46 \end{pmatrix} \quad (\text{new unit charges})$$

$$NRC = \begin{pmatrix} 5 & 4 & 5 \\ 3 & 8 & 6 \end{pmatrix} \begin{pmatrix} 7.7 \\ 0.45 \\ 0.46 \end{pmatrix}$$

$$= \begin{pmatrix} 42.6 \\ 29.46 \end{pmatrix} \begin{matrix} \Rightarrow \text{Peter} \\ \Rightarrow \text{Jane} \end{matrix}$$

Answer Peter: \$..... **42.60**

Jane: \$ **29.46** [2]

2025 'O' Level E.Math Paper 2
Finale Set

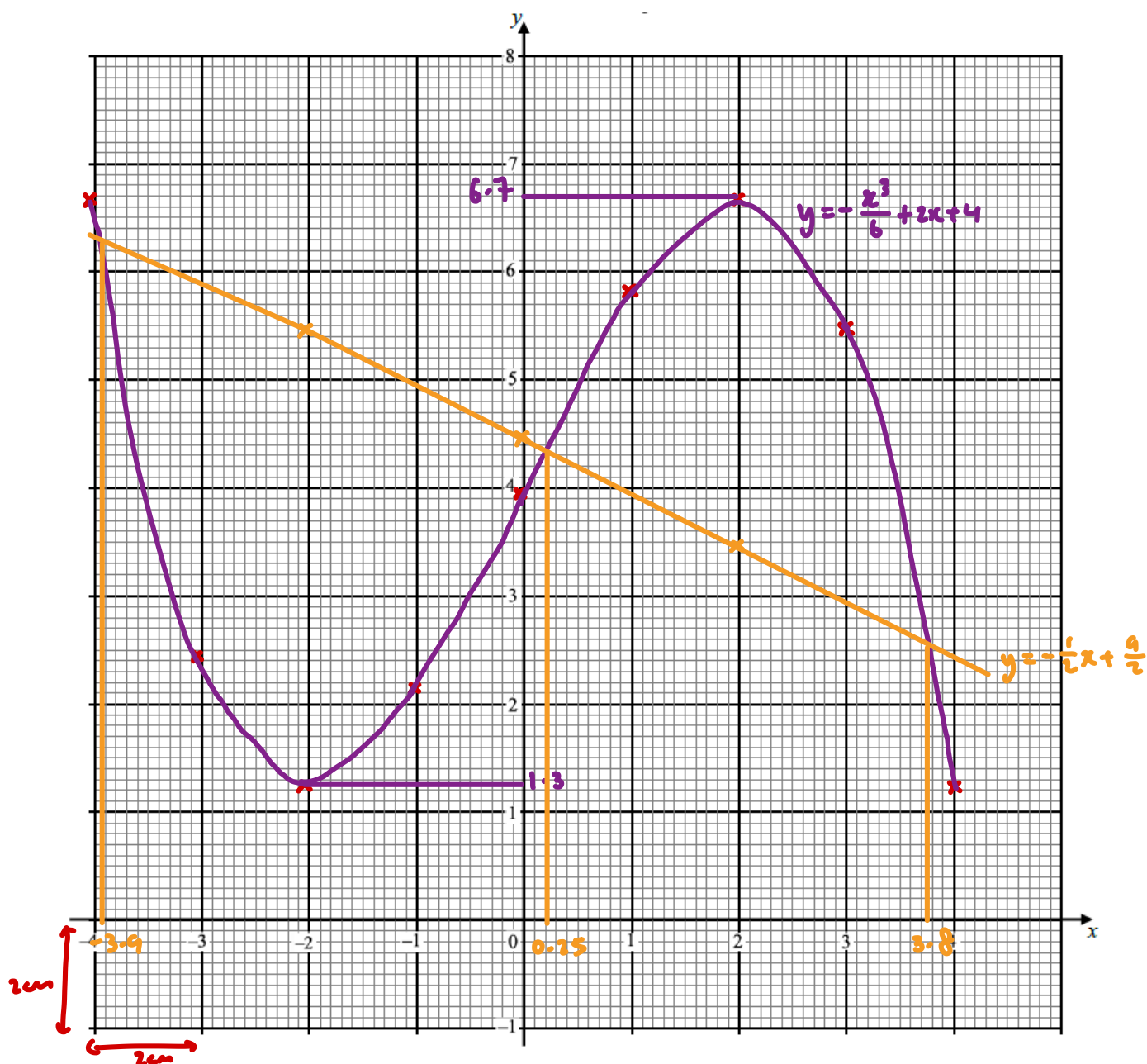
Question 4 – Graphical Solutions [2023/FFMS/4E/Prelim/II/4]

