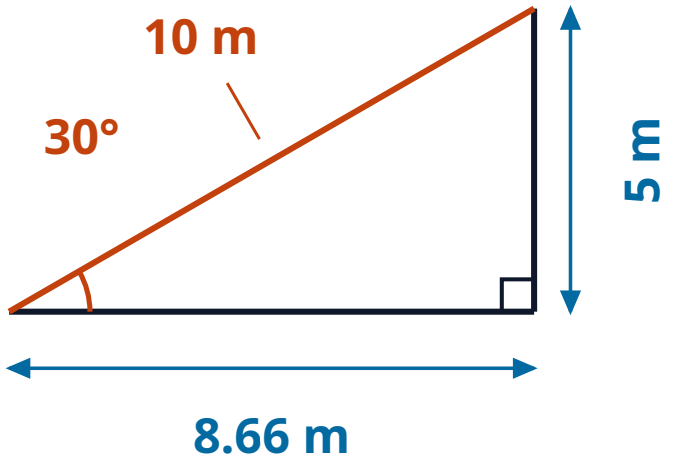
Mathematics 10-3

Unit G: Geometry and trigonometry

Primary trigonometric ratios

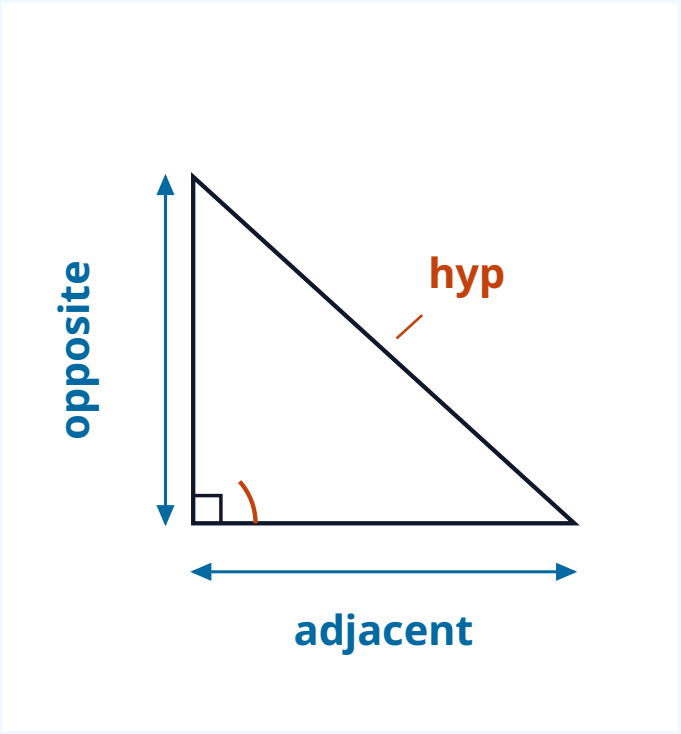
A ladder at 30 degrees

- A 10 metre ladder leans against a wall at 30 degrees to the ground.
- The height it reaches is 5 metres.
- Sine of 30 degrees is 0.5, so height equals 10 times 0.5.
- The same angle on a longer ladder keeps that 0.5 ratio.



Three ratios from similar right triangles

- Opposite means the leg across from the angle.
- Adjacent means the leg beside the angle.
- Hypotenuse means the longest side.
- Tangent equals opposite divided by adjacent.
- Sine equals opposite divided by hypotenuse.
- Cosine equals adjacent divided by hypotenuse.
- For 30 degrees, sine is 0.5, cosine is 0.866, and tangent is 0.577.
- For 45 degrees, sine and cosine are both 0.707 and tangent is 1.



Key terms

opposite

The leg across from the acute angle you are using. (opp)

adjacent

The leg that sits beside the acute angle and forms that angle with the hypotenuse. (adj)

sine

The ratio of the opposite leg to the hypotenuse for a fixed acute angle. (sin = opp/hyp)

cosine

The ratio of the adjacent leg to the hypotenuse for a fixed acute angle. (cos = adj/hyp)

