ACADEMIC STUDIES

MATH

Support Materials and Exercises
for

FRACTIONS
Book 2
The Addition and Subtraction of Fractions

SPRING 1999

ADDING FRACTIONS WITH COMMON DENOMINATORS

$\frac{1}{3}+\frac{1}{3}$ $\frac{3}{6}+\frac{2}{6}$ $1\frac{1}{7}+2\frac{3}{7}$ $2\frac{3}{5}+3\frac{3}{4}$

Like whole numbers (1, 77, 2000), we can add, subtract, multiply and divide fractions.

> To add fractions that have the same denominators just add the numerators and keep the same denominator that you started with.

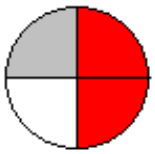
.....The answer is called the **SUM.**

Example: $\frac{2}{5}+\frac{1}{5}=\frac{3}{5}$

two fifths + one fifth = three fifths

Have you noticed?... Like whole numbers, we are finding out how much of something we have altogether. When we add fractions, we are asking ourselves...how much of the WHOLE do we have altogether? In this case, we want to know how many fifths we have altogether.

Example 2: How many fourths of this circle have been shaded?



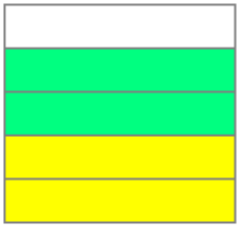
$\frac{2}{4}$ of this circle has been shaded one way, and $\frac{1}{4}$ has been shaded another way. Altogether, $\frac{3}{4}$ of the circle has been shaded.

2 + 1 = 3 (numerator), and keep the original denominator (4).

$$\frac{2}{4}+\frac{1}{4}=\frac{3}{4}$$

two quarters + one quarter = three quarters

Example 3: $\frac{2}{5}+\frac{2}{5}=\frac{4}{5}$



2 + 2 = 4 (numerator), and keep the original denominator (5).

two fifths + two fifths = four fifths

REMEMBER: YOUR ANSWER MAY NOT BE IN THE SIMPLEST FORM, SO YOU WILL HAVE TO REDUCE IT!!

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

$$\frac{5}{8}+\frac{1}{8}=\frac{6}{8}=\frac{3}{4}$$

CHANGING IMPROPER FRACTIONS TO MIXED NUMBERS WHEN ADDING FRACTIONS WITH COMMON DENOMINATORS.

Sometimes when fractions are added, the sum is an improper fraction. This means of course that you end up with more than one whole “thing” as an answer. This “improper” fraction **must** be changed to a mixed number. This is its reduced form.

Take a look...

Example 1

$\frac{3}{4}+\frac{2}{4}=\frac{5}{4}$ $\frac{5}{4}=1\frac{1}{4}$

To arrive at the answer $1\frac{1}{4}$, just divide 4 into 5.

“Four goes into five once, (this will be the whole number), with one left over (this will be the numerator of the new fraction) and you keep the same denominator that you started with.”

What a mouthful!

Example 2

$\frac{2}{3}$ cup of flour + $\frac{2}{3}$ cup of flour = $\frac{4}{3}$ cups of flour total.

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

“Four goes into five once with one left over, and keep the same denominator, four.

Sometimes, an improper fraction does not have a remainder. That is, when we divide, we end up with a whole number only.

Watch!

Example 3

$$\frac{10}{7}+\frac{4}{7}=\frac{14}{7}=2$$

Divide. “Seven goes into fourteen twice with no remainder. In other words, there are exactly two groups of seven in fourteen.”

Example 4

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

Divide. “Four goes into four once with no remainder.

Exercise 1

Add these fractions and reduce your answers if needed.

1) $\frac{2}{5}+\frac{2}{5}$

2) $\frac{5}{4}+\frac{3}{4}$

3) $\frac{4}{7}+\frac{3}{7}$

4) $\frac{4}{9}+\frac{1}{9}$

5) $\frac{2}{8}+\frac{3}{8}$

6) $\frac{3}{6}+\frac{2}{6}$

7) $\frac{2}{3}+\frac{1}{3}$

8) $\frac{1}{7}+\frac{4}{7}$

9) $\frac{8}{6}+\frac{4}{6}$

10) $\frac{2}{5}+\frac{1}{5}$

11) $\frac{4}{11}+\frac{3}{11}$

12) $\frac{30}{40}+\frac{5}{40}$

13) $\frac{3}{13}+\frac{9}{13}$

14) $\frac{3}{8}+\frac{5}{8}$

15) $\frac{10}{12}+\frac{1}{12}$

16) $\frac{3}{5}+\frac{1}{5}$

17) $\frac{2}{4}+\frac{1}{4}$

18) $\frac{6}{8}+\frac{1}{8}$

19) $\frac{2}{5}+\frac{3}{5}$

20) $\frac{6}{12}+\frac{3}{12}$

21) $\frac{4}{8}+\frac{3}{8}$

22) $\frac{5}{7}+\frac{1}{7}$

23) $\frac{4}{10}+\frac{2}{10}$

24) $\frac{10}{14}+\frac{3}{14}$

25) $\frac{15}{25}+\frac{4}{25}$

26) $\frac{100}{200}+\frac{50}{200}$

Exercise 2

Change these improper fractions to mixed numbers. Reduce to lowest terms.

26) $\frac{6}{4}$ 2) $\frac{12}{5}$ 3) $\frac{20}{12}$ 4) $\frac{60}{7}$ 5) $\frac{22}{6}$ 6) $\frac{14}{4}$

7) $\frac{25}{6}$ 8) $\frac{32}{5}$ 9) $\frac{8}{5}$ 10) $\frac{13}{4}$ 11) $\frac{12}{5}$ 12) $\frac{16}{7}$

13) $\frac{40}{30}$ 14) $\frac{10}{6}$ 15) $\frac{18}{12}$ 16) $\frac{7}{2}$ 17) $\frac{100}{40}$ 18) $\frac{55}{13}$

19) $\frac{15}{2}$ 20) $\frac{45}{10}$ 21) $\frac{7}{3}$ 22) $\frac{33}{12}$ 23) $\frac{20}{13}$ 24) $\frac{24}{7}$

25) $\frac{9}{5}$ 26) $\frac{44}{10}$

Exercise 3

Complete the equation by filling in the missing fraction. Reduce to lowest terms.

1) $\frac{1}{4}+?=\frac{4}{4}$ or 1 2) $?+\frac{3}{7}=\frac{6}{7}$ 3) $\frac{2}{8}+\frac{7}{8}=?$ 4) $?+\frac{5}{9}=1$

5) $\frac{4}{10}+?=\frac{7}{10}$ 6) $\frac{2}{3}+\frac{1}{3}=?$ 7) $\frac{3}{8}+?=\frac{3}{8}$ 8) $?+\frac{1}{6}=\frac{1}{2}$ *reduced*

9) $\frac{2}{8}+?=\frac{3}{4}$ *reduced* 10) $?+\frac{4}{10}=\frac{3}{5}$ *reduced* 11) $?+\frac{20}{30}=1$

12) $\frac{6}{12}+?=\frac{2}{3}$ *reduced* 13) $?+\frac{4}{9}=\frac{8}{9}$ 14) $\frac{10}{20}+\frac{13}{20}=?$ 15) $?+\frac{3}{7}=1\frac{1}{7}$ *reduced*

Exercise 4

Connect the pairs of equivalent fractions.

$\frac{1}{4}+\frac{2}{4}$	$\frac{6}{14}+\frac{4}{14}$
$\frac{2}{5}+\frac{1}{5}$	$\frac{1}{3}+\frac{1}{3}$
$\frac{6}{10}+\frac{4}{10}$	$\frac{1}{5}+\frac{1}{5}+\frac{1}{5}$
$\frac{3}{7}+\frac{2}{7}$	$\frac{20}{27}+\frac{1}{27}$
$\frac{2}{9}+\frac{5}{9}$	$\frac{3}{8}+\frac{3}{8}$
$\frac{5}{10}+\frac{3}{10}$	$\frac{3}{5}+\frac{1}{5}$
$\frac{5}{12}+\frac{3}{12}$	$\frac{4}{6}+\frac{1}{6}$
$\frac{8}{12}+\frac{2}{12}$	$\frac{3}{8}+\frac{5}{8}$

ADDING FRACTIONS WITH DIFFERENT DENOMINATORS

Fractions with different denominators cannot be added until both denominators have been changed to the same number.

