



Unit 2 Revision Sheet F 3D Shapes Similarity Higher

Note: Higher tier students must also revise using the foundation tier revision worksheets as this content can also be assessed on higher tier papers.

Questions

Q1.

The diagram shows a triangular prism $ABCDEF$ with a horizontal base $ABEF$.

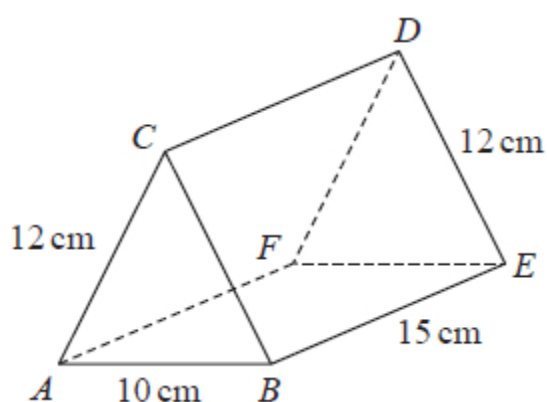


Diagram NOT
accurately drawn

$$AC = BC = FD = ED = 12 \text{ cm} \quad AB = 10 \text{ cm} \quad BE = 15 \text{ cm}$$

Calculate the size of the angle between AD and the base $ABEF$.
Give your answer correct to 3 significant figures.

(Total for question = 4 marks)

Q2.

Here is a sector, AOB , of a circle with centre O and angle $AOB = x^\circ$

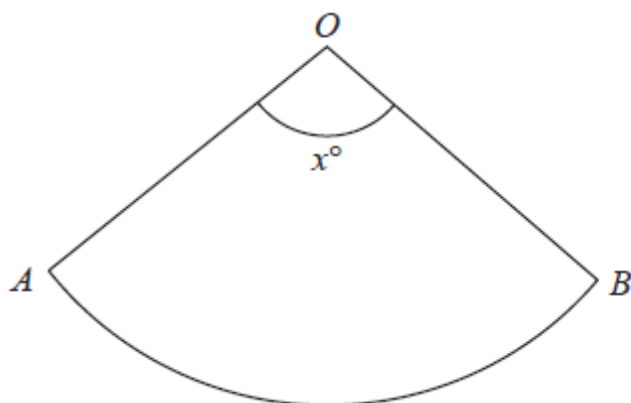


Diagram NOT
accurately drawn

The sector can form the curved surface of a cone by joining OA to OB .

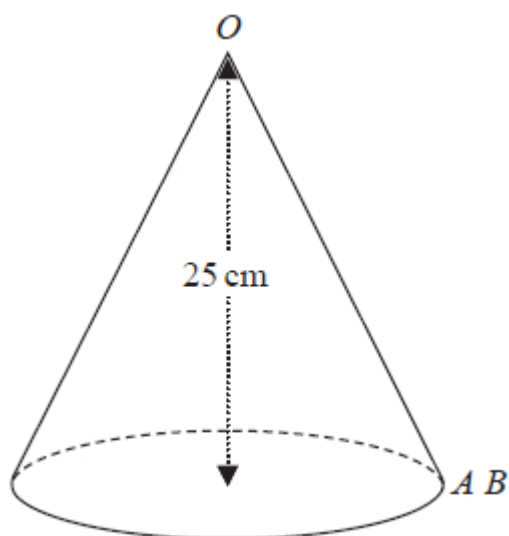


Diagram NOT
accurately drawn

The height of the cone is 25 cm.
The volume of the cone is 1600 cm^3

Work out the value of x .
Give your answer correct to the nearest whole number.

(Total for question = 6 marks)

Q3.
A cylinder has diameter 14 cm and height 20 cm.

Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

(Total for question = 2 marks)

Q4.

A solid aluminium cylinder has radius 10 cm and height h cm.

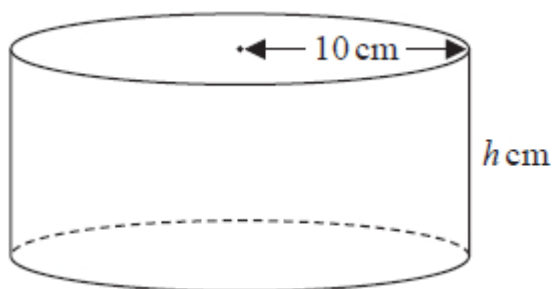


Diagram NOT
accurately drawn

The mass of the cylinder is 5.4 kg.
The density of aluminium is 0.0027 kg/cm^3

Calculate the value of h .
Give your answer correct to one decimal place.

