Adding and Subtracting Fractions

In This Lesson You Will Learn:

- how to add and subtract fractions that don't have the same denominator

When adding fractions, they must have the same denominator. The numerators are added together, and the denominator stays the same.

Sample Problem

Add $\frac{1}{4}$ to $\frac{7}{16}$

Step one: Find equivalent fractions that will give them both the same denominator.

LCM of 4 and 16 is 16.

$$\frac{1}{4} \overset{\times 4}{=} \frac{4}{16}$$

Step two: Add together the numerators.

4 + 7 = 11

Remember! The denominator doesn't change.

Answer: $\frac{1}{4} + \frac{7}{16} = \frac{11}{16}$

Can this answer be simplified? No, $\frac{11}{16}$ is already in its simplest form.

The same method is used for subtracting.

Sample Problem

Solve $\frac{18}{24} - \frac{2}{4}$

Step one: Find equivalent fractions that will give them both the same denominator.

LCM of 24 and 4 is 24.

$$\frac{2}{4} \overset{\times 6}{=} \frac{12}{24}$$

Step two: Subtract the numerator.

$18 - 12 = 6$

Answer: $\frac{18}{24} - \frac{2}{4} = \frac{6}{24}$

Can this answer be simplified? Yes.

$$\frac{6}{24} \overset{\div 6}{=} \frac{1}{4}$$

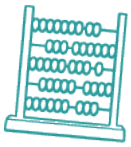
Applying Your Knowledge

Calculate $\frac{3}{4} + \frac{1}{9}$

LCM of 4 and 9 is 36.

$\frac{3}{4} = \frac{\square}{36}$

$\frac{1}{9} = \frac{\square}{36}$



Practice

1. Write the answers to these equations, simplifying your answer wherever possible.

a. $\frac{1}{5} + \frac{8}{15}$ _____

b. $\frac{2}{16} + \frac{5}{8}$ _____

c. $\frac{1}{7} + \frac{4}{5}$ _____

d. $\frac{11}{13} - \frac{4}{26}$ _____

e. $\frac{1}{6} - \frac{1}{9}$ _____

f. $\frac{9}{14} - \frac{21}{42}$ _____

g. $\frac{16}{19} - \frac{30}{38}$ _____

h. $\frac{1}{2} + \frac{8}{17}$ _____

i. $\frac{5}{6} + \frac{5}{8}$ _____

j. $\frac{65}{80} - \frac{2}{10}$ _____

k. $\frac{6}{12} - \frac{4}{15}$ _____

l. $\frac{9}{32} + \frac{92}{128}$ _____

Helpful Hint

Sometimes it's easier to simplify the fractions *before* adding or subtracting.

Why can we only add fractions when the denominators are the same? You may use diagrams to explain your answer.

Challenge Yourself

2. Fill in the missing fraction. Write the fraction in its simplest form.

a. $\frac{3}{8} + \square = \frac{1}{2}$

b. $\square - \frac{2}{7} = \frac{6}{14}$

c. $\frac{21}{60} - \square = \frac{1}{20}$

d. $\square + \frac{30}{52} = \frac{23}{26}$

e. $\frac{15}{27} + \square = \frac{2}{3}$

f. $\square - \frac{9}{24} = \frac{7}{24}$

Problem Solving

3. Henny's thumb is $\frac{3}{4}$ of an inch long. Ilana's thumb is $\frac{10}{16}$ of an inch long. How much longer is Henny's thumb?

4. Kalman has a coin collection. He keeps $\frac{1}{3}$ of the collection in his bedroom, $\frac{1}{8}$ in his backpack, and $\frac{1}{6}$ in his school desk. He carries the rest of his coins in his pocket. What fraction of his collection is in his pocket?

5. Meir swims $\frac{2}{15}$ of a mile. He then rests for a few minutes before swimming another $\frac{3}{20}$ of a mile. He takes another rest and swims a final $\frac{1}{5}$ of a mile. How far does he swim altogether?

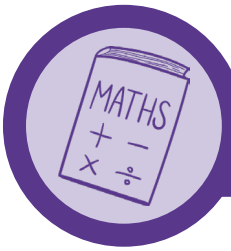
Helpful Hint

When subtracting from a whole number, write it as a fraction with the same denominator.

