

Grade 5 - Multiplication as Scaling - Lesson

Common Core 5.NF.B.5a, 5.NF.B.5b · maths-pdf.fr/en/

Multiplication as scaling means that multiplying a number by a factor stretches or shrinks it. A factor greater than 1 makes the product larger than the other factor. A factor equal to 1 keeps it the same. A factor less than 1, such as $\frac{3}{4}$, makes the product smaller.

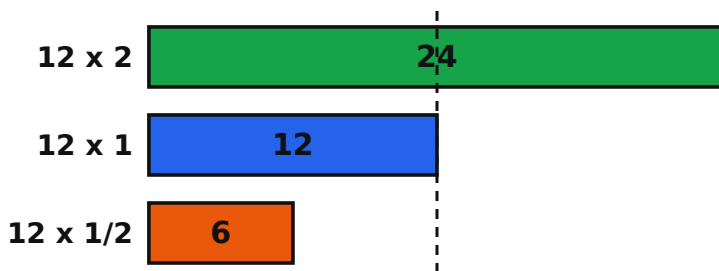
Grade 5 · Common Core State Standards: **5.NF.B.5a, 5.NF.B.5b**

Key facts

- A scale factor greater than 1 makes the product larger.
- A scale factor equal to 1 leaves the product the same.
- A scale factor less than 1 makes the product smaller.
- A fraction times a fraction less than 1 is smaller than both factors.
- Compare the factor to 1 to predict the size before you calculate.

What does it mean to scale a number by multiplying?

Multiplying can make a number larger, smaller, or keep it the same. This is called scaling. A scale factor is the number you multiply by. Look at $12 \times 2 = 24$, $12 \times 1 = 12$, and $12 \times \frac{1}{2} = 6$. The bars show how 12 stretches to 24 or shrinks to 6.



Multiplying 12 by 2 stretches it. Multiplying by $\frac{1}{2}$ shrinks it.

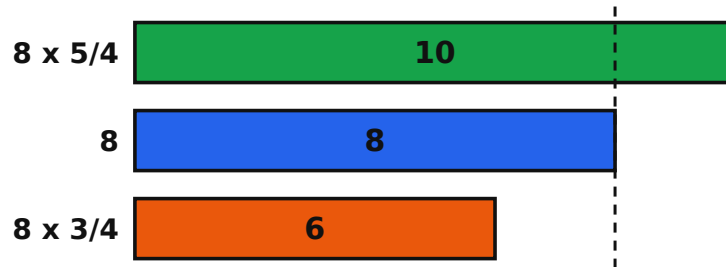
Scaling rules

When you multiply a number n by a scale factor f :

- If f is greater than 1, the product is greater than n .
- If f equals 1, the product equals n .
- If f is less than 1, the product is less than n .

How can you tell if a product is larger or smaller without calculating?

Compare the scale factor to 1. A fraction with a numerator greater than its denominator is greater than 1, such as $\frac{5}{4}$. A fraction with a numerator less than its denominator is less than 1, such as $\frac{3}{4}$. A fraction with equal numerator and denominator equals 1.

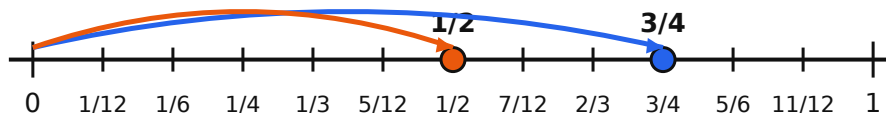


A factor of $\frac{5}{4}$ is greater than 1, so the product is larger than 8. A factor of $\frac{3}{4}$ is less than 1, so the product is smaller.

Scale factor	Compared with 1	Product compared with 8
$\frac{5}{4}$	greater	$8 \times \frac{5}{4} = 10$ is larger
$\frac{4}{4}$	equal	$8 \times \frac{4}{4} = 8$ is the same
$\frac{3}{4}$	less	$8 \times \frac{3}{4} = 6$ is smaller

What happens when you multiply two fractions less than 1?

The product is smaller than both factors. You take a part of a part. For example, $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$, and $\frac{1}{2}$ is smaller than $\frac{3}{4}$ and smaller than $\frac{2}{3}$.

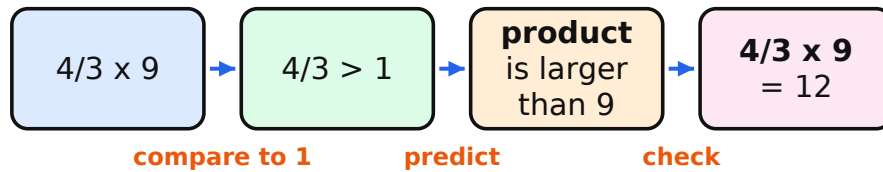


$\frac{3}{4}$ times $\frac{2}{3}$ is $\frac{1}{2}$, which is smaller than $\frac{3}{4}$.

What are the steps for predicting and checking?

1. Find the scale factor.
2. Compare it with 1.
3. Predict whether the product is greater than, less than, or equal to the other factor.
4. Multiply.
5. Check that the answer matches the prediction.

Worked example: Is $\frac{4}{3} \times 9$ greater than 9? The factor $\frac{4}{3}$ is greater than 1, so yes. Check: $\frac{4}{3} \times 9 = \frac{36}{3} = 12$, and 12 is greater than 9.



Predict the size first, then calculate to check.

Questions about multiplication as scaling

Does multiplication always make a number bigger?

No. Multiplying by a number greater than 1 makes it bigger, but multiplying by a fraction less than 1 makes it smaller. For example, 8 times $\frac{3}{4}$ is 6, which is less than 8.

How do I know if a fraction is greater than 1?

Compare the numerator and denominator. If the numerator is greater than the denominator, such as $\frac{5}{4}$, the fraction is greater than 1. If it is smaller, such as $\frac{3}{4}$, the fraction is less than 1.

Why is a fraction times a fraction smaller than both factors?

You take a part of a part. One half of one third is only one sixth, which is smaller than both one half and one third.

What happens when I multiply by 1?

The number stays the same. Any fraction that equals 1, such as $\frac{4}{4}$ or $\frac{7}{7}$, also keeps the number the same.

Why predict the size before calculating?

A prediction helps catch mistakes. If a factor is less than 1 but the product is larger than the other factor, there must be an error in the calculation.