(Total for question = 5 marks)



Q5.

The total surface area of a solid hemisphere is equal to the curved surface area of a cylinder.

The radius of the hemisphere is r cm.

The radius of the cylinder is twice the radius of the hemisphere.

Given that

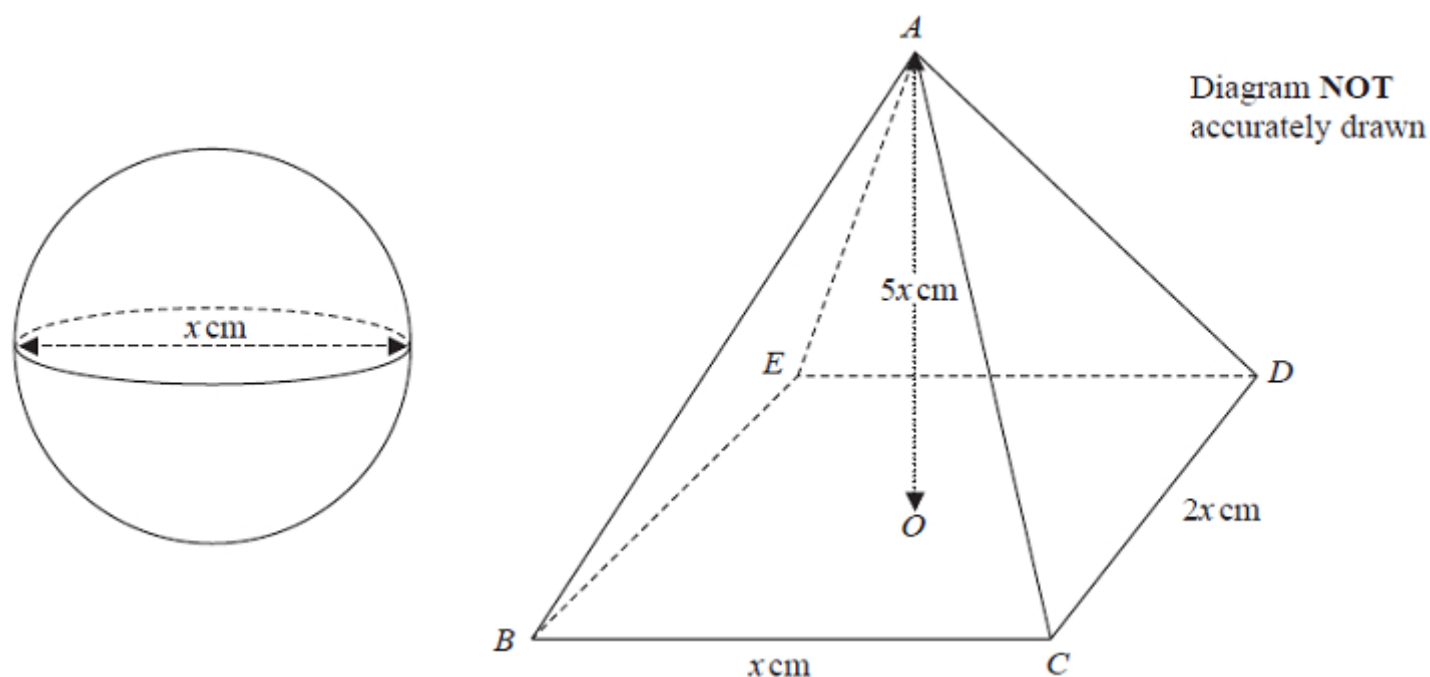
$$\text{volume of hemisphere} : \text{volume of cylinder} = 1 : m$$

find the value of m .

(Total for question = 4 marks)

Q6.

The diagram shows a sphere of diameter x cm and a pyramid $ABCDE$ with a horizontal rectangular base $BCDE$.



The vertex A of the pyramid is vertically above the centre O of the base so that $AB = AC = AD = AE$.

$BC = x$ cm, $CD = 2x$ cm and $AO = 5x$ cm.

The volume of the sphere is 288π cm³

Calculate the total surface area of the pyramid.

Give your answer correct to the nearest cm²

(Total for question = 6 marks)



Q7.

$ABCDE$ and $AFGHJ$ are regular pentagons.

