READING MATERIAL

Read About Adding and Subtracting Fractions (Unlike Denominators)

WHAT IS ADDING & SUBTRACTING FRACTIONS WITH UNLIKE DENOMINATORS?

Two fractions have unlike denominators if the numbers in the denominators are not the same. You can use multiplication and division to rewrite fractions to have a common denominator.

To better understand adding and subtracting fractions with unlike denominators...

LET'S BREAK IT DOWN!

Cookies

Let's say that Marcos and April each have a large cookie. They each ate part of their cookie. Marco has $\frac{1}{9}$ of his cookie left and April has $\frac{2}{3}$ of hers left. How much cookie do they have left, combined? To answer this question, you need to rewrite the fractions with a common denominator by finding equivalent fractions, and then add. Start with the fraction with the smaller denominator, $\frac{2}{3}$. We can find an equivalent fraction by multiplying both the numerator and denominator by the same number. Multiply $\frac{2}{3}$ by $\frac{3}{3}$ to find an equivalent fraction with denominator 9. $\frac{2}{3} \times \frac{3}{3} = \frac{6}{9}$. $\frac{6}{9}$ has the same denominator as $\frac{1}{9}$ and is equivalent to $\frac{2}{3}$. Now we can rewrite the original addition as $\frac{1}{9} + \frac{6}{9} = \frac{7}{9}$. They have $\frac{7}{9}$ of a cookie left. Try this one yourself. **You ate $\frac{2}{5}$ of a pizza and your sister ate $\frac{1}{10}$ of the same pizza. How much of the pizza did you eat in all?**

Algorithm for Finding a Common Denominator

Let's say you want to add $\frac{1}{3} + \frac{2}{5}$. You know that you need to find a common denominator. Starting with $\frac{1}{3}$, list equivalent fractions: $\frac{1}{3} \times \frac{2}{2} = \frac{2}{6}$, $\frac{1}{3} \times \frac{3}{3} = \frac{3}{9}$, $\frac{1}{3} \times \frac{4}{4} = \frac{4}{12}$, $\frac{1}{3} \times \frac{5}{5} = \frac{5}{15}$, $\frac{1}{3} \times \frac{6}{6} = \frac{6}{18}$. None of those fractions have a denominator of 5, so you need to find equivalent fractions for $\frac{2}{5}$ as well: $\frac{2}{5} \times \frac{2}{2} = \frac{4}{10}$, $\frac{2}{5} \times \frac{3}{3} = \frac{6}{15}$, $\frac{2}{5} \times \frac{4}{4} = \frac{8}{20}$. Both $\frac{1}{3}$ and $\frac{2}{5}$ have an equivalent fraction with a denominator of 15. Rewrite the original addition as $\frac{5}{15} + \frac{6}{15} = \frac{11}{15}$.

There is a faster way to find a common denominator. If you multiply the numerator and the denominator of each fraction by the denominator of the other fraction, you always get fractions with a common denominator. Here's how this works: Starting with $\frac{1}{3}$, you see that the other fraction, $\frac{2}{5}$, has a denominator of 5 so you multiply the numerator and denominator by 5: $\frac{1}{3} \times \frac{5}{5} = \frac{5}{15}$. Next, you see that $\frac{1}{3}$ has a denominator of 3, so you multiply the numerator and denominator of the other fraction by 3: $\frac{2}{5} \times \frac{3}{3} = \frac{6}{15}$. Rewrite the original addition as $\frac{5}{15} + \frac{6}{15} = \frac{11}{15}$. Try this one yourself. **Add $\frac{1}{6} + \frac{3}{4}$ by finding a common denominator using the faster way.**

Guinea Pig Weights

Let's say that you have two tiny guinea pigs. One weighs $\frac{4}{5}$ of a pound and the other weighs $\frac{2}{3}$ of a pound. You want to figure out how much more one guinea pig weighs than the other. You can find this difference using the equation $\frac{4}{5} - \frac{2}{3}$

= ?. First, find equivalent fractions that have a common denominator. The second fraction has a denominator of 3, so multiply the numerator and denominator of the first fraction by 3. $\frac{4}{5} \times \frac{3}{3} = \frac{12}{55}$. Next, multiply $\frac{2}{3} \times \frac{5}{5}$ since 5 is the denominator of $\frac{4}{5}$. $\frac{2}{3} \times \frac{5}{5} = \frac{10}{15}$. Rewrite the original equation $\frac{4}{5} - \frac{2}{3}$ as $\frac{12}{15} - \frac{10}{15} = \frac{2}{15}$. One guinea pig weighs $\frac{2}{15}$ of a pound more than the other guinea pig. Try this one yourself. **My bag of candy weighs $\frac{3}{4}$ of a pound and my friend's bag of candy weighs $\frac{2}{3}$ of a pound. How much more does my bag of candy weigh?**

