

Grade 7 · Unit Rates with Fractions · Lesson

Common Core 7.RP.A.1 · mathovore.fr

A unit rate with fractions compares two quantities when one or both are fractions, such as $\frac{1}{2}$ mile in $\frac{1}{4}$ hour. Divide the first quantity by the second to find the amount for 1 unit. Here $\frac{1}{2} \div \frac{1}{4} = 2$, so the unit rate is 2 miles per hour.

Grade 7 Common Core: 7.RP.A.1

Key facts:

- A unit rate is the amount of one quantity per 1 unit of another quantity.
- A rate with fractions is a complex fraction, and it equals the first fraction divided by the second.
- Dividing by a fraction means multiplying by its reciprocal.
- Convert units first when the two quantities use different units, such as minutes and hours.
- Check by multiplying the unit rate by the second quantity to get the first quantity.

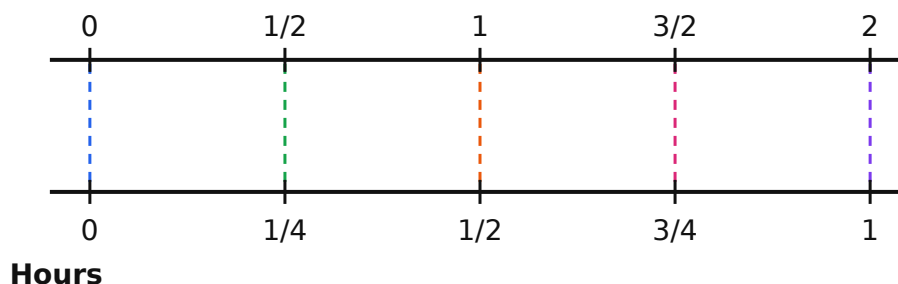
What is a unit rate with fractions?

A **rate** compares two different quantities, such as miles and hours. When one or both quantities are fractions, the rate is a *complex fraction*. Maya walks $\frac{1}{2}$ mile in $\frac{1}{4}$ hour, so her rate is $\frac{\frac{1}{2} \text{ mi}}{\frac{1}{4} \text{ h}}$.

Unit rate with fractions

If $\frac{a}{b}$ of one quantity goes with $\frac{c}{d}$ of another, the **unit rate** is the amount of the first quantity for **1** unit of the second: $\frac{a}{b} \div \frac{c}{d}$.

Miles walked



Each $\frac{1}{4}$ hour adds $\frac{1}{2}$ mile, so 1 hour matches 2 miles.

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

1. Write the rate as (first quantity) $\div$ (second quantity).
2. Change the division into multiplication by the reciprocal of the second fraction.
3. Multiply, then simplify.
4. Say the answer with units: miles per hour, cups per batch, dollars per pound.

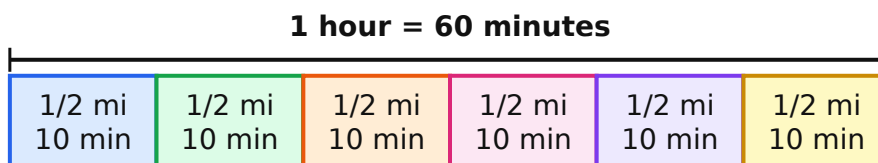
Example. Sofia reads $\frac{2}{3}$ of a chapter in $\frac{1}{6}$ hour. $\frac{2}{3} \div \frac{1}{6} = \frac{2}{3} \times \frac{6}{1} = \frac{12}{3} = 4$, so she reads 4 chapters per hour. Check: $4 \times \frac{1}{6} = \frac{2}{3}$.



Divide, flip, multiply, simplify.

What if the two quantities use different units?

Convert one of them first so the rate is in the unit you want. Ethan walks $\frac{1}{2}$ mile in 10 minutes. Since 10 minutes is $\frac{1}{6}$ of an hour, $\frac{1}{2} \div \frac{1}{6} = \frac{1}{2} \times 6 = 3$ miles per hour.

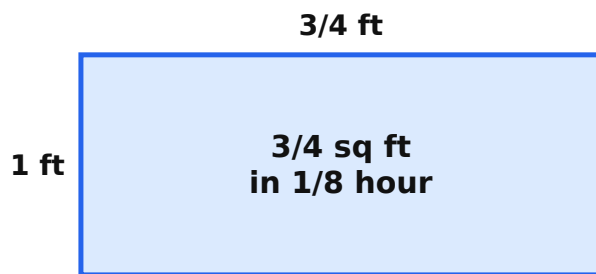


$$6 \times \frac{1}{2} \text{ mile} = 3 \text{ miles}$$

Six pieces of $\frac{1}{2}$ mile make 3 miles in 1 hour.

Can a unit rate involve area?

Yes. Priya paints $\frac{3}{4}$ square foot of a poster in $\frac{1}{8}$ hour. $\frac{3}{4} \div \frac{1}{8} = \frac{3}{4} \times 8 = 6$ square feet per hour.



The painted area is $\frac{3}{4}$ sq ft.

What mistakes should you avoid?

- Multiplying the two fractions instead of dividing. A rate of $\frac{1}{2}$ mile in $\frac{1}{4}$ hour is not $\frac{1}{8}$ mile per hour.
- Dividing in the wrong order. The unit named before the word *per* goes first, so miles per hour is miles $\div$ hours.
- Forgetting to convert. Ten minutes must become $\frac{1}{6}$ hour before you divide to get miles per hour.
- Leaving off the units. The number 3 means little until you write 3 miles per hour.

How can you use a table of rates?

Situation	Division	Unit rate
$\frac{1}{2}$ mi in $\frac{1}{4}$ h	$\frac{1}{2} \div \frac{1}{4}$	2 mi per h
$\frac{3}{4}$ cup per $\frac{1}{2}$ batch	$\frac{3}{4} \div \frac{1}{2}$	$1\frac{1}{2}$ cups per batch
\$3 for $\frac{3}{4}$ lb	$3 \div \frac{3}{4}$	\$4 per lb

Unit Rates with Fractions: frequently asked questions

What is a complex fraction?

A complex fraction has a fraction in its numerator, its denominator, or both. In a rate such as $\frac{\frac{1}{2} \text{ mi}}{\frac{1}{4} \text{ h}}$, the fraction bar means division, so it equals $\frac{1}{2} \div \frac{1}{4}$.

How do you divide by a fraction?

Multiply by the reciprocal of the fraction you are dividing by. For example, $\frac{3}{4} \div \frac{1}{8} = \frac{3}{4} \times \frac{8}{1} = 6$.

Why does dividing by a small fraction give a big rate?

A small fraction of an hour fits many times into 1 hour. If you cover $\frac{1}{2}$ mile in only $\frac{1}{4}$ hour, you would cover four times as much in a full hour, which is 2 miles.

Which quantity goes first in the division?

The quantity named before the word per goes first. Miles per hour means miles $\div$ hours, and cups per batch means cups $\div$ batches.

How can I check a unit rate?

Multiply the unit rate by the second quantity. If the unit rate is 3 miles per hour and the time is $\frac{1}{6}$ hour, then $3 \times \frac{1}{6} = \frac{1}{2}$ mile, which matches the original distance.