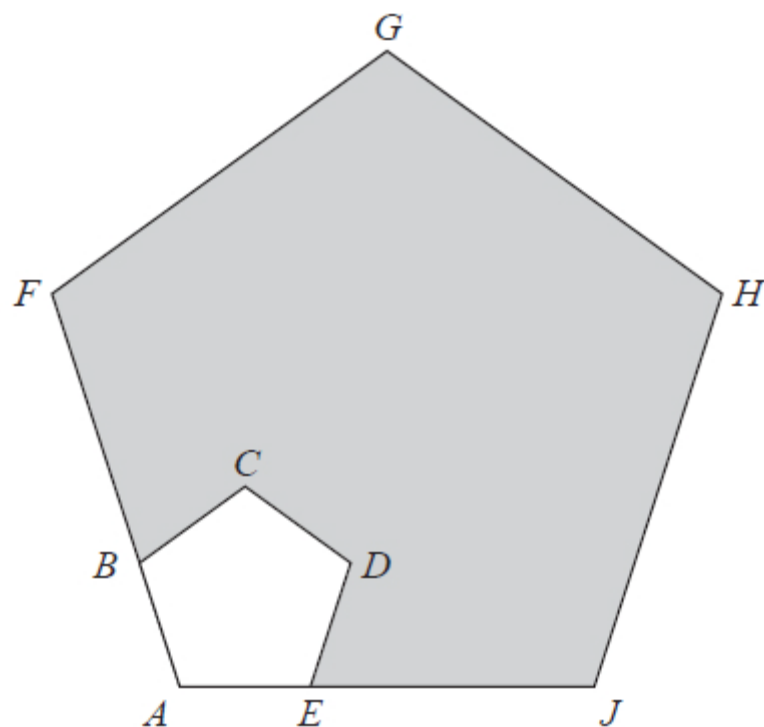


Diagram **NOT**
accurately drawn

AEJ and ABF are straight lines.

$$EJ = 4AE$$

The area of $ABCDE$ is 8 cm^2

Calculate the area of the shaded region.

(Total for question = 3 marks)

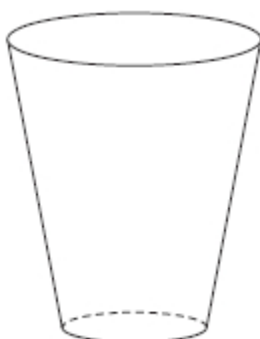


Q8.

The diagram shows two mathematically similar vases, **A** and **B**.



A



B

Diagram **NOT**
accurately drawn

A has a volume of 405 cm^3

B has a volume of 960 cm^3

B has a surface area of 928 cm^2

Work out the surface area of **A**.

(Total for question = 3 marks)

Q9.

R and **S** are two similar solid shapes.

Shape **R** has surface area 108 cm^2 and volume 135 cm^3

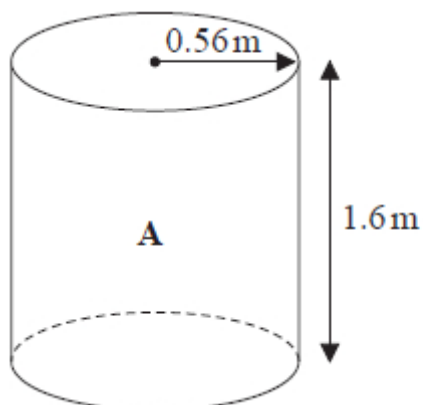
Shape **S** has surface area 300 cm^2

Work out the volume of shape **S**.

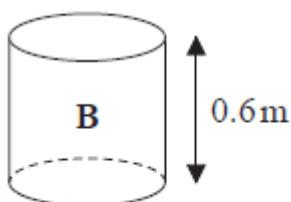
(Total for question = 3 marks)

Q10.

The diagram shows two cylinders, **A** and **B**.



A



B

Diagram **NOT**
accurately drawn

Cylinder **A** has height 1.6 m and radius 0.56 m.



(a) Work out the curved surface area of cylinder **A**.

Give your answer in m^2 correct to 3 significant figures.

(2)

Cylinder **B** is mathematically similar to cylinder **A**.

The height of cylinder **B** is 0.6 m.

(b) Work out the radius of cylinder **B**.

(2)

(Total for question = 4 marks)



Mark Scheme

Q1.

