LEARNER GUIDE

The constant ratio

Introduction to Trigonometry. A short guide to walk beside you — read as much or as little as helps. *Connection before curriculum. Always.*

What this lesson is about

This is the first lesson of trigonometry, and it begins with a single surprising fact. If you take a right-angled triangle and enlarge it — multiply every side length by the same scale factor — the sides all change, but the angle stays the same and so does the ratio of any two sides. In this lesson you compare the vertical side with the horizontal side and watch the ratio vertical ÷ horizontal stay perfectly still as you scale the triangle up and down. You see that same-angle right-angled triangles are similar, meet the idea that this fixed ratio belongs to the angle, and even use a known ratio to find a side you cannot measure. The question you are exploring is: why does the ratio of two sides stay the same when only the size changes?

What you are learning to notice

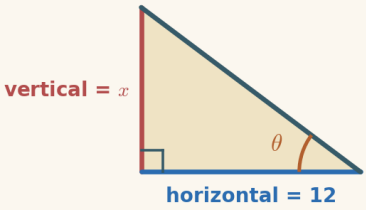
- That enlarging a right-angled triangle by a scale factor changes every side length but not the angle.
- That the ratio vertical ÷ horizontal stays the same however big or small you draw the triangle.
- That two right-angled triangles are similar when their corresponding angles are equal and their corresponding sides are in the same ratio.
- That this fixed ratio belongs to the angle, not to the size — and that a known ratio lets you find a missing side.

Moving through it, one step at a time

In Ratio Locks, drag the scale-factor slider to enlarge and shrink a right-angled triangle; watch the vertical, horizontal and hypotenuse lengths change while the ratio vertical ÷ horizontal locks at one value. In Stack the similar triangles, build a family of similar triangles and check that every one gives the same ratio. In Similar or not?, compare two triangles' ratios to decide whether they are similar. Then, in Find the hidden length, use a known ratio and one side to work out a side you were not given. There is no rush; use the square grid on the Scratchpad to draw two similar triangles and check the ratio for yourself.

Worked examples

Two full examples to follow. Read them slowly — the aim is to see how each line follows from the one before, not to memorise a rule. It can help to cover the steps and predict the next line before you reveal it.

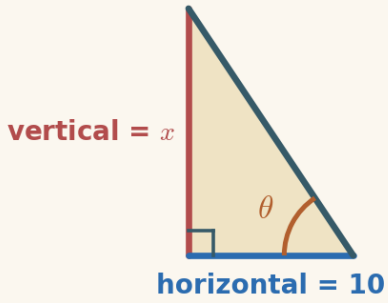


Example 1 — finding a hidden length

Two triangles are the same shape (similar), so they share the same ratio. The first has vertical 3 and horizontal 4. The second has horizontal 12 — find its vertical.

1. the shape's ratio is vertical ÷ horizontal	$\frac{3}{4} = 0.75$
2. same shape, so its ratio is 0.75 too	$\frac{x}{12} = 0.75$
3. rearrange (x is on top, so multiply)	$x = 12 \times 0.75$
4. work it out	$x = 9$

$x = 9$



Example 2 — a steeper shape

A steeper shape has the ratio vertical ÷ horizontal = 1.5 (for example, vertical 6 and horizontal 4). Another triangle of the same shape has horizontal 10 — find its vertical.

1. the shape's ratio is vertical ÷ horizontal	$\frac{6}{4} = 1.5$
2. same shape, so its ratio is 1.5 too	$\frac{x}{10} = 1.5$
3. rearrange (x is on top, so multiply)	$x = 10 \times 1.5$
4. work it out	$x = 15$

$x = 15$

A gentle reminder

You can pause. You can return. You do not need to complete everything in one sitting.

If you get stuck

Getting stuck is part of doing mathematics, not a sign that something is wrong. There is support built into the lesson, and using it is a strong move:

- **Reconnection Routes** — if an earlier idea feels shaky (right-angled triangles and the hypotenuse (from the Pythagoras unit), a ratio written as a division (a ÷ b), and the idea of similar

shapes (an enlargement by a scale factor)), open a short recap and return whenever you are ready.

- **Socratic prompt** — a question to nudge your thinking.
- **Hint** — a little more help with the step in front of you.
- **Check** — try an answer and see how you are doing; a wrong try is useful information.
- **Worked solution** — a full model to compare your thinking against.

How the worked solution unlocks

The worked solution unlocks after you use the Socratic prompt, use the hint, and check two answers. Those steps are the learning — the worked solution is there to confirm your thinking, not to replace it.

Using support is part of learning. It is not cheating.

Recording your thinking

You can show your working in whatever way suits you today — the on-screen Scratchpad, paper, a spoken explanation, or a photo of a sketch. There is no single right format. If you do not finish everything in one sitting, that is completely fine: what you have done is information for your next step, never a failure.

Before you begin

Settle into a comfortable pace and take the steps one at a time. If your attention drifts, pause and come back — the lesson will keep your place. When you are ready, begin.

NEO by Nudge Education · nudgeeducation.online · Curriculum by Gerry Docherty. Learner Guide v0.1.