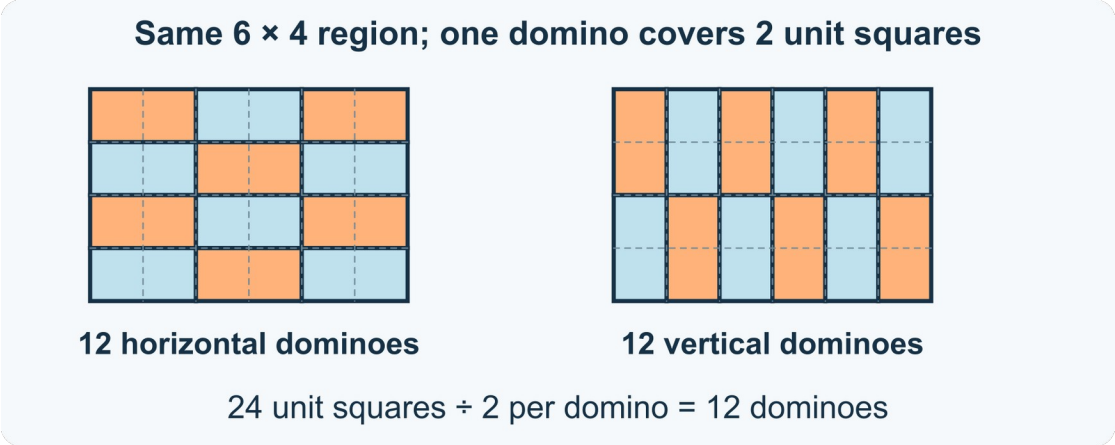
A tiling pattern with a rule

How can a repeated shape cover a region without gaps or overlaps?

Cover a small drawn region with repeated two-square tiles, then explain why a count alone is not a complete proof.

Make | 15–25 minutes, or one row | Paper and a pencil or pen, Optional squared paper or ruler; a rough labelled grid is enough

Start here Draw a rectangle with 6 equal columns and 4 equal rows. One little square is one unit of area. Your tile is a domino covering two neighbouring squares.



Two arrangements, the same covered region

1 State the rule

Use whole dominoes only. Each must cover exactly two side-by-side unit squares. Tiles may turn, but cannot overlap, cross the boundary or leave gaps.

2 Make a complete arrangement

Draw three horizontal dominoes across each row. Repeat that row four times. Trace the outline of each tile so the unit grid does not hide where one tile ends.

3 Check placement and count

Check every one of the 24 unit squares belongs to exactly one tile. Four rows with three dominoes give 12 tiles; 12 × 2 = 24 unit squares.

4 Try another arrangement

Turn all dominoes vertically. Each column now has two dominoes, and six columns still use 12. Describe the changed placement and unchanged coverage, or keep just the first arrangement.

Constructed example two ways to cover 24 squares

These are original drawn arrangements, not a record of a real tiled floor.

• Horizontal: 3 dominoes per row × 4 rows = 12 dominoes.

• Vertical: 2 dominoes per column × 6 columns = 12 dominoes.

• Both cover 12 × 2 = 24 unit squares without cutting tiles. The drawn placement, as well as the area count, checks this region.

What this example can show Matching total area is necessary here, but does not by itself prove that any other board can be tiled. The shape and placement also matter.

A different way

Use the supplied arrangement and point to one row, dictate where a tile goes, or trace only a 2-by-2 corner. No cutting or coloured pens are needed.

If you want to go further

Cross out just one unit square on a copy. There are now 23 squares. Explain why whole two-square dominoes cannot cover an odd number of squares; do not claim this rules out every other altered board.

Something to notice

Did I check the actual placement as well as the total area?