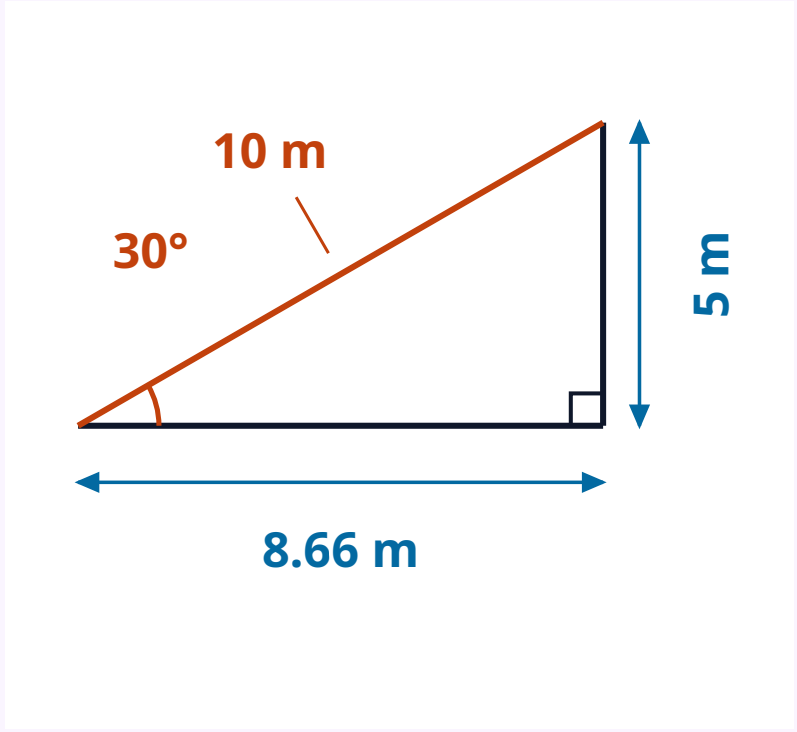
Key terms

tangent

The ratio of the opposite leg to the adjacent leg for a fixed acute angle. (tan = opp/adj)

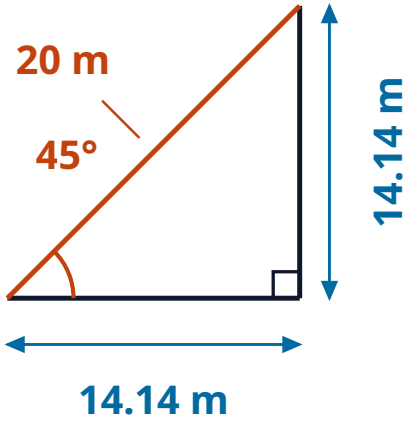
Height and base of the 10 metre ladder

- The height is opposite the 30 degree ground angle, so height equals hypotenuse times sine.
- Height equals 10 times 0.5, which is 5 metres.
- The base is adjacent, so base equals 10 times cosine of 30 degrees.
- That is 10 times 0.866, which is 8.66 metres.



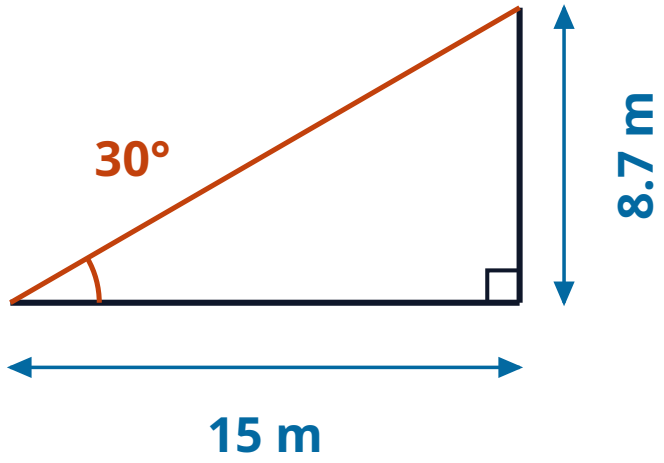
A 20 metre ladder at 45 degrees

- At 45 degrees, sine and cosine are both 0.707, and the two legs match.
- Height equals 20 times 0.707, which is 14.14 metres.
- The base equals 20 times 0.707 as well, so the base is also 14.14 metres.



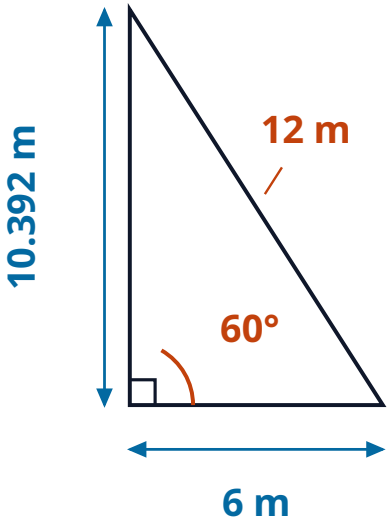
A pole from the ground

- You stand 15 metres from a pole.
- The angle of elevation to the top is 30 degrees.
- The 15 metre ground distance is the adjacent side.
- The pole height is the opposite side.
- Height equals 15 times tangent of 30 degrees.
- Tangent of 30 is 0.577, so 15 times 0.577 equals 8.655 metres, about 8.7 metres.



A 12 metre hypotenuse at 60 degrees

- Sine of 60 degrees is 0.866 and cosine of 60 degrees is 0.5.
- The opposite side equals 12 times 0.866, which is 10.392 metres.
- The adjacent side equals 12 times 0.5, which is 6 metres.
- A sensible check is that both legs are shorter than the 12 metre hypotenuse.



Ratio check

- Find the wall height for a 10 metre ladder at 30 degrees to the ground.
- Find the pole height when you stand 15 metres away at an elevation of 30 degrees.
- Use tangent 0.577.

