9.4 Subtracting Fractions with Models

You will need
- fraction strips
- number lines

GOAL
Subtract fractions less than 1 using fraction strips and number lines.

Learn about the Math

Yuki notices that $\frac{3}{4}$ of the houses on Fox Street have garages and $\frac{1}{6}$ have sheds.

? How many more of the houses have garages than sheds?

A. Model $\frac{3}{4}$ and $\frac{1}{6}$ using fraction strips.

B. Determine the common denominator of $\frac{3}{4}$ and $\frac{1}{6}$. Redraw your models with this denominator.

C. How many parts of the new fraction strip represent the difference between $\frac{3}{4}$ and $\frac{1}{6}$?

D. How many more houses have garages than sheds?

Reflecting

1. How could you have predicted that the answer in step D would be greater than $\frac{2}{4}$?

2. What equivalent fractions did you use for $\frac{3}{4}$ and $\frac{1}{6}$ in step B?

3. How did using a common denominator help you make the fraction strips in step C?

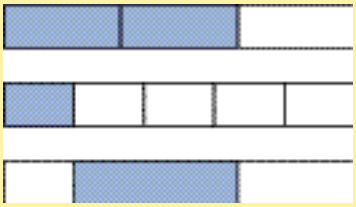
4. Explain how you can use fraction strips and a common denominator to subtract fractions.

Work with the Math

Example 1: Estimating and subtracting using fraction strips

Estimate and then subtract $\frac{2}{3} - \frac{1}{5}$ using fraction strips.

Ryan's Solution

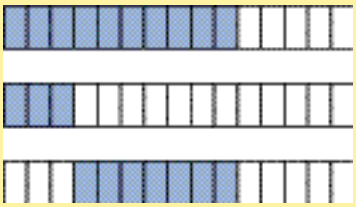


I used fraction strips to show both fractions.

Then I figured out the difference between the longer coloured part and the shorter coloured part.

It looks like the difference is about $\frac{1}{2}$.

15 is a common denominator of $\frac{2}{3}$ and $\frac{1}{5}$ because 15 is a common multiple of 3 and 5. So, I divided the fraction strips into fifteenths.



The $\frac{2}{3}$ strip becomes $\frac{10}{15}$ because $\frac{2}{3} = \frac{2 \times 5}{3 \times 5}$, which is $\frac{10}{15}$.

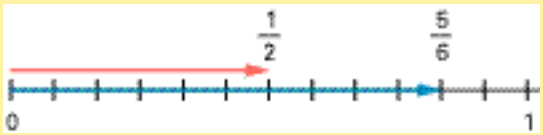
The $\frac{1}{5}$ strip becomes $\frac{3}{15}$ because $\frac{1}{5} = \frac{1 \times 3}{5 \times 3}$, which is $\frac{3}{15}$.

The difference is $\frac{10}{15} - \frac{3}{15} = \frac{7}{15}$.

Example 2: Subtracting using a number line

Subtract $\frac{5}{6} - \frac{1}{2}$ using a number line.

Yuki's Solution

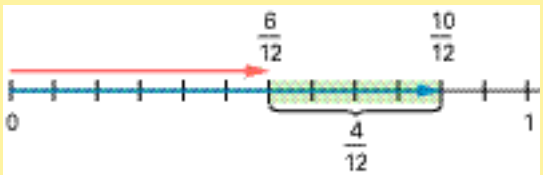


I used a number line showing twelfths, since 12 is a common denominator for $\frac{5}{6}$ and $\frac{1}{2}$.

$\frac{5}{6} = \frac{5 \times 2}{6 \times 2}$ $\quad$ $\frac{1}{2} = \frac{1 \times 6}{2 \times 6}$

$= \frac{10}{12}$ $\quad$ $= \frac{6}{12}$

I drew arrows to show $\frac{5}{6}$ and $\frac{1}{2}$.



I need to find the distance from $\frac{5}{6}$ to $\frac{1}{2}$.

There are four spaces between $\frac{1}{2}$ and $\frac{5}{6}$.

Since each space is $\frac{1}{12}$, then $\frac{5}{6} - \frac{1}{2} = \frac{4}{12}$.

A Checking

5. **a)** How do you know that the difference for $\frac{4}{5} - \frac{1}{3}$ is about $\frac{1}{2}$?

b) Use fraction strips to subtract $\frac{4}{5} - \frac{1}{3}$.

6. Use a number line to model the difference for $\frac{4}{3} - \frac{1}{2}$. Show your work.

7. Suppose that $\frac{3}{5}$ of the students in your class have pets, and $\frac{1}{6}$ have more than one pet.

a) Use fraction strips or a number line to calculate the fraction of the students with only one pet.

b) How many students have no pets?