Read or explore more

Horizon topic Tessellations

https://launchhorizonhq.com/learn/tessellations/

Horizon topic Geometry Symmetry

https://launchhorizonhq.com/learn/geometry-symmetry/

Horizon topic Mathematics

https://launchhorizonhq.com/learn/mathematics/

NRICH, University of Cambridge Tiling

https://nrich.maths.org/problems/tiling

NRICH, University of Cambridge Tessellating Triangles

https://nrich.maths.org/problems/tessellating-triangles

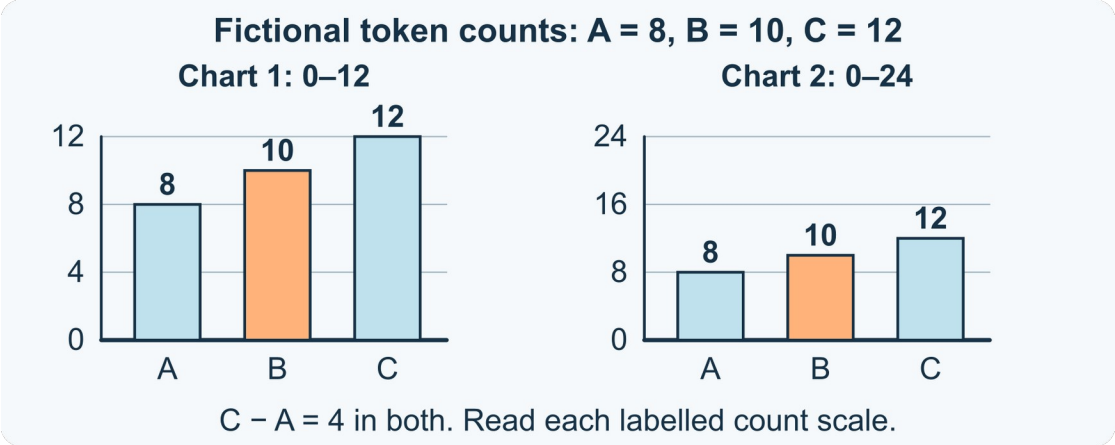
Two charts from the same invented table

Which display choices change an impression without changing the values?

Display the same fictional token counts with two labelled scales, and separate a visual impression from a numerical difference.

Investigate | 15-25 minutes, or one comparison | Paper and a pen or pencil, The supplied invented counts; no survey or spreadsheet needed

Start here Write this fictional table: token type A = 8, B = 10, C = 12. These are invented token counts, not responses from people.



Same counts, two zero-based scales

1 Make the first display

Draw a bar chart with three equal-width bars labelled A, B and C. Use equally spaced marks 0, 4, 8 and 12 on the count axis; all bars begin at zero.

2 Change only the scale range

Draw the same-size plotting area again. Use marks 0, 8, 16 and 24, still equally spaced and starting at zero. Plot the same three counts, keeping labels, bar widths and order unchanged.

3 Read values before impressions

Read each bar against its own scale. C exceeds A by 12 - 8 = 4 tokens in both charts. C is 12 ÷ 8 = 1.5 times A, regardless of the changed display range.

4 Choose and explain

Say which chart makes the values easier to read for your purpose, and why. A bar looks half as tall on the second scale, but its labelled count has not halved. Keep both scales visible.

Invented table 8 10 and 12

This original comparison uses the same fictional data twice. Both count axes begin at zero; neither chart reports a survey.

• Chart 1 ranges from 0 to 12; chart 2 from 0 to 24 in an equally tall plotting area.

• The bars in chart 2 are half the drawn height of the corresponding bars in chart 1. Both still represent A = 8, B = 10, C = 12.

• The total is 30 tokens, and C − A = 4 tokens on either chart.

What this example can show Different scales can change an impression. These diagrams do not establish what every viewer notices, or make an unlabelled or cut-off bar axis acceptable.

A different way

Use the two supplied charts, read the numbers aloud or compare only A and C. No personal data, software or drawing accuracy test is needed.

If you want to go further

Keep one zero-based scale and reverse the category order in a third chart. Explain how order changes the reading sequence while the values and total remain 8, 10, 12 and 30.

Something to notice

Did I read the axis before judging the size of the difference?

Read or explore more

Horizon topic Statistics Data

https://launchhorizonhq.com/learn/statistics-data/

Horizon topic Coordinates Graphs

https://launchhorizonhq.com/learn/coordinates-graphs/

Horizon topic Mathematics

https://launchhorizonhq.com/learn/mathematics/

Office for National Statistics Chart details: Axes and gridlines

https://service-manual.ons.gov.uk/data-visualisation/guidance/axes-and-gridlines

Oak National Academy Securing constructing bar charts by hand

https://www.thenational.academy/teachers/programmes/maths-secondary-ks3/units/graphical-representations-of-data/lessons/securing-constructing-bar-charts-by-hand

