Height and Distance

~ Quantitative Aptitude · SSC Exams ~

← circled = key info!

This whole chapter is just right-triangle trigonometry in disguise. Draw the triangle, mark the angle, and reach for **tanθ = height / base**.

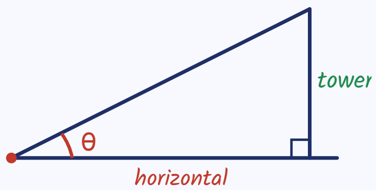
① Basic Definitions

Line of sight → the straight line from the observer's eye to the object viewed.

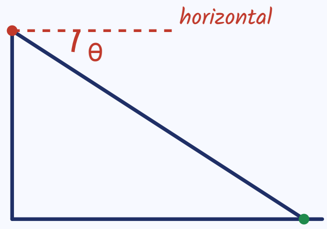
Horizontal line → the level line through the eye, parallel to the ground.

Angle of ELEVATION → angle the line of sight makes **above** the horizontal (looking **up**).

Angle of DEPRESSION → angle the line of sight makes **below** the horizontal (looking **down**).



Elevation (look up)



Depression (look down)

Key link → the angle of **depression** from A (top) to B (ground) **equals** the angle of **elevation** from B up to A — they are **alternate angles** between two parallel horizontals.

Worked example — alternate angles

A man at the top of a **30 m** cliff sees a boat at an angle of **depression 45°**.

Idea → depression 45° = elevation 45° from the boat. In that triangle tan45° = h/d = 1.

So → d = h = **30 m**. The boat is 30 m from the foot of the cliff. ✅

② The Tool Kit — $\tan\theta$ ⊿

In a right triangle the angle sits at the observer. The **vertical** is opposite it, the **horizontal** is adjacent.

Master formula

- $\tan\theta$ = opposite / adjacent = **height / base**
- $\sin\theta$ = opposite / hypotenuse · $\cos\theta$ = adjacent / hypotenuse
- So **height = base × $\tan\theta$** and **base = height / $\tan\theta$ = height × $\cot\theta$**

Standard angle values — memorise!

θ	$\sin\theta$	$\cos\theta$	$\tan\theta$	$\cot\theta$
30°	$1/2$	$\sqrt{3}/2$	**$1/\sqrt{3}$**	$\sqrt{3}$
45°	$1/\sqrt{2}$	$1/\sqrt{2}$	**1**	1
60°	$\sqrt{3}/2$	$1/2$	**$\sqrt{3}$**	$1/\sqrt{3}$

Numbers to keep on your fingertips ⟶ $\sqrt{3} \approx 1.732$, $1/\sqrt{3} \approx 0.577$, $\sqrt{2} \approx 1.414$. Rationalise: $1/\sqrt{3} = \sqrt{3}/3$.

Worked example — read the triangle

A pole casts a right triangle of **height 50 m** over a **base of 50 m**. Find the elevation.

Step 1 — $\tan\theta$ = height / base = $50 / 50 = 1$.

Step 2 — $\tan\theta = 1 \Rightarrow \theta =$ **45°**. ∴ equal height & base always means 45°. ✅

✓ Complementary pairs ⟶ $\tan 30° \cdot \tan 60° = (1/\sqrt{3})(\sqrt{3}) = 1$. In general $\tan\theta \cdot \tan(90° - \theta) = 1$.

Quick reads

base 10, θ=30° → $h = 10/\sqrt{3} \approx$ **5.77**

base 10, θ=45° → h = **10**

base 10, θ=60° → $h = 10\sqrt{3} \approx$ **17.32**

h 10, θ=30° → base $= 10\sqrt{3} \approx$ **17.32**

③ Single-Triangle Problems

One angle, one distance

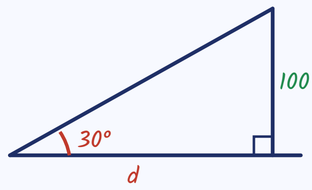
- height $\mathbf{h = d \cdot \tan\theta}$ · distance $\mathbf{d = h \cdot \cot\theta = h \,/\, \tan\theta}$
- If $\mathbf{\theta = 45°}$ then $\tan\theta = 1 \Rightarrow$ **height = distance**.

