

Equivalent Fractions and Comparing: math lesson, Grade 4 – download the PDF

Pizza night: one friend takes $\frac{1}{2}$ of a pizza, another takes $\frac{2}{4}$. Who got more?

Neither! The two fractions look different, yet they name exactly the same amount.

In this chapter you will learn to build equivalent fractions, to write fractions in simplest form, and to compare any two fractions with confidence.

1. Fractions as parts of a whole

A fraction describes equal parts of one whole. The whole can be a pizza, a candy bar, a ribbon, or a distance on a number line.

D Fraction and unit fraction

In $\frac{a}{b}$, the **denominator** b tells how many equal parts the whole is cut into. The **numerator** a tells how many of those parts we count. A **unit fraction** has a numerator of 1, such as $\frac{1}{4}$ or $\frac{1}{10}$.

$\frac{3}{4}$



Every fraction is built from unit fractions. The fraction $\frac{3}{4}$ is three copies of $\frac{1}{4}$:

$$\frac{3}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$$

E Example 1: a granola bar

A granola bar is cut into 5 equal pieces and Noah eats 2 of them. Each piece is $\frac{1}{5}$ of the bar, so Noah ate $\frac{1}{5} + \frac{1}{5} = \frac{2}{5}$ of the bar. The fraction left is $\frac{3}{5}$, because $2 + 3 = 5$ pieces make the whole bar.



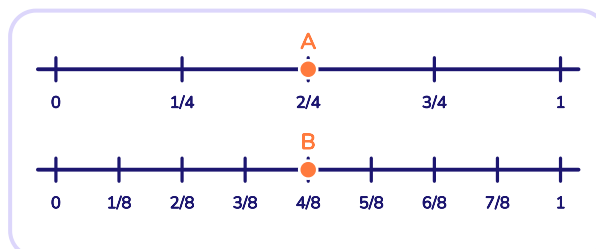
Careful: equal parts only

A bar cut into one big piece and two small pieces is not cut into thirds. A fraction only makes sense when all the parts are the same size.

2. Fractions on a number line

To place a fraction on a number line, look at the distance from 0 to 1. Cut that distance into b equal lengths. Each length is $\frac{1}{b}$. The point $\frac{a}{b}$ is exactly a jumps of that length away from 0.

The number line below has two scales. The top scale is cut into fourths and the bottom scale into eighths. Notice that point A and point B sit at the very same place.

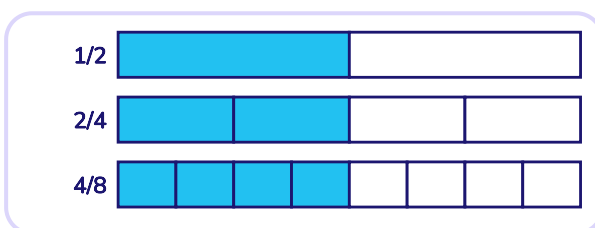


3. Equivalent fractions

D Equivalent fractions

Two fractions are **equivalent** when they name the same amount. They cover the same part of a whole and they land on the same point of a number line. We write

$$\frac{1}{2} = \frac{2}{4} = \frac{4}{8}.$$



Look at the bars. Cutting each half into 2 smaller parts gives fourths. Cutting each fourth again gives eighths. The pieces get smaller and there are more of them, but the shaded amount never changes.

P Rule for equivalent fractions

If you multiply the numerator and the denominator by the same number (not zero), or divide both by the same number, you get an equivalent fraction.

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

Why does this work? Multiplying both numbers by n means cutting every part into n smaller equal parts. You count n times as many parts, and each part is n times smaller. Multiplying by $\frac{n}{n}$ is multiplying by 1, so the amount stays the same.

4. Generating equivalent fractions

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Method: find a fraction with a given denominator

1. Compare the two denominators and find the number you multiply by (or divide by).
2. Do the same operation to the numerator.
3. Check by drawing a bar or by going back with the opposite operation.

E

Example 2: twelfths for two thirds

Find $\frac{2}{3} = \frac{?}{12}$. Since $3 \times 4 = 12$, multiply the numerator by 4 too: $2 \times 4 = 8$. So $\frac{2}{3} = \frac{8}{12}$.

⚠

Common mistake: adding instead of multiplying

Adding the same number to the top and the bottom changes the amount. For instance $\frac{2}{3}$ and $\frac{4}{5}$ are not equivalent, even though both numbers went up by 2. Always multiply or divide.

