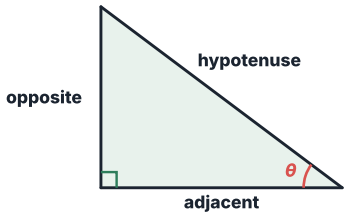
JUNIOR CYCLE MATHS · FREE REVISION SHEET

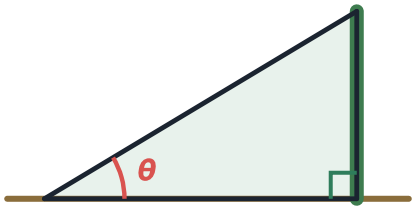
Trigonometry

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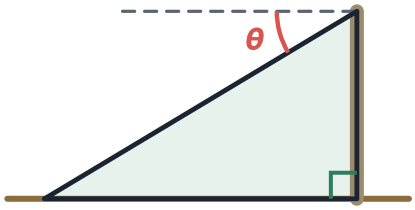
Learning outcomes (2018 specification): GT.4, U.6. Play the game: **leim.ie/clinometer-challenge.html**



Label the sides from the angle θ



Elevation: looking UP from the horizontal



Depression: looking DOWN from the horizontal

1. Name the sides

Hypotenuse: opposite the right angle (longest). **Opposite:** across from θ. **Adjacent:** next to θ. Change the angle and opposite/adjacent swap.

2. SOH CAH TOA

SOH	CAH	TOA
sin θ = O ÷ H	cos θ = A ÷ H	tan θ = O ÷ A

Use the ratio with the side you **have** and the side you **want**. The ratio depends only on the angle, not on the size of the triangle (similar triangles).

3. Finding a side

x on top: ×
$\sin 35° = x \div 12$
$x = 12 \times \sin 35°$
$= 6.9$

x on the bottom: ÷
$\sin 40° = 8 \div x$
$x = 8 \div \sin 40°$
$= 12.4$

An angle: $^{-1}$
$\tan \theta = 5 \div 8$
$\theta = \tan^{-1}(5 \div 8)$
$= 32°$

4. The calculator

Always in **DEG** mode: sin 30° must give 0.5 (−0.988 means RAD). $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$ are on SHIFT. Keep the full value until the last step.

5. Elevation and depression

Both are measured from the **horizontal**. The angle of depression from the top equals the angle of elevation from the bottom (alternate angles). Measured from someone's eyes? Add their **eye height** at the end.

Higher Level: two angles from one point: find both heights, subtract. One ratio from another: tan A = 3/4 → sides 3, 4, 5 (Pythagoras) → sin A = 3/5.

Classic mistakes: RAD mode · labelling from the wrong angle · × when x is on the bottom · sin instead of $\sin^{-1}$ · depression measured from the vertical cliff · rounding too early.

Exam tip: write the ratio with the numbers in it (tan 32° = h ÷ 18) before you press any buttons, then round only at the end and give units.

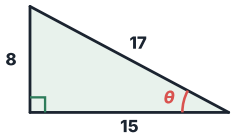
PRACTICE · 30 QUESTIONS · SIDES 1 D.P., ANGLES NEAREST DEGREE

Have a go

↗ Léim

A. Name the sides and the ratios

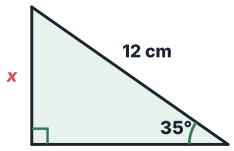
Diagram A



1. Diagram A: which side is opposite θ? _____
2. Diagram A: which side is adjacent to θ? _____
3. Diagram A: write sin θ as a fraction. _____
4. Diagram A: write cos θ as a fraction. _____
5. Diagram A: write tan θ as a fraction. _____
6. sin 40° to 4 d.p. _____
7. tan 72° to 4 d.p. _____

B. Find a side

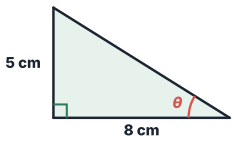
Diagram B



8. Diagram B: find x. _____
9. Hypotenuse 20 cm, angle 50°: find the adjacent side. _____
10. Adjacent 9 m, angle 28°: find the opposite side. _____
11. Opposite 7 cm, angle 41°: find the hypotenuse. _____
12. Adjacent 15 m, angle 58°: find the hypotenuse. _____
13. Opposite 11 cm, angle 33°: find the adjacent side. _____
14. Hypotenuse 8 m, angle 25°. Which finds the opposite side: 8 × sin 25°, 8 ÷ sin 25° or 8 × tan 25°? _____

