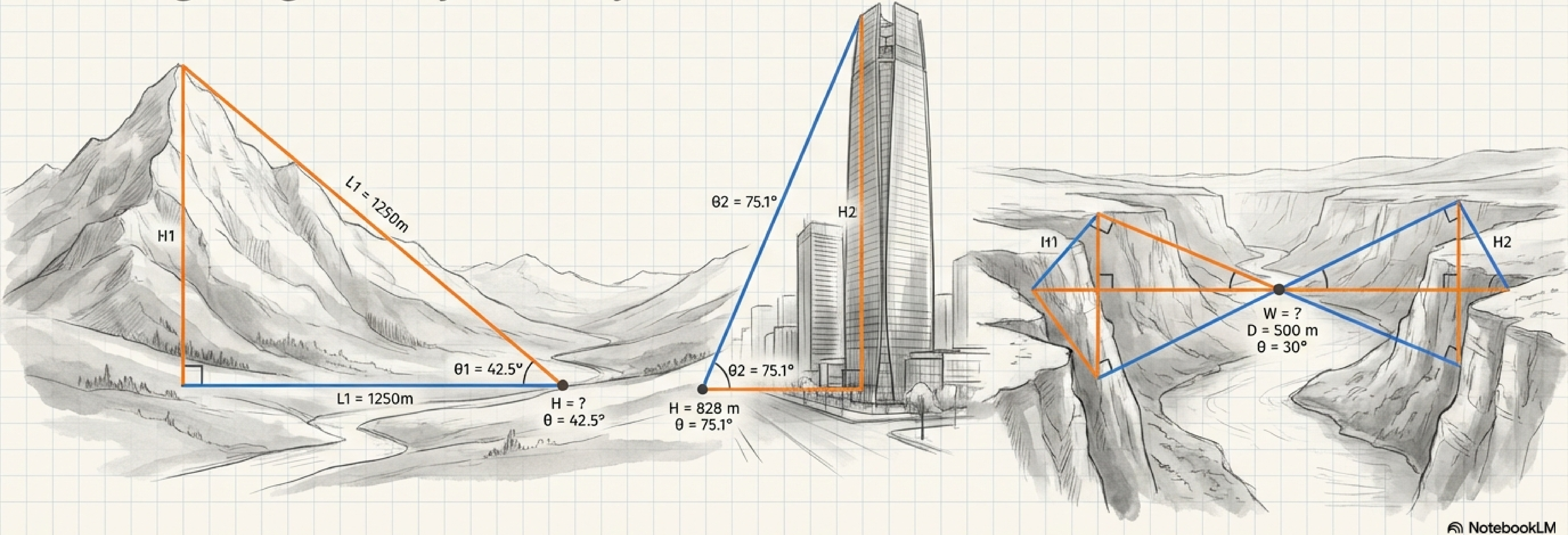
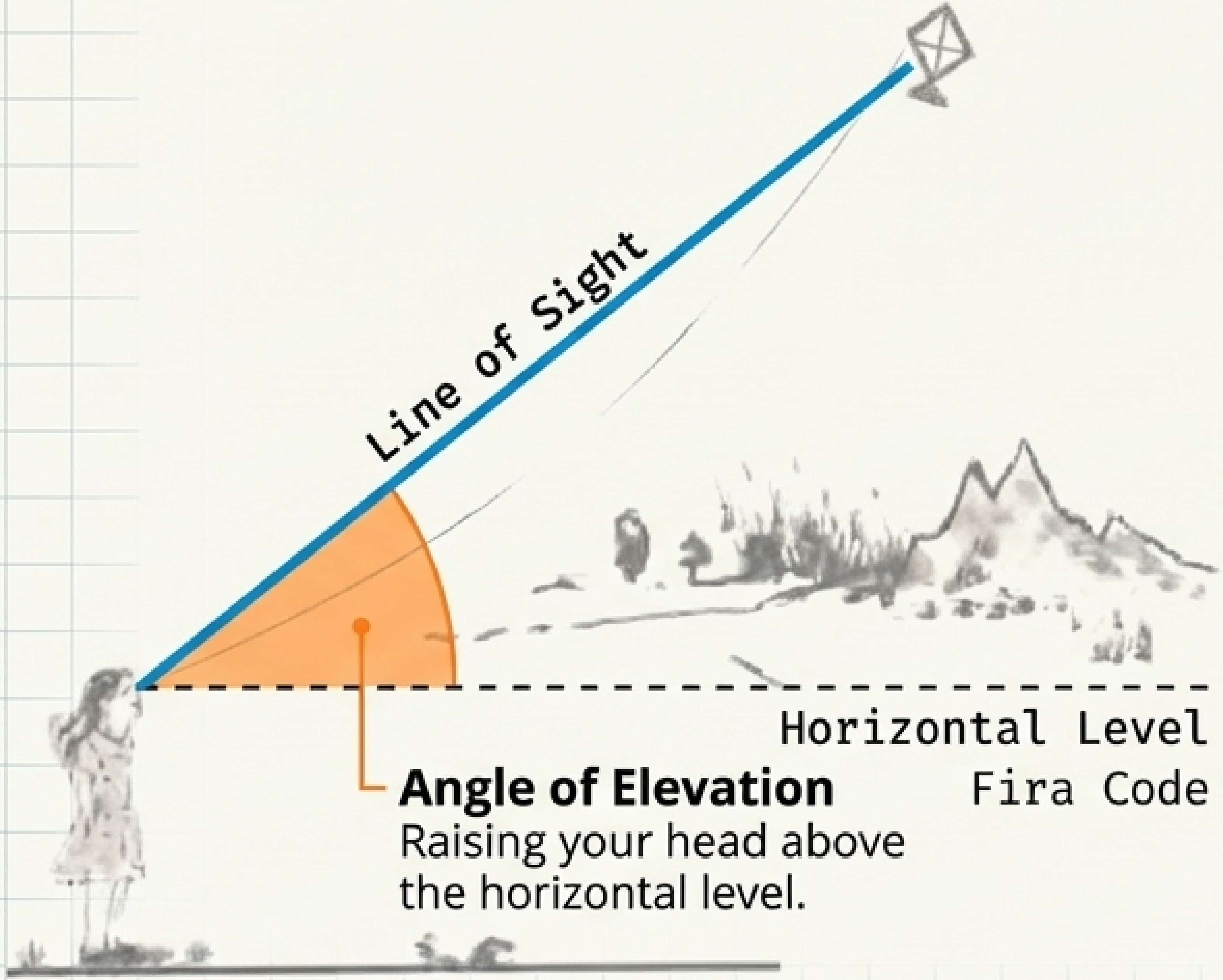
A Visual Field Guide to Heights and Distances