Q	Working	Answer	Mark	Notes
	$[AM =]\sqrt{5^2 + 15^2} (= \sqrt{250} = 15.8...)$ where M is midpoint of EF , oe other correct method to find AM $[AD =]\sqrt{12^2 + 15^2} (= \sqrt{369} = 19.2...)$ $[DM =]\sqrt{12^2 - 5^2} (= \sqrt{119} = 10.9...)$		4	M2 for a complete method to find two of AM, AD, DM (where M is the midpoint of EF) Other longer ways to find AM, AD, DM may be used but must be a complete method eg $\angle DEM = \cos^{-1}\left(\frac{5}{12}\right) (= 65.37...)$ and $DM = 12 \sin 65.37...$ $\angle DEM = \cos^{-1}\left(\frac{5}{12}\right) (= 65.37...)$ and $DM = 5 \tan 65.37...$ Use $10 \div 2$ as 5 throughout (M1 For a complete method to find one of AM, AD, DM (where M is the midpoint of EF))
	eg $\tan DAM = \frac{\sqrt{119}}{\sqrt{250}} \left(= \frac{10.9...}{15.8...} \right)$ oe or $\sin DAM = \frac{\sqrt{119}}{\sqrt{369}} \left(= \frac{10.9...}{19.2...} \right)$ oe or $\cos DAM = \frac{\sqrt{250}}{\sqrt{369}} \left(= \frac{15.8...}{19.2...} \right)$ oe			M1 a correct method to find the required angle –other longer methods may be used but they must get to the stage of an equation for the required angle eg $\sin DAM = \frac{10.9...}{\sqrt{15.8...^2 + 10.9...^2}}$ NB: “10.9...” and “15.8...” must come from correct working
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	34.6		A1 any answer which rounds to 34.6
				Total 4 marks



Q2.

Question	Working	Answer	Mark	Notes
	$1600 = \frac{1}{3} \times \pi \times r^2 \times 25$ oe		6	M1 for substituting into volume formula for cone correctly and equating to 1600
	eg $r = \sqrt{\frac{1600}{\frac{1}{3}\pi \times 25}}$ or $r = \sqrt{\frac{192}{\pi}} (= \sqrt{61.1(154..)} = 7.8176...)$			M1 dep for correct rearrangement of volume formula for r
	$l = \sqrt{7.817...^2 + 25^2} (= \sqrt{686.1154...} = 26.193...)$			M1 Dep on M2 correct method to find slant height of cone (radius of sector)
	$2 \times \pi \times "7.817..." (= 49.1196...)$ or $\pi \times "7.817..." \times "26.193..." (= 643.315...)$			M1 for using $C = 2\pi r$ oe using figures from correct method or for using $A = \pi r l$ using figures from correct method
	"49.1196..." = $2 \times \pi \times "26.193..." \times \frac{x}{360}$ or "643.315..." = $\pi \times "26.193..."^2 \times \frac{x}{360}$			M1 for using arc length = $2\pi r \times \frac{x}{360}$ or for using area of sector = $\pi r^2 \times \frac{x}{360}$
		107°		A1 for 107° - 108°
				<i>Total 6 marks</i>

Q3.

Question	Working	Answer	Mark	Notes
	$\pi \times 7^2 \times 20 (= 3078.76...)$ or 980π			M1 for complete method to find volume
		3080	2	A1 for answer in range 3077.2 – 3080
				Total 2 marks



Q4.

Q	Working	Answer	Mark	Notes
	$0.0027 = \frac{5.4}{(V)} \text{ oe}$		5	M1 for correctly using density = $\frac{\text{mass}}{\text{volume}}$
	$(V =) \frac{5.4}{0.0027} = 2000$			M1 for correctly rearranging for V
	$\pi \times 10^2 \times h = 2000 \text{ oe}$			M1 ft their 2000 for $\pi \times 10^2 \times h = \text{their } V$
	$(h =) \frac{2000}{\pi \times 10^2} \text{ oe } (= 6.3661...)$			M1 ft their 2000 dep on previous M1 for correctly rearranging for h
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	6.4		A1 awrt 6.4
				Total 5 marks

Q5.

Question	Working	Answer	Mark	Notes
	<p>Eg $\frac{4\pi r^2}{2} (+\pi r^2) = 2\pi(2r)h \text{ oe}$</p> <p>$h = \frac{3}{4}r \text{ or } r = \frac{4}{3}h$</p> <p>Eg $\frac{1}{2} \times \frac{4}{3} \times \pi \times r^3 \text{ and}$</p> <p>$\pi \times (2r)^2 \times \frac{3}{4}r$</p> <p>OR</p> <p>$\frac{1}{2} \times \frac{4}{3} \times \pi \times \left(\frac{4}{3}h\right)^3 \text{ and}$</p> <p>$\pi \times (2 \times \frac{4}{3}h)^2 \times h$</p>	4.5 oe	4	<p>M1 for use of, for example, r and $2r$ in an equation condone omission of flat surface area</p> <p>A1 for a correct expression for either r or h</p> <p>M1 dep on award of first M1 ft for candidate's expression for r or h for correct expressions for volume of hemisphere and volume of cylinder ; both in terms of either r or h</p> <p>A1</p>



Q6.