The fractions $\frac{2}{7}$ and $\frac{3}{7}$ can be added, because the denominators are the same. By adding the numerators and keeping the same denominator, we arrive at the answer $\frac{5}{7}$.

The fractions $\frac{2}{7}$ and $\frac{3}{8}$ cannot be added yet, because the denominators are different.

To add fractions with different denominators, follow these simple steps:

a) Find a common denominator for all fractions by creating equivalent fractions.

b) Add the new numerators together.

c) Put this sum over the new denominator.

d) Reduce your answer if possible.

Example 1:

$$\frac{1}{4}+\frac{3}{5}$$

step1: Find a common denominator for 4 and 5 by creating equivalent fractions.

The common denominator is 20.

$\frac{1}{4}=\frac{?}{20}$ $\frac{1}{4}=\frac{5}{20}$

$\frac{3}{5}=\frac{?}{20}$ $\frac{3}{5}=\frac{12}{20}$

step 2: Add the new numerators together. 5 + 12 = 17

step 3: Put the new numerator over the original denominator.

$\frac{17}{20}$

step 4: Reduce if possible. The fraction $\frac{17}{20}$ cannot be reduced.

Example 2:

$\frac{3}{8}+\frac{2}{3}$

step 1: Find an common denominator for 8 and 3 by creating equivalent fractions.

The common denominator is 24. This is because 24 can be divided by 8 evenly and 3 evenly!

$\frac{3}{8}=\frac{?}{24}$ $\frac{3}{8}=\frac{9}{24}$

$\frac{2}{3}=\frac{?}{24}$ $\frac{2}{3}=\frac{16}{24}$

step 2: Add the new numerators together. 9 + 16 = 25

step 3: Put the new numerator over the new denominator.

$\frac{25}{24}$

step 4: Reduce if possible. $\frac{25}{24}$ can be reduced to $1\frac{1}{24}$.

$\frac{3}{8}+\frac{2}{3}=1\frac{1}{24}$

Example 3: You can add more than two fractions at a time. Just follow the same steps!

$$\frac{1}{4}+\frac{5}{12}+\frac{1}{2}$$

step 1: Find a common denominator for 4, 12 and 2 by creating equivalent fractions.

The common denominator is 12. Hint: choose the largest denominator, 12 and go through the times tables for 12 dividing each product by the other two denominators.

12 x 1 = 12 Can 12 be divided by 4 evenly and 2 evenly? yes.
12 ÷ 4 = 3
12 ÷ 2 = 6

Because 12 can be divided evenly by all denominators, you don't have to go any further! You can use 12 as the new denominator!

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

$\frac{5}{12}=\frac{?}{12}$ $\frac{5}{12}=\frac{5}{12}$

$\frac{1}{2}=\frac{?}{12}$ $\frac{1}{2}=\frac{6}{12}$

step 2: Add the new denominators together. 3 + 5 + 6 = 14

step 3: Put the new denominator over the new denominator.

$\frac{14}{12}$

step 4: Reduce if possible. $\frac{14}{12}$ can be reduced to $1\frac{2}{12}$, which equals $1\frac{1}{6}$**.**

You will be happy to know that there is a shortcut to finding common denominators!

All you have to do is **multiply the original denominators together!** This product is the new denominator! Be careful though, <u>it may not be the smallest common denominator</u>.

Take a look!

Example 1: $\frac{3}{4}+\frac{4}{5}$ 4 x 5 = 20

Example 2: $\frac{2}{6}+\frac{7}{8}$ 6 x 8 = 48

Example 3: $\frac{4}{7}+\frac{2}{3}$ 7 x 3 = 21

Get the idea? This works with more than two denominators too!

Example 4: $\frac{2}{3}+\frac{5}{6}+\frac{3}{4}$ 3 x 6 x 4 = 72

Did you notice? 72 is not the smallest common denominator, 12 is. But, you can still reduce your answer at the end.

Exercise 5

Practice finding common denominators for the following fractions.

1) $\frac{2}{3}+\frac{3}{5}$

2) $\frac{5}{6}+\frac{6}{7}$

3) $\frac{2}{4}+\frac{5}{8}$

4) $\frac{1}{2}+\frac{7}{9}$

5) $\frac{3}{4}+\frac{6}{7}$

6) $\frac{8}{9}+\frac{9}{10}$

7) $\frac{1}{3}+\frac{1}{6}$

8) $\frac{2}{4}+\frac{1}{3}$

9) $\frac{1}{12}+\frac{3}{4}$

10) $\frac{5}{6}+\frac{6}{8}$

11) $\frac{1}{3}+\frac{6}{7}$

12) $\frac{3}{18}+\frac{5}{9}$

13) $\frac{4}{10}+\frac{1}{2}+\frac{2}{3}$

14) $\frac{2}{4}+\frac{1}{3}+\frac{1}{12}$

15) $\frac{5}{10}+\frac{2}{4}+\frac{6}{8}$

16) $\frac{3}{6}+\frac{3}{9}+\frac{1}{3}$

17) $\frac{1}{2}+\frac{3}{5}+\frac{9}{10}$

18) $\frac{10}{20}+\frac{7}{10}+\frac{3}{5}$

19) $\frac{7}{9}+\frac{7}{8}$

20) $\frac{4}{6}+\frac{3}{7}$

Exercise 6

Fill in the missing numbers.

1) $\frac{2}{3}+\frac{4}{7}=$

$\frac{?}{21}+\frac{12}{21}$

2) $\frac{5}{6}+\frac{6}{8}$

$\frac{20}{24}+\frac{?}{24}$

3) $\frac{1}{2}+\frac{9}{10}$

$\frac{?}{10}+\frac{9}{10}$

4) $\frac{4}{5}+\frac{5}{6}$

$\frac{24}{30}+\frac{?}{30}$

5) $\frac{3}{5}+\frac{4}{9}$

$\frac{27}{?}+\frac{20}{?}$

6) $\frac{1}{10}+\frac{3}{5}+\frac{1}{2}$

$\frac{?}{10}+\frac{?}{10}+\frac{?}{10}$

7) $\frac{2}{3}+\frac{4}{5}$

$\frac{10}{?}+\frac{8}{?}$

8) $\frac{2}{5}+\frac{4}{10}+\frac{12}{15}$

$\frac{?}{30}+\frac{?}{30}+\frac{?}{30}$

9) $\frac{10}{12}+\frac{5}{24}+\frac{5}{6}$

$\frac{20}{?}+\frac{5}{?}+\frac{20}{?}$

10) $\frac{4}{7}+\frac{1}{2}$

$\frac{?}{14}+\frac{?}{14}$

Exercise 7

Answer the following questions using the diagram below.

<table>
<tr><td>1</td><td>6</td><td rowspan="2">3</td><td>5</td><td>2</td></tr>
<tr><td>8</td><td>7</td><td colspan="3">4</td></tr>
</table>

Example: section 1 + section 8 = $\frac{1}{16}+\frac{1}{16}=\frac{2}{16}$

1) Write a fraction for each section of the diagram that tells how much space of the whole is occupied.

2) Use fractions to show how much of the whole each numbered section represents. . .

   a. 1 and 2
   b. 4 and 2
   c. 3 and 7
   d. 3 and 5 and 7
   e. 5 and 4 and 2
   f. 3 and 5 and 6 and7

3) Which section(s) takes up the most amount of space?

4) Which section(s) takes up the least amount of space?

Exercise 8

Express each of the following sums in the simplest form.

5) $\frac{2}{5}+\frac{1}{2}$

6) $\frac{2}{3}+\frac{4}{6}$

7) $\frac{10}{12}+\frac{6}{8}$

8) $\frac{2}{7}+\frac{5}{14}$

9) $\frac{5}{6}+\frac{3}{4}$

10) $\frac{3}{8}+\frac{5}{7}$

11) $\frac{7}{9}+\frac{3}{5}$

12) $\frac{1}{6}+\frac{2}{10}$

13) $\frac{2}{5}+\frac{4}{8}$

14) $\frac{9}{25}+\frac{4}{5}$

11) $\frac{7}{8}+\frac{3}{4}$

12) $\frac{3}{6}+\frac{5}{9}$

13) $\frac{1}{7}+\frac{2}{10}$

14) $\frac{20}{30}+\frac{10}{20}$

15) $\frac{7}{10}+\frac{1}{2}$

16) $\frac{7}{8}+\frac{4}{0}$

17) $\frac{5}{6}+\frac{7}{12}$

18) $\frac{8}{9}+\frac{1}{2}$

19) $\frac{3}{7}+\frac{20}{21}$

20) $\frac{10}{12}+\frac{3}{4}$

ADDING MIXED NUMBERS

The following fractions are **"mixed numbers"**: $3\frac{1}{2}$ $10\frac{2}{3}$

A mixed number, also called : "mixed fraction", is a number that is made up of more than one kind of number - that's why it's called "mixed". It always has a whole number part as well as a fraction part.