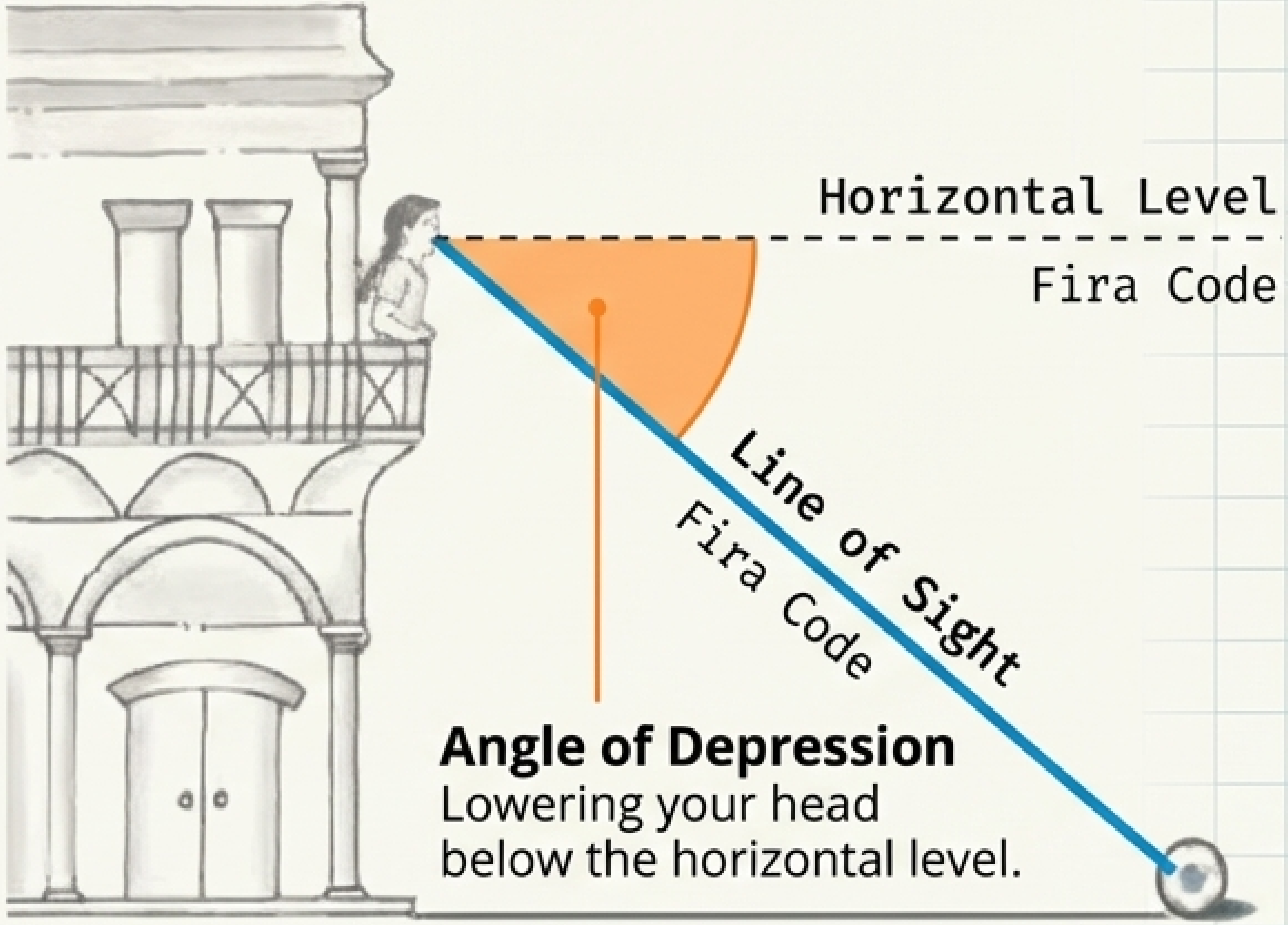
Decoding the physical world using the geometry of the eye.



