FIBO / MATH · UNIT 4 · RATIOS, PROPORTIONS & CHANCE

Solving Proportions — Lecture

A proportion says two ratios are equal. If you know three of the four numbers, the fourth is forced — and cross-multiplication finds it. Scale recipes, read maps, and convert units without guessing.

BY THE END OF THIS LESSON, YOU WILL BE ABLE TO

- ✓ Recognize a proportion and test one with the cross-product check
- ✓ Solve for a missing term — in the numerator or the denominator
- ✓ Set up and solve real map, recipe, and scale problems

⏱ About 30 min · Needs: ratios, equations · Unit 4 · Ratios, Proportions & Chance

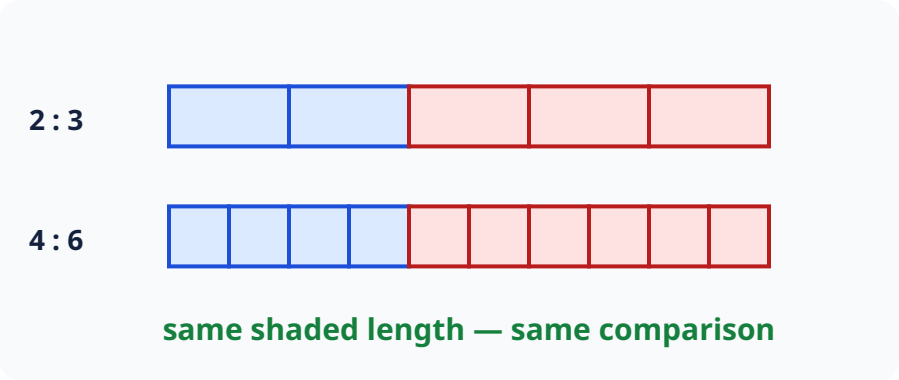
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Printable companion to the interactive lesson at fibotutors.com — full color. Worked examples and application solutions are shown in full; Try-It answers live in the separate Answer Key.

CONCEPTS

The Big Picture

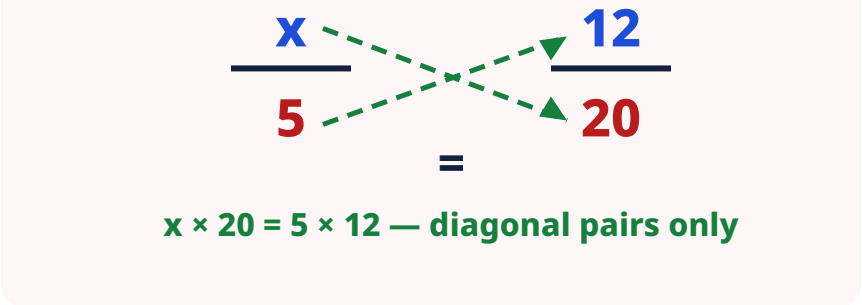
A proportion is a statement that two ratios are equal. 2 : 3 and 4 : 6 name the same comparison — the second is just the first scaled up by 2.



Both bars span the same total length: 2 : 3 and 4 : 6 are the same proportion.

Every proportion hides an equation. If three numbers are known, the fourth is forced — cross-multiplication is the move that finds it.

For $\frac{a}{b} = \frac{c}{d}$: multiply diagonally to get a × d = b × c, then solve.



The green X connects the pairs. Diagonal products that match mean a true proportion — and when one value is x, the equation solves it.

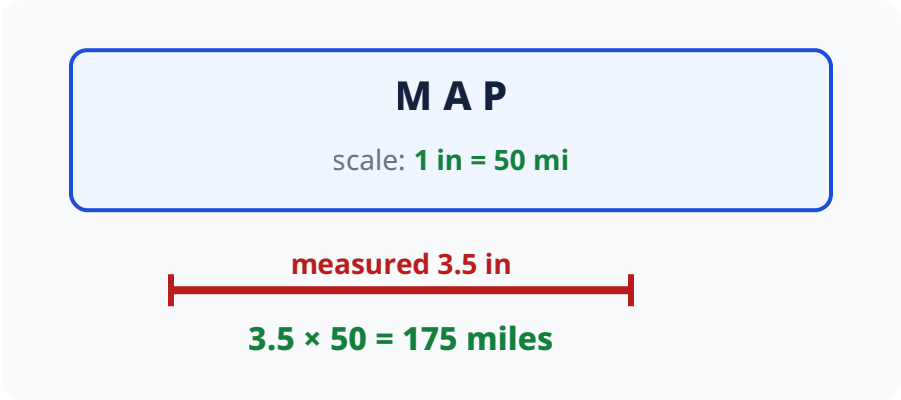
Three steps, every time: Step 1 cross-multiply · Step 2 solve the one-step equation · Step 3 check by plugging back in.