Worked example 1

A tower is **100 m** tall. From a point on the ground the elevation of its top is **30°**. How far is the point from the base?

Set up → $\tan 30° = h/d \Rightarrow 1/\sqrt{3} = 100/d$.

Solve → $d = 100\sqrt{3} \approx$ **173.2 m**. ✅



Worked example 2 – the 45° shortcut

From a point **60 m** from the foot of a tower the elevation of the top is **45°**. Find the height.

Solve → $h = d \cdot \tan 45° = 60 \times 1 =$ **60 m**. (height = distance). ✅

Worked example 3

The elevation of the top of a **60 m** tower is **60°**. Find the observer's distance.

Solve → $d = h/\tan 60° = 60/\sqrt{3} = 20\sqrt{3} \approx$ **34.64 m**. ✅

Bigger angle → nearer the object (steeper look-up). Smaller angle → farther away. At 30° the base is $\sqrt{3}$ times the height; at 60° the base is height/$\sqrt{3}$.

Try these

$d = 80,\ \theta = 30° \rightarrow h = 80/\sqrt{3} \approx$ **46.19**

$h = 40,\ \theta = 45° \rightarrow d =$ **40**

$h = 90,\ \theta = 60° \rightarrow d = 90/\sqrt{3} = 30\sqrt{3} \approx$ **51.96**

$d = 50,\ \theta = 60° \rightarrow h = 50\sqrt{3} \approx$ **86.6**

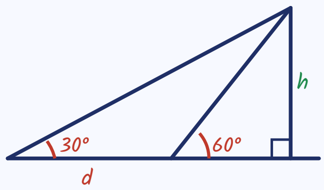
④ Observer Moves — two angles

*Walk a distance **d** toward a tower; the elevation grows from **α** to **β**. One height, two right triangles sharing it.*

General result

- $\boldsymbol{h = d \,/\, (\cot\alpha - \cot\beta)}$ *(α is the far/smaller angle, β the near/larger)*
- *Special case* $\boldsymbol{30°} \rightarrow \boldsymbol{60°}$: $h = \boldsymbol{(\sqrt{3}/2)\cdot d}$

Derivation — 30° → 60°



At 60° (near, base = x): $\tan 60° = h/x \Rightarrow \boldsymbol{x = h/\sqrt{3}}$.

At 30° (far, base = x+d): $\tan 30° = h/(x+d) \Rightarrow \boldsymbol{x+d = h\sqrt{3}}$.

Subtract → $d = h\sqrt{3} - h/\sqrt{3} = h(2/\sqrt{3})$.

∴ $\boldsymbol{h = \sqrt{3}\cdot d \,/\, 2}$. ✅

Worked example — 30° → 60°

A man walks **40 m** toward a tower; the elevation of the top rises from **30° to 60°**. Find the height.

Solve → $h = (\sqrt{3}/2)\times 40 = 20\sqrt{3} \approx$ **34.64 m**.

Check → via formula $h = 40/(\cot 30° - \cot 60°) = 40/(\sqrt{3} - 1/\sqrt{3}) = 40/(2/\sqrt{3}) = 20\sqrt{3}$. ✅

*Once you have h, the remaining distance to the base is $x = h/\sqrt{3} = 20\sqrt{3}/\sqrt{3} =$ **20 m** — exactly half of the 40 m walked.*

④ Observer Moves — more cases

The formula **$h = d / (\cot\alpha - \cot\beta)$** handles every angle pair — just plug the cot values.

Worked example — 30° → 45°

Walking **100 m** toward a tower changes the elevation from **30° to 45°**. Find the height.

Solve → $h = 100/(\cot 30° - \cot 45°) = 100/(\sqrt{3}-1)$.

Rationalise → $\times(\sqrt{3}+1)/(\sqrt{3}+1)$: $h = 100(\sqrt{3}+1)/2 = 50(\sqrt{3}+1) \approx$ **136.6 m**. ✅

Worked example — 45° → 60°

Walking **20 m** nearer, the elevation rises from **45° to 60°**. Find the height.

Solve → $h = 20/(\cot 45° - \cot 60°) = 20/(1-1/\sqrt{3}) = 20\sqrt{3}/(\sqrt{3}-1)$.