The table below shows some values of x and corresponding values of y for $y = -\frac{x^3}{6} + 2x + 4$.

- (a) Complete the table of values, giving your answer correct to 1 decimal place. [1]

x	-4	-3	-2	-1	0	1	2	3	4
y	6.7	2.5	1.3	2.2	4	5.8	6.7	5.5	1.3

On the grid below, draw the graph of $y = -\frac{x^3}{6} + 2x + 4$ for $-4 \leq x \leq 4$. [3]



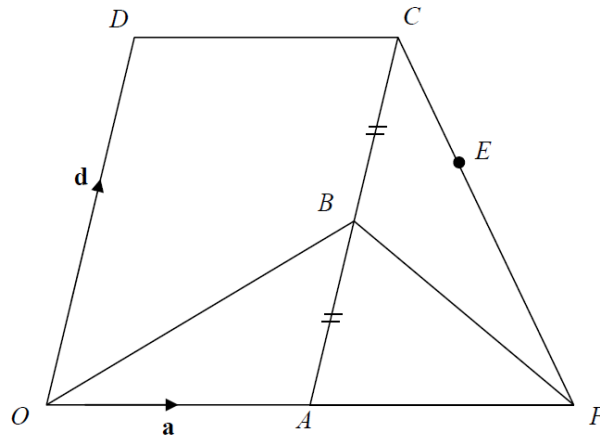
[Turn Over]

Question 5 – Vectors [2023/MFTSS/4E/Prelim/I/5]

In the diagram below, $OACD$ is a parallelogram and B is the midpoint of AC .

CE and OA produced intersect at the point F .

$CE:CF=1:3$ and $OA:OF=1:2$.



- (a) Given that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OD} = \mathbf{d}$, express and simplify the following vectors in terms of $\mathbf{a}$ and $\mathbf{d}$,

- (i) $\overrightarrow{OB}$, [1]

$$\begin{aligned}\overrightarrow{OB} &= \overrightarrow{OA} + \overrightarrow{AB} \\ &= \underline{\mathbf{a}} + \underline{\frac{1}{2}\mathbf{d}}\end{aligned}$$

- (ii) $\overrightarrow{CF}$, [1]

$$\begin{aligned}\overrightarrow{CF} &= \overrightarrow{CA} + \overrightarrow{AF} \\ &= \underline{-\mathbf{d}} + \underline{\mathbf{a}} \\ &= \underline{\mathbf{a} - \mathbf{d}}\end{aligned}$$

- (iii) $\overrightarrow{OE}$. [2]

$$\begin{aligned}\overrightarrow{OE} &= \overrightarrow{OF} + \overrightarrow{FE} \\ &= \underline{2\mathbf{a}} - \underline{\frac{2}{3}(\mathbf{a} - \mathbf{d})} \\ &= \underline{2\mathbf{a}} - \underline{\frac{2}{3}\mathbf{a}} + \underline{\frac{2}{3}\mathbf{d}} \\ &= \underline{\frac{4}{3}\mathbf{a}} + \underline{\frac{2}{3}\mathbf{d}}\end{aligned}$$

2025 'O' Level E.Math Paper 2
Finale Set

Question 7 – Number Patterns [N2023/II/8]

The diagram shows part of a number grid.

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48

A cross outlining five numbers, as shown, is placed on the grid.