REAL LIFE FIRST

Math in the Wild

REAL LIFE FIRST

📷 **Picture this: an open road atlas or phone map showing the scale bar**



Set up inches over miles on both sides — $\frac{1}{50} = \frac{3.5}{x}$ — and cross-multiply.

Where you already meet proportions: map scales, recipe scaling, unit conversion, scale models. One rule rules them all: the units must sit in the *same position* on both sides, or the answer is fiction.

WORKED EXAMPLES

See Every Step

Example 1 — Basic: x in the numerator

Solve $\frac{x}{5} = \frac{12}{20}$.

Step 1 Cross-multiply the diagonal pairs: x × 20 = 5 × 12.

Step 2 Simplify: 20x = 60, so x = 60 ÷ 20 = **3**.

Step 3 Check: $\frac{3}{5}$ and $\frac{12}{20}$ both equal 0.6. ✓

x = 3

→ The unknown was on top — the diagonal still paired it with 20.

✏️ Workspace — rework this example

✏️ Try It 1 — your turn

Solve $\frac{y}{7} = \frac{4}{28}$.

(Answer in the separate Answer Key — try it on your own first!)

✏️ Workspace — solve the Try-It here

Example 2 — x in the denominator

Solve $\frac{3}{7} = \frac{9}{x}$.

Step 1 Cross-multiply: $3 \times x = 7 \times 9$.

Step 2 Simplify: $3x = 63$, so $x = 63 \div 3 = 21$.

Step 3 Check: $\frac{9}{21}$ simplifies (÷3) to $\frac{3}{7}$. ✓

x = 21

→ Denominator or numerator — the move is identical.

✏️ Workspace — rework this example

✏️ Try It 2 — your turn

Solve $\frac{5}{12} = \frac{15}{z}$.

(Answer in the separate Answer Key — try it on your own first!)

✏️ Workspace — solve the Try-It here

Example 3 — Word problem: eggs and pancakes

2 eggs make 3 pancakes. With 12 eggs, how many pancakes can you make?

Step 1 Set up eggs over pancakes on both sides: $\frac{2}{3} = \frac{12}{p}$.

Step 2 Cross-multiply: $2 \times p = 3 \times 12$, so $2p = 36$.

Step 3 Solve: $p = 36 \div 2 = 18$.

p = 18 pancakes

→ Sanity check: 12 eggs is 6 times as many as 2 — and 18 is 6 times 3. The scaling agrees.

✏️ Workspace — rework this example

✏️ Try It 3 — your turn

4 cups of flour make 10 cookies. How many cups for 25 cookies?

(Answer in the separate Answer Key — try it on your own first!)

✏️ Workspace — solve the Try-It here

Example 4 — A non-integer answer

Solve $\frac{4}{9} = \frac{2}{x}$.

Step 1 Cross-multiply: $4 \times x = 9 \times 2$.

Step 2 Simplify: $4x = 18$, so $x = 18 \div 4 = \frac{9}{2} = 4.5$.

Step 3 Check: $2 \div 4.5 = 0.444\ldots$, and $4 \div 9 = 0.444\ldots$. ✓

x = 4.5

→ Proportions are allowed to give decimals and fractions — the move does not care.

✏️ Workspace — rework this example

✏️ Try It 4 — your turn

Solve $\frac{3}{8} = \frac{w}{24}$.

(Answer in the separate Answer Key — try it on your own first!)

