‘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 $\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta ABD}$.]
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

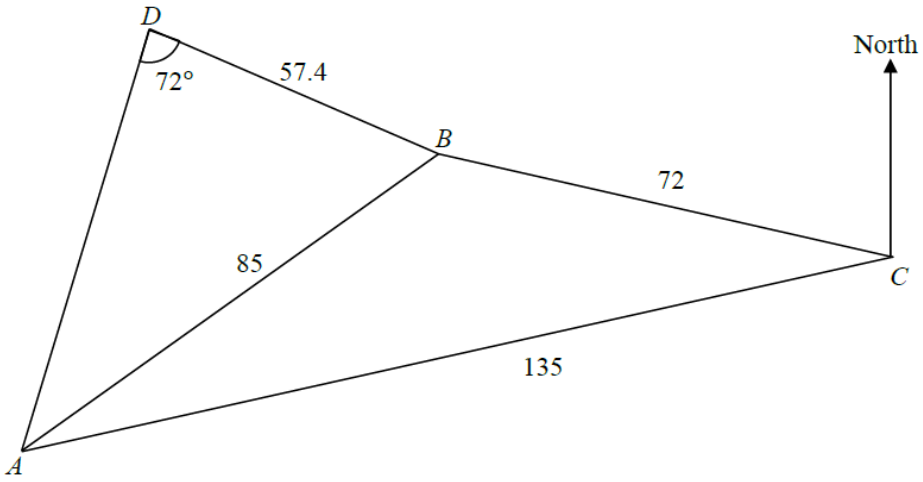
Section 2: Lighter-weightage questions

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 $ADB = 72°$.

(a) Find the bearing of *A* from *B*.

Answer ……° [4]

[Turn Over

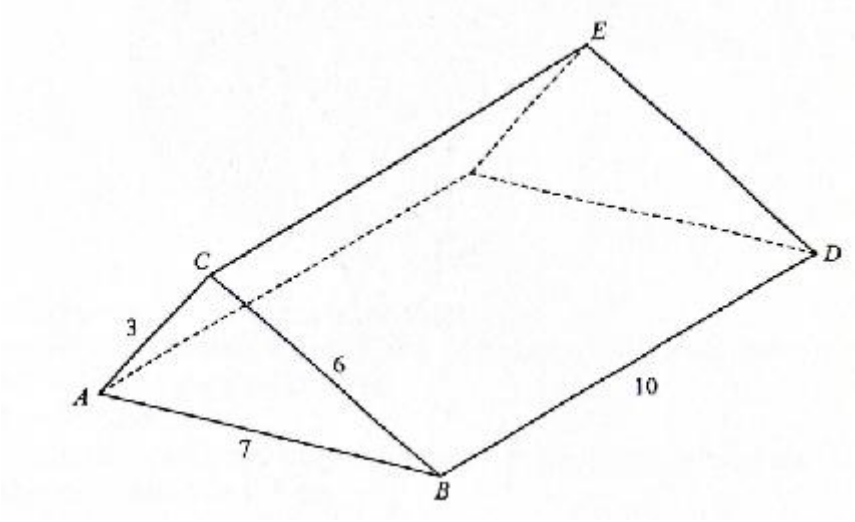
(b) The plot of land *ADB* is to be filled with top soil. Calculate the area to be filled with top soil. [4]

Answer ..... 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]

Answer .....° [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 $BAC = 58.4°$, correct to 1 decimal place.

Answer

[3]

(b) Calculate the surface area of the prism.

Answer ……cm^2 [3]

(c) Calculate the vertical distance of C above AB.

Answer ……cm [2]

(d) Calculate the angle of elevation E from A.

Answer ……° [4]

Question 3 – Matrices [2023/TKGS/4E/Prelim/II/4]

The table below shows the number of parcels, cards and letters sent by Peter and Jane.

	Parcel	Cards	Letters
Peter	5	4	5
Jane	3	8	6

(a) Represent the information in the table in a 2×3 matrix **N**.

Answer $\mathbf{N} =$ ..... [1]

Postage is charged at \$7 for a parcel, \$0.50 for a card and \$0.40 for a letter.

(b) Represent the postage charges in a column matrix **C**.

Answer $\mathbf{N} =$ ..... [1]

(c) Evaluate the matrix $\mathbf{P} = \mathbf{NC}$.

Answer $\mathbf{P} =$ ..... [2]

(d) Explain what the elements in **P** represent.

Answer .....

..... [1]

[Turn Over

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.

Answer $\mathbf{R} =$ ..... [1]

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

Answer .....

..... [1]

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

Answer Peter: $.....

