# Guide to:
# 3D pythagoras / trig.

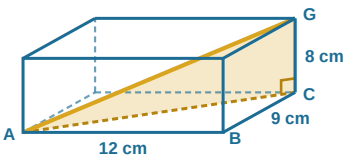
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**Explanation:**

To solve 3D Pythagoras and trigonometry problems, identify and sketch the key **2D right-angled triangle** inside the 3D shape. For a cuboid with dimensions l, w, and h, the floor diagonal is $\sqrt{(l^2 + w^2)}$ and the 3D space diagonal can be found in one step using $\mathbf{d = \sqrt{(l^2 + w^2 + h^2)}}$.

The angle between a line (such as a space diagonal or slant edge) and a horizontal plane (the base) is always the angle between the line and its **projection (shadow) on the base** directly underneath it.

**Example 1:** A cuboid ABCD.EFGH measures 12 cm by 9 cm by 8 cm (vertical height). Find space diagonal AG and its angle with the base ABCD (1 d.p.).




**Solution:**

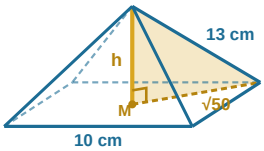
Base diagonal AC = $\sqrt{(12^2 + 9^2)} = \sqrt{225} =$ **15 cm**

Space diagonal AG = $\sqrt{(15^2 + 8^2)} = \sqrt{289} =$ **17 cm**

In ΔACG: $\tan(\angle GAC) = \frac{8}{15} \Rightarrow \angle GAC = 28.072...°$

**Answer: AG = 17 cm, angle = 28.1°**

**Example 2:** A square-based pyramid has base side 10 cm and slant edges 13 cm. Find its vertical height h (3 s.f.).




**Solution:**

Base diagonal = $\sqrt{(10^2 + 10^2)} = \sqrt{200}$ cm

Half diagonal (corner to M) = $\frac{\sqrt{200}}{2} =$ **$\sqrt{50}$ cm**

$h = \sqrt{(13^2 - (\sqrt{50})^2)} = \sqrt{(169 - 50)} = \sqrt{119}$

**Answer: h = 10.9 cm (3 s.f.)**

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