Roots of Reason

What Is a Ratio?

A ratio **compares two quantities**.

3 cups of blue paint, 2 cups of yellow paint

for every 3 blues, there are 2 yellows.

three ways to write it

3 : 2	3 to 2	$\frac{3}{2}$
with a colon	*in words*	*as a fraction*

P **Part to part**

blue to yellow = 3 : 2

compares one part with another part

W **Part to whole**

blue to all paint = 3 : 5

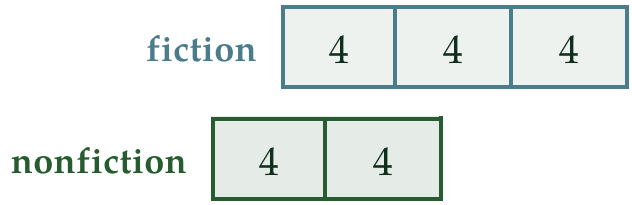
compares one part with the total

Order matters. Blue to yellow is 3 : 2. Yellow to blue is 2 : 3.

Roots of Reason

Tape Diagrams

Fiction to nonfiction books is 3 : 2. There are 20 books. How many are fiction?



5 boxes share 20 books, so each box holds 4.

1 Draw one box per part

3 : 2 means 3 boxes for fiction, 2 boxes for nonfiction. All boxes are the same size.

2 Find one box's value

20 ÷ 5 boxes = 4 each

3 Count your boxes

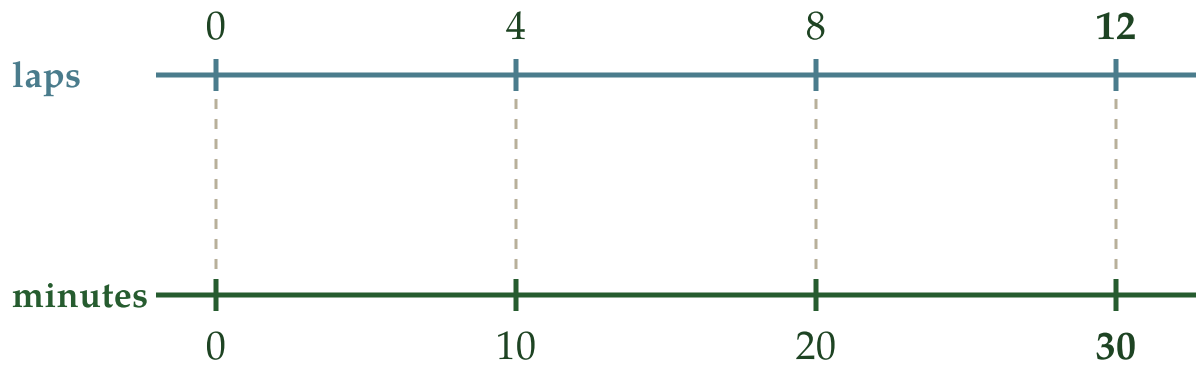
3 × 4 = **12 fiction**

Every box holds the **same amount**. That is the whole trick.

Roots of Reason

Double Number Lines

Mia swims 4 laps every 10 minutes. How many laps in 30 minutes?



the pair 4 and 10 repeats: +4 laps for every +10 minutes.

1 Zeros line up

Both lines start at 0. Each tick above sits exactly over its partner below.

2 Move together

Whatever you do to one line, do to the other. Doubling 10 minutes doubles 4 laps.

3 Read the answer

30 min sits under **12 laps**

A double number line keeps two quantities **locked in step**.

Roots of Reason

Ratio Tables

A recipe uses 2 cups of flour for every 3 cups of milk.

flour	2	4	6	20
milk	3	6	9	30
	× 2	× 3	× 10	

multiply BOTH rows by the same number. always both.

✓ Same ratio, new numbers

2 : 3, 4 : 6, and 20 : 30 all describe the same recipe. Bigger batch, same taste.

✗ Never add across

Adding 1 to both sides gives 3 : 4. That is a different recipe. Ratios grow by multiplying.

A ratio table is a list of **equivalent ratios**. Every column tells the same story.

Roots of Reason

Unit Rate

A unit rate is a ratio scaled down until one side is **1**.

$12	for	4 pounds
÷ 4		÷ 4
$3	for	1 pound

"per" means for each 1. apples cost $3 per pound.

$ Unit price

$12 for 4 lb → $3 per lb

$10 for 5 lb → $2 per lb

now you can compare deals

→ Speed

120 miles in 2 hours

120 ÷ 2 = **60 miles per hour**

a rate of distance for each 1 hour

Divide both sides by the same number until one side reads **1**. What remains is the rate.