Q	Working	Answer	Mark	Notes
	eg $\frac{4}{3}\pi r^3 = 288\pi \text{ oe } \frac{4}{3}\pi \left(\frac{x}{2}\right)^3 = 288\pi \text{ oe}$		6	M1 for using the formula for the volume of a sphere correctly and equating it to 288π
	$x = 12$			A1
	$\sqrt{(5 \times 12)^2 + (0.5 \times 12)^2} (= 6\sqrt{101} = 60.299\dots) \text{ oe}$ or $(OC =) 0.5\sqrt{24^2 + 12^2} (= 6\sqrt{5}) \text{ and } AC = \sqrt{(6\sqrt{5})^2 + 60^2} (= 6\sqrt{105})$ and $\sqrt{(6\sqrt{105})^2 - 12^2} (= 6\sqrt{101}) \text{ oe}$			M1 (dep on first M1 and using their value for x) for using Pythagoras to find the perp height of faces CAD or BAE or a correct method to find angle CAD or BAE
	$\sqrt{(5 \times 12)^2 + (1 \times 12)^2} (= 12\sqrt{26} = 61.188\dots) \text{ oe}$ or $(OC =) 0.5\sqrt{24^2 + 12^2} (= 6\sqrt{5}) \text{ and } AC = \sqrt{(6\sqrt{5})^2 + 60^2} (= 6\sqrt{105})$ and $\sqrt{(6\sqrt{105})^2 - 6^2} (= 12\sqrt{26}) \text{ oe}$			M1 (dep on first M1 and using their value for x) for using Pythagoras to find the perp height of faces ABC or AED or a correct method to find angle BAC or DAE



	$(12 \times 2(12)) + 2(0.5 \times 12 \times 12\sqrt{26}) + 2(0.5 \times 2 \times 12 \times 6\sqrt{101})$ oe eg $'288' + 2 \times '72\sqrt{26}' + 2 \times '72\sqrt{101}'$ or $'288' + 2 \times '367.129' \dots + 2 \times '723.59' \dots$ oe		M1 (dep on first M1 using their value for x and correct working for heights of each triangle)for working out the total surface area of the pyramid
	Correct answer scores full marks (unless from obvious incorrect working)	2469	A1 2469 - 2470
			Total 6 marks

Q7.

Q	Working	Answer	Mark	Notes
	$(1 + 4)^2 (= 25)$			M1
	$5^2 \times 8 - 8$ oe			M1 complete method
		192	3	A1
				Total 3 marks

Q8.

Question	Working	Answer	Mark	Notes
	e.g. $\sqrt[3]{\frac{960}{405}} \left(= \frac{4}{3} \right) (=1.3\dots)$ or $\sqrt[3]{\frac{405}{960}} \left(= \frac{3}{4} \right) (=0.75)$ $\left(\frac{3}{4} \right)^2 \times 928$ or $928 \div \left(\frac{4}{3} \right)^2$ oe	522	3	M1 for a correct linear scale factor M1 for a complete method A1



Q9.

Q	Working	Answer	Mark	Notes
	$\sqrt{\frac{300}{108}}$ or $\sqrt{\frac{108}{300}}$ or $\sqrt{\frac{25}{9}}$ oe or $\sqrt{\frac{9}{25}}$ oe or $\left(\frac{300}{108}\right)^3 = \left(\frac{V}{135}\right)^2$ oe			M1 for a correct linear scale factor (fraction or ratio) or for the use of $\left(\frac{A_1}{A_2}\right)^3 = \left(\frac{V_1}{V_2}\right)^2$
	$135 \times \left(\sqrt{\frac{300}{108}}\right)^3$ oe or $\sqrt{\frac{300^3}{108^3}} \times 135^2$ or $\sqrt{390625}$			M1
		625	3	A1
				Total 3 marks

Q10.

Question	Working	Answer	Mark	Notes
(a)	$2 \times \pi \times 0.56 \times 1.6$		2	M1 Award even if part of a calculation including 1 or 2 circles
		5.63		A1 awrt 5.63
(b)	$\frac{0.6}{1.6} (=0.375)$ or $\frac{1.6}{0.6} (= \frac{8}{3} = 2.\dot{6})$ or $\frac{r}{0.56} = \frac{0.6}{1.6}$ or $(r =) \frac{0.56 \times 0.6}{1.6}$ or $0.56 \div 2.\dot{6}$ oe		2	M1 Correct scale factor (given as a fraction or ratio) or correct equation in r or a correct expression for r . Allow 2.6666... to 1 dp rounded or truncated
		0.21		A1 Allow 21 cm oe if units shown
				Total 4 marks