NotebookLM

The Core Toolkit: Vocabulary of the Eye

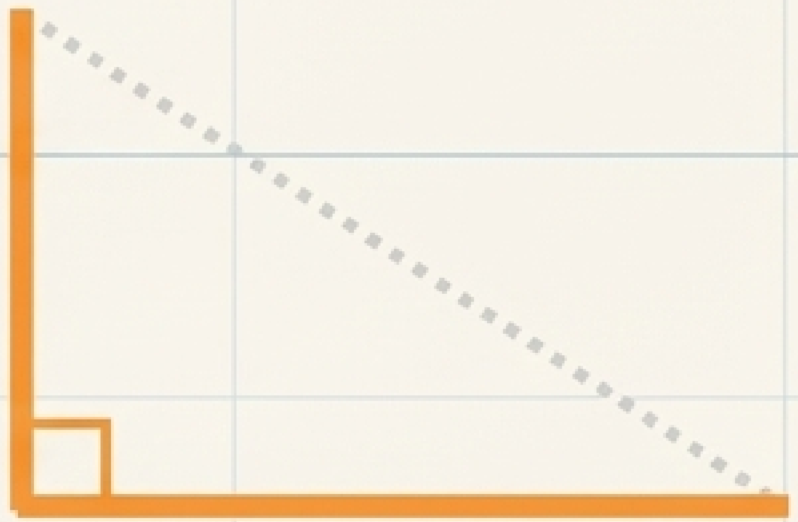




The Golden Rule of Ratios

You don't need all of trigonometry—just the ratio that connects your **two knowns** to your one unknown.

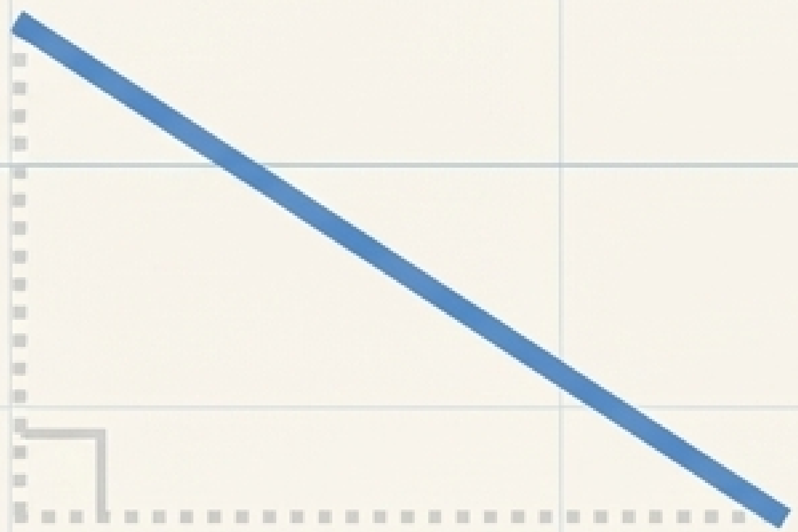
Tool 1: Tangent (`tan`)



When to use Tangent:

- Ground distances
- Vertical heights
- Shadows and towers

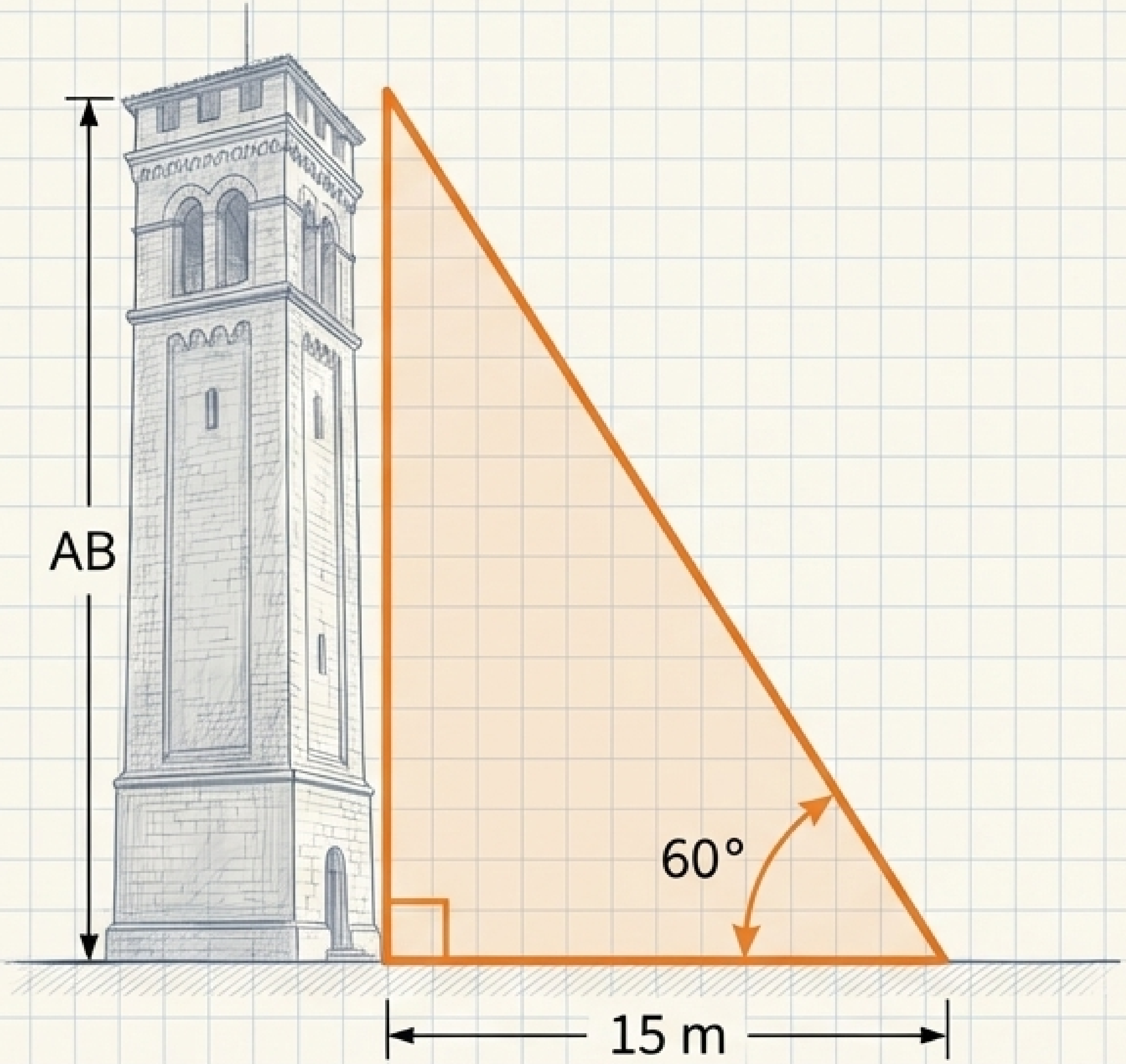
Tool 2: Sine (`sin`) / Cosine (`cos`)