C. Find an angle

Diagram C



15. Diagram C: find θ. _____
16. Opposite 6 cm, hypotenuse 10 cm: find θ. _____
17. Adjacent 7 m, hypotenuse 12 m: find θ. _____
18. Opposite 9 cm, adjacent 4 cm: find θ. _____
19. $\sin^{-1}(0.45)$ _____
20. $\tan^{-1}(1.8)$ _____
21. cos A = 0.3. Find A to 1 d.p. _____

D. Elevation and depression

22. A tree is 25 m away. The angle of elevation of its top is 38°. How tall is it? _____
23. A kite string is 60 m long and makes 53° with the ground. How high is the kite? _____
24. A 6 m ladder reaches 5.5 m up a wall. Find the angle it makes with the ground. _____
25. From the top of a 45 m lighthouse, the angle of depression of a boat is 18°. How far is the boat from the lighthouse? _____
26. *Higher Level.* From 30 m away, the angles of elevation of the top of a tower and the top of a flagpole on it are 40° and 47°. How tall is the flagpole? _____

Questions 27–30 are on the next page.

EXAM-STYLE · THEN CHECK

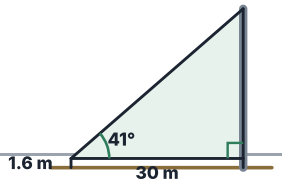
Exam corner + answers

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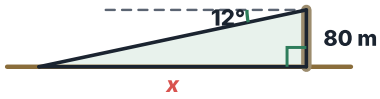
E. Exam-style questions (show your work)

27. **A ramp.** A ramp is 6 m long and makes an angle of 4° with the ground. Find (a) the height it rises and (b) the horizontal distance it covers, both to 2 decimal places.

28. **The clinometer.** Oisín stands 30 m from a building. The angle of elevation of the top is 41° and his eyes are 1.6 m above the ground. (a) Find the height of the building. (b) What is the angle of elevation from 50 m away?



29. **A cliff.** From the top of an 80 m cliff, the angle of depression of a boat is 12°. (a) How far is the boat from the foot of the cliff? (b) How far is it from the top of the cliff in a straight line?



30. **Sides and angles.** Triangle PQR has |∠PQR| = 90°, |PQ| = 9 cm and |PR| = 15 cm. (a) Find |QR|. (b) Write sin ∠QPR as a fraction. (c) Find |∠QPR| to the nearest degree.

Answers

A	1. 8 · 2. 15 · 3. 8/17 · 4. 15/17 · 5. 8/15 · 6. 0.6428 · 7. 3.0777
B	8. 6.9 cm · 9. 12.9 cm · 10. 4.8 m · 11. 10.7 cm · 12. 28.3 m · 13. 16.9 cm · 14. 8 × sin 25°
C	15. 32° · 16. 37° · 17. 54° · 18. 66° · 19. 27° · 20. 61° · 21. 72.5°
D	22. 19.5 m · 23. 47.9 m · 24. 66° · 25. 138.5 m · 26. 7.0 m
E	27. (a) 6 × sin 4° = **0.42 m** (b) 6 × cos 4° = **5.99 m** · 28. (a) 30 × tan 41° = 26.07… + 1.6 = **27.7 m** (b) $\tan^{-1}$(26.07… ÷ 50) = **28°** · 29. (a) 80 ÷ tan 12° = **376.4 m** (b) 80 ÷ sin 12° = **384.8 m** · 30. (a) √($15^2 - 9^2$) = **12 cm** (b) **12/15 = 4/5** (c) $\sin^{-1}$(0.8) = **53°**

Got one wrong? Check DEG mode, then label the sides again from the angle you are using. Then play **Clinometer Challenge** at leim.ie/clinometer-challenge.html: the "Go back over these" list at the end shows the working for each mistake.

All questions written by Léim. Léim is independent and not connected with the State Examinations Commission or the NCCA.