Rationalise → $h = 20\sqrt{3}(\sqrt{3}+1)/2 = 10(3+\sqrt{3}) \approx$ **47.32 m**. ✅

*Moving **away** instead of toward? Same formula — the elevation now **drops** ($\beta \to \alpha$), and d is the distance walked back. Answer for the height is identical.*

Worked example — find the distances too

Tower height from the 30°→60° case with $d = 40$ m was $h = 20\sqrt{3}$.

- Near base (60°): $x = h/\sqrt{3} = 20\sqrt{3}/\sqrt{3} =$ **20 m**.
- Far base (30°): $x+d = h\sqrt{3} = 20\sqrt{3}\times\sqrt{3} =$ **60 m**. ($60 - 20 = 40$ ✓)

Try these (find h)

$d=60$, 30°→60° → $h = 30\sqrt{3} \approx$ **51.96**

$d=90$, 30°→60° → $h = 45\sqrt{3} \approx$ **77.94**

$d=50$, 30°→45° → $25(\sqrt{3}+1) \approx$ **68.3**

$d=10$, 45°→60° → $5(3+\sqrt{3}) \approx$ **23.66**

⑤ Shadow Problems

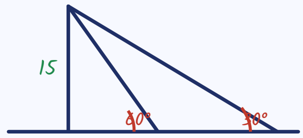
The sun's rays are the line of sight; the pole's **shadow is the base**. Lower the sun (smaller elevation) → longer the shadow.

Shadow facts (pole height h)

- shadow $= h \,/\, \tan\theta = \boldsymbol{h \cdot \cot\theta}$
- $\theta = 45°$ → shadow $= h$ · $\theta = 30°$ → shadow $= \boldsymbol{h\sqrt{3}}$ · $\theta = 60°$ → shadow $= \boldsymbol{h/\sqrt{3}}$

Worked example

The sun's elevation drops from **60° to 30°**. The shadow of a **15 m** pole lengthens — by how much?



At 60° → $s_1 = 15/\sqrt{3} = 5\sqrt{3} \approx 8.66$ m.

At 30° → $s_2 = 15\sqrt{3} \approx 25.98$ m.

Increase → $s_2 - s_1 = 15\sqrt{3} - 5\sqrt{3} = 10\sqrt{3} \approx$ **17.32 m**. ✅

> Reverse question: "shadow = $\sqrt{3}$ × height → sun's elevation?" Since $\cot\theta = \sqrt{3}$, $\theta = 30°$. If shadow = height → 45°.

Worked example — 45° → 30°

A **10 m** pole's shadow when the sun sinks from **45° to 30°**: increase $= 10\sqrt{3} - 10 = 10(\sqrt{3}-1) \approx$ **7.32 m**. ✅

Try these

$h=20, \theta=30°$ → shadow $= 20\sqrt{3} \approx$ **34.64**

shadow $= h$ → $\theta =$ **45°**

$h=12, \theta=60°$ → shadow $= 12/\sqrt{3} = 4\sqrt{3} \approx$ **6.93**

shadow $= h/\sqrt{3}$ → $\theta =$ **60°**

⑥ Depression to Two Objects

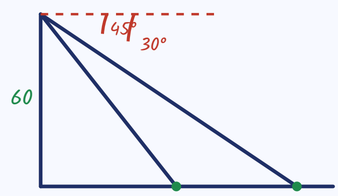
From the top of a building of height h, look down at two objects on the ground — a **near** one (angle β) and a **far** one (angle α), $\beta > \alpha$.

Key result

- near distance $= h\cdot\cot\beta$ · far distance $= h\cdot\cot\alpha$
- gap between objects $= \mathbf{h(\cot\alpha - \cot\beta)}$

Worked example

From the top of a **60 m** building the depressions of two cars (same side, in a line) are **45°** (near) and **30°** (far). Find the distance between them.



Near → $60\cdot\cot 45° = 60$.

Far → $60\cdot\cot 30° = 60\sqrt{3} \approx 103.9$.

Gap → $60\sqrt{3} - 60 = 60(\sqrt{3}-1) \approx$ **43.9 m**. ✅

Always convert depression → elevation first (they are equal). Then it is just two single triangles sharing the same height h.

