

Grade 7 - Unit Rates with Fractions - Lesson

Common Core 7.RP.A.1 · maths-pdf.fr/en/

A unit rate compares two quantities when the second quantity is 1. When the quantities are fractions, divide the first fraction by the second. If Maya walks $\frac{1}{2}$ mile in $\frac{1}{4}$ hour, her unit rate is $\frac{1}{2} \div \frac{1}{4} = 2$ miles per hour. Unit rates make speeds and prices easy to compare.

Grade 7 · Common Core State Standards: **7.RP.A.1**

Key facts

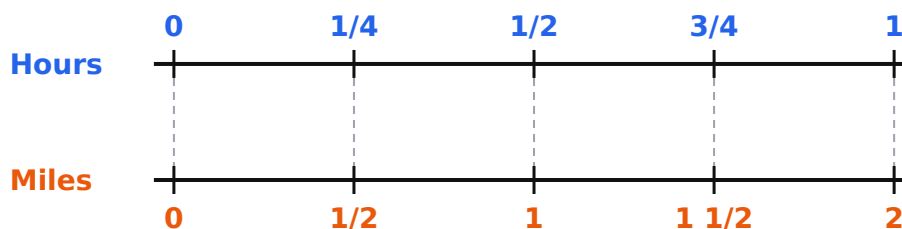
- A unit rate has 1 as its second quantity, such as 2 miles per 1 hour.
- With fractions, write a complex fraction and divide: $a/b \div c/d = a/b \times d/c$.
- Dividing by a fraction means multiplying by its reciprocal.
- Compare rates by finding each unit rate: a lower unit price is the better buy, and a higher speed is faster.
- Every rate has two unit rates, and they are reciprocals of each other.

What is a unit rate?

A **rate** compares two quantities with different units, such as miles and hours. A **unit rate** is a rate in which the second quantity is exactly 1, such as 40 miles per 1 hour.

Unit rate

A unit rate tells how much of the first quantity goes with **one unit** of the second quantity. The word *per* means “for each one.”



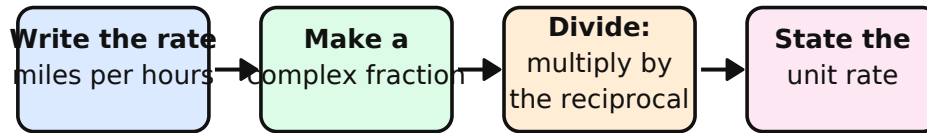
Maya walks $\frac{1}{2}$ mile every $\frac{1}{4}$ hour. The tick for 1 hour lines up with 2 miles, so her unit rate is 2 miles per hour.

In Grade 7, the numbers in a rate can be fractions. The idea does not change: scale the rate until the second quantity becomes 1.

How do you find a unit rate when the numbers are fractions?

Write the rate as a **complex fraction**, which is a fraction whose numerator or denominator is also a fraction. Then divide the numerator by the denominator.

$$\frac{\frac{1}{2} \text{ mile}}{\frac{1}{4} \text{ hour}} = \frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times 4 = 2 \text{ miles per hour}$$



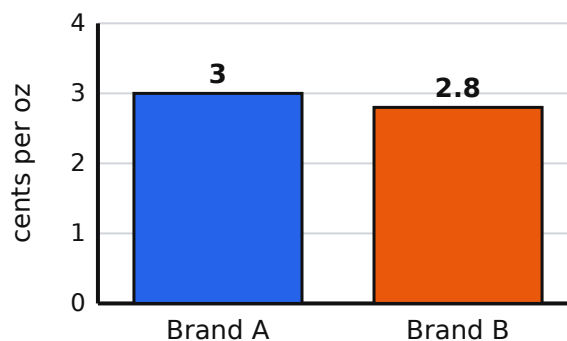
Four steps turn any fraction rate into a unit rate.

1. Decide which quantity goes on top. "Miles per hour" puts miles on top and hours on the bottom.
2. Write the complex fraction.
3. Rewrite the division as multiplication by the reciprocal.
4. Multiply and simplify. Attach the unit.

Example. Jamal paints $\frac{2}{3}$ of a fence in $\frac{3}{4}$ hour. The rate is $\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$ of a fence per hour.

How do you compare two rates?

Find the unit rate for each one, then compare. A lower unit price is the better buy, and a higher unit speed is faster. Brand A sells 12 ounces for \$3.60, which is \$0.30 per ounce. Brand B sells 25 ounces for \$7.00, which is \$0.28 per ounce.



Brand A costs 30 cents per ounce and Brand B costs 28 cents per ounce, so Brand B is the better buy.

Can the unit rate be flipped?

Yes. Every rate has two unit rates. If Maya walks 2 miles per hour, she also takes $\frac{1}{2}$ hour per mile. Pick the one that answers the question.

Rate	Unit rate	Flipped unit rate
2 miles in 1 hour	2 miles per hour	$\frac{1}{2}$ hour per mile
$\frac{3}{4}$ page in $\frac{1}{2}$ min	$\frac{3}{2}$ pages per min	$\frac{2}{3}$ min per page

Hours	1/4	1/2	1	2
Miles	1/2	1	2	4

Every column in the table has the same unit rate, 2 miles per hour.

Check any unit rate by multiplying it by the second quantity. You should get the first quantity back.

Questions about unit rates with fractions

What is a unit rate?

A unit rate compares a quantity to exactly one unit of another quantity. Examples are 55 miles per hour and \$0.28 per ounce.

How do you divide fractions to find a unit rate?

Write the rate as a complex fraction, then multiply the top fraction by the reciprocal of the bottom fraction. For $\frac{3}{4}$ mile in $\frac{1}{2}$ hour, $\frac{3}{4} \times 2 = \frac{3}{2}$, so the rate is $1\frac{1}{2}$ miles per hour.

What is a complex fraction?

A complex fraction has a fraction in its numerator, its denominator, or both. It is just a division problem written in fraction form.

How do I know which quantity goes on top?

Read the word before per. In miles per hour, miles go on top. In hours per mile, hours go on top.

How do I compare unit prices?

Divide each price by its amount to get price per unit, using the same unit for both. The smaller unit price is the better buy.