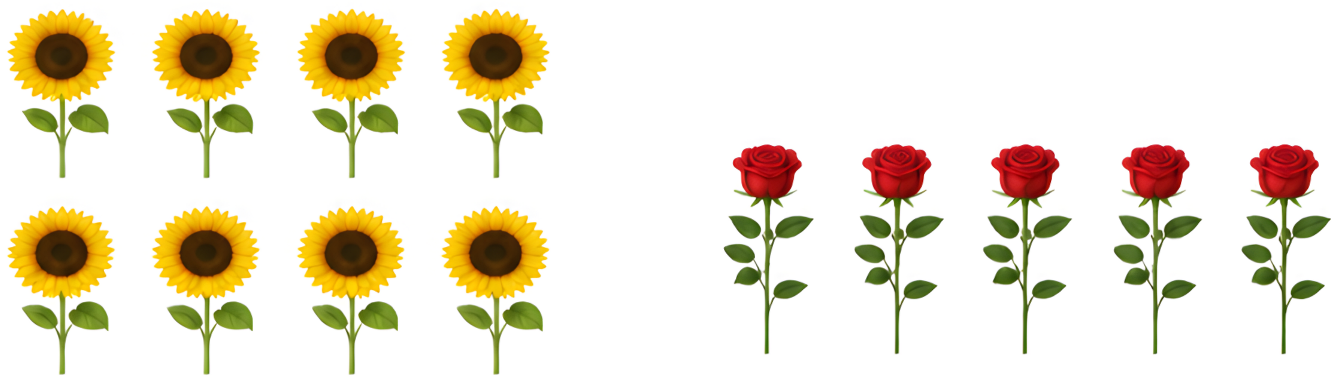
Understanding Ratios

Have you ever compared two things side by side? Maybe you noticed that for every 2 slices of pizza you eat, your friend eats 3. Or that a recipe calls for 2 cups of flour for every 1 cup of sugar. These everyday comparisons are the foundation of one of the most powerful tools in mathematics: the ratio.

A ratio is a way of expressing how two quantities relate to each other. Ratios appear everywhere in daily life — in cooking, sports statistics, map scales, and even in the colors mixed to paint a wall. Learning to recognize and write ratios gives you a precise mathematical language to describe the world around you.

In this lesson, you will explore what ratios mean, how to write them in different ways, and how to use ratio language to describe real situations clearly and accurately.



The Challenge:

A school garden has 8 sunflowers and 5 roses.

A student says: “There are more sunflowers than roses.”

Her classmate says: “For every 8 sunflowers, there are 5 roses.”

Which statement gives more mathematical information — and why does that difference matter?

Discovering the Rule

Let us start by looking at a simple, familiar situation to understand what a ratio really means.

Imagine a fruit bowl with **4 apples** and **6 oranges**.
We want to describe the relationship between the number of apples and the number of oranges. Instead of just saying "there are more oranges," mathematics gives us a precise way to express this comparison.

Step 1 — Identify the two quantities being compared:

- Quantity A: **4 apples**
- Quantity B: **6 oranges**

Step 2 — Ask the comparison question:

"For every **4 apples**, how many oranges are there?"
The answer: **6 oranges**.

Step 3 — Express the relationship:

We can write this comparison as:

