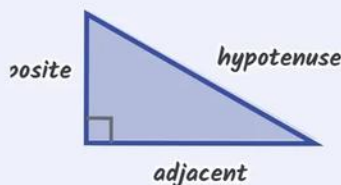


the first meeting with the ratios: naming the sides, the standard angles, and one identity

Naming the three sides *

- the ratios are defined only in a right angled triangle, and only for one of its two acute angles
- the hypotenuse is the side opposite the right angle. It is the longest side and never changes, whichever acute angle is chosen
- the opposite side is the one facing the chosen angle, not touching it at all
- the adjacent side is the one touching the chosen angle that is not the hypotenuse
- switch to the other acute angle and opposite and adjacent trade places, while the hypotenuse stays put
- so the very first step in any question is to mark the angle you are working with



the three sides labelled from the point of view of the marked acute angle: the hypotenuse faces the right angle, the opposite side faces the marked angle, and the adjacent side is the remaining one touching it

The six ratios *

sine	$\sin\theta = \frac{\text{opp}}{\text{hyp}}$
cosine	$\cos\theta = \frac{\text{adj}}{\text{hyp}}$
tangent	$\tan\theta = \frac{\text{opp}}{\text{adj}}$
cosecant, reciprocal of sine	$\csc\theta = \frac{\text{hyp}}{\text{opp}}$
secant, reciprocal of cosine	$\sec\theta = \frac{\text{hyp}}{\text{adj}}$
cotangent, reciprocal of tangent	$\cot\theta = \frac{\text{adj}}{\text{opp}}$

the three on the right are simply the three on the left turned upside down. Notice that sine pairs with cosecant and cosine with secant, which is the opposite of what the names suggest

Why the ratios depend only on the angle

- take two right triangles with the same acute angle but different sizes
- they have two equal angles apiece, the right angle and that acute angle, so they are similar
- in similar triangles corresponding sides are in the same ratio
- so the ratio of opposite to hypotenuse is identical in both, however large or small each triangle is
- that is why $\sin 30^\circ$ has one fixed value rather than depending on which triangle it is measured in
- it also means the ratios have no units, being lengths divided by lengths