6. **Motty wants to know what proportion of his class plays sports. He takes a survey and discovers that $\frac{6}{10}$ of his classmates play baseball, $\frac{1}{2}$ play football, and $\frac{4}{5}$ play basketball. Motty says, "Some boys play more than one sport." Circle the correct statement and use your work to explain your reasoning.**

Motty is right. Motty is wrong. Motty could be right or wrong.



Improper Fractions and Mixed Numbers

In This Lesson You Will Learn:

- how to convert between improper fractions and mixed numbers
- how to add and subtract improper fractions and mixed numbers

Can You Do This?

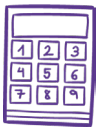
Use the words in the box to complete the sentences.

greater	*mixed*	*number*	*proper*	*fraction*	*less*	*denominator*

A _____ fraction is always _____ than one. An improper fraction has a numerator that is _____than the _____ . A _____ is made of an integer and a _____ .

Calculating Equivalent Fractions

Sometimes you will come across questions that involve an **improper fraction** or a **mixed number**. You must know how to convert between these types of numbers, as often you will be asked to give your answer in a specific format.



Sample Problem

Convert $\frac{14}{12}$ to a mixed number.

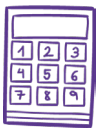
Step one: Calculate how many whole numbers we have. This will be the integer value of our mixed number.

How many times does 12 go into 14?

One time, with a remainder of **2**.

$$1\frac{2}{12}$$

Step two: Use the remainder as the numerator of the new fraction, keeping the denominator the same.



Answer: $\frac{4}{12} = 1\frac{2}{12}$

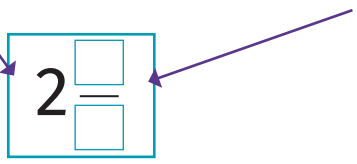
Can this answer be simplified? Yes.

$\frac{2}{12} \overset{\div 2}{=} \frac{1}{6} = 1\frac{1}{6}$

Applying Your Knowledge

Convert $\frac{18}{7}$ to a mixed number.

7 goes into 18 two times, with a remainder of?



Practice

1. Convert these improper fractions to mixed numbers, simplifying your answers wherever possible.

a. $\frac{12}{10}$ _____

b. $\frac{17}{5}$ _____

c. $\frac{8}{7}$ _____

d. $\frac{9}{2}$ _____

e. $\frac{16}{6}$ _____

f. $\frac{25}{7}$ _____

g. $\frac{50}{8}$ _____

h. $\frac{20}{3}$ _____

i. $\frac{58}{4}$ _____

j. $\frac{9}{2}$ _____

Let's Think

Look at your answers. How many had to be simplified? Look at those problems. What do you notice about those fractions?

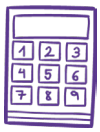
_____

How can this knowledge make it easier for you to convert those fractions to mixed numbers?

_____

Converting Mixed Numbers to Improper Fractions

Converting mixed numbers to improper fractions involves three simple steps. The important thing to remember when converting between these formats is that the denominator always stays the same. It will only change when the answer is simplified, if that is necessary.

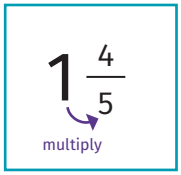


Sample Problem

Convert $1\frac{4}{5}$ to an improper fraction.

Step one: Multiply the integer by the denominator.

1 x 5 = 5



Step two: Add your answer to the numerator.

5 + 4 = 9

Step three: Use your answer as the numerator of the new fraction, keeping the denominator the same.

Answer: $1\frac{4}{5} = \frac{9}{5}$

Applying Your Knowledge

Convert $2\frac{3}{4}$ to an improper fraction.

$2 \times 4 = 8$

8 + ☐ **=?** ☐

$2\frac{3}{4}$

multiply

Practice

1. Convert these mixed numbers to improper fractions.

a. $1\frac{1}{9}$ _____

b. $3\frac{1}{2}$ _____

c. $1\frac{3}{8}$ _____

d. $2\frac{5}{12}$ _____

e. $9\frac{1}{10}$ _____

f. $4\frac{7}{11}$ _____

g. $6\frac{4}{5}$ _____

h. $8\frac{1}{4}$ _____

i. $2\frac{3}{14}$ _____

j. $5\frac{5}{8}$ _____

Helpful Hint

When you're not sure if an answer is correct, try converting it back to see if it matches with the original mixed number.