4 to 6 OR **4 : 6** OR $\frac{4}{6}$

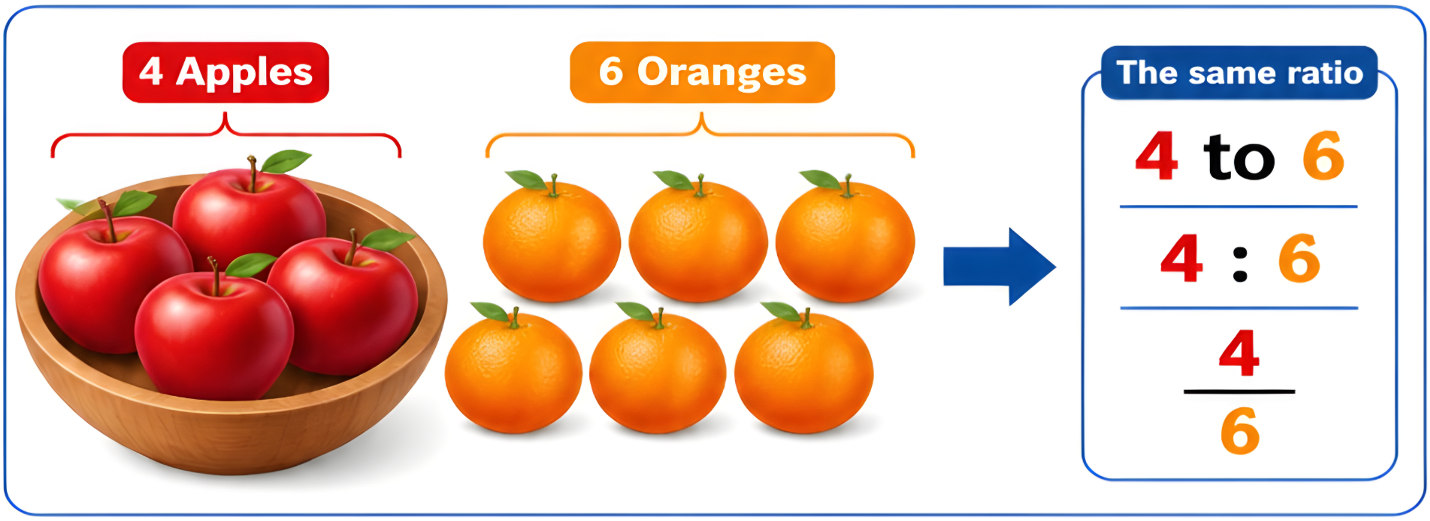
All three forms say exactly the same thing: for every **4 apples**, there are **6 oranges**.

Step 4 — Notice what the ratio tells us:

The ratio **4** to **6** shows proportion, not just difference. It tells us the relative size of one quantity compared to the other — not simply that there are 2 more oranges, but that the quantities relate in a 4-to-6 pattern.

Step 5 — Reverse the ratio:

The ratio of oranges to apples would be written as **6** to **4**. The order matters. Switching the quantities creates a completely different ratio with a different meaning.



Three ways to write a ratio

Now that you understand what a ratio expresses, it is essential to recognize the three accepted notations used in mathematics. Each one communicates the same relationship in a slightly different format.

THE THRES NOTATIONS OF A RATIO

For a ratio comparing quantity a to quantity b:

1. **WORD FORM:** "a to b"
   Example: "4 to 6"
2. **COLON FORM:** $a : b$
   Example: 4 : 6
3. **FRACTION FORM:** a/b
   Example: 4/6

Important: The **ORDER** of the quantities matters.
"4 to 6" and "6 to 4" are two **DIFFERENT** ratios.

Key observation about fraction form:

When a ratio is written as a/b, it looks like a fraction — but a ratio is not always the same as a fraction. A ratio compares any two quantities. A fraction represents a part of a whole. In this lesson, we focus on ratios as comparisons between two separate quantities.

Key observation about order:

The ratio of apples to oranges (4:6) answers the question: "How many apples for every orange?" The ratio of oranges to apples (6:4) answers: "How many oranges for every apple?" Always identify which quantity comes first based on the question being asked.

Using ratio language

Mathematicians and scientists do not just write ratios — they also use specific language to describe them out loud and in writing. Ratio language helps communicate relationships clearly without ambiguity.

Common ratio language expressions:

- "For every ___ , there are ___."
- "The ratio of ___ to ___ is ___."
- "___ to every ___."
- "For each ___, there are ___."

Applying ratio language to real situations:

Look at the examples below and notice how the same relationship can be expressed using proper ratio language:

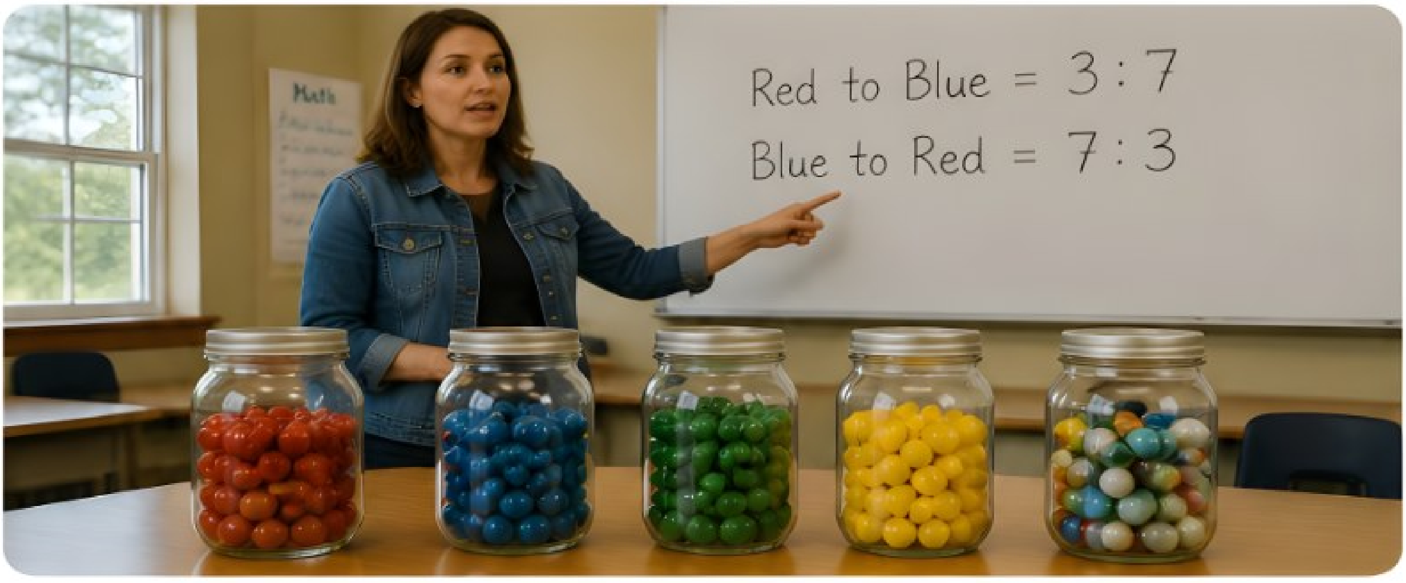
Situation: A bag contains 3 red marbles and 7 blue marbles.

- Ratio of red to blue: **3 to 7** (or **3:7**)
- Language: "For every 3 red marbles, there are 7 blue marbles."
- Reversed: The ratio of blue to red is **7 to 3**.
- Language: "For every 7 blue marbles, there are 3 red marbles."

Situation: A class has 12 boys and 15 girls.

- Ratio of boys to girls: **12 to 15** (or **12:15**)
- Language: "The ratio of boys to girls is 12 to 15."
- Ratio of girls to boys: 15 to 12
- Language: "For every 15 girls, there are 12 boys."

Important: When using ratio language, always name which quantity comes first. The phrasing must match the written order of the ratio.



Understanding ratios

Essential definitions

RATIO

A ratio is a comparison of two quantities using division. It shows how much of one quantity there is relative to another quantity.

A ratio can be written in three equivalent forms:

- **Word form:** "a to b"
- **Colon form:** a : b
- **Fraction form:** a/b

Example: Comparing 5 cats to 2 dogs

$$\rightarrow \text{“5 to 2”} = 5{:}2 = \frac{5}{2}$$

CCSS Standard: 6.RP.A.1

Ratio language

Ratio language refers to the specific words and phrases used to describe a ratio in spoken or written form.

Common expressions:

- "For every ___, there are ___."
- "The ratio of ___ to ___ is ___."
- "For each ___, there are ___."

Example: "For every 5 cats, there are 2 dogs."

Order in a ratio

The order in which quantities appear in a ratio determines its meaning. Changing the order creates a different ratio with a different interpretation.

Example:

- Cats to dogs → 5:2 (5 cats per 2 dogs)
- Dogs to cats → 2:5 (2 dogs per 5 cats)

Always identify the question first to determine which quantity is listed first.

Examples Applied

Example 1

A recipe uses 2 cups of sugar and 5 cups of flour.

What is the ratio of sugar to flour? Write it in all three forms and describe it using ratio language.

Solution:

- **Quantity A (first):** sugar → 2 cups
- **Quantity B (second):** flour → 5 cups

Three forms:

Word form	Colon form	Fraction form
2 to 5	2 : 5	2/5

Ratio language:

"For every 2 cups of sugar, there are 5 cups of flour."

Also: The ratio of flour to sugar is 5 to 2, or 5:2.
"For every 5 cups of flour, there are 2 cups of sugar."