Jane: $ ..... [2]

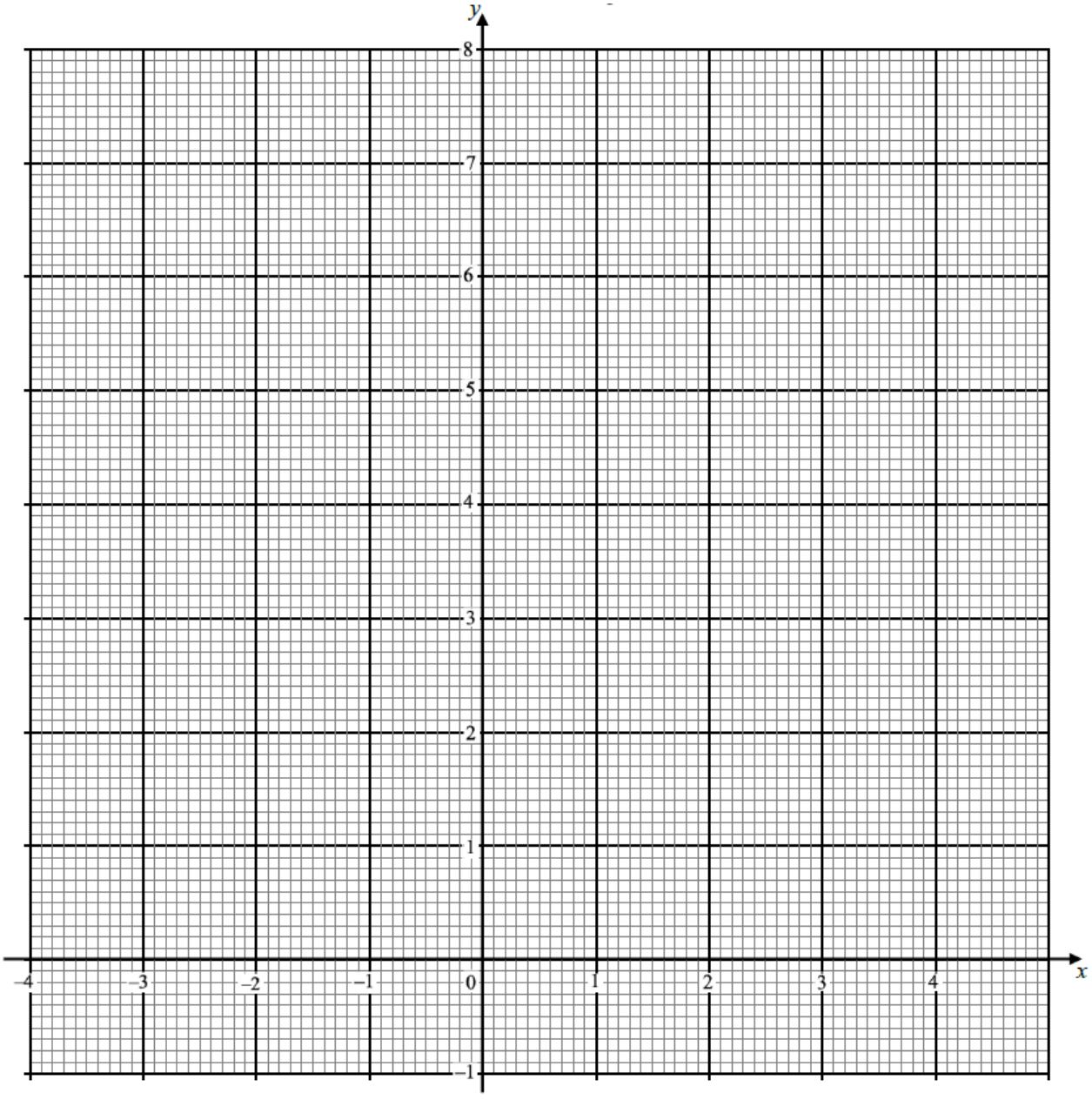
Question 4 – Graphical Solutions [2023/FFMS/4E/Prelim/II/4]

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		6.7	5.5	1.3

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



[Turn Over

(b) The equation $-\frac{x^3}{6}+2x+4=k$ has three solutions.

Use your graph to find the range of values for k.

Answer ..... [1]

(c) The equation $x^3-15x+3=0$ can be solved by finding the points of intersection of the straight line $y=ax+b$ and the curve $y=-\frac{x^3}{6}+2x+4$.

(i) Find the values of a and the value of b.

Answer $a=$.....