When to use Sine/Cosine:

- Tangible physical paths
- Ladders and ropes
- Flight paths and strings

Scenario 1: The Direct Look



IDENTIFY

- **Target:** Tower Height (AB)
- **Knowns:** Ground distance (15 m), Angle of Elevation (60°)
- **Selected Tool:** Tangent

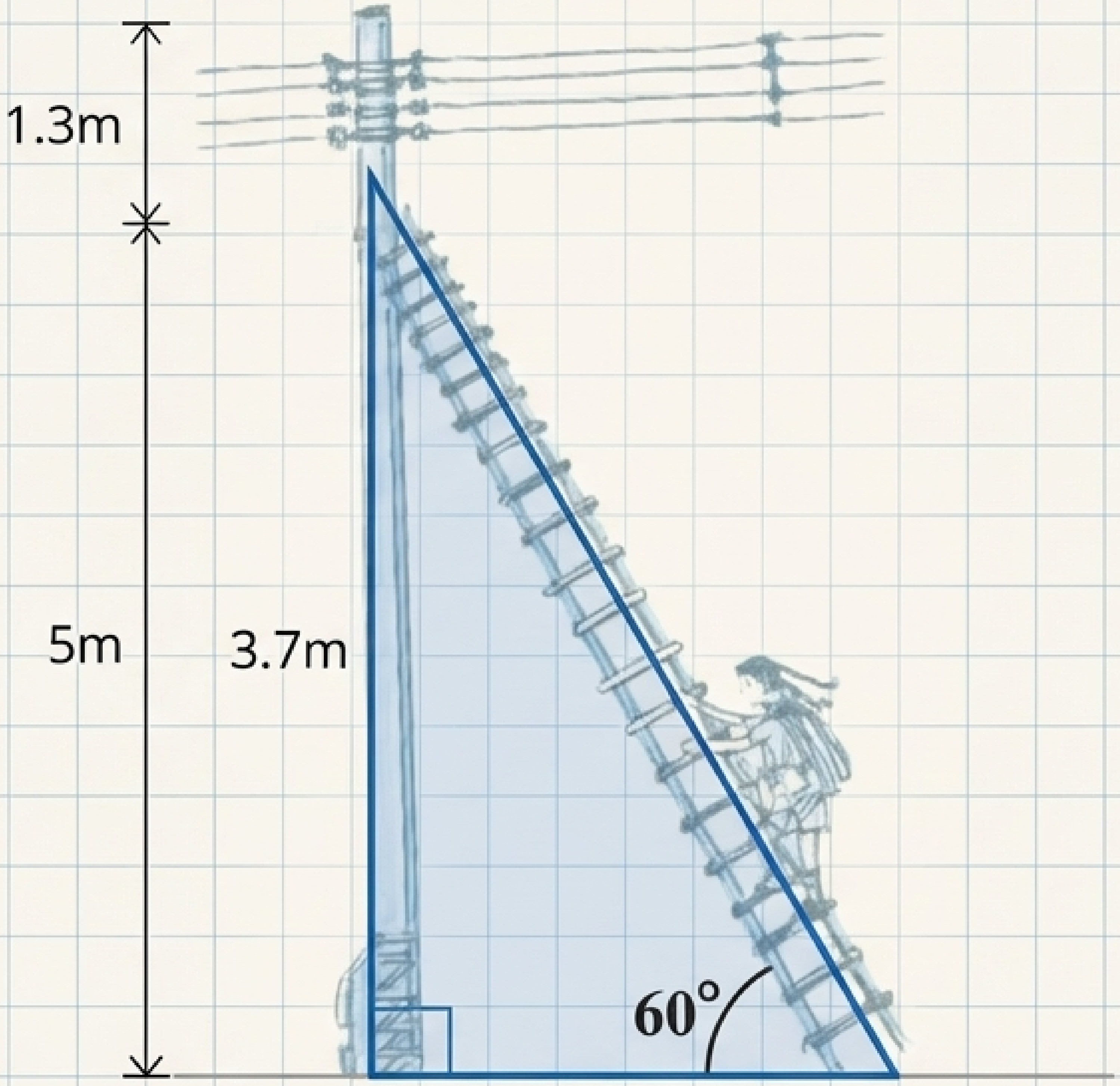
EXECUTE

$$\tan(60°) = \frac{AB}{15}$$

$$\sqrt{3} = \frac{AB}{15}$$

Result: Height = $15\sqrt{3}$ m

Scenario 2: The Tangible Hypotenuse



IDENTIFY

- **Target:** Ladder Length (BC)
- **Knowns:** Adjusted Height (3.7m), Angle (60°)
- **Selected Tool:** Sine (focus on hypotenuse)