Worked example — find the height

From a cliff top the depressions of two boats **on opposite sides**, in line, are **45°** and **30°**; the boats are **the sum** of the two feet apart. If the near boat is 40 m from the foot at 45°, then $h = 40\cdot\tan 45° =$ **40 m**. Far boat $= 40\sqrt{3} \approx 69.3$ m. ✅

Try these (gap, same side)

$h=30$, $45°\&30°$ → $30(\sqrt{3}-1) \approx$ **21.96**

$h=50$, $45°\&30°$ → $50(\sqrt{3}-1) \approx$ **36.6**

$h=90$, $60°\&30°$ → $90(\sqrt{3}-1/\sqrt{3}) = 60\sqrt{3} \approx$ **103.9**

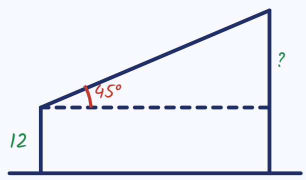
$h=45$, $60°\&45°$ → $45(1-1/\sqrt{3}) \approx$ **19.02**

⑦ Two Towers / Poles

Two verticals on level ground a fixed distance apart. Sight the top of one from the foot or top of the other — drop a horizontal to make a right triangle.

Worked example 1 — top-to-top

A **12 m** pole and a taller tower stand **16 m** apart. From the top of the pole, the elevation of the tower's top is **45°**. Find the tower's height.



Rise above pole-top = $16 \cdot \tan 45° = 16$ m.

Tower = $12 + 16 =$ **28 m**. ✅

Worked example 2 — elevation from the foot

Two towers stand **30 m** apart. From the **foot** of tower B the elevation of the top of tower A is **30°**. Find A's height.

Solve → $h_0 = 30 \cdot \tan 30° = 30/\sqrt{3} = 10\sqrt{3} \approx$ **17.32 m**. ✅

Worked example 3 — up & down

From the top of a **20 m** building, the top of a tower has elevation **45°** and its foot has depression **45°**. Find the tower's height and the distance apart.

Depression 45° to the foot → horizontal distance = $20 \cdot \cot 45° = 20$ m.

Elevation 45° to top → extra height = $20 \cdot \tan 45° = 20$ m.

Tower = $20 + 20 =$ **40 m**; distance apart = **20 m**. ✅

✓ Trick → the horizontal gap is the **same** in both triangles. Compute it once, then use tan for each vertical piece.

Try these

10 m pole, gap 24, elev 45° top→top → **34 m**

gap 15, elev 60° from foot → $15\sqrt{3} \approx$ **25.98**

gap 40, elev 30° from foot → $40/\sqrt{3} \approx$ **23.09**

15 m bldg, up 45° down 45° → tower **30 m**

⑧ Object Between Two Observers

A tower stands **between** two points on **opposite sides**, a distance **d** apart. Elevations are α and β. The two feet **add up** to d.

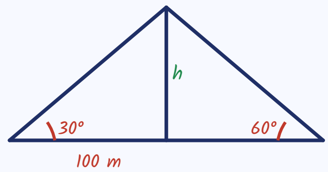
Key result (opposite sides)

- $h \cdot \cot\alpha + h \cdot \cot\beta = d \Rightarrow \mathbf{h = d / (\cot\alpha + \cot\beta)}$

(contrast: **same-side** / moving observer uses $\cot\alpha - \cot\beta$)

Worked example

A tower stands between two points **100 m** apart on opposite sides. The elevations of the top are **30°** and **60°**. Find the height.



Solve → $h = 100/(\cot 30° + \cot 60°) = 100/(\sqrt{3} + 1/\sqrt{3})$.

$\sqrt{3} + 1/\sqrt{3} = (3+1)/\sqrt{3} = 4/\sqrt{3}$.

So → $h = 100\sqrt{3}/4 = 25\sqrt{3} \approx$ **43.3 m**. ✅

Opposite sides → *ADD* the cotangents; **same side** → *SUBTRACT*. One sign error flips the whole answer — picture which side each observer stands on.

