Pythagoras Trigonometry 3d

GCSE Maths · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

A cuboid measures 3 cm by 4 cm by 12 cm. Find the length of its space diagonal.

Step 1 · Base diagonal

$\sqrt{(3^2 + 4^2)} = 5$ cm

Step 2 · Triangle with the height

$\sqrt{(5^2 + 12^2)}$

Step 3 · Evaluate

$\sqrt{169} = 13$ cm

Answer: 13 cm

Check: $\sqrt{(9 + 16 + 144)} = \sqrt{169}$ ✓

2. Now try one with the steps

Find the angle between the space diagonal of the same cuboid and its base.

Step 1 · Right-angled triangle: base diagonal 5, height 12

Step 2 · Inverse tan

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Find the diagonal of a rectangle measuring 6 cm by 8 cm. [1]

2. Find the space diagonal of a cube of side 5 cm, to 1 decimal place. [2]

3. Find the space diagonal of a cuboid measuring 2 cm by 3 cm by 6 cm. [2]

4. Find the space diagonal of a cuboid measuring 4 cm by 4 cm by 7 cm. [2]

5. Will a 1.3 m rod fit inside a box measuring 0.6 m by 0.8 m by 1.0 m? Show your working. [3]

6. A cuboid is 8 cm by 6 cm by 5 cm (height). Find the angle between the space diagonal and the base, to 1 decimal place. [3]

7. A cuboid is 4 cm by 3 cm by 10 cm (height). Find the angle between the space diagonal and the base, to 1 decimal place. [3]

8. A square-based pyramid has base 10 cm and vertical height 12 cm. Find the length of a slant edge, to 1 decimal place. [3]

9. For the pyramid in question 8, find the angle between a slant edge and the base, to 1 decimal place. [3]

10. For the pyramid in question 8, find the slant height of a triangular face (from the apex to the middle of a base edge). [2]

11. A cone has vertical height 12 cm and base radius 5 cm. Find its slant height. [1]

12. What is the longest straight pencil that fits in a box 30 cm by 40 cm by 120 cm? [2]

13. Find the angle between the space diagonal of a cube and its base, to 1 decimal place. [3]

14. A room is 5 m by 4 m by 3 m high. A laser beam runs straight from one floor corner to the opposite ceiling corner. How long is the beam, to 2 decimal places? [2]

15. A 9 m vertical flagpole stands at one corner of a rectangular field 30 m by 40 m. Find the angle of elevation of the top of the pole from the opposite corner, to 1 decimal place. [3]

4. Before you hand it in

Space diagonal of 3 × 4 × 12 = $\sqrt{(3^2 + 12^2)}$
The space diagonal's triangle has the BASE DIAGONAL (5) and the height (12) shorter sides: $\sqrt{(25 + 144)} = 13$.

Angle with the base: tan θ = 12/4
The angle between a line and a plane is measured to its projection on the plane — here the base diagonal, 5.

Pyramid height from half the base edge (3) and the slant EDGE (8)
The slant EDGE goes to a corner, so pair it with centre-to-corner (half the diagonal, $3\sqrt{2}$). Centre-to-edge-midpoint pairs with the face's slant height.

Rounding the base diagonal to 7.1 before the next step
Keep exact values ($5\sqrt{2}$) or the full calculator value until the end; early rounding can change the final answer.