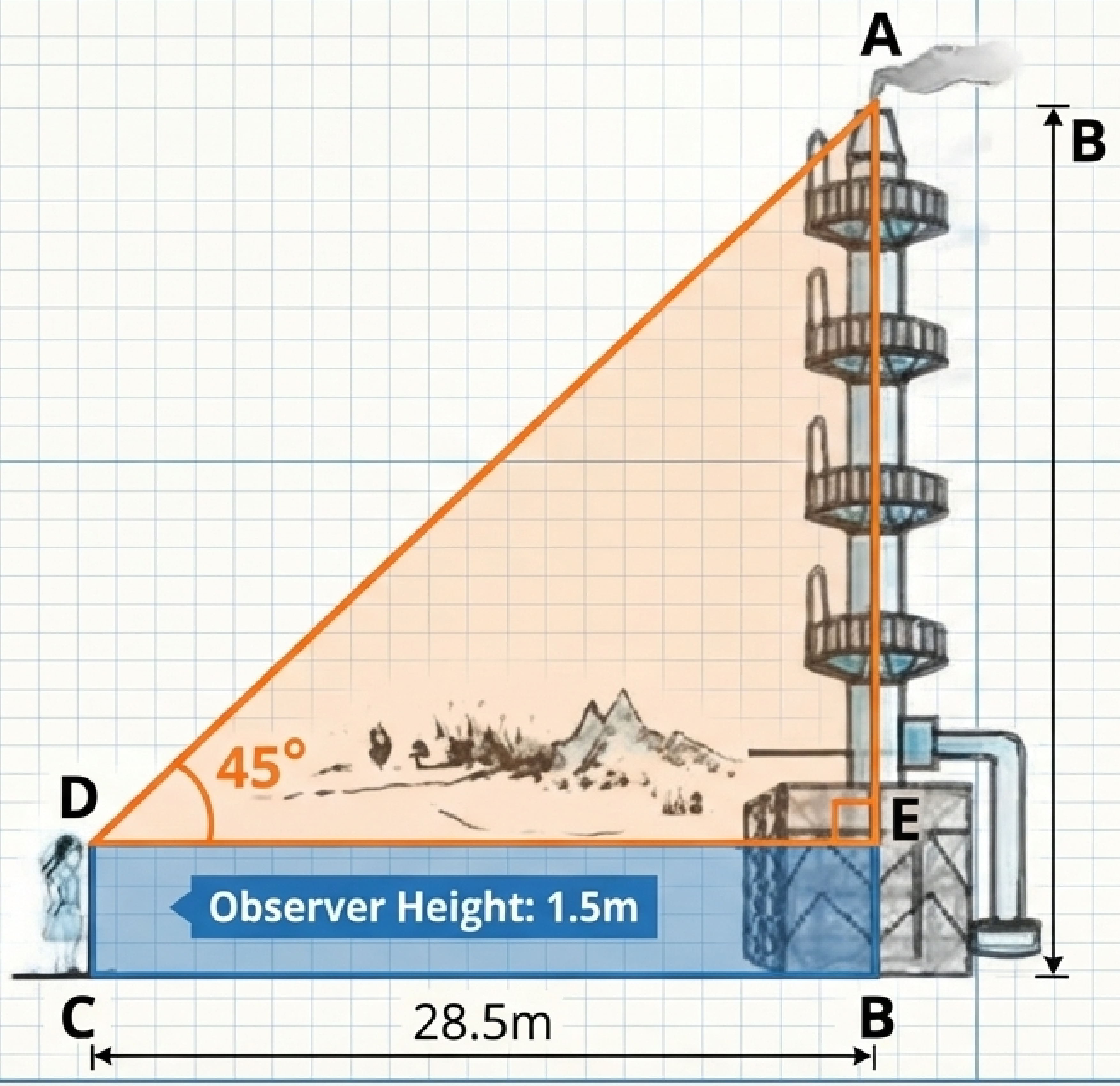
EXECUTE

$$\sin(60°) = \frac{3.7}{BC}$$

$$\frac{\sqrt{3}}{2} = \frac{3.7}{BC}$$

Result: Ladder Length ≈ 4.28 m

Scenario 3: Accounting for the Observer



IDENTIFY

Target: Total Chimney Height (AB)

Knowns: Distance (28.5m), Angle (45°), Eye Level (1.5m)