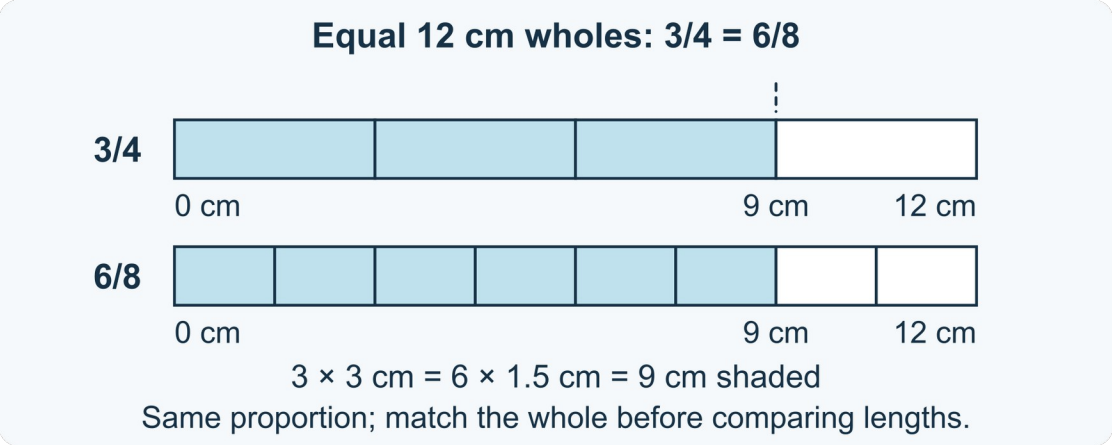
Show one fraction two ways

What must stay the same for two fraction pictures to be equivalent?

Shade equivalent fractions on equal-length strips and explain the difference between an equal proportion and an equal physical amount.

Make | 15–25 minutes, or one strip comparison | Paper and a pencil or pen, Optional ruler; use the labelled supplied strips if measuring is inconvenient

Start here Draw two equally long strips and label each whole as 12 cm. Divide strip A into four equal parts and strip B into eight equal parts.



One 12 cm whole: 3/4 = 6/8

1 Choose one whole

Keep the whole lengths identical for this direct length comparison. The parts inside each strip must be equal to one another; quarters and eighths do not have the same part length.

2 Shade the same proportion

Shade three parts of A and six parts of B. A quarter of 12 cm is 3 cm, so three quarters cover 9 cm. An eighth is 1.5 cm, so six eighths also cover 9 cm.

3 Explain the equivalence

Write 3/4 = 6/8. Multiplying both numerator and denominator by 2 gives the same proportion. The numerator counts shaded parts; the denominator counts equal parts in one whole.

4 Check what the picture proves

Compare the shaded endpoints, or use the labels to explain their match. If a new whole were only 8 cm long, three quarters would cover 6 cm: still the fraction 3/4, but a different length.

Original strip model of equivalent fractions

The supplied strips are a constructed model. Both represent a whole length of 12 cm; they are not measurements from a real object.

• A: 12 ÷ 4 = 3 cm per quarter; 3 × 3 = 9 cm shaded.

• B: 12 ÷ 8 = 1.5 cm per eighth; 6 × 1.5 = 9 cm shaded.

• Both shade 9/12 of the same whole, which is 3/4 = 6/8.

What this example can show Equivalent fractions name the same proportion even when used with different-sized wholes. Equal shaded lengths are evidence only when the whole lengths are comparable; unequal parts would make these particular fraction labels unreliable.

A different way

Point to the supplied shaded endpoints, dictate a label or use a folded-paper sketch without measuring. A spoken explanation is enough.

If you want to go further

Use the same 12 cm whole to show 1/3 = 2/6. Calculate the shaded length as 4 cm in both cases, then explain why unequal whole lengths would change the amount.

Something to notice

Have I kept the proportion separate from the size of the whole?

Read or explore more

Horizon topic Fractions Equivalence

https://launchhorizonhq.com/learn/fractions-equivalence/

Horizon topic Ratios Proportion

https://launchhorizonhq.com/learn/ratios-proportion/

Horizon topic Area Perimeter

https://launchhorizonhq.com/learn/area-perimeter/

NRICH, University of Cambridge Fractional Wall

https://nrich.maths.org/problems/fractional-wall

The Open University, OpenLearn Teaching mathematics: The fraction wall

https://www.open.edu/openlearn/mod/oucontent/view.php?id=82589&section=1.1.1