- (i) The cross is placed in a different position on the grid.
The sum of the largest and smallest of the numbers outlined is 204.
Complete the cross to show the numbers outlined.

[3]

Let x be the smallest number.

Largest number = $x+16$

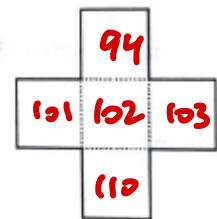
$$\Rightarrow x + (x+16) = 204$$

$$2x + 16 = 204$$

$$2x = 188$$

$$x = 94$$

Answer



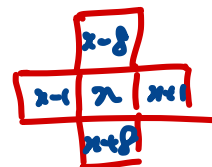
- (ii) The cross can be placed anywhere on the grid.

The difference between the product of the left and right numbers and the product of the top and bottom numbers is found.

Show that this difference is always 63.

[3]

Let the middle number be x .



$$\therefore \text{Difference} = (\text{Left})(\text{Right}) - (\text{Top})(\text{Bottom})$$

$$= (x-1)(x+1) - (x-8)(x+8)$$

$$= x^2 - 1^2 - [x^2 - 8^2]$$

$$= x^2 - 1 - x^2 + 64$$

$$= 63 \text{ (shown)}$$

63

Question 8 – Number Patterns [N2013/II/4]

The first three terms in a sequence of numbers $T_1, T_2, T_3, \dots$ are given below.

$$T_1 = 1^2 + 2 = 3$$

$$T_2 = 2^2 + 4 = 8$$

$$T_3 = 3^2 + 6 = 15$$

(a) (i) Find T_4 . [1]

(ii) Find an expression, in terms of n , for T_n . [2]

(iii) Evaluate T_{50} . [1]

(b) The first four terms in a different sequence are $-5, -1, 3, 7$.

Find an expression, in terms of n , for the n th term, P_n , of this sequence. [2]

(c) By forming an equation in n , find the values of n for which $\frac{P_n}{T_n} = \frac{1}{5}$. [3]

$$(a)(i) T_4 = 4^2 + 8 = 24$$

$$(ii) T_n = n^2 + 2n$$

$$(iii) T_{50} = 50^2 + 2(50) = 2600$$

$$\begin{array}{ll} (b) & P_1 = -5 \\ & P_2 = -1 \quad 2+4 \\ & P_3 = 3 \quad 2+4 \\ & P_4 = 7 \quad 2+4 \\ & a = -5 \\ & d = 4 \\ & P_n = -5 + (4)(n-1) \\ & = -5 + 4n - 4 \\ & = \underline{\underline{4n - 9}} \end{array}$$

$$(c) \frac{P_n}{T_n} = \frac{1}{5}$$

$$\frac{4n-9}{n^2+2n} = \frac{1}{5}$$

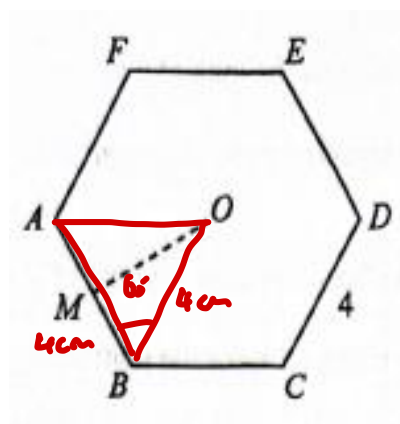
$$5(4n-9) = 1(n^2+2n)$$

$$20n - 45 = n^2 + 2n$$

$$0 = n^2 - 18n + 45$$

$$\begin{array}{l} (n-15)(n-3) = 0 \\ \underline{\underline{n=15}} \text{ or } \underline{\underline{n=3}} \end{array}$$

Question 9 – Polygons, Mensuration [N2012/II/9]



A regular hexagon, $ABCDEF$, has sides of length 4 cm.
 M is the midpoint of AB and O is the centre of the hexagon.