$3\frac{1}{2}$  fraction part

whole number part

You may be asking... when will I ever have to add mixed numbers?? I'm glad you asked!

You may want to add up the number of hours you worked in the last two weeks to see if you are owed overtime. Let's say you worked $30\frac{1}{2}$ hours one week, and $35\frac{2}{3}$ hours another week. You would of course need to add these amounts together to arrive at a total.

To add mixed numbers that have common denominators, follow these simple steps:

Example: $4\frac{2}{7}+1\frac{3}{7}$

1. Add the whole numbers. 4+1= 5
2. Add the fractions. $\frac{2}{7}+\frac{3}{7}=\frac{5}{7}$
3. Write the whole number beside the fraction. $5\frac{5}{7}$
4. Reduce the answer if possible.
   The fraction $5\frac{5}{7}$ cannot be reduced.

Example 2: $5\frac{4}{8}+\frac{2}{8}$ * you can also add a mixed number and a proper fraction. The whole number in the second fraction is 0.

a. Add the whole numbers. 5+0=5
b. Add the fractions. $\frac{4}{8}+\frac{2}{8}=\frac{6}{8}$
c. Write the whole number beside the fraction. $5\frac{6}{8}$
d. Reduce the fraction if possible. $5\frac{6}{8}=5\frac{3}{4}$

Example 3: $1\frac{3}{8}+2\frac{3}{8}+6\frac{1}{8}$

a. 1+2+6=8
b. $\frac{3}{8}+\frac{3}{8}+\frac{1}{8}=\frac{7}{8}$
c. $8\frac{7}{8}$ This answer cannot be reduced.

Exercise 9: Add these mixed numbers. Always reduce where possible.

1) $1\frac{2}{4}+5\frac{1}{4}$

2) $4\frac{3}{7}+\frac{2}{7}$

3) $3\frac{5}{10}+3\frac{1}{10}$

4) $8\frac{9}{15}+4\frac{3}{15}$

5) $\frac{1}{9}+4\frac{2}{9}+6\frac{4}{9}$

6) $3\frac{1}{7}+10\frac{5}{7}$

7) $2\frac{4}{12}+3\frac{5}{12}+11\frac{2}{12}$

8) $6\frac{9}{16}+4\frac{3}{16}$

9) $1\frac{4}{8}+5\frac{3}{8}$

10) $10\frac{1}{10}+3\frac{3}{10}+7\frac{2}{10}$

11) $12\frac{7}{9}+2\frac{1}{9}$

12) $7\frac{4}{10}+4\frac{2}{10}$

13) $9\frac{9}{20}+\frac{4}{20}+6\frac{2}{20}$

14) $6\frac{5}{25}+12\frac{12}{25}$

15) $3\frac{8}{18}+11\frac{5}{18}$

16) $2\frac{9}{19}+6\frac{7}{19}$

17) $8\frac{3}{11}+\frac{6}{11}$

18) $10\frac{50}{100}+20\frac{30}{100}$

19) $1\frac{100}{200}+9\frac{50}{200}$

20) $17\frac{3}{14}+1\frac{3}{14}+4\frac{5}{14}$

Sometimes when you add the fraction parts you get a whole number as an answer. If this happens, just add that whole number to the other one. Take a look!

Example: $2\frac{3}{5}+2\frac{2}{5}$

a. 2+2=4

b. $\frac{3}{5}+\frac{2}{5}=\frac{5}{5}=1$*Remember-any number divided by itself is 1.

c. 4+1=5 The answer is 5.

Example 2: $10\frac{7}{9}+3\frac{2}{9}$

a. 10+3=13

b. $\frac{7}{9}+\frac{2}{9}=\frac{9}{9}=1$

c. 13+1=14

Example 3: $6\frac{1}{10}+3\frac{6}{10}+1\frac{3}{10}$

a. 6+3+1=10

b. $\frac{1}{10}+\frac{6}{10}+\frac{3}{10}=\frac{10}{10}=1$

c. 10+1=11

Exercise 10: Add the groups of mixed numbers below. Each sum is a whole number.

1) $3\frac{2}{5}+6\frac{3}{5}$

2) $10\frac{11}{20}+5\frac{3}{20}+6\frac{6}{20}$

3) $7\frac{1}{6}+1\frac{2}{6}+3\frac{3}{6}$

4) $8\frac{7}{15}+6\frac{8}{15}$

5) $9\frac{9}{10}+3\frac{1}{10}$

6) $5\frac{5}{12}+10\frac{3}{12}+7\frac{4}{12}$

7) $2\frac{12}{20}+16\frac{8}{20}$

8) $6\frac{3}{9}+1\frac{3}{9}+2\frac{3}{9}$

9) $11\frac{2}{8}+12\frac{6}{8}$

10) $20\frac{30}{45}+10\frac{10}{45}+2\frac{5}{45}$

11) $1\frac{4}{14}+7\frac{10}{14}$

12) $3\frac{3}{10}+4\frac{4}{10}+5\frac{3}{10}$

Exercise 11: Change these mixed numbers to improper fractions.

1) $7\frac{7}{10}$

2) $12\frac{3}{5}$

3) $4\frac{6}{7}$

4) $8\frac{2}{9}$

5) $10\frac{3}{7}$

6) $4\frac{5}{8}$

7) $1\frac{2}{10}$

8) $6\frac{7}{8}$

Exercise 12: Change these improper fractions to mixed numbers.

1) $\frac{12}{7}$

2) $\frac{20}{12}$

3) $\frac{12}{5}$

4) $\frac{15}{7}$

5) $\frac{10}{3}$

6) $\frac{7}{2}$

7) $\frac{11}{4}$

8) $\frac{25}{9}$

Exercise 13: Mixed practice. Reduce answers if possible.

1) $1\frac{1}{9}+3\frac{3}{9}+6\frac{4}{9}$

2) $2\frac{3}{12}+7\frac{11}{12}$

3) $3\frac{3}{12}+\frac{5}{12}+10\frac{2}{12}$

4) $1\frac{4}{10}+3\frac{3}{10}+2\frac{3}{10}$

5) $15\frac{1}{20}+7\frac{7}{20}+8\frac{2}{20}$

6) $\frac{9}{16}+4\frac{3}{16}$

7) $10\frac{3}{15}+\frac{6}{15}+1\frac{1}{15}+9\frac{2}{15}$

8) $4\frac{5}{10}+6\frac{2}{10}+11\frac{3}{10}$

9) $7\frac{10}{25}+4\frac{4}{25}+10\frac{5}{25}+\frac{1}{25}$

10) $7\frac{3}{8}+\frac{3}{8}$

11) $2\frac{3}{9}+2\frac{6}{9}$

12) $\frac{6}{10}+4\frac{4}{10}$

13) $2\frac{5}{8}+4\frac{3}{8}+0$

14) $3\frac{3}{7}+4\frac{1}{7}$

15) $50\frac{30}{80}+20\frac{25}{80}$

16) $4\frac{11}{18}+\frac{1}{18}$

17) $7\frac{3}{10}+7\frac{3}{10}+7\frac{3}{10}$

Exercise 14: Fill in the missing fraction.

1) $1\frac{3}{7}+?=6\frac{6}{7}$

2) $?+7\frac{9}{15}=18\frac{14}{15}$

3) $10\frac{4}{18}+?=16\frac{12}{18}$

4) $?+9\frac{7}{25}=20\frac{16}{25}$

5) $8\frac{6}{10}+?=11\frac{9}{10}$

6) $?+13\frac{11}{20}=21\frac{16}{20}$

7) $?+3\frac{3}{7}=10\frac{7}{7}$

8) $\frac{1}{2}+?=2$

9) $4\frac{5}{12}+?=\frac{8}{12}$

You might also get an improper fraction when you add the fraction part of mixed numbers. Just change it to a mixed number, then add the two numbers together.