✏️ Workspace — solve the Try-It here

USE IT FOR REAL

Application Problems

USE IT FOR REAL

App 1 — Reading the map

A map scale says 1 inch = 50 miles. You measure 3.5 inches between two cities. How far apart are they really?

$$\frac{1\text{ in}}{50\text{ mi}} = \frac{3.5\text{ in}}{x\text{ mi}}$$

inches over miles — same order both sides

Inches sit on top on both sides. That placement is the whole problem.

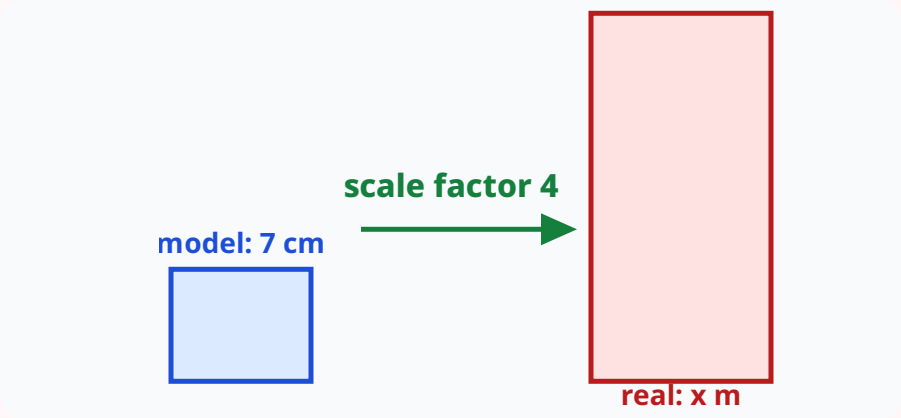
Solution. **Step 1** Set up: $\frac{1}{50} = \frac{3.5}{x}$ (inches over miles, both sides).

Step 2 Cross-multiply: $1 \times x = 50 \times 3.5$, so $x = 175$ miles.

✏️ Workspace — solve it your way first, then compare

App 2 — The scale model

An architect's model uses the scale 1 cm = 4 m. The model of a tower is 7 cm tall. How tall is the real tower?



The real tower is 4 times the model in every direction — the model stands 7 cm, the tower stands 28 m.

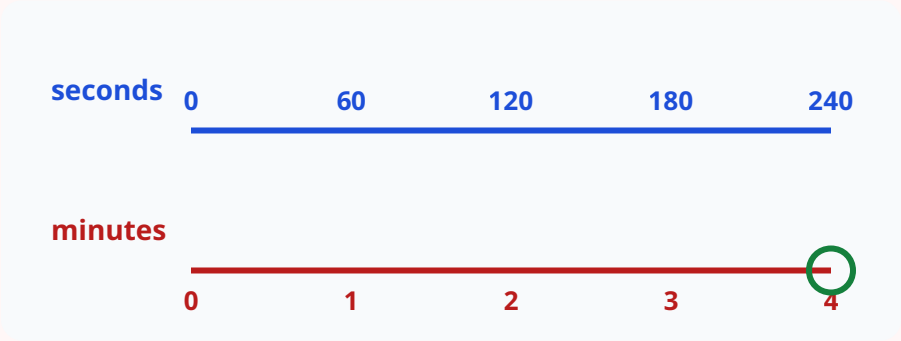
Solution. **Step 1** Set up: $\frac{1}{4} = \frac{7}{x}$ (cm over m, both sides).

Step 2 Cross-multiply: $1 \times x = 4 \times 7$, so $x = 28$ meters.

✏️ Workspace — solve it your way first, then compare

App 3 — Converting seconds to minutes

A song lasts 240 seconds. How many minutes is that?



240 seconds sits above 4 on the minutes line — a proportion in disguise.

Solution. **Step 1** Set up: $\frac{60}{1} = \frac{240}{m}$ (seconds over minutes).

Step 2 Cross-multiply: $60 \times m = 1 \times 240$, so $m = 240 \div 60 = 4$ minutes.

✏️ Workspace — solve it your way first, then compare

KEEP FOREVER

Key Points — Cheat Sheet

- Proportion: a/b = c/d — two equal ratios
- Cross-multiply diagonals only: a × d = b × c, then solve
- Finish the one-step equation — divide, do not stop at 20x = 60
- Units in the same position on both sides, always
- Check by plugging back: both fractions must name the same number
- Scaling view: find the factor on the known side, apply it to the other