Understanding Scaling and Comparing

How students move from adding to scaling, and how to help them see it.

Three Guiding Questions

Use these to frame a planning conversation or a classroom visit. Work them before the Insight or the video, then return to them afterward.

1. When your students enlarge a shape, double a recipe, or extend a ratio, are they adding the same amount to each quantity, or scaling both by the same factor?

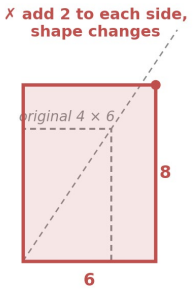
2. Does the student track the factor that links two quantities, how many times as much, or the difference between them, how many more?

3. Can the student hold a ratio as one unit and scale it up and down on a ratio table and a double number line, rather than reading it as two separate numbers?

Before and After: From Adding to Scaling

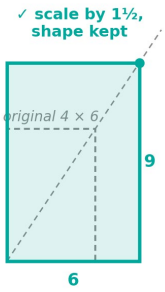
The same task can be read two ways. The additive reader adds the same amount to each quantity; the multiplicative reader scales both by the same factor. Enlarging a 4-by-6 rectangle so its width becomes 6 shows the difference. Watch whether the far corner stays on the original diagonal.

BEFORE · Adding



Adding 2 to each side changes the shape (6 × 8). The corner leaves the diagonal.

AFTER · Scaling



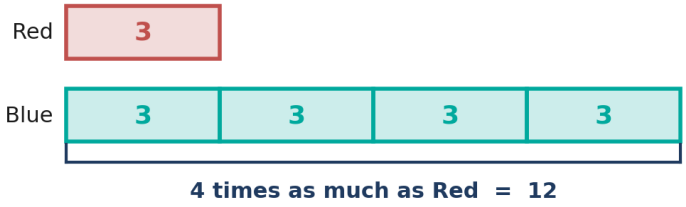
Scaling every side by 1½ keeps the shape (6 × 9). The corner stays on the diagonal.

Takeaway: adding preserves the difference and distorts the figure; scaling preserves the factor and keeps the figure, the taste, or the rate the same.

Worked Examples: Visual Models and the Language to Use

Each example pairs a model students can reason on with the language that makes the multiplicative relationship explicit. Keep the model in view and let the words name what the model shows.

1. Multiplicative Comparison

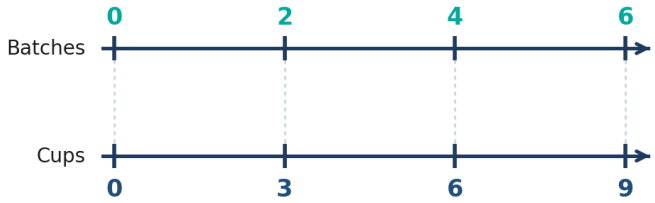


Blue is 4 times as much as Red, not 9 more.

Language to use:

- "How many times as much is Blue as Red?"
- "Blue is four times as much as Red."
- Ask "how many times as much," not "how many more."

2. Scaling a Recipe: the Double Number Line

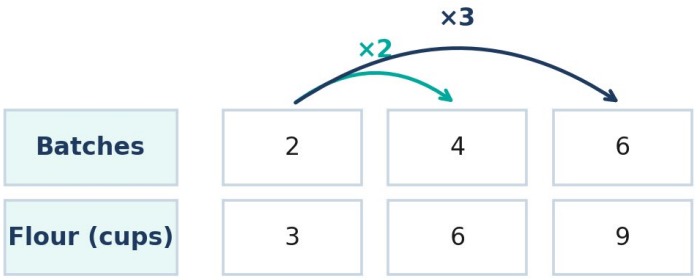


Batches and cups scale together along parallel lines. Build the visual model first.

Language to use:

- "As the batches double, what happens to the cups?"
- "Both quantities scale by the same factor, so the recipe stays the same."

3. The Same Recipe: the Ratio Table

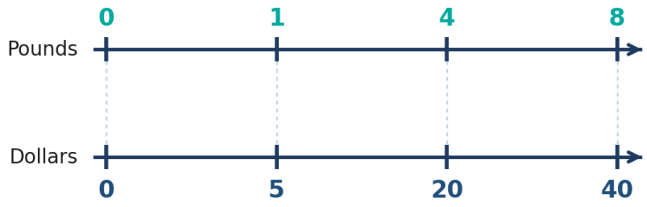


The same relationship, now written symbolically. Scale both rows by the same factor.

Language to use:

- "Three cups for two batches. How do we reach six batches?"
- "Scale both rows by the same factor."
- "What does one batch give you?"

4. Rate and the Unit Rate

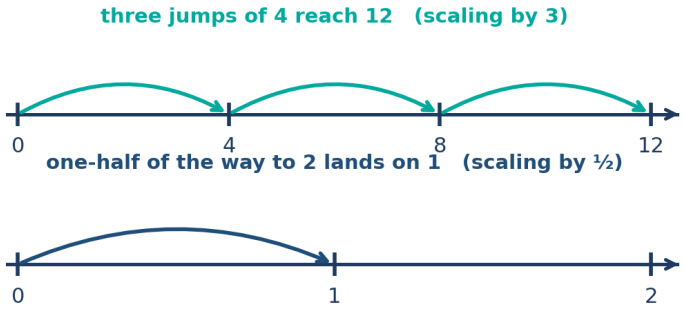


Find the value of one pound, then scale.

Language to use:

- "What does one pound cost?"
- "Now scale to four pounds, then to eight."
- "Treat the rate as one relationship, not two loose numbers."

5. The Number Line as a Scaling Model



Scaling by a whole number repeats a jump; a fraction is a jump of less than one.

Language to use:

- "Three jumps of four reach twelve. That is scaling by three."
- "One-half of the way to two lands on one. That is scaling by one-half."

The Language Shift

Small changes in what you say move students from the difference to the factor.

Instead of	Say
"How many more?"	"How many times as much?"
"Add the same to each side."	"Scale every side by the same factor."
"A 3 and a 4."	"A ratio of 3 to 4, one relationship."
"Cross multiply."	"Build it up on a ratio table, then check."
"Multiplying makes it bigger."	"A factor less than one makes it smaller."

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