

Foundation / Higher



Maths GCSE Problem Solving Questions Workbook

3D Trigonometry

GRADES 6 – 9



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3D trigonometry and cones

EXAMPLE

A cone has radius 5 cm and slope length of 13 cm
Calculate the angle of the slope
Give your answer to 1 decimal place

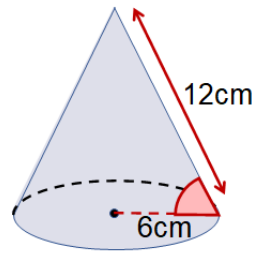
$$\cos\theta = \frac{5}{13}$$

$$\theta = \cos^{-1}\left(\frac{5}{13}\right) = 67.4^\circ$$



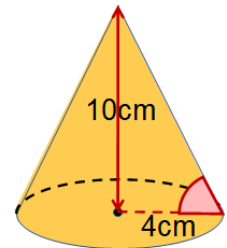
- 1 A cone has radius 6 cm and slope length of 12 cm
Calculate the angle of the slope
Give your answer to 1 decimal place






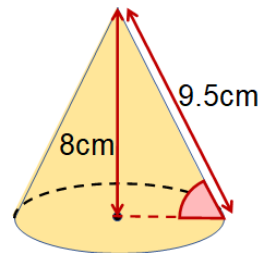
- 2 A cone has radius 4 cm and perpendicular height of 10 cm
Calculate the angle of the slope
Give your answer to 1 decimal place





- 3 A cone has perpendicular height of 8 cm and slope length of 9.5 cm
Calculate the angle of the slope
Give your answer to 1 decimal place





- 4 Fine sand is poured out of a bucket to form a cone shaped pile. The angle of repose (slope) of the pile is 35° .
A diameter of the sand at the base is 50cm.
a) How high is the pile of sand?

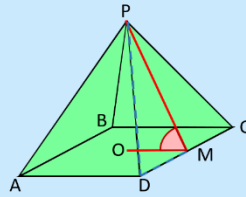




3D Trigonometry and pyramids

EXAMPLE

ABCDP is a pyramid with a square base ABCD
If PD is 10cm and AD is 6cm, calculate the slope angle between the faces ABDC and PDC



$$PM^2 = (10)^2 - (3)^2$$

$$PM^2 = 91$$

$$PM = \sqrt{91} = 9.54 \text{ cm}$$

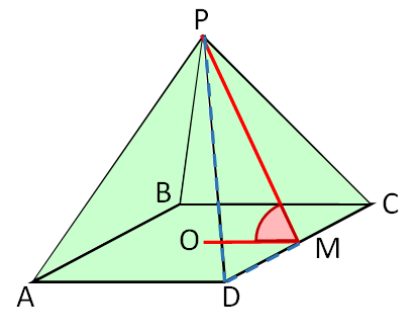
$$OM = \frac{1}{2}AD = 3\text{cm}$$

$$\cos\theta = \frac{3}{9.54}$$

$$\cos^{-1}\left(\frac{3}{9.54}\right) = \theta = 71.67^\circ$$

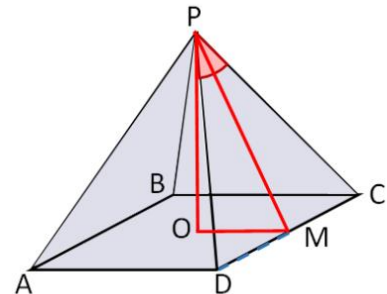
- 1 ABCDP is a pyramid with a square base ABCD
If PD is 7cm and AD is 4cm, calculate the slope angle between the faces ABDC and PDC

✎



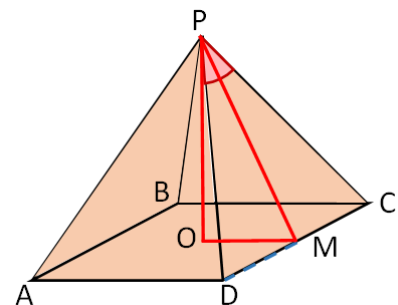
- 2 ABCDP is a pyramid with a square base ABCD
O is the directly below the apex of the pyramid
If OP is 8cm and AD is 6cm, calculate the angle DPC?

✎



- 3 ABCDP is a pyramid with a square base ABCD
O is the directly below the apex of the pyramid
If OP is 11cm and AD is 7cm, calculate the angle DPC?

✎



Page 1 – 3D trigonometry and cones

1. $60^\circ : \cos\theta = \frac{6}{12} \rightarrow \theta = \cos^{-1}\left(\frac{6}{12}\right) = 60.0$

2. $68.2^\circ : \tan\theta = \frac{10}{4} \rightarrow \theta = \tan^{-1}\left(\frac{10}{4}\right) = 68.2$

3. $57.4^\circ : \sin\theta = \frac{8}{9.5} \rightarrow \theta = \sin^{-1}\left(\frac{8}{9.5}\right) = 57.36^\circ$

4. $17.5\text{cm} : \tan(35) = \frac{h}{25} \rightarrow \tan(35) \times 25 = 17.5$

Page 2 – 3D Pythagoras and pyramids

1. a) $5.66\text{cm} : BD^2 = AB^2 + AD^2$

$$BD^2 = (4)^2 + (4)^2 = 32 \rightarrow BD = \sqrt{32}$$

b) $6.71\text{cm} : PD^2 = PM^2 + DM^2$

$$7^2 = PM^2 + (2)^2 \rightarrow 7^2 - 2^2 = PM^2$$

$$45 = PM^2 \rightarrow PM = \sqrt{45}$$

2. a) $3.54\text{ cm} : BD^2 = AB^2 + AD^2 \text{ (} AD = AB \text{)}$

$$BD^2 = 2(AB)^2 \rightarrow 5^2 = 2(AB)^2$$

$$\frac{25}{2} = AB^2 \rightarrow AB = \sqrt{12.5}$$

b) $8.19\text{cm} : PD^2 = PM^2 + DM^2$

$$PD^2 = (8)^2 + (AB \div 2)^2 = 64 + 3.125$$

$$PD = \sqrt{67.125}$$

3. a) $5.66\text{cm} : BD^2 = AB^2 + AD^2$

$$BD^2 = (8)^2 + (8)^2 = 128 \rightarrow BD = \sqrt{128} = 11.31$$

$$MD = \frac{1}{2}BD = 11.31 \div 2 = 5.66$$

b) $10.58\text{cm} : PD^2 = PM^2 + MD^2$

$$12^2 = PM^2 + (5.66 \dots)^2 \rightarrow 144 - 32 = PM^2$$

$$112 = PM^2 \rightarrow PM = \sqrt{112} = 10.58\text{cm}$$