

Grade 4 · Multiplying a Fraction by a Whole Number · Lesson

Common Core 4.NF.B.4 · mathovore.fr

A fraction such as $\frac{3}{4}$ is a multiple of its unit fraction: it is 3 copies of $\frac{1}{4}$. To multiply a whole number by a fraction, multiply the whole number by the numerator and keep the denominator, so $5 \times \frac{2}{3} = \frac{10}{3}$, which is $3\frac{1}{3}$.

Grade 4 Common Core: 4.NF.B.4

Key facts:

- A unit fraction has a numerator of 1, like $\frac{1}{8}$.
- Any fraction $\frac{a}{b}$ equals a copies of $\frac{1}{b}$, so $\frac{5}{8} = 5 \times \frac{1}{8}$.
- To find $n \times \frac{a}{b}$, multiply n by the numerator a and keep the denominator b .
- If the numerator is bigger than the denominator, write the product as a mixed number.
- Fraction multiplication is repeated addition: $3 \times \frac{2}{5} = \frac{2}{5} + \frac{2}{5} + \frac{2}{5}$.

What does it mean for a fraction to be a multiple?

A **unit fraction** has a numerator of 1, such as $\frac{1}{4}$. Every other fraction is made by counting copies of a unit fraction. The fraction $\frac{3}{4}$ is three fourths, so $\frac{3}{4} = 3 \times \frac{1}{4}$.



Three shaded pieces of size $\frac{1}{4}$ make $\frac{3}{4} = 3 \times \frac{1}{4}$.

Fraction as a multiple of a unit fraction

For any fraction, $\frac{a}{b} = a \times \frac{1}{b}$. The denominator names the size of each piece. The numerator counts how many pieces you have.

How do you multiply a whole number by a fraction?

Multiplication is repeated addition. The product $3 \times \frac{2}{5}$ means $\frac{2}{5} + \frac{2}{5} + \frac{2}{5}$. Two fifths

three times is six fifths, and the pieces stay the same size.

Row 1	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
Row 2	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
Row 3	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

Three rows with $\frac{2}{5}$ shaded each: $3 \times \frac{2}{5} = \frac{6}{5}$.

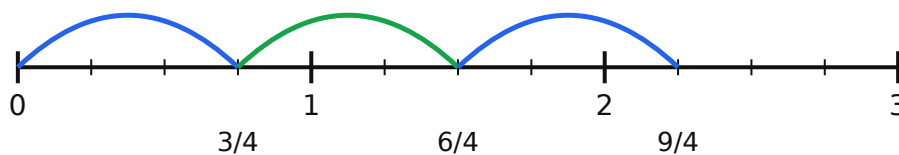
So multiply the whole number by the numerator and keep the denominator:

$$n \times \frac{a}{b} = \frac{n \times a}{b}$$

Product	Repeated addition	Answer
$4 \times \frac{1}{3}$	$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$	$\frac{4}{3}$
$3 \times \frac{2}{5}$	$\frac{2}{5} + \frac{2}{5} + \frac{2}{5}$	$\frac{6}{5}$
$5 \times \frac{3}{8}$	$\frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8}$	$\frac{15}{8}$

What if the product is more than one whole?

When the numerator is larger than the denominator, the fraction is greater than 1. Write it as a mixed number by finding how many wholes fit. On the number line, three hops of $\frac{3}{4}$ reach $\frac{9}{4}$. Since $\frac{8}{4} = 2$, the product is 2 wholes and 1 fourth more, or $2\frac{1}{4}$.



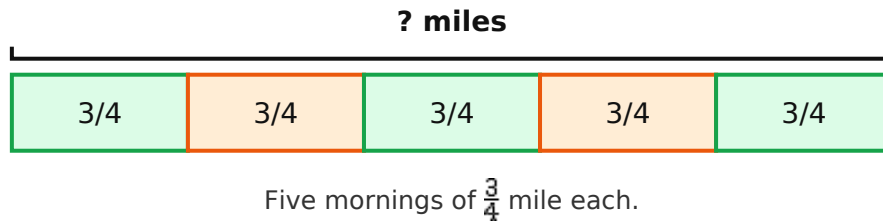
Three hops of $\frac{3}{4}$ land on $\frac{9}{4}$, which is $2\frac{1}{4}$.

How do you solve a fraction word problem?

1. Find the number of equal groups and the size of each group.
2. Write a multiplication sentence.
3. Multiply the numerator by the whole number and keep the denominator.
4. Rewrite as a mixed number if it is more than 1.
5. Check the answer against an estimate and include the unit.

Example. Jamal runs $\frac{3}{4}$ mile every morning for 5 mornings. How far does he run?

$5 \times \frac{3}{4} = \frac{15}{4} = 3\frac{3}{4}$. He runs $3\frac{3}{4}$ miles. Check: $\frac{3}{4}$ is a little less than 1, so five of them should be a little less than 5. The answer fits.



Multiplying a Fraction by a Whole Number: frequently asked questions

What is a unit fraction?

A unit fraction is a fraction with 1 as the numerator, such as $\frac{1}{6}$. It names one equal piece of a whole. Every fraction, like $\frac{5}{6}$, is a count of unit fractions.

Why does the denominator stay the same when multiplying by a whole number?

The denominator tells the size of the pieces, and the pieces do not change when you collect more of them. Three groups of $\frac{2}{5}$ are six fifths, not six fifteenths.

How do you turn an improper fraction into a mixed number?

Find how many full wholes fit in the fraction, then write what is left over. For $\frac{15}{4}$, four fourths make 1 whole, so 3 wholes use 12 fourths and 3 fourths remain: $3\frac{3}{4}$.

Does $3 \times \frac{2}{5}$ equal $\frac{2}{5} \times 3$?

Yes. Changing the order of the factors does not change the product. Both mean three groups of two fifths, which is $\frac{6}{5}$.

How can you check a fraction product?

Use repeated addition or a number line to see if you get the same answer. You can also estimate: $4 \times \frac{5}{6}$ should be a little less than 4.