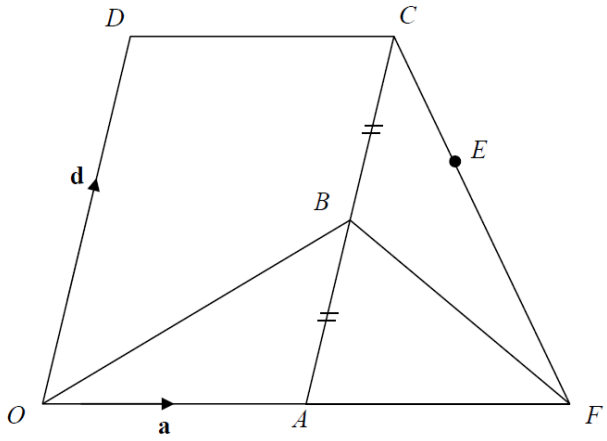
$b=$..... [2]

(ii) By drawing the line $y=ax+b$, solve the equation $x^3-15x+3=0$.

Answer $x=$..... or ..... or ..... [3]

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 **a** and **d**,

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

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

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

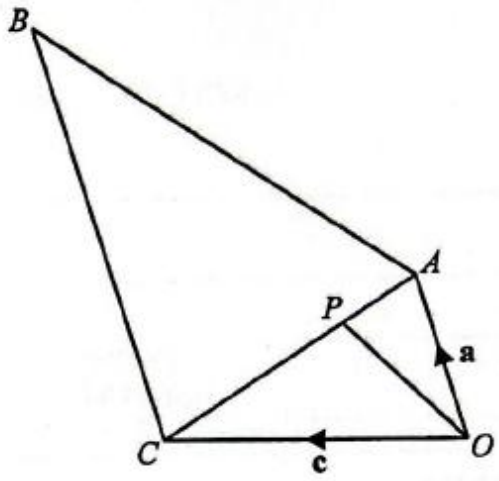
(b) Show that points O, B and E lie on a straight line. [2]

(c) P is a point on OA and T is a point on AC such that $\overrightarrow{OB} = 2\overrightarrow{PT}$.

Show that triangles APT and AOB are similar.
Give a reason for each statement you make. [3]

(d) Find the ratio area of triangle OAB : area of parallelogram $OACD$. [1]

Question 6 – Vectors [N2020/I/24]



$OABC$ is a quadrilateral
$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{CP} = m(\mathbf{a} - \mathbf{c})$.

(a) Write $\overrightarrow{OP}$ in terms of **a**, **c** and m. [1]

(b) $\overrightarrow{OB} = 4(1-m)\mathbf{c} + 4m\mathbf{a}$.

(i) Show that O, P and B lie on a straight line. [2]

(ii) $\overrightarrow{CB} = k\mathbf{a}$.
Find the value of m and the value of k. [3]

(iii) Write down the ratio $CP : CA$. [1]

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

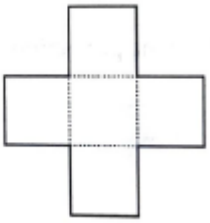
The diagram shows part of a number grid.

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]

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]

(b) The nth term of a sequence is given by $T_n = \dfrac{n^2 - 1}{3n - 1}$.

The term $T_k = \dfrac{15}{4}$.

Find the value of T_{k+1}. [4]

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

The first three terms in a sequence of numbers $T_1,\ T_2,\ T_3,...$ 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]

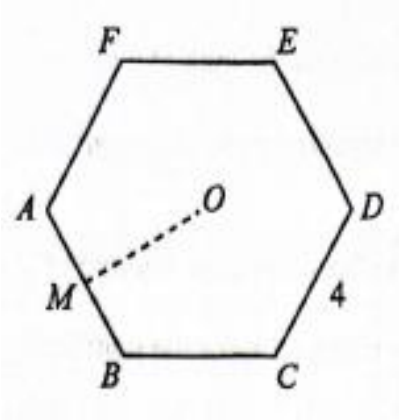
(iii) Evaluate T_{50}. [1]

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

Find an expression, in terms of n, for the nth 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]

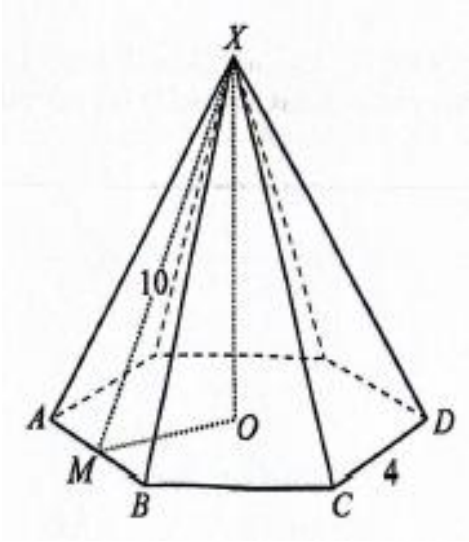
Question 9 – Polygons, Mensuration [N2012/II/9]



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]

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]

Working Space for Question 9

Question 10 – Direct and Inverse Proportion

(i) [2023/AISS/4E/Prelim/I/7]

P is directly proportional to the cube of Q.
P is increased by 700%.
Calculate the percentage change in Q.