Example 2

A parking lot has 18 cars and 6 motorcycles.

Write the ratio of motorcycles to cars in all three notations.

Solution:

- **Quantity A (first):** motorcycles → 6
- **Quantity B (second):** cars → 18

Three forms:

Word form	Colon form	Fraction form
6 to 18	6 : 18	6/18

Ratio language:

"For every 6 motorcycles, there are 18 cars."

Note: The ratio of cars to motorcycles would be 18:6 — a completely different ratio because the order is reversed.

Example 3

A soccer team won 9 games and lost 3 games during the season.

Write the ratio of wins to losses and the ratio of losses to wins.
Describe each using ratio language.

Solution:

Ratio of wins to losses:

- 9 to 3 → 9:3 → $9/3$
- "The ratio of wins to losses is 9 to 3."
- "For every 9 games won, 3 games were lost."

Ratio of losses to wins:

- 3 to 9 → 3:9 → $3/9$
- "The ratio of losses to wins is 3 to 9."
- "For every 3 games lost, 9 games were won."

These two ratios describe the same season but from opposite perspectives.

Example 4

A paint mixture uses 1 part blue paint and 4 parts white paint to create a light blue color.

Write the ratio of blue to white, and of white to the total mixture.
Use ratio language for each.

Solution:

Ratio of blue to white:

- 1 to 4 → 1:4
- "For every 1 part of blue paint, there are 4 parts of white paint."

Total parts in the mixture: $1 + 4 = 5$ parts

Ratio of white to total:

- 4 to 5 → 4:5
- "For every 5 parts of mixture, 4 parts are white."

This second ratio compares a part to the whole — a useful variation of ratio thinking.

Special Cases

Part-to-Part vs. Part-to-Whole Ratios

Most ratios compare one group directly to another separate group. These are called part-to-part ratios. However, a ratio can also compare one part to the total — called a part-to-whole ratio.

Consider a jar with 3 red candies and 5 green candies. The total is 8 candies.

- **Part-to-part:** red to green → 3:5
- **Part-to-whole**: red to total → 3:8
- **Part-to-whole**: green to total → 5:8

Both types are valid ratios. The key is to be clear about what each quantity represents when writing or reading a ratio.

Ratios Are Not Always Reducible in Context

Although 4:6 and 2:3 are mathematically equivalent (since $\frac{4}{6}$ simplifies to $\frac{2}{3}$), in some real-world situations the original numbers carry meaning. For example, if 4 students chose art and 6 chose music, the ratio 4:6 reflects the actual count. Whether to simplify a ratio depends on the context and question being asked. In this lesson, we work with the original quantities unless told otherwise.

A Ratio Does Not Imply a Fixed Total

A ratio of 2:3 does not mean there are exactly 2 and 3 of something — it means the quantities follow that proportional relationship. There could be 4 and 6, or 10 and 15, or 20 and 30. The ratio describes a pattern, not a fixed count. This is an important distinction that becomes central in future work with proportions and equivalent ratios.

Synthesis and application

Ratios give mathematics a precise language for comparison. Instead of saying "there are more of one thing than another," a ratio tells us exactly how the two quantities relate — and that relationship holds meaning whether we are reading a recipe, analyzing sports data, mixing paint, or interpreting a map scale.

Where ratios appear in real life:

- **Cooking:** A recipe calls for ingredients in specific ratios to ensure the right taste and texture every time.
- **Sports:** Statistics like wins-to-losses, shots-to-goals, and assists-to-points are all expressed as ratios.
- **Science:** Mixing chemicals, diluting solutions, and comparing populations all rely on ratio reasoning.
- **Art and Design:** Proportions in drawings, screen resolutions, and color mixing are defined by ratios.

Tips for working with ratios successfully:

1. Always identify which quantity comes first based on the question asked.
2. Write the ratio in the form requested — word, colon, or fraction — and make sure they all match.
3. Use ratio language to confirm the meaning: "For every ____, there are ____."
4. Remember that reversing the order creates a different ratio with a different meaning.

The big idea to remember:

A ratio is not just a pair of numbers — it is a relationship. When you write 3:5, you are saying something about how two quantities connect to each other. That connection is the foundation for proportional reasoning, one of the most essential skills in all of mathematics. Every time you describe a ratio clearly, you are thinking like a mathematician.