Worked example — equal angles

Opposite points **80 m** apart, both elevations **45°**: $h = 80/(\cot 45° + \cot 45°) = 80/2 =$ **40 m**. Tower sits exactly mid-way. ✅

Try these (opposite sides)

d=60, 30°&60° → $15\sqrt{3} \approx$ **25.98**	d=120, 30°&60° → $30\sqrt{3} \approx$ **51.96**
d=100, 45°&45° → **50**	d=40, 30°&60° → $10\sqrt{3} \approx$ **17.32**

⑨ Broken Tree & Ladder

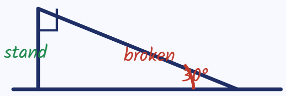
The broken part / the ladder is the **hypotenuse**. Use sin, cos, tan on the leaning line.

Broken tree (breaks at height, top touches ground)

- standing part = $x \cdot \tan\theta$ · broken part = $x \cdot \sec\theta = x/\cos\theta$
- total height = $\mathbf{x(\tan\theta + \sec\theta)}$ (x = distance of top from foot)

Worked example — broken tree

A tree breaks in the wind; the top touches the ground **10 m** from the foot, making **30°** with the ground. Find the original height.



Standing = $10 \cdot \tan 30° = 10/\sqrt{3} \approx 5.77$.

Broken = $10 \cdot \sec 30° = 20/\sqrt{3} \approx 11.55$.

Total = $30/\sqrt{3} = 10\sqrt{3} \approx$ **17.32 m**. ✅

Worked example — ladder

A ladder leans against a wall making **60°** with the ground; its foot is **2.5 m** from the wall. Find the ladder's length and the height reached.

Length = base / $\cos 60° = 2.5/0.5 =$ **5 m**.

Height = base $\cdot \tan 60° = 2.5\sqrt{3} \approx$ **4.33 m**. ✅

💡 *For a ladder: height reached = length·sinθ, base = length·cosθ. If length & angle are given, use sin/cos directly — no need for the base first.*

⑨ Observer of Given Height

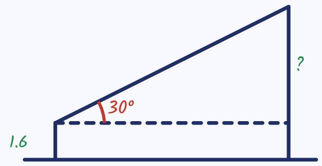
When the person's **eye height** is given, the angle is measured from the **eye level**, not the ground. Solve for the part **above the eye**, then add the eye height.

Rule

- height above eye = $d \cdot \tan\theta$
- **tower height = $(d \cdot \tan\theta)$ + eye height**

Worked example 1

A man **1.6 m** tall stands **$20\sqrt{3}$ m** from a tower. The elevation of the top, from his eyes, is **30°**. Find the tower's height.



Above eye = $20\sqrt{3} \cdot \tan 30° = 20\sqrt{3}/\sqrt{3} = 20$ m.

Tower = $20 + 1.6 =$ **21.6 m.** ✅

Worked example 2 — find the distance

A boy **1.5 m** tall sees the top of a **51.5 m** tower at elevation **45°** from his eyes. How far is he standing?

Above eye = $51.5 - 1.5 = 50$ m.

Distance = $50/\tan 45° =$ **50 m.** ✅

✓ *If the question ignores the observer's height, treat it as 0 — the angle is then measured from the ground. Read carefully whether "from his eyes" appears.*

Worked example 3 — on a platform

From a **10 m** high platform the elevation of a tower top is **45°** and its base's depression is **30°**. Horizontal distance = $10 \cdot \cot 30° = 10\sqrt{3} \approx 17.32$ m. Extra height = $10\sqrt{3} \cdot \tan 45° = 10\sqrt{3}$. Tower = $10 + 10\sqrt{3} \approx$ **27.32 m.** ✅

⑩ Flagstaff & River-Width

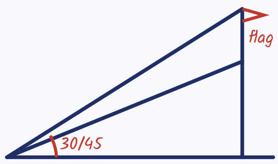
A flagstaff on a tower gives **two** elevations from one point — to the top of the tower and to the top of the flag.

From a point distance d away

- tower $= d\cdot\tan\alpha$ · tower + flag $= d\cdot\tan\beta$
- flag height $= \mathbf{d(\tan\beta - \tan\alpha)}$

Worked example — flagstaff

From a point **30 m** from a tower's base, the top of the tower has elevation **30°** and the top of a flag on it, **45°**. Find the flag's height.



Tower $= 30\cdot\tan 30° = 30/\sqrt{3} = 10\sqrt{3} \approx 17.32$ m.

Tower+flag $= 30\cdot\tan 45° = 30$ m.