Adding and Subtracting Improper Fractions and Mixed Numbers

Nechama bought herself a new bracelet. It has a silver chain of $4\frac{1}{4}$ inches and a gold piece which is $2\frac{1}{3}$ inches long. What is the length of the entire bracelet? Give your answer as an improper fraction.

There are two ways of calculating this equation. Both methods have been started for you in the boxes below. Complete them, showing your work.

Method 1: Add the integers and the fractions separately, then convert to an improper fraction.

$4 + 2 = 6$

$\frac{1}{4} = \frac{3}{12}$

$\frac{1}{3} = \frac{4}{12}$

$\frac{3}{12} = \frac{4}{12} =$ ☐

Method 2: Convert to improper fractions and add together, using a common denominator.

$4 \times 4 = 16$ $\qquad$ $2 \times 3 = 6$

$16 + 1 = 17$ $\qquad$ $6 + 1 = 7$

$4\frac{1}{4} = \frac{17}{4}$ $\qquad$ $2\frac{1}{3} =$ ☐

Which method did you find easier? Why?

Practice

1. Calculate these equations using either method 1 or method 2. Give your answers as improper fractions, simplifying wherever possible.

a. $1\frac{3}{5} + \frac{1}{5}$ _____

b. $2\frac{1}{3} + 3\frac{1}{3}$ _____

c. $1\frac{1}{2} + 4\frac{1}{4}$ _____

d. $8\frac{8}{14} - 2\frac{3}{7}$ _____

e. $7\frac{4}{7} + 2\frac{6}{21}$ _____

f. $5\frac{2}{3} + \frac{5}{6}$ _____

g. $4\frac{3}{5} - \frac{14}{15}$ _____

h. $3\frac{10}{15} - 1\frac{4}{5}$ _____

2. Calculate these equations. Give your answers as mixed numbers, simplifying wherever possible.

a. $\frac{4}{5} + \frac{3}{5}$ _____

b. $\frac{8}{6} + \frac{9}{6}$ _____

c. $\frac{4}{2} + \frac{9}{2}$ _____

d. $\frac{3}{4} + \frac{11}{12}$ _____

e. $\frac{1}{3} + \frac{17}{9}$ _____

f. $\frac{29}{12} - \frac{5}{18}$ _____

g. $\frac{13}{6} - \frac{1}{18}$ _____

h. $\frac{17}{6} - \frac{3}{4}$ _____

Challenge Yourself

3. **These equations involve proper fractions not in their simplest form, improper fractions, and mixed numbers. Write the method that you will use to calculate the answers and follow those steps for each problem. Give your answers as mixed numbers.**

Method:

a. $\frac{14}{5} + 3\frac{3}{10} + \frac{28}{40}$ _____

b. $9\frac{1}{2} + \frac{9}{24} - \frac{25}{8}$ _____

c. $\frac{33}{4} - \frac{42}{63} - 2\frac{1}{6}$ _____

Problem Solving

4. **Asher goes on a hike. He sees this signpost. What is the distance between the campsite and the lake?**

_____

5. **Perele and Rina both own jump ropes. Perele's is $6\frac{3}{4}$ feet long and Rina's is $7\frac{5}{6}$ feet long. How much longer is Rina's jump rope than Perele's?**

_____

6. **Shaya lives on a very long street. $4\frac{1}{2}$ blocks down the road is his friend Tzvi's house. . . grocery store is $10\frac{2}{5}$ blocks after that, and it's $3\frac{7}{10}$ blocks further to the ice cream store.**

a. Sketch a diagram to represent this information.

b. How many blocks does Tzvi have to walk to get to the ice cream store?

c. How many blocks does Shaya have to walk to get to the ice cream store?

7. **Mrs Winer is filling the bathtub, which can hold $78\frac{2}{3}$ gallons of water. First she fills it with $\frac{151}{3}$ gallons of hot water, then she turns on the cold water and goes to find her kids. When she comes back, the water has just reached the top of the bathtub. She drains out $24\frac{5}{12}$ gallons of water and gives her kids a bath.**

a. How much cold water entered the bathtub?

b. In how much water did Mrs Winer bathe her kids?