Selected Tool: Tangent + Addition

EXECUTE

tan(45°) = AE / 28.5

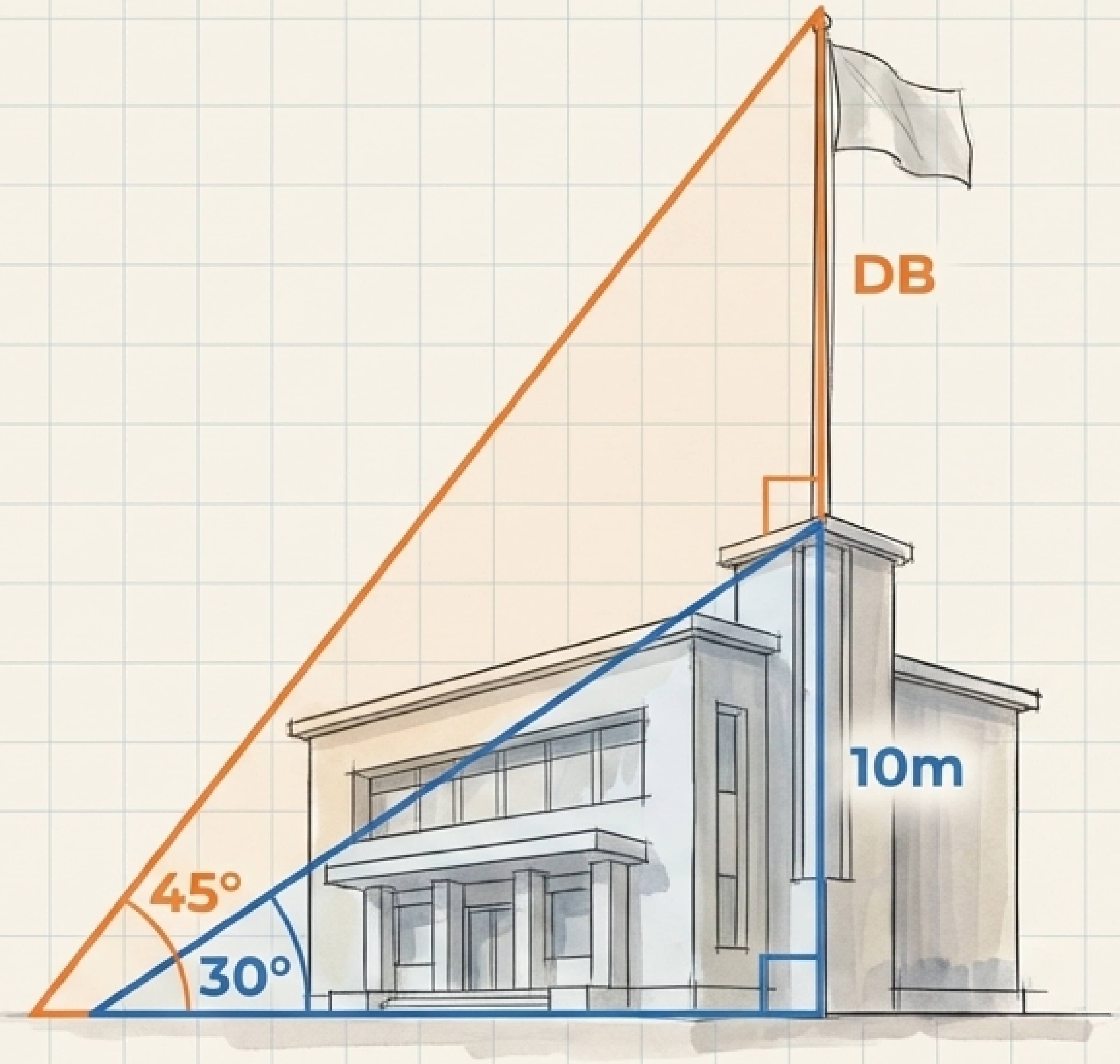
1 = AE / 28.5

AE = 28.5 m

Insight: Math calculates from the eye. Add the human back.

Result: 28.5m + 1.5m = 30 m

Scenario 4: Stacked Objects



IDENTIFY

- **Target:** Flagstaff length (DB)
- **Knowns:** Building Height (10m), Angles (30° & 45°)
- **Insight:** Solve the inner triangle first to unlock the shared ground distance.

EXECUTE

Step 1 (Base):

$\tan(30°) = 10 / AP$

$AP = 10\sqrt{3}$

Step 2 (Total Height):