Answer ……% [2]

(ii) [2023/NAS/4E/Prelim/I/13]

Given that p is inversely proportional to the square root of q, calculate the percentage change in p when q is increased by 400%.

Answer ……% [2]

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]

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

(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]

(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]

Answer $ ..... [3]

Question 12 – Coordinate Geometry [N2021/II/5]

The coordinates of point A are $(5,5)$.

Line p passes through point A and has gradient $-\frac{2}{9}$.

(a) Show that the equation of line p is $9y+2x=55$. [2]

(b) The equation of line q is $3y=4x-26$.

Find the coordinates of the point of intersection of line p and line q. [3]

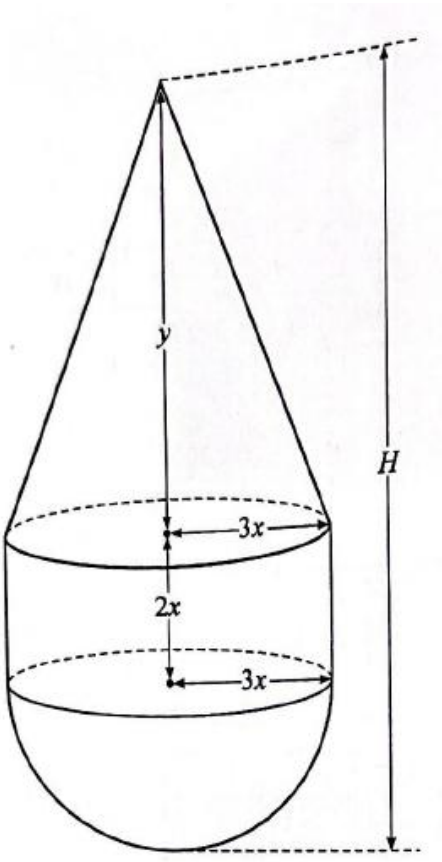
(c) Line p intersects the y-axis at point B and line q intersects the y-axis at point C.

Line q intersects the line $x=5$ at point D.

(i) Explain why $ABCD$ is a trapezium and state the distance between the parallel sides. [2]

(ii) Calculate the area of trapezium $ABCD$. [4]

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.

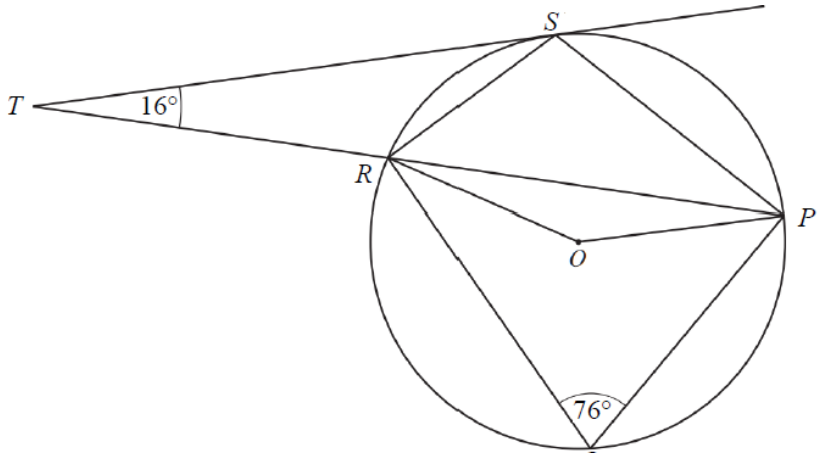
(a) The volume of the cone is twice the volume of the hemisphere.

Show that $y = 12x$. [4]

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

Calculate the total height, H, of the solid. [6]

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 $PTS = 16°$ and angle $PQR = 76°$.

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

(i) angle PSR,

Answer Angle PSR = ... [1]

(ii) angle PRO,

Answer Angle PRO = ... [2]

(b) Show that triangle *RST* is similar to triangle *SPT*.

Give a reason for each statement you made.

Answer

……

……

……

……[2]

(c) Find angle *SPT*.

Answer Angle *SPT* = …… [2]

(d) Given that $3ST = 2PT$ and area of triangle *STR* is 28 cm^2, find the area of triangle *RSP*.

Answer …… cm^2 [3]