$3\frac{2}{5}+2\frac{4}{5}$

1) Add the whole numbers. 3+2=5
2) Add the fractions. $\frac{2}{5}+\frac{4}{5}=\frac{6}{5}$
3) Change the improper fraction to a mixed number. $\frac{6}{5}=1\frac{1}{5}$
4) Add the whole number and mixed number. $5+1\frac{1}{5}=6\frac{1}{5}$

Example 2: $1\frac{3}{8}+4\frac{8}{8}$

1) 1+4=5
2) $\frac{3}{8}+\frac{8}{8}=\frac{11}{8}$
3) $\frac{11}{8}=1\frac{3}{8}$
4) $5+1\frac{3}{8}=6\frac{3}{8}$

Example 3: $1\frac{6}{10}+3\frac{8}{10}$

1) 3+1=4
2) $\frac{6}{10}+\frac{8}{10}=\frac{14}{10}$
3) $\frac{14}{10}=1\frac{4}{10}$
4. $4+1\frac{4}{10}=5\frac{4}{10}=5\frac{2}{5}$

The answer is $5\frac{2}{5}$.

Exercise 15: Add the following mixed numbers. Don't forget to reduce your answers!

1) $1\frac{2}{6}+3\frac{5}{6}$ 2) $4\frac{3}{10}+7\frac{9}{10}$ 3) $10\frac{4}{9}+5\frac{8}{9}$

4) $4\frac{7}{12}+1\frac{8}{12}$ 5) $2\frac{2}{7}+6\frac{1}{7}+\frac{6}{7}$ 6) $\frac{11}{20}+8\frac{8}{20}+\frac{4}{20}$

7) $7\frac{7}{11}+3\frac{9}{11}$ 8) $2\frac{6}{15}+1\frac{10}{15}$ 9) $9\frac{4}{12}+8\frac{11}{12}$

Finally, mixed numbers can be added to whole numbers and vice-versa. All you have to do is add the whole numbers together and keep the fraction. this makes sense because you are adding whole amounts plus another part of a whole.

example: $3+2\frac{1}{2}=5\frac{1}{2}$ $3+2=5,5+\frac{1}{2}=5\frac{1}{2}$

Exercise 16: Practice adding these kinds of numbers...and reducing!

1) $7+4\frac{5}{10}$ 2) $6\frac{7}{12}+10$ 3) $12+8\frac{4}{12}$ 4) $4\frac{5}{9}+6$

5) $2\frac{2}{4}+10$ 6) $9\frac{8}{16}+5$ 7) $12\frac{10}{15}+10$ 8) $1+1\frac{1}{100}$

Adding Mixed Numbers with Unlike Denominators

Sometimes the mixed numbers have different denominators. So the first step is to change the fractions to equivalent fractions with a common denominator. Then go on as usual.

example: $2\frac{1}{5}+1\frac{6}{10}$

1) Change fractions to equivalent fractions that have a common denominator.

$\frac{1}{5}=\frac{?}{10}$ $\frac{1}{5}=\frac{2}{10}$

$\frac{6}{10}=\frac{?}{10}$ $\frac{6}{10}=\frac{6}{10}$

b. Add the whole numbers. 2+1=3

f. Add the fractions. $\frac{2}{10}+\frac{6}{10}=\frac{8}{10}$

7) Combine the whole number and fraction. $3\frac{8}{10}$

8) Reduce. $3\frac{8}{10}=3\frac{4}{5}$

The answer is $3\frac{4}{5}$.

more examples...

example 2: $3\frac{2}{4}+4\frac{5}{12}$

1) $\frac{2}{4}=\frac{?}{12}$ $\frac{2}{4}=\frac{6}{12}$

$\frac{5}{12}=\frac{?}{12}$ $\frac{5}{12}=\frac{5}{12}$

2) 3+4=7
3) $\frac{6}{12}=\frac{5}{12}=\frac{11}{12}$
4) $7\frac{11}{12}$ This is the answer.

example 3: $3\frac{6}{10}+\frac{8}{10}$

1. $\frac{6}{10}=\frac{?}{20}$ $\frac{6}{10}+\frac{12}{20}$

$\frac{8}{10}=\frac{?}{20}$ $\frac{8}{10}=\frac{16}{20}$

2. 3+0=3
3. $\frac{12}{20}+\frac{16}{20}=\frac{28}{20}$
4. $3\frac{28}{20}=3+1\frac{8}{20}$
5. $4\frac{8}{20}=4\frac{2}{5}$

The answer is $4\frac{2}{5}$.

Exercise 17: Add these mixed numbers.

Reduce your answers!

1) $2\frac{3}{8}+4\frac{1}{24}$

2) $10\frac{3}{6}+9\frac{1}{3}$

3) $9\frac{3}{5}+4\frac{2}{6}$

4) $7\frac{7}{9}+2\frac{1}{27}$

5) $1\frac{3}{14}+\frac{2}{28}$

6) $5\frac{5}{10}+8\frac{6}{20}$

7) $6\frac{4}{30}+\frac{2}{60}$

8) $4\frac{2}{8}+3\frac{5}{6}$

9) $10\frac{4}{8}+5\frac{5}{9}$

10) $3\frac{3}{5}+9\frac{8}{9}$

11) $2\frac{2}{7}+11\frac{3}{6}$

12) $\frac{6}{10}+3\frac{2}{100}$

13) $\frac{11}{12}+2\frac{12}{48}$

14) $3\frac{1}{4}+10\frac{5}{8}$

15) $3\frac{7}{8}+4\frac{3}{10}$

16) $1\frac{1}{2}+6\frac{4}{10}$

17) $7\frac{5}{7}+\frac{3}{4}$

18) $2\frac{3}{4}+9\frac{7}{32}$

19) $6\frac{4}{10}+7\frac{7}{30}$

20) $9\frac{6}{9}+1\frac{1}{6}$

21) $2\frac{3}{4}+\frac{8}{10}$

22) $2\frac{2}{5}+10\frac{5}{8}$

23) $4\frac{5}{6}+9\frac{4}{8}$

24) $3\frac{1}{3}+5\frac{2}{12}$

25) $\frac{6}{12}+4\frac{3}{4}$

SUBTRACTION

Subtracting fractions is very similar to adding fractions. The equation is always set up the same. The only difference is the operation we use. You subtract instead of add.

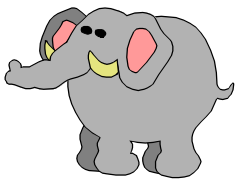
Subtract fractions with like denominators
Let's look at the following equation:

$$\frac{4}{5} - \frac{2}{5} =$$

The denominators are the same. We call these "like denominators." In subtracting like denominators, we simply subtract the second numerator from the first. 4-2=2. The new numerator is 2. The denominator stays the same. So, $\frac{4}{5} - \frac{2}{5} = \frac{2}{5}$

Let's try another one. $\frac{5}{7} - \frac{2}{7} =$ the denominators are like denominators, so all that we have to do is subtract the second numerator from the first. 5-2=3. The new numerator is 3. The denominator stays the same. So,
$\frac{5}{7} - \frac{2}{7} = \frac{3}{7}$.

Don't forget that when working with fractions, you must <u>ALWAYS</u> reduce your answer to its lowest terms. ($\frac{13}{15} - \frac{8}{15} = \frac{5}{15} = \frac{1}{5}$)



Exercise 18: Now you try a few:

1) $\frac{8}{11} - \frac{5}{11} =$
2) $\frac{4}{9} - \frac{3}{9} =$
3) $\frac{7}{15} - \frac{5}{15} =$
4) $\frac{7}{10} - \frac{3}{10} =$
5) $\frac{7}{15} - \frac{2}{15} =$
6) $\frac{2}{17} - \frac{1}{17} =$
7) $\frac{14}{23} - \frac{9}{23} =$
8) $\frac{9}{13} - \frac{7}{13} =$
9) $\frac{21}{24} - \frac{9}{24} =$
10) $\frac{12}{21} - \frac{5}{21} =$
11) $\frac{2}{3} - \frac{1}{3} =$
12) $\frac{4}{5} - \frac{2}{5} =$
13) $\frac{23}{32} - \frac{5}{32} =$
14) $\frac{15}{28} - \frac{13}{28} =$
15) $\frac{19}{40} - \frac{3}{40} =$

Subtracting when the denominators are different

Subtracting fractions that have different denominators takes additional steps than fractions with like denominators. You must first find a common denominator; next, you create equivalent fractions using this common denominator; then, you subtract.