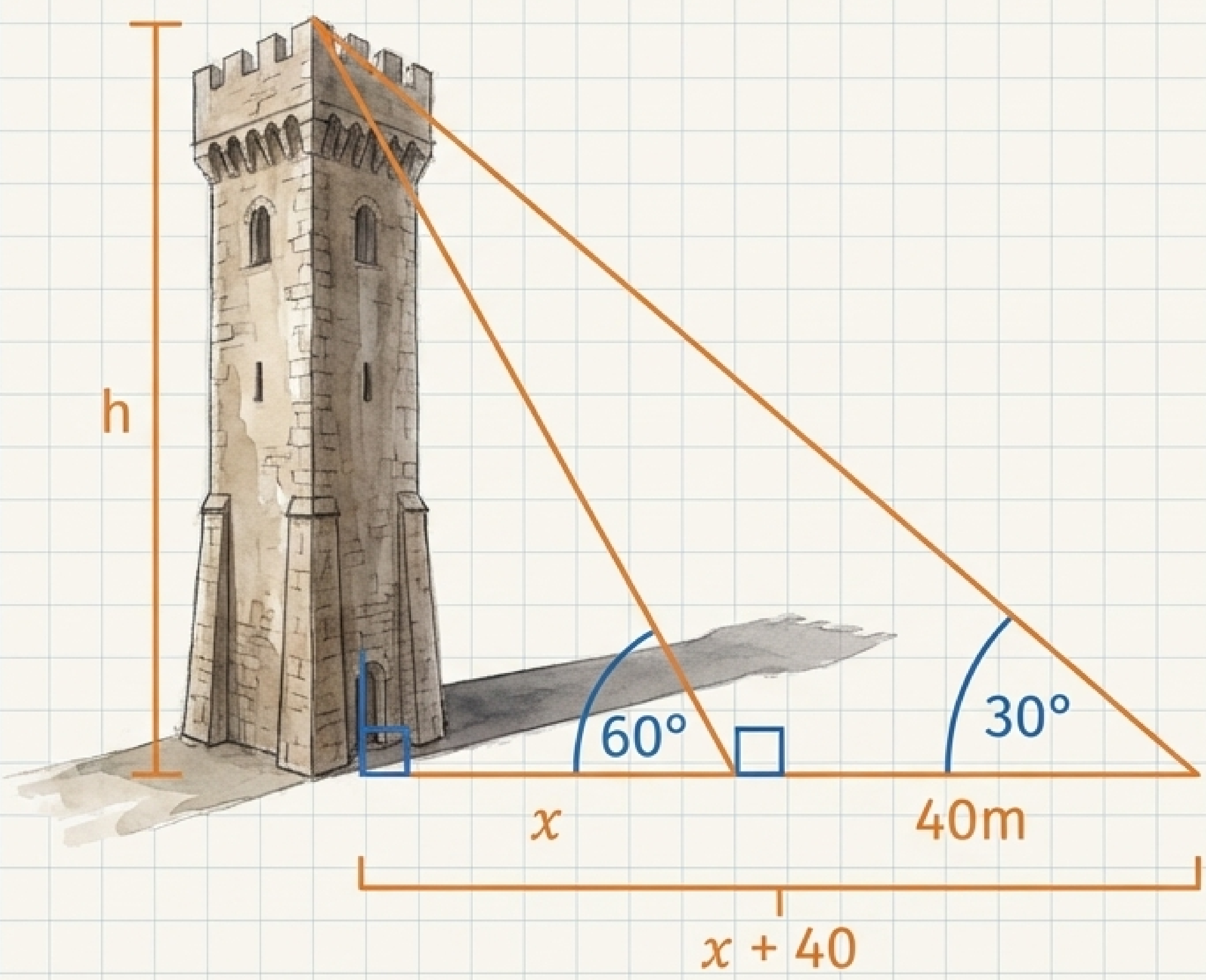
$\tan(45°) = AD / 10\sqrt{3}$

$1 = AD / 10\sqrt{3}$

$AD = 17.32$ m

Result: 17.32m (Total) - 10m (Building) = 7.32 m flagstaff

Scenario 5: Changing Perspectives



IDENTIFY

- **Target:** Tower Height (h)
- **Knowns:** Shadow grows by 40m when angle drops 60° → 30°.
- **Insight:** Two triangles, two variables (h, x). Set up overlapping tangent equations.

EXECUTE

$\tan(60°) = \frac{h}{x} \quad \rightarrow \quad h = x\sqrt{3}$

$\tan(30°) = \frac{h}{x+40} \quad \rightarrow \quad h = \frac{x+40}{\sqrt{3}}$

Solve the overlapping equations:

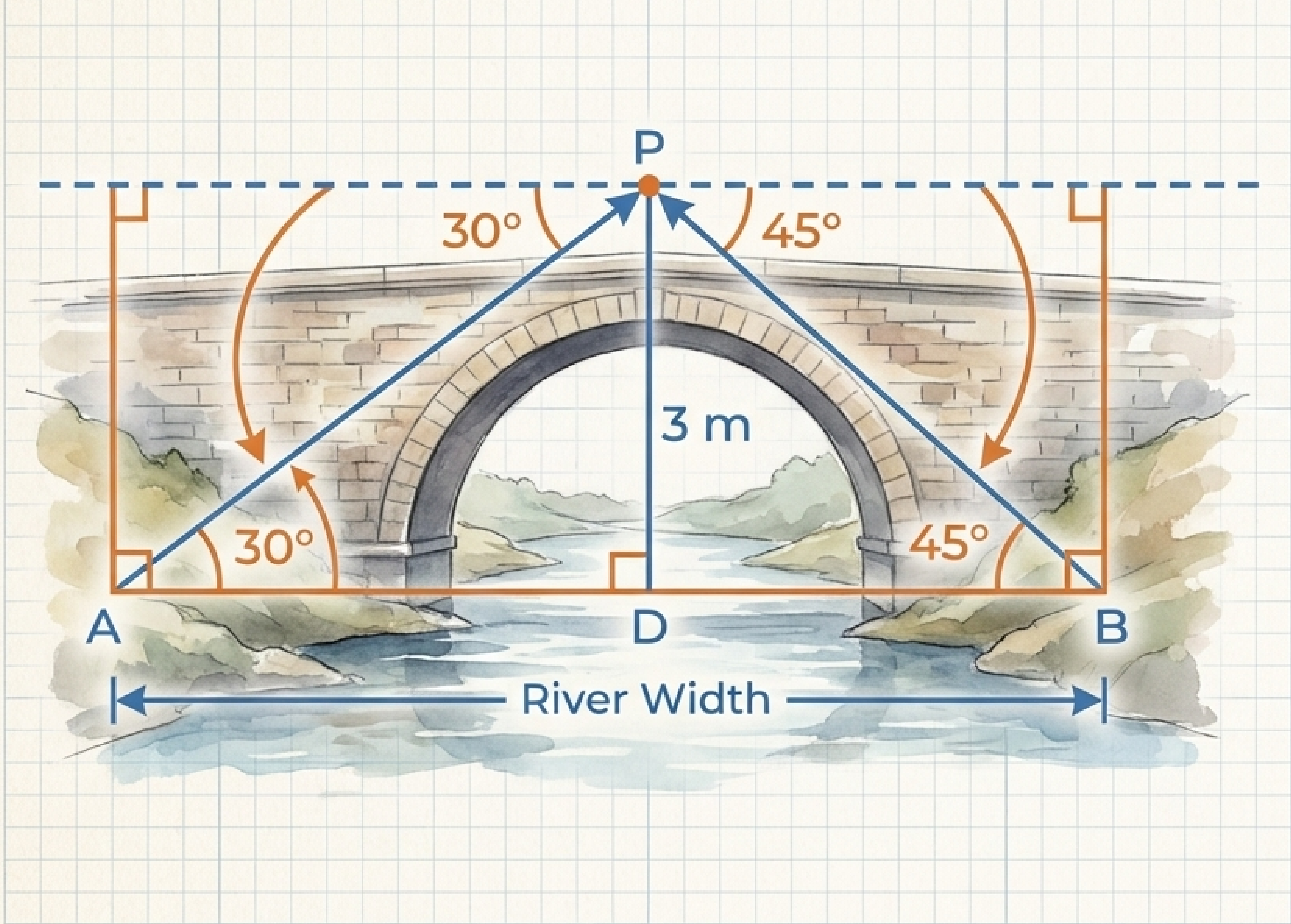
$$x\sqrt{3} = \frac{x+40}{\sqrt{3}}$$

$$3x = x + 40$$

$$x = 20$$

Result: $h = 20\sqrt{3}$ m

Scenario 6: The View From Above



IDENTIFY

- **Target:** River Width (Total Base)
- **Knowns:** Bridge Height (3m), Depression Angles (30° & 45°)
- **Insight:** Use alternate interior angles to flip the perspective to the ground.