5. Simplifying fractions

Simplifying is the reverse of building an equivalent fraction. You divide the numerator and the denominator by a number that goes into both, called a **common factor**.

D**Simplest form**

A fraction is in **simplest form** when the only number that divides both the numerator and the denominator is 1.

E**Example 3: simplify two fractions**

a) $\frac{6}{8}$: both numbers are divisible by 2, so $\frac{6}{8} = \frac{6 \div 2}{8 \div 2} = \frac{3}{4}$. Only 1 divides both 3 and 4, so we are done.

b) $\frac{30}{100}$: both numbers are divisible by 10, so $\frac{30}{100} = \frac{3}{10}$.

!**Tip from Zyro**

Not sure which factor to use? Divide by 2 again and again while you can. For example

$\frac{8}{12} = \frac{4}{6} = \frac{2}{3}$. Small steps are safe steps!

6. Benchmark fractions such as $\frac{1}{2}$

A **benchmark** is an easy number that helps you judge a harder one. The most useful benchmarks are 0, $\frac{1}{2}$ and 1. To compare a fraction with $\frac{1}{2}$, find half of the denominator and look at the numerator.

P**Comparing with one half**

- If the numerator is less than half of the denominator, the fraction is less than $\frac{1}{2}$.
- If the numerator is exactly half of the denominator, the fraction equals $\frac{1}{2}$.
- If the numerator is greater than half of the denominator, the fraction is greater than $\frac{1}{2}$.

E**Example 4: using one half as a checkpoint**

Compare $\frac{3}{8}$ and $\frac{7}{12}$. Half of 8 is 4 and $3 < 4$, so $\frac{3}{8} < \frac{1}{2}$. Half of 12 is 6 and $7 > 6$, so $\frac{7}{12} > \frac{1}{2}$. Therefore $\frac{3}{8} < \frac{7}{12}$.

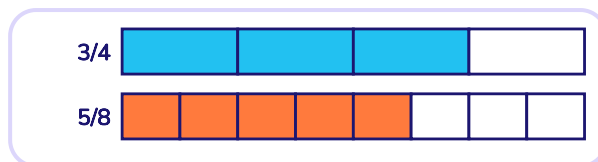
7. Comparing fractions with unlike denominators

Two easy cases first. If the denominators are the same, the pieces have the same size, so the larger numerator wins: $\frac{5}{8} > \frac{3}{8}$. If the numerators are the same, compare the piece sizes: the greater the denominator, the smaller each piece. So $\frac{3}{4} > \frac{3}{8}$.

When both numbers are different, rewrite the fractions with the same denominator.

M**Method: use a common denominator**

1. Find a number that both denominators divide into (a common denominator).
2. Rewrite each fraction as an equivalent fraction with that denominator.
3. Compare the numerators.



E Example 5: three fourths or five eighths?

Since $4 \times 2 = 8$, write $\frac{3}{4} = \frac{6}{8}$. Now compare $\frac{6}{8}$ and $\frac{5}{8}$: the numerators give $6 > 5$.
So $\frac{3}{4} > \frac{5}{8}$, as the bars show.

E Example 6: five sixths or three fourths?

Both 6 and 4 divide into 12. We get $\frac{5}{6} = \frac{10}{12}$ and $\frac{3}{4} = \frac{9}{12}$. Because $10 > 9$, we have $\frac{5}{6} > \frac{3}{4}$.

I 8. Comparing with the symbols $<$, $>$ and $=$

We record a comparison with a symbol. The symbol $<$ means "is less than", $>$ means "is greater than", and $=$ means "is equal to". The pointed end always aims at the smaller number, and the wide opening faces the larger one:

$$\frac{5}{8} < \frac{3}{4}$$

$$\frac{3}{4} > \frac{5}{8}$$

$$\frac{2}{4} = \frac{1}{2}$$

You can only compare fractions of the **same whole**. Half of a small cookie is not more than a third of a giant cookie, but when both cookies are the same size, the fractions tell the whole story. On a number line, the fraction on the right is always the greater one.

Key takeaways

- A fraction $\frac{a}{b}$ counts a equal parts of size $\frac{1}{b}$.
- Equivalent fractions name the same amount and the same point on a number line.
- Multiply or divide the numerator and the denominator by the same number to get an equivalent fraction. Never add.
- A fraction is in simplest form when only 1 divides both of its numbers.
- To compare, use $\frac{1}{2}$ as a benchmark or rewrite the fractions with a common denominator.
- Write the result with $<$, $>$ or $=$.



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