(*note: the common denominator is in brackets)

Ex: $\frac{4}{9} - \frac{1}{4} =$ (36)

$\frac{16}{36} - \frac{9}{36} = \frac{7}{36}$

$\frac{11}{12} - \frac{9}{60} =$ (30)

$\frac{55}{60} - \frac{9}{60} = \frac{46}{60} = \frac{23}{30}$

$\frac{9}{15} - \frac{3}{15} = \frac{6}{15} = \frac{2}{5}$

$\frac{9}{15} - \frac{1}{5} =$(15)

Exercise 19: Now, you try.

1) $\frac{2}{3} - \frac{1}{4} =$
2) $\frac{6}{15} - \frac{1}{3} =$
3) $\frac{7}{10} - \frac{2}{3} =$
4) $\frac{15}{21} - \frac{2}{7} =$
5) $\frac{14}{25} - \frac{2}{5} =$
6) $\frac{9}{10} - \frac{24}{100} =$
7) $\frac{5}{6} - \frac{2}{3} =$
8) $\frac{7}{18} - \frac{1}{3} =$
9) $\frac{9}{13} - \frac{8}{26} =$

Let's review the steps up to this point

Step 1: find the common denominator
Step 2: create equivalent fractions
Step 3: subtract the numerators
Step 4: reduce to lowest terms

Subtracting Mixed Numbers

When subtracting mixed numbers, the fractions are always subtracted before the whole numbers.

ex: $4\frac{5}{8} - 2\frac{1}{4} =$ Step 1: find the common denominator (8)

$4\frac{5}{8} - 2\frac{2}{8} =$ Step 2: create equivalent fractions

$\frac{5}{8} - \frac{2}{8} = \frac{3}{8}$ Step 3: subtract the fraction

4-2= 2 Step 4: subtract the whole number

So, $4\frac{5}{8} - 2\frac{2}{8} = 2\frac{3}{8}$ Step 5: reduce to lowest terms if necessary

Let's look at another one:

$9\frac{12}{14} - 8\frac{2}{7} =$ find the common denominator = 14

$9\frac{12}{14} - 8\frac{4}{14} =$ create equivalent fractions $\{\frac{12}{14} = \frac{12}{14}, \frac{2}{7} = \frac{4}{14}\}$

$\frac{8}{14}$ subtract the fraction $\{\frac{12}{14} - \frac{4}{14} = \frac{8}{14}\}$

1 subtract the whole number {9-8=1}

$=1\frac{8}{14}$ reduce if necessary

$=1\frac{4}{7}$

So, $9\frac{12}{14} - 8\frac{2}{7} = 1\frac{4}{7}$

Here's one more without the steps outlined. See if you can follow it:

$15\frac{2}{3} - 4\frac{3}{9} = 15\frac{6}{9} - 4\frac{3}{9} = 11\frac{3}{9} = 11\frac{1}{3}$

How did you make out? Could you follow the steps? If you could, good for you! If not, go back and review the steps outlined above.

Exercise 20: Try these

D. $18\frac{3}{18} - 2\frac{1}{9} =$

E. $12\frac{9}{25} - 11\frac{1}{5} =$

F. $43\frac{5}{9} - 15\frac{2}{18} =$

G. $7\frac{14}{15} - 3\frac{3}{5} =$

5) $92\frac{20}{30} - 81\frac{1}{2} =$

6) $10\frac{3}{4} - 2\frac{2}{3} =$

7) $42\frac{2}{3} - 18\frac{1}{2} =$

8) $101\frac{4}{20} - 57\frac{2}{50} =$

Borrowing

With fractions, just like with regular subtraction, the time will come when you need to borrow from a whole number in order to complete the subtraction process.

Let's look at the following equation: $5\frac{1}{4} - 2\frac{3}{4}$. The first numerator is smaller than the second. What we need to do is borrow one from our whole number (5) in order to complete the problem.

Let's take a look at the steps for borrowing: $5\frac{1}{4} - 2\frac{3}{4}$

Step one: borrow one from the whole number 5 ☞ 4

Step two: add the 1 you borrowed to the fraction $\frac{1}{4} + 1 = 1\frac{1}{4}$

Step three: change the mixed number from step two into an improper fraction $1\frac{1}{4} = \frac{5}{4}$ (remember to make an improper fraction, you multiply the whole number by the denominator and then add the numerator)

NOTE: when borrowing one (1) from a whole number, the easiest way to make an improper fraction is to simply add the denominator to the numerator. The sum becomes the new numerator. This cuts out the multiplication step. Think of it this way: any number times one equals itself (9x1=9, 10x1=10, 429x1=429, etc.). So, $1\frac{1}{4}$ = 4x1+1 or = 4+1= $\frac{5}{4}$

Step four: subtract as usual

$5\frac{1}{4} - 2\frac{3}{4} =$

$4\frac{5}{4} - 2\frac{3}{4} = 2\frac{2}{4} = 2\frac{1}{2}$

Example 2

$6\frac{3}{8} - 2\frac{11}{24}$ -find a common denominator (24)

$6\frac{9}{24} - 2\frac{11}{24}$ -create equivalent fractions

$5\frac{33}{24} - 2\frac{11}{24}$ -borrow 1 from your whole number and create an improper fraction (by multiplying the denominator by the whole number that you borrowed (1) and adding the numerator or by simply adding the denominator to the numerator)

$5\frac{33}{24} - 2\frac{11}{24} = 3\frac{22}{24}$ -subtract (fraction first, then whole number)

$3\frac{22}{24} = 3\frac{11}{12}$ -reduce if necessary

Exercise 21: Now, you try some

a. $14\frac{3}{16} - 10\frac{5}{16} =$

b. $3\frac{1}{3} - 2\frac{2}{3} =$

c. $41\frac{18}{51} - 39\frac{19}{51} =$

d. $34\frac{1}{4} - 5\frac{2}{3} =$

e. $78\frac{2}{5} - 18\frac{5}{6} =$

f. $5\frac{3}{20} - \frac{19}{20} =$

g. $2\frac{1}{2} - 1\frac{2}{3} =$

h. $17\frac{1}{6} - 15\frac{5}{7} =$

i. $14\frac{3}{5} - 3\frac{7}{8} =$

j. $3\frac{7}{15} - 1\frac{2}{3} =$

11) $50\frac{4}{7} - 10\frac{9}{10} =$

12) $100\frac{2}{25} - 99\frac{3}{4} =$

13) $15\frac{3}{50} - \frac{2}{25} =$

14) $73\frac{1}{2} - 43\frac{7}{10} =$

15) $1\frac{1}{5} - \frac{2}{5} =$

16) $24\frac{7}{25} - 5\frac{4}{5} =$

17) $4\frac{3}{7} - \frac{8}{9} =$

18) $1\frac{8}{75} - \frac{29}{50} =$

19) $84\frac{8}{19} - 43\frac{1}{2} =$

20) $5\frac{3}{5} - \frac{7}{10} =$

Fractions that equal one

At this time, we need to look at fractions that equal 1 (one). Any fraction that has the same numerator and denominator equals 1 (one): $\frac{3}{3} = 1$, $\frac{29}{29} = 1$, $\frac{439}{439} = 1$. Any number over itself equals one. This makes sense if you think of it this way: a fraction stands for the numerator divided by the numerator. That is why when you are making a mixed number out of an improper fraction, you divide the numerator by the denominator ($\frac{12}{5} = 5\overline{)12}$ R2 = $2\frac{2}{5}$). When you take the fraction $\frac{439}{439}$ what you are saying is 439 divided by 439 which equals 1; therefore, $\frac{439}{439} = 1$.

***This is true for any number over itself. ***

Exercise 22: Change the following fractions to mixed numbers or whole numbers.

a. $\frac{25}{10}$

b. $\frac{18}{5}$

c. $\frac{4}{4}$

d. $3\frac{21}{14}$

e. $\frac{6}{5}$

f. $\frac{51}{3}$

g. $5\frac{8}{3}$

h. $\frac{125}{25}$

i. $18\frac{13}{2}$

j. $6\frac{72}{3}$

11) $\frac{50}{6}$

12) $\frac{321}{321}$

13) $\frac{15}{2}$

14) $\frac{6}{6}$

15) $2\frac{3}{3}$

16) $\frac{14}{14}$

17) $4\frac{16}{6}$

18) $\frac{10}{10}$

19) $45\frac{16}{16}$

20) $7\frac{67}{5}$

Subtract fractions from whole numbers

Let's say that you are doing a craft project and you need $15\frac{2}{3}$ cm of ribbon. You have 25 cm of ribbon to work with. How much ribbon would you have left over after your craft project? This problem requires you to subtract a fraction from a whole number.