- (a) Show that the area of the hexagon $ABCDEF$ is 41.6 cm^2 , correct to 3 significant figures. [3]

$$\angle AOB = 360^\circ \div 6 \text{ (Ls at a Pt)} \\ = 60^\circ$$

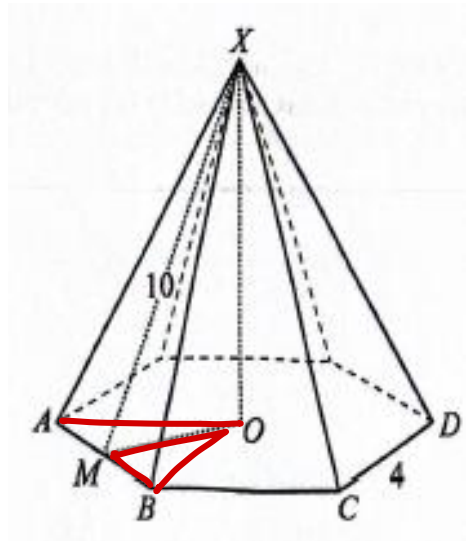
$$\angle ABO = \frac{180^\circ - 60^\circ}{2} \text{ (base L, isos. } \triangle) \\ = 60^\circ$$

$$\begin{aligned} \text{Area of hexagon} &= 6 \times \text{Area of } \triangle ABO \\ &= 6 \left(\frac{1}{2} \right) (4)(4) (\sin 60^\circ) \\ &= 41.569 \\ &= \underline{\underline{41.6 \text{ cm}^2}} \text{ (shown)} \end{aligned}$$

Hexagon $ABCDEF$ forms the base of a pyramid.

The vertex, X , is directly above O .

The slant height, MX , of the pyramid is 10 cm.



(b) Calculate the total surface area of the pyramid. [2]

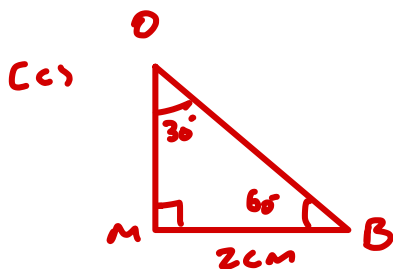
(c) Calculate the height, OX , of the pyramid. [2]

(d) Calculate the volume of the pyramid. [2]

(e) Another similar pyramid is made, with a hexagonal base of side 9 cm.

Find the volume of this pyramid. [2]

$$\begin{aligned}
 \text{(b) Total SA of pyramid} &= 41.6 + 6 \times \text{Area of } \triangle OAB \\
 &= 41.6 + 6 \left(\frac{1}{2} \right) (4) (10) \\
 &= 161.6 \\
 &= \underline{\underline{162 \text{ cm}^2}}
 \end{aligned}$$



$$\begin{aligned}
 \tan 60^\circ &= \frac{OM}{2} \\
 OM &= 2 \tan 60^\circ \\
 &= 3.4641 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Height of pyramid, } XO &= \sqrt{10^2 - (3.4641)^2} \\
 &= 9.3803
 \end{aligned}$$

$$\begin{aligned}
 \text{(d) Volume of pyramid} &= \frac{1}{3} \times \text{Base Area} \times \text{Height} \\
 &= \frac{1}{3} \times 41.6 \times 9.3803 \\
 &= 130.07 \\
 &= \underline{\underline{130 \text{ cm}^3}}
 \end{aligned}$$

Working Space for Question 9

$$\begin{aligned} (e) \quad \frac{V_1}{V_2} &= \left(\frac{L_1}{L_2}\right)^3 \\ \frac{130.07}{V_2} &= \left(\frac{4}{9}\right)^3 \\ V_2 &= \frac{130.07}{\left(\frac{4}{9}\right)^3} \\ &= 1481.57 \\ &= \underline{\underline{1480 \text{ cm}^3}} \quad (3 \text{ sf}) \end{aligned}$$

Question 11 – Finance (Hire Purchase, Compound Interest) [N2010/II/3]

- (a) The cash price of a new computer is \$1299.

Alan buys this computer on hire purchase.