B Practising

8. Use fraction strips to estimate and then calculate each difference.

a) $\frac{5}{8} - \frac{1}{4}$

b) $\frac{7}{10} - \frac{1}{4}$

c) $\frac{7}{6} - \frac{2}{3}$

d) $\frac{11}{8} - \frac{3}{4}$

e) $\frac{3}{10} - \frac{1}{5}$

f) $\frac{5}{3} - \frac{5}{4}$

9. Use number lines to calculate each difference.

a) $\frac{3}{5} - \frac{1}{10}$

b) $\frac{5}{2} - \frac{3}{4}$

c) $\frac{8}{3} - \frac{7}{9}$

d) $\frac{7}{4} - \frac{2}{3}$

e) $\frac{3}{10} - \frac{1}{5}$

f) $\frac{9}{4} - \frac{9}{8}$

10. Draw and colour a shape so that $\frac{5}{8}$ is blue and $\frac{1}{3}$ is yellow.

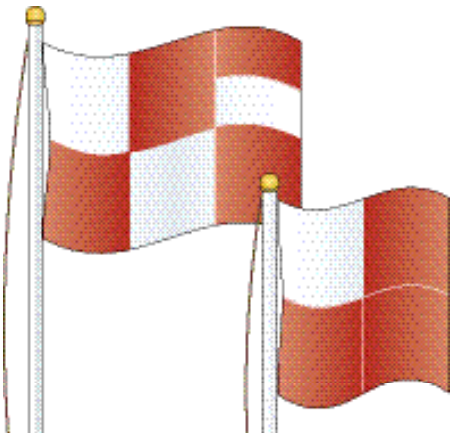
a) What fraction describes how much more is blue than yellow?

b) What fraction describes the part of the shape that is not blue or yellow?

11. **a)** What fraction of the larger flag is red?

b) What fraction of the smaller flag is red?

c) How much more of the smaller flag is red?



12. At Oakville School, $\frac{2}{10}$ of the students are in Grades 7 and 8, and $\frac{1}{4}$ of the students are in Grades 5 and 6.

a) Are there more Grade 5 and 6 students or Grade 7 and 8 students?

b) What is the difference between the sizes of the two groups of students? Give your answer as a fraction of the whole school.

13. Rosa does $\frac{1}{2}$ of her book report on Tuesday and another 20% of her book report on Wednesday. What fraction of the book report is left to do?

14. Anne needs $\frac{1}{6}$ c. of sugar to make a dessert. Ken says that she should fill a $\frac{1}{2}$ c. measuring cup with sugar and then pour out enough to fill a $\frac{1}{3}$ c. measuring cup. He says that $\frac{1}{6}$ c. of sugar will be left in the $\frac{1}{2}$ c. measuring cup. Do you agree? Explain.

15. Mohammed surveyed students in the school about their favourite activities. The results are shown in the following table. Use the fractions to answer the questions.

Activity	Fraction of students who prefer activity
swimming	$\frac{1}{4}$
tobogganing	$\frac{1}{6}$
skating	$\frac{1}{12}$
soccer	$\frac{1}{3}$

a) What fraction describes how many more students prefer playing soccer to swimming?

b) What fraction describes how many more students prefer swimming to skating?

c) What fraction describes how many more students prefer tobogganing to skating?

16. a) Subtract each pair of fractions. Look for a pattern in the differences.

i) $\frac{1}{3} - \frac{1}{4}$ **iii)** $\frac{1}{5} - \frac{1}{6}$

ii) $\frac{1}{4} - \frac{1}{5}$ **iv)** $\frac{1}{6} - \frac{1}{7}$

b) Use the pattern you saw in part (a) to help you calculate $\frac{1}{2} - \frac{1}{3}$.

17. Addition is not the same as subtraction. Yet, some of the steps for adding fractions are the same as the steps for subtracting fractions. Which steps are the same? Why are they the same?

C Extending

18. To subtract $\frac{4}{3} - \frac{3}{4}$, Ann decides to add $\frac{1}{4}$ to $\frac{1}{3}$.

a) Model $\frac{4}{3}$ and $\frac{3}{4}$ on a number line.

b) Explain Ann's method.

c) What is the difference for $\frac{4}{3} - \frac{3}{4}$?

19. A travel agency is finding volunteers for a travel group. Between $\frac{1}{4}$ and $\frac{1}{2}$ of the group must be between the ages of 15 and 21, and at least $\frac{1}{2}$ of the group must be over the age of 21.

a) What is the least fraction of the group that can be under 15? Show your work.

b) What is the greatest fraction of the group that can be under 15? Show your work.

20. Can the sum of two fractions equal the difference between the same two fractions? Explain.

21. What digit can you put in both boxes to make the following equation true?

$$\frac{\square}{7} - \frac{2}{\square} = \frac{11}{21}$$