Flag $= 30 - 10\sqrt{3} \approx$ **12.68 m**. ✅

Worked example — width of a river

A tree stands on a river bank. From a point on the opposite bank directly across, the top has elevation **60°**. Moving **20 m** straight back, the elevation is **30°**. Find the river's width and tree height.

This is a 30°→60° move → tree $h = (\sqrt{3}/2)\times 20 = 10\sqrt{3} \approx 17.32$ m.

Width (base at 60°) $= h/\sqrt{3} = 10\sqrt{3}/\sqrt{3} =$ **10 m**; tree ≈ **17.32 m**. ✅

> River-width is just the "observer moves away" case in disguise — the width is the **near** base. Find the height first, then divide by tan of the near angle.

⑪ Quick Ratio Facts

Exam-winning shortcuts — memorise the ratios so you skip the full working.

Remember these

- **$\theta = 45°$** $\Rightarrow$ height = distance (and shadow = height).
- **30°** $\to$ **60°** walk d: $h = \sqrt{3}/2 \cdot d$, and the **remaining** distance = half of d.
- **$\tan 30° \cdot \tan 60° = 1$** (so $\tan 30° = \cot 60°$).
- base at 30° : base at 60° = $\sqrt{3} : 1/\sqrt{3}$ = **3 : 1** (for the same height).

Given (height h)	Base / shadow	Ratio base:h
$\theta = 30°$	$h\sqrt{3}$	$\sqrt{3} : 1$
$\theta = 45°$	h	$1 : 1$
$\theta = 60°$	$h/\sqrt{3}$	$1 : \sqrt{3}$

Mini-example — use the ratio

Elevation 30°, tower 50 m $\to$ base = $50\sqrt{3} \approx 86.6$ m instantly (no tan needed). At 60° the same tower's base = $50/\sqrt{3} \approx$ **28.87 m**. ✅

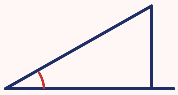
Config cheat-sheet — which formula?

- Move toward / same side $\to$ $h = d \,/\, (\cot\alpha - \cot\beta)$
- Object between, opposite sides $\to$ $h = d \,/\, (\cot\alpha + \cot\beta)$
- Two depressions, same side $\to$ gap = $h(\cot\alpha - \cot\beta)$
- Flagstaff (two elevations) $\to$ flag = $d(\tan\beta - \tan\alpha)$

✓ − for same side, + for opposite sides. Spot the picture, pick the sign, plug the cots — done in seconds.

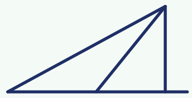
Standard Results at a Glance

Single triangle



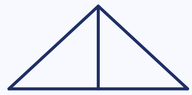
$h = d\cdot\tan\theta$

Move toward



$h = d/(\cot\alpha - \cot\beta)$

Between (opp.)



$h = d/(\cot\alpha + \cot\beta)$

Every formula in one box

- $h = d\cdot\tan\theta$ · shadow $= h\cdot\cot\theta$ · depression = elevation
- toward: $h = d/(\cot\alpha - \cot\beta)$ · $30°\to60°$: $h = \sqrt{3}d/2$
- between (opp): $h = d/(\cot\alpha + \cot\beta)$
- two depressions: gap $= h(\cot\alpha - \cot\beta)$
- broken tree: total $= x(\tan\theta + \sec\theta)$ · flag: $d(\tan\beta - \tan\alpha)$

Warm-up worked — pick the right tool

Tower between two points 90 m apart, opposite sides, elevations 30° & 60°.
Opposite → add: $h = 90/(\sqrt{3} + 1/\sqrt{3}) = 90\sqrt{3}/4 = 22.5\sqrt{3} \approx$ **38.97 m**. ✅

Try these (mixed)

tower 70, elev 45° → d = **70**

pole 24, sun 30° → shadow $= 24\sqrt{3} \approx$ **41.57**

d=80 walk 30°→60° → $h = 40\sqrt{3} \approx$ **69.3**

flag: d=40, 30°&45° → $40 - 40/\sqrt{3} \approx$ **16.9**

Solved Examples Σ

Q1 — single triangle

Tower 150 m, elevation 30°. Distance? → $d = 150 \cdot \cot 30° = 150\sqrt{3} \approx$ **259.8 m**.