He pays a deposit of one third of the cash price followed by 24 monthly instalments of \$40.30.

- (i) What is total amount that Alan will pay for the computer? [2]

$$\begin{aligned}\text{Hire Purchase Price} &= \text{Deposit} + \text{Total Instalments} \\ &= \left(\frac{1}{3}\right)(1299) + (24)(40.30) \\ &= 433 + 967.2 \\ &= \underline{\underline{\$1400.20}}\end{aligned}$$

- (ii) Find the extra cost of buying the computer on hire purchase as a percentage of the cash price. [2]

$$\begin{aligned}\text{Percentage} &= \frac{1400.20 - 1299}{1299} \times 100\% \\ &= 7.7906 \\ &= \underline{\underline{7.79\% (3sf)}}\end{aligned}$$

- (b) Betty buys an identical computer.

To pay for it, she borrows the whole cost of \$1299 for 3 years at a compound interest of 6% per year.

Calculate how much interest Betty will pay. [3]

$$\begin{aligned}\text{Total Amt} &= P\left(1 + \frac{r}{100}\right)^n \\ &= 1299\left(1 + \frac{6}{100}\right)^3 \\ &= 1547.1297 \\ \text{Interest} &= 1547.1297 - 1299 \\ &= \$248.1297 \\ &= \underline{\underline{\$248.13 (2dp)}}\end{aligned}$$

2025 'O' Level E.Math Paper 2
Finale Set

- (c) Carol bought a digital camera for \$759 from a trader.
When Carol bought the camera, the trader made a profit of 15% of the price he paid for it.

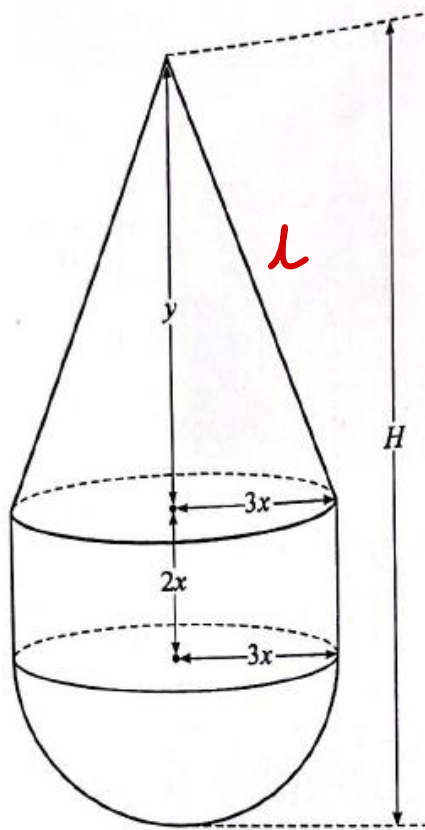
Calculate how much the trader paid for it.

[2]

$$\begin{aligned} 115\% &\Rightarrow \$759 \\ 1\% &\Rightarrow \$ \frac{759}{115} \\ 100\% &\Rightarrow \$ \frac{759}{115} \times 100 \\ &= \underline{\underline{\$660}} \end{aligned}$$

Answer \$ **660** [3]

Question 13 – Mensuration (3D solids) [N2021/II/4]



The diagram shows a solid formed from a cone, a cylinder and a hemisphere.

The cone has base radius $3x$ cm and height y cm.

The cylinder has radius $3x$ cm and height $2x$ cm.

The hemisphere has radius $3x$ cm.

- (a) The volume of the cone is twice the volume of the hemisphere.

Show that $y = 12x$.

[4]

$$(a) \quad \frac{1}{3} \pi (3x)^2 (y) = 2 \left(\frac{2}{3} \right) (\pi) (3x)^3$$

$$3x^2 y = 36x^3$$

$$y = \frac{36x^3}{3x^2}$$

$$y = 12x \text{ (shown)} \quad (\text{since } x \neq 0)$$

- (b) The total surface area of the solid is 300 cm^2 .

Calculate the total height, H , of the solid.