Rollerblading and Long Jumping

Let's say that you rollerbladed $2\frac{3}{4}$ miles yesterday and $3\frac{1}{3}$ miles today. How many total miles did you rollerblade? To answer this, solve $2\frac{3}{4} + 3\frac{1}{3}$. You can add the fractions and the whole numbers separately and combine the answers. Let's start with the fractions and add $\frac{3}{4} + \frac{1}{3}$. They have unlike denominators, so multiply each fraction's numerator and denominator by the other fraction's denominator to get equivalent fractions: $\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$ and $\frac{1}{3} \times \frac{4}{4} = \frac{4}{12}$. Add the new numerators. $\frac{9}{12} + \frac{4}{12} = \frac{13}{12}$. Since this fraction is greater than 1, regroup from an improper to a mixed number: $\frac{13}{12} = \frac{12}{12} + \frac{1}{12} = 1\frac{1}{12}$. Next, add the whole numbers: 2 + 3 = 5. Then combine the totals: $5 + 1\frac{1}{12} = 6\frac{1}{12}$. You rollerbladed a total of $6\frac{1}{12}$ miles.

Let's look at an example of subtracting mixed numbers. Let's say Marcos had a long jump of $5\frac{1}{6}$ feet and April jumped $4\frac{2}{3}$ feet. We can figure out how much farther Marco jumped by solving $5\frac{1}{6} - 4\frac{2}{3} = ?$. Start by finding $\frac{1}{6} - \frac{2}{3}$. The denominators are unlike, so we need to find equivalent fractions with a common denominator: 2 × 3 = 6, so multiply the numerator and denominator of $\frac{2}{3}$ by 2: $\frac{2}{3} \times \frac{2}{2} = \frac{4}{6}$. The fraction subtraction is now $\frac{1}{6} - \frac{4}{6}$. 4 is greater than 1, so we need to regroup from 5 to make a fraction greater than $\frac{4}{6}$. Regroup $\frac{1}{1}$ into $\frac{6}{6}$. $5 = 4\frac{6}{6}$. Add the new

sixths to $\frac{1}{6}$: $\frac{6}{6} + \frac{1}{6} = \frac{7}{6}$. Now we can subtract the fractions: $\frac{7}{6} - \frac{4}{6} = \frac{3}{6}$. Finally, subtract the remaining whole number parts of the mixed numbers: 4 – 4 = 0. Marcos jumped $\frac{3}{6}$ of a foot farther than April. Try this one yourself. **I hiked 6 $\frac{1}{8}$ miles on Saturday and another 4 $\frac{2}{3}$ miles on Sunday. How many total miles did I hike this weekend?**

ADD & SUBTRACT FRACTIONS (UNLIKE DENOMINATORS) VOCABULARY

Numerator	In a fraction, the number of equal parts being considered.
Denominator	In a fraction, the number of equal-size parts that a whole has been split into.
Equivalent Fractions	Fractions with different numerators and denominators that name the same number.
Like Denominator	The same denominator.
Unlike Denominator	Different denominators.
Benchmark Number	Numbers such as 0, $\frac{1}{2}$, and 1 that can be used to estimate an answer or evaluate the reasonableness of an answer.

ADD & SUBTRACT FRACTIONS (UNLIKE DENOMINATORS) DISCUSSION QUESTIONS

Which part of a fraction tells you the number of equal-sized parts that the whole is broken into?

The denominator.

What is the meaning of the numerator when adding or subtracting fractions?

The number of equal-sized pieces being added or subtracted.

How can we find equivalent fractions with a common denominator for two fractions with unlike denominators?

For each fraction, multiply the numerator and denominator by a number so that the denominators of both fractions are equal. One possible multiplier is the denominator of the other fraction.

Which of the following benchmark numbers—0, $\frac{1}{2}$, or 1—can you use to help estimate when adding $\frac{4}{9}$ to another fraction?

$\frac{1}{2}$.

Rafay says that $5 - 3\frac{1}{3} = 2\frac{1}{3}$. Is Rafay correct? If not, what did Rafay do wrong?

No; Rafay subtracted the whole number parts but didn't subtract $\frac{1}{3}$ from 5. He should have regrouped to get $4\frac{3}{3} - 3\frac{1}{3} = 1\frac{2}{3}$.