EXECUTE

Left Bank:

$$\tan(30°) = \frac{3}{AD} \rightarrow AD = 3\sqrt{3}$$

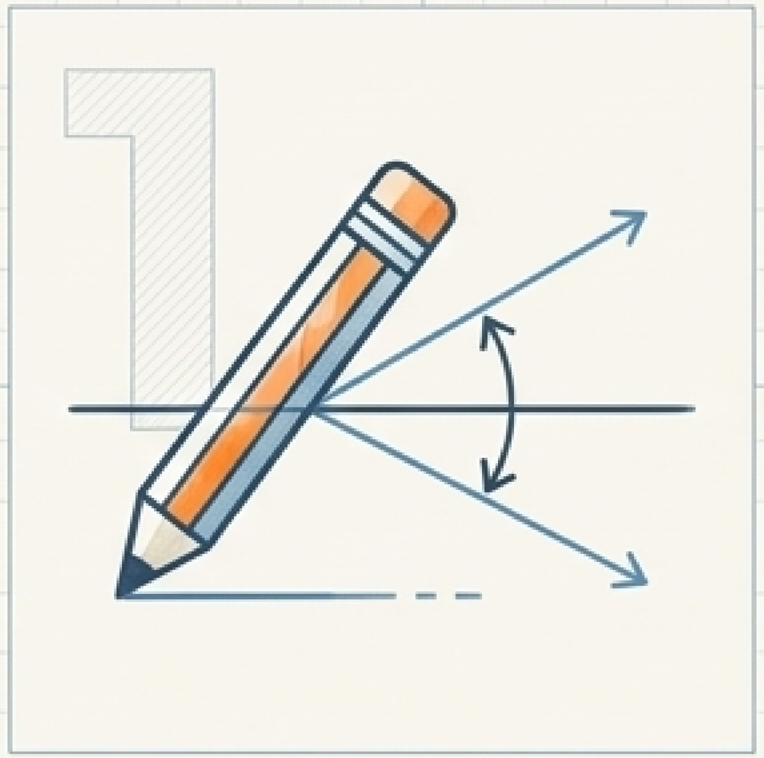
Right Bank:

$$\tan(45°) = \frac{3}{DB} \rightarrow DB = 3$$

Result: Width = $3\sqrt{3} + 3 = 3(1 + \sqrt{3})$ m

The Master Playbook

How to measure the world around you in 4 steps.

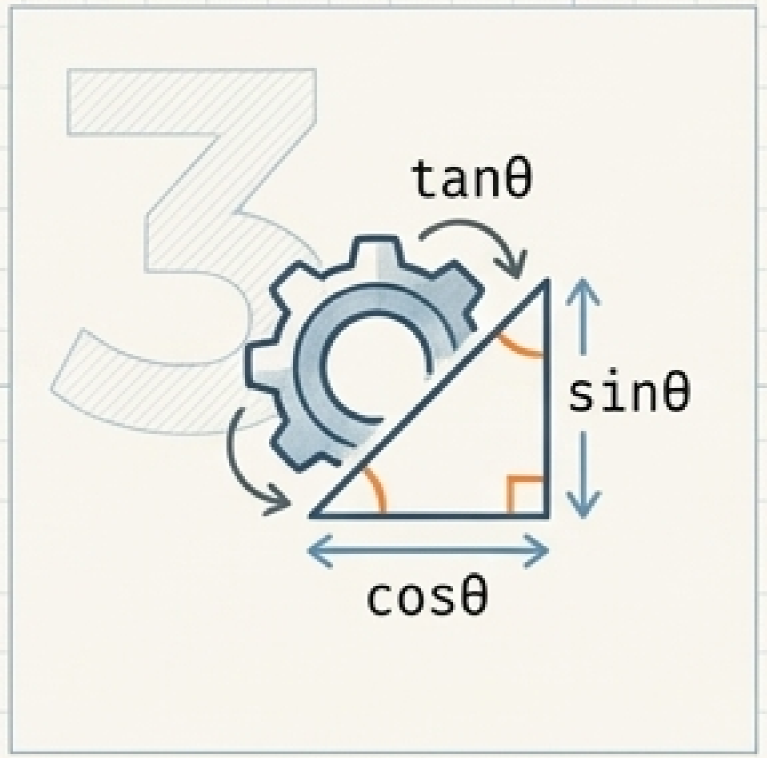


1. Draw the Reality

Sketch the line of sight and the horizontal level. Identify if you are looking up (elevation) or down (depression).

2. Map the Triangles

Overlay right-angled triangles onto your sketch. Look for shared bases or stacked heights.



3. Pick the Ratio

Identify your knowns and unknowns. Use Tangent for heights/distances, and Sine/Cosine for physical paths.

4. Solve & Adjust

Calculate the unknown. **Crucial:** Always check if you need to add the observer's height back to the final answer!