[6]

By Pythagoras Thm,

$$\begin{aligned} L &= \sqrt{(3x)^2 + y^2} \quad \text{part (a)} \\ &= \sqrt{9x^2 + (12x)^2} \\ &= \sqrt{153x^2} \\ &= \sqrt{153} x \\ &= 12.369x \end{aligned}$$

$$\begin{aligned} \text{CSA of cone} &= \pi(3x)(12.369x) \\ &= 116.57x^2 \end{aligned}$$

$$\begin{aligned} \text{CSA of cylinder} &= 2\pi(3x)(2x) \\ &= 37.699x^2 \end{aligned}$$

$$\begin{aligned} \text{CSA of hemisphere} &= 2\pi(3x)^2 \\ &= 56.548x^2 \end{aligned}$$

$$\therefore 116.57x^2 + 37.699x^2 + 56.548x^2 = 300$$

$$210.817x^2 = 300$$

$$x^2 = \frac{300}{210.817}$$

$$x = \pm \sqrt{\frac{300}{210.817}}$$

$$= \pm 1.1929$$

$$= 1.1929 \quad (\text{since } x > 0)$$

$$\therefore \text{Height} = 5x + y$$

$$= 5x + 12x$$

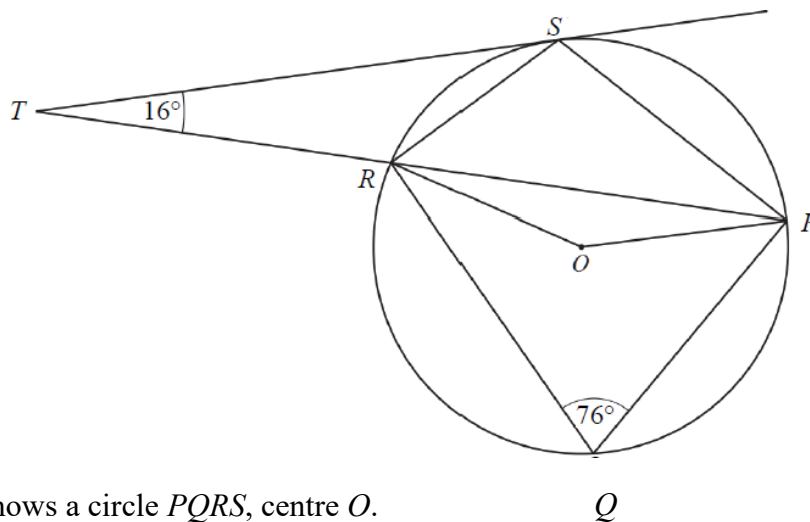
$$= 17x$$

$$= 17(1.1929)$$

$$= 20.2793$$

$$= \underline{\underline{20.3 \text{ cm}}} \quad (3 \text{ sf})$$

Question 14 – Properties of Circles [2024/TKSS/4E/Prelim/II/6]



The diagram shows a circle $PQRS$, centre O .

PRT is a straight line and ST is a tangent to the circle.

Angle $PTS = 16^\circ$ and angle $PQR = 76^\circ$.

(a) Giving reasons for each step of your working, find

(i) angle PSR ,

$$\begin{aligned} \angle PSR &= 180^\circ - 76^\circ \text{ (} \angle \text{s in opp. segments)} \\ &= \underline{\underline{104^\circ}} \end{aligned}$$

Answer Angle $PSR = \underline{\underline{104^\circ}}$ [1]

(ii) angle PRO ,

$$\begin{aligned} \angle POR &= 76^\circ \times 2 \text{ (} \angle \text{ at centre} = 2 \times \angle \text{ at circumference)} \\ &= 152^\circ \end{aligned}$$

$$\begin{aligned} \angle PRO &= \frac{180^\circ - 152^\circ}{2} \text{ (base } \angle \text{, iso. } \Delta) \\ &= \underline{\underline{14^\circ}} \end{aligned}$$

Answer Angle $PRO = \underline{\underline{14^\circ}}$ [2]