Q2 — observer moves

Walk 30 m, elevation 30°→60°. Height? → $h = \sqrt{3}/2 \times 30 = 15\sqrt{3} \approx$ **25.98 m**.

Q3 — two depressions (same side)

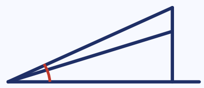
Building 45 m, depressions 45° & 30° to two cars. Gap $= 45(\cot 30° - \cot 45°) = 45(\sqrt{3}-1) \approx$ **32.9 m**.

Q4 — object between (opposite)

Points 60 m apart opposite sides, elevations 30° & 60°. $h = 60/(\sqrt{3}+1/\sqrt{3}) = 60\sqrt{3}/4 = 15\sqrt{3} \approx$ **25.98 m**.

Q5 — flagstaff

Point 20 m away; top of tower 45°, top of flag 60°. Tower $= 20 \cdot \tan 45° = 20$; tower+flag $= 20\sqrt{3} \approx 34.64$. Flag $= 20(\sqrt{3}-1) \approx$ **14.64 m**.



Q6 — shadow

Pole 10 m; sun's elevation 45°→30°. Increase in shadow $= 10\sqrt{3} - 10 = 10(\sqrt{3}-1) \approx$ **7.32 m**.

Golden habit ⟶ **draw the triangle first**, label h, d, θ, decide same-side (−) or opposite (+), then substitute. The diagram prevents 90% of errors.

Practice Set

1. Tower 50 m, elev 45°. Distance?
2. Tower 100 m, elev 30°. Distance?
3. Elev 60°, distance 30 m. Height?
4. Walk 50 m, 30°→60°. Tower height?
5. Pole 20 m, sun 30°. Shadow?
6. Shadow = height. Sun's elevation?
7. Building 40 m, depr 30° to a car. Distance?
8. 10 m pole, gap 24 m, top→top 45°. Other?
9. Between, 80 m apart, 30°&60°. Height?
10. Point 15 m away, elev 60°. Height?
11. Ladder 10 m at 60°. Height reached?
12. Flag: 10 m away, 30° tower, 45° flag. Flag?
13. $\tan 30° \cdot \tan 60° = ?$
14. Man 1.7 m, elev 45°, d 40 m. Tower?
15. Tree breaks, 8 m from foot at 30°. Height?

Answer Key — with working

1→ 50 m ($\tan 45°=1$) · **2→ $100\sqrt{3}$ ≈ 173.2** ($d=100\cdot\cot 30°$) · **3→ $30\sqrt{3}$ ≈ 51.96** ($h=30\cdot\tan 60°$) · **4→ $25\sqrt{3}$ ≈ 43.3** ($\sqrt{3}/2\times 50$) · **5→ $20\sqrt{3}$ ≈ 34.64** ($20\cdot\cot 30°$) · **6→ 45°** ($\cot\theta=1$) · **7→ $40\sqrt{3}$ ≈ 69.28** ($40\cdot\cot 30°$) · **8→ 34 m** ($10 + 24\cdot\tan 45°$) · **9→ $20\sqrt{3}$ ≈ 34.64** ($80\sqrt{3}/4$) · **10→ $15\sqrt{3}$ ≈ 25.98** ($15\cdot\tan 60°$) · **11→ $5\sqrt{3}$ ≈ 8.66** ($10\cdot\sin 60°$) · **12→ $10-10/\sqrt{3}$ ≈ 4.23** ($10-10\cdot\tan 30°$) · **13→ 1** ($(1/\sqrt{3})\cdot\sqrt{3}$) · **14→ 41.7 m** ($40\cdot\tan 45° + 1.7$) · **15→ $8\sqrt{3}$ ≈ 13.86** ($8(\tan 30°+\sec 30°)$).

Quick Revision

- ✓ $\tan\theta$ = height/base. $\tan 30°=1/\sqrt{3}$, $\tan 45°=1$, $\tan 60°=\sqrt{3}$; $\sqrt{3}\approx 1.732$.
- ✓ Depression = elevation. Move toward → subtract cots; between (opp.) → add cots.
- ✓ 45° ⇒ height = distance. 30°→60° walk d ⇒ $h = \sqrt{3}d/2$, remaining = $d/2$.

☆ Look up, look down — solve with tan! ☆