In order to do this, you need to borrow one (1) from your whole number. This leaves 24. To make a fraction out of the one (1) that you borrowed, you simply place any number over itself in a fraction (**remember any number over itself equals one**).

Because the first step in subtracting fractions is to locate a common denominator, the easiest thing to do is to use the denominator of the fraction that is already in your equation; so, for the equation $25-15\frac{2}{3}$, you would choose three (3) as your denominator. Your equation would become $24\frac{3}{3}-15\frac{2}{3}$. Now you would follow through with your subtracting: $24\frac{3}{3}-15\frac{2}{3}=9\frac{1}{3}$; therefore, you would have $9\frac{1}{3}$ cm of ribbon left over.

Example 2

$14-7\frac{4}{15}$ -borrow from the whole number (14-1=13) and find a common denominator (15)

$13\frac{15}{15}-7\frac{4}{15}$

$6\frac{11}{15}$ -subtract (and reduce to lowest terms if necessary)

Exercise 23: Now you try!

a. $5-\frac{3}{4}=$

b. $15\text{-}3\frac{4}{17}=$

c. $43-5\frac{3}{5}=$

d. $38-\frac{43}{50}=$

e. $22\text{-}4\frac{3}{8}=$

f. $32\text{-}14\frac{2}{3}=$

g. $45\text{-}21\frac{4}{17}=$

h. $8\text{-}\frac{1}{2}=$

i. $36\text{-}5\frac{3}{8}=$

j. $100\text{-}57\frac{8}{9}=$

11) $92\text{-}47\frac{1}{9}=$

12) $57-3\frac{4}{7}=$

13) $10\text{-}5\frac{4}{5}=$

14) $18-2\frac{16}{17}=$

15) $70-35\frac{8}{15}=$

16) $26\text{-}\frac{4}{25}=$

17) $68\text{-}42\frac{5}{21}=$

18) $92\text{-}3\frac{2}{19}=$

19) $5\text{-}4\frac{25}{26}=$

20) $71\text{-}1\frac{3}{100}=$

Keep these steps in mind when you subtract fractions:

Step 1: find the common denominator/borrow from a whole number if necessary
Step 2: create an equivalent fraction
Step 3: borrow from the whole number if necessary
Step 4: subtract the fractions
Step 5: subtract the whole numbers

Answer Key

Exercise 1 page 5:

11) $\frac{2}{5}+\frac{2}{5}=\frac{4}{5}$

12) $\frac{5}{4}+\frac{3}{4}=\frac{8}{4}=2$

13) $\frac{4}{7}+\frac{3}{7}=\frac{7}{7}=1$

14) $\frac{4}{9}+\frac{1}{9}=\frac{5}{9}$

15) $\frac{2}{8}+\frac{3}{8}=\frac{5}{8}$

16) $\frac{3}{6}+\frac{2}{6}=\frac{5}{6}$

17) $\frac{2}{3}+\frac{1}{3}=\frac{3}{3}=1$

18) $\frac{1}{7}+\frac{4}{7}=\frac{5}{7}$

9) $\frac{8}{6}+\frac{4}{6}=\frac{12}{6}=2$

10) $\frac{2}{5}+\frac{1}{5}=\frac{3}{5}$

11) $\frac{4}{11}+\frac{3}{11}=\frac{7}{11}$

12) $\frac{30}{40}+\frac{5}{40}=\frac{35}{40}=\frac{7}{8}$

13) $\frac{3}{13}+\frac{9}{13}=\frac{12}{13}$

14) $\frac{3}{8}+\frac{5}{8}=\frac{8}{8}=1$

15) $\frac{10}{12}+\frac{1}{12}=\frac{11}{12}$

16) $\frac{3}{5}+\frac{1}{5}=\frac{4}{5}$

17) $\frac{2}{4}+\frac{1}{4}=\frac{3}{4}$

18) $\frac{6}{8}+\frac{1}{8}=\frac{7}{8}$

19) $\frac{2}{5}+\frac{3}{5}=\frac{5}{5}=1$

20) $\frac{6}{12}+\frac{3}{12}=\frac{9}{12}=\frac{3}{4}$

21) $\frac{4}{8}+\frac{3}{8}=\frac{7}{8}$

22) $\frac{5}{7}+\frac{1}{7}=\frac{6}{7}$

23) $\frac{4}{10}+\frac{2}{10}=\frac{6}{10}=\frac{3}{5}$

24) $\frac{10}{14}+\frac{3}{14}=\frac{13}{14}$

25) $\frac{15}{25}+\frac{4}{25}=\frac{19}{25}$

26) $\frac{100}{200}+\frac{50}{200}=\frac{150}{400}=\frac{3}{8}$

Exercise 2 page 6:

a. $\frac{6}{4}=1\frac{2}{4}=1\frac{1}{2}$

b. $\frac{12}{5}=2\frac{2}{5}$

c. $\frac{20}{12}=1\frac{8}{12}=1\frac{2}{3}$

d. $\frac{60}{7}=8\frac{4}{7}$

e. $\frac{22}{6}=3\frac{4}{6}=3\frac{2}{3}$

f. $\frac{14}{4}=3\frac{2}{4}=3\frac{1}{2}$

g. $\frac{25}{6}=4\frac{1}{6}$

h. $\frac{32}{5}=6\frac{2}{5}$

i. $\frac{8}{5}=1\frac{3}{5}$

10) $\frac{13}{4}=3\frac{2}{4}=3\frac{1}{2}$

11) $\frac{12}{5}=2\frac{2}{5}$

12) $\frac{16}{7}=2\frac{2}{7}$

13) $\frac{40}{30}=1\frac{10}{30}=1\frac{1}{3}$

14) $\frac{10}{6}=1\frac{4}{6}=1\frac{2}{3}$

15) $\frac{18}{12}=1\frac{6}{12}=1\frac{1}{2}$

16) $\frac{7}{2}=3\frac{1}{2}$

17) $\frac{100}{40}=2\frac{20}{40}=2\frac{1}{2}$

18) $\frac{55}{13}=4\frac{3}{13}$

19) $\frac{15}{2}=7\frac{1}{2}$

20) $\frac{45}{10}=4\frac{5}{10}=4\frac{1}{2}$

21) $\frac{7}{3}=2\frac{1}{3}$

22) $\frac{33}{12}=2\frac{9}{12}=2\frac{3}{4}$

23) $\frac{20}{13}=1\frac{7}{13}$

24) $\frac{24}{7}=3\frac{3}{7}$

25) $\frac{9}{5}=1\frac{4}{5}$

26) $\frac{44}{10}=4\frac{4}{10}=4\frac{2}{5}$

Exercise 3 page 6:

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

2. $\frac{3}{7}+\frac{3}{7}=\frac{6}{7}$

3. $\frac{2}{8}+\frac{7}{8}=\frac{9}{8}=1\frac{1}{8}$

4. $\frac{4}{9}+\frac{5}{9}=1$

5. $\frac{4}{10}+\frac{3}{10}=\frac{7}{10}$

6) $\frac{2}{3}+\frac{1}{3}=\frac{3}{3}=1$

7) $\frac{3}{8}+0=\frac{3}{8}$

8) $\frac{2}{6}+\frac{1}{6}=\frac{1}{2}$

9) $\frac{2}{8}+\frac{4}{8}=\frac{3}{4}$

10) $\frac{2}{10}+\frac{4}{10}=\frac{3}{5}$

11) $\frac{10}{30}+\frac{20}{30}=1$

12) $\frac{6}{12}+\frac{2}{12}=\frac{2}{3}$

13) $\frac{4}{9}+\frac{4}{9}=\frac{8}{9}$

14) $\frac{10}{20}+\frac{13}{20}=\frac{23}{20}=1\frac{3}{20}$

15) $\frac{5}{7}+\frac{3}{7}=1\frac{1}{7}$

Exercise 4 page 7:

$\frac{1}{4}+\frac{2}{4}=\frac{3}{8}+\frac{3}{8}$

$\frac{2}{5}+\frac{1}{5}=\frac{1}{5}+\frac{1}{5}+\frac{1}{5}$

$\frac{6}{10}+\frac{4}{10}=\frac{3}{8}+\frac{5}{8}$

$\frac{3}{7}+\frac{2}{7}=\frac{6}{14}+\frac{4}{14}$

$\frac{2}{9}+\frac{5}{9}=\frac{20}{27}+\frac{1}{27}$

$\frac{5}{10}+\frac{3}{10}=\frac{3}{5}+\frac{1}{5}$

$\frac{5}{12}+\frac{3}{12}=\frac{1}{3}+\frac{1}{3}$

$\frac{8}{12}+\frac{2}{12}=\frac{4}{6}+\frac{1}{6}$

Exercise 5 page 13:

1.	15	6)	90	11)	21	16)	18
2.	42	7)	6	12)	18	17)	10
3.	8	8)	12	13)	30	18)	20
4.	18	9)	12	14)	12	19)	18
5.	28	10)	24	15)	40	20)	42

Exercise 6 page 14:

1. $\frac{2}{3}+\frac{4}{7}$

   $\frac{14}{21}+\frac{12}{21}$

2. $\frac{5}{6}+\frac{6}{8}$

   $\frac{20}{24}+\frac{18}{24}$

3. $\frac{1}{2}+\frac{9}{10}$

   $\frac{5}{10}+\frac{9}{10}$

4) $\frac{4}{5}+\frac{5}{6}$

   $\frac{24}{30}+\frac{25}{30}$

5) $\frac{3}{5}+\frac{4}{9}$

   $\frac{27}{45}+\frac{20}{45}$

6) $\frac{1}{10}+\frac{3}{5}+\frac{1}{2}$

   $\frac{1}{10}+\frac{6}{10}+\frac{5}{10}$

7) $\frac{2}{3}+\frac{4}{5}$

   $\frac{10}{15}+\frac{8}{15}$

8) $\frac{2}{5}+\frac{4}{10}+\frac{12}{15}$

   $\frac{12}{30}+\frac{12}{30}+\frac{24}{30}$

9) $\frac{10}{12}+\frac{5}{24}+\frac{5}{6}$

   $\frac{20}{24}+\frac{5}{24}+\frac{20}{24}$

10) $\frac{4}{7}+\frac{1}{2}$

    $\frac{8}{14}+\frac{7}{14}$

Exercise 7 page 15:

a. section 1 = $\frac{1}{16}$ section 5 = $\frac{1}{8}$

section 2 = $\frac{2}{16}$ section 6 = $\frac{1}{16}$

section 3 = $\frac{1}{4}$ section 7 = $\frac{1}{16}$

section 4 = $\frac{1}{4}$ section 8 = $\frac{1}{16}$

b. sections 1 and 2 = $\frac{3}{16}$ sections 3,5 and 7 = $\frac{7}{16}$

sections 4 and 2 = $\frac{6}{16}$ sections 5,4 and 2 = $\frac{8}{16}$

sections 3 and 7 = $\frac{5}{16}$ sections 3,5,6 and 7 = $\frac{8}{16}$

c. Sections 3 and 4 take up the most amount of space.

d. Sections 1,6,7,and 8 take up the least amount of space.

Exercise 8 page 16:

a. $\frac{2}{5}=\frac{4}{10}$

$\frac{1}{2}=\frac{5}{10}$

$\frac{4}{10}+\frac{5}{10}=\frac{9}{10}$

3) $\frac{10}{12}=\frac{20}{24}$

$\frac{6}{8}=\frac{18}{24}$

$\frac{20}{24}+\frac{18}{24}=\frac{38}{24}=1\frac{14}{24}=1\frac{7}{12}$

5) $\frac{5}{6}=\frac{10}{12}$

$\frac{3}{4}=\frac{9}{12}$

$\frac{10}{12}=\frac{9}{12}=\frac{19}{12}=1\frac{7}{12}$

b. $\frac{2}{3}=\frac{4}{6}$

$\frac{4}{6}=\frac{4}{6}$

$\frac{4}{6}+\frac{4}{6}=\frac{8}{6}=1\frac{2}{6}=1\frac{1}{3}$

4) $\frac{2}{7}=\frac{4}{14}$

$\frac{5}{14}=\frac{5}{14}$

$\frac{4}{14}+\frac{5}{14}=\frac{9}{14}$

6) $\frac{3}{8}=\frac{21}{56}$

$\frac{5}{7}=\frac{40}{56}$

$\frac{21}{56}+\frac{40}{56}=\frac{61}{56}=1\frac{5}{56}$

g. $\frac{7}{9}=\frac{35}{45}$

$\frac{3}{5}=\frac{27}{45}$

$\frac{35}{45}+\frac{27}{45}=\frac{62}{45}=1\frac{17}{45}$

12) $\frac{3}{6}=\frac{18}{36}$

$\frac{5}{9}=\frac{20}{36}$

$\frac{18}{36}+\frac{20}{36}=\frac{38}{36}=1\frac{2}{36}=1\frac{1}{18}$

17) $\frac{5}{6}=\frac{10}{12}$

$\frac{7}{12}=\frac{7}{12}$

$\frac{10}{12}+\frac{7}{12}=\frac{17}{12}=1\frac{5}{12}$

h. $\frac{1}{6}=\frac{5}{30}$

$\frac{2}{10}=\frac{6}{30}$

$\frac{5}{30}+\frac{6}{30}=\frac{11}{30}$

13) $\frac{1}{7}=\frac{10}{70}$

$\frac{2}{10}=\frac{14}{70}$

$\frac{24}{70}=\frac{12}{35}$

18) $\frac{8}{9}=\frac{16}{18}$

$\frac{1}{2}=\frac{9}{18}$

$\frac{16}{18}+\frac{9}{18}=\frac{25}{18}=1\frac{7}{18}$

i. $\frac{2}{5}=\frac{16}{40}$

$\frac{4}{8}=\frac{20}{40}$

$\frac{16}{40}+\frac{20}{40}=\frac{36}{40}=\frac{9}{10}$

14) $\frac{20}{30}=\frac{40}{60}$

$\frac{10}{20}=\frac{30}{60}$

$\frac{40}{60}+\frac{30}{60}=\frac{70}{60}=1\frac{10}{60}=1\frac{5}{6}$

19) $\frac{3}{7}=\frac{9}{21}$

$\frac{20}{21}=\frac{20}{21}$

$\frac{9}{21}+\frac{20}{21}=\frac{29}{20}=1\frac{9}{20}$

j. $\frac{9}{25}=\frac{9}{25}$

$\frac{4}{5}=\frac{20}{25}$

$\frac{9}{25}+\frac{20}{25}=\frac{29}{25}=1\frac{4}{25}$

15) $\frac{7}{10}=\frac{7}{10}$

$\frac{1}{2}=\frac{5}{10}$

$\frac{7}{10}+\frac{5}{10}=\frac{12}{10}=1\frac{2}{10}=1\frac{1}{5}$

20) $\frac{10}{12}=\frac{10}{12}$

$\frac{3}{4}=\frac{9}{12}$

$\frac{10}{12}+\frac{9}{12}=\frac{19}{12}=1\frac{7}{12}$

k. $\frac{7}{8}=\frac{7}{8}$

$\frac{3}{4}=\frac{6}{8}$

$\frac{7}{8}+\frac{6}{8}=\frac{13}{8}=1\frac{5}{8}$

16) $\frac{7}{8}=\frac{7}{8}$

$\frac{4}{1}=\frac{32}{8}$

$\frac{7}{8}+\frac{32}{8}=\frac{41}{8}=5\frac{1}{8}$

Exercise 9 page 19:

a. $1\frac{2}{4}+5\frac{1}{4}=6\frac{3}{4}$

b. $4\frac{3}{7}+\frac{2}{7}=4\frac{5}{7}$

c. $3\frac{5}{10}+3\frac{1}{10}=6\frac{6}{10}=6\frac{3}{5}$

d. $8\frac{9}{15}+4\frac{3}{15}=12\frac{12}{15}=12\frac{4}{5}$

e. $\frac{1}{9}+4\frac{2}{9}+6\frac{4}{9}=10\frac{7}{9}$

f. $3\frac{1}{7}+10\frac{5}{7}=13\frac{6}{7}$

g. $2\frac{4}{12}+3\frac{5}{12}+11\frac{2}{12}=16\frac{11}{12}$

h. $6\frac{9}{16}+4\frac{3}{16}=10\frac{12}{16}=10\frac{3}{4}$

i. $1\frac{4}{8}+5\frac{3}{8}=6\frac{7}{8}$

j. $10\frac{1}{10}+3\frac{3}{10}=7\frac{2}{10}=20\frac{6}{10}=20\frac{3}{5}$

k. $12\frac{7}{9}+2\frac{1}{9}=14\frac{8}{9}$

l. $7\frac{4}{10}+4\frac{2}{10}=12\frac{6}{10}=12\frac{3}{5}$

m. $9\frac{9}{20}+\frac{4}{20}+6\frac{2}{20}=15\frac{15}{20}=15\frac{3}{4}$

14) $6\frac{5}{25}+12\frac{12}{25}=18\frac{17}{25}$

15) $3\frac{8}{18}+11\frac{5}{18}=14\frac{13}{18}$

16) $2\frac{9}{19}+6\frac{7}{19}=8\frac{16}{19}$

17) $8\frac{3}{11}+\frac{6}{11}=8\frac{9}{11}$

18) $10\frac{50}{100}+20\frac{30}{100}=30\frac{80}{100}=30\frac{4}{5}$

19) $1\frac{100}{200}+9\frac{50}{200}=10\frac{150}{200}=10\frac{3}{4}$

20) $17\frac{3}{14}+1\frac{3}{14}=4\frac{4}{14}=22\frac{11}{14}$

Exercise 10 page 21:

a. $3\frac{2}{5}+6\frac{3}{5}=9\frac{5}{5}=9+1=10$

b. $10\frac{11}{20}+5\frac{3}{20}+6\frac{6}{20}=21\frac{20}{20}=21+1=22$

c. $7\frac{1}{6}+1\frac{2}{6}+3\frac{3}{6}=11\frac{6}{6}=11+1=12$

d. $8\frac{7}{15}+6\frac{8}{15}=15\frac{15}{15}=15+1=16$

e. $9\frac{9}{10}+3\frac{1}{10}=12+\frac{10}{10}=12+1=13$

f. $5\frac{5}{12}+10\frac{3}{12}+7\frac{4}{12}=15\frac{12}{12}=15+1=16$

7) $2\frac{2}{20}+16\frac{8}{20}=18\frac{20}{20}=18+1=19$

8) $6\frac{3}{9}+1\frac{3}{9}+2\frac{3}{9}=9\frac{9}{9}=9+1=10$

9) $11\frac{2}{8}+12\frac{6}{8}=23\frac{8}{8}=23+1=24$

10) $20\frac{30}{45}+10\frac{10}{45}+2\frac{5}{45}=32\frac{45}{45}=32+1=33$

11) $1\frac{4}{14}+7\frac{10}{14}=8\frac{14}{14}=8+1=9$

12) $3\frac{3}{10}+4\frac{4}{10}+5\frac{3}{10}=12\frac{10}{10}=12+1=13$

Exercise 11 page 21:

a. $7\frac{7}{10}=\frac{77}{10}$

b. $12\frac{3}{5}=\frac{63}{5}$

c. $4\frac{6}{7}=\frac{34}{7}$

d. $8\frac{2}{9}=\frac{74}{9}$

5) $10\frac{3}{7}=\frac{73}{7}$

6) $4\frac{5}{8}=\frac{37}{8}$

7) $1\frac{2}{10}=\frac{12}{10}$

8) $6\frac{7}{8}=\frac{55}{8}$

Exercise 12 page 21:

a. $\frac{12}{7}=1\frac{5}{7}$

b. $\frac{20}{12}=1\frac{8}{12}=1\frac{2}{3}$

c. $\frac{12}{5}=2\frac{2}{5}$

d. $\frac{15}{7}=2\frac{1}{7}$

5) $\frac{10}{3}=3\frac{1}{3}$

6) $\frac{7}{2}=3\frac{1}{2}$

7) $\frac{11}{4}=2\frac{3}{4}$

8) $\frac{25}{9}=2\frac{7}{9}$

Exercise 13 page 22:

i. $1\frac{1}{9}+3\frac{3}{9}+6\frac{4}{9}=10\frac{8}{9}$

ii. $2\frac{3}{12}+7\frac{11}{12}=9\frac{14}{12}=9+1\frac{2}{12}=10+\frac{1}{2}$

iii. $3\frac{3}{12}+\frac{5}{12}+10\frac{2}{12}=13\frac{10}{12}=13\frac{5}{6}$

iv. $1\frac{4}{10}+3\frac{3}{10}+2\frac{3}{10}=6\frac{10}{10}=6+1=7$

v. $15\frac{1}{20}+7\frac{7}{20}+8\frac{2}{20}=30\frac{10}{20}=30\frac{1}{2}$

vi. $\frac{9}{16}+4\frac{3}{16}=4\frac{12}{16}=4\frac{3}{4}$

vii. $10\frac{3}{15}+\frac{6}{15}+1\frac{1}{15}+9\frac{2}{15}=20\frac{12}{15}=20\frac{4}{5}$

viii. $4\frac{5}{10}+6\frac{2}{10}+11\frac{3}{10}=21\frac{10}{10}=22$

ix. $7\frac{10}{25}+4\frac{4}{25}+10\frac{5}{25}+\frac{1}{25}=21\frac{20}{25}$

x. $7\frac{3}{8}+\frac{3}{8}=7\frac{6}{8}=7\frac{3}{4}$

xi. $2\frac{3}{9}+2\frac{6}{9}=4\frac{9}{9}=4+1=5$

xii. $\frac{6}{10}+4\frac{4}{10}=4\frac{10}{10}=4+1=5$

xiii. $2\frac{5}{8}+4\frac{3}{8}+0=6\frac{8}{8}=6+1=7$

xiv. $3\frac{3}{7}+4\frac{1}{7}=7\frac{4}{7}$

xv. $50\frac{30}{80}+20\frac{25}{80}=70\frac{55}{80}=70\frac{11}{16}$

xvi. $4\frac{11}{18}+\frac{1}{18}=4\frac{12}{18}=4\frac{2}{3}$

Exercise 14 page 33:

1) $5\frac{3}{7}$

2) $11\frac{5}{15}$

3) $6\frac{8}{18}$

4) $11\frac{9}{25}$

5) $3\frac{3}{10}$

6) $8\frac{5}{20}$

7) $7\frac{4}{7}$

8) $1\frac{1}{2}$

9) $4\frac{3}{12}$

xvii. $7\frac{3}{10}+7\frac{3}{10}+7\frac{3}{10}=21\frac{9}{10}$

Exercise 15 page 35:

a. $1\frac{2}{6}+3\frac{5}{6}=4\frac{7}{6}=4+1\frac{1}{6}=5\frac{1}{6}$

b. $4\frac{3}{10}+7\frac{9}{10}=11\frac{12}{10}=11+1\frac{2}{10}+12\frac{2}{10}=12\frac{1}{5}$

c. $10\frac{4}{9}+5\frac{8}{9}=15\frac{12}{9}=15+1\frac{3}{9}=1\frac{1}{3}$

d. $4\frac{7}{12}+1\frac{8}{12}=5\frac{15}{12}=5+1\frac{3}{12}=6\frac{1}{4}$

e. $2\frac{2}{7}+6\frac{1}{7}+\frac{6}{7}=8\frac{9}{7}=8+1\frac{2}{7}$

f. $\frac{11}{20}+8\frac{8}{20}+\frac{4}{20}=8\frac{23}{20}=8+1\frac{3}{20}=9\frac{3}{20}$

g. $7\frac{7}{11}+3\frac{9}{11}=10\frac{16}{11}=10+1\frac{5}{11}=11\frac{5}{11}$

h. $2\frac{6}{15}+1\frac{10}{15}=3\frac{16}{15}=3+1\frac{1}{15}=4\frac{1}{15}$

i. $9\frac{4}{12}+8\frac{11}{12}=17\frac{15}{12}=17+1\frac{3}{12}=18\frac{3}{12}=18\frac{1}{4}$

Exercise 16 page 24:

1) $7+4\frac{5}{10}=11\frac{5}{10}=11\frac{1}{2}$

2) $6\frac{7}{12}+10=16\frac{7}{12}$

3) $12+8\frac{4}{12}=20\frac{4}{12}=20\frac{1}{3}$

4) $4\frac{5}{9}+6=10\frac{5}{9}$

5) $2\frac{2}{4}+10=12\frac{2}{4}=12\frac{1}{2}$

6) $9\frac{8}{16}+5=14\frac{8}{16}=14\frac{1}{2}$

7) $12\frac{10}{15}+10=22\frac{10}{15}=22\frac{2}{3}$

8) $1+1\frac{1}{100}=2\frac{1}{100}$

Exercise 17 page 27:

1. $2\frac{3}{8}=\frac{9}{24}$
   $+$
   $4\frac{1}{24}=\frac{1}{24}$

   $\frac{9}{24}+\frac{1}{24}=\frac{10}{24}+6=6\frac{10}{24}=6\frac{5}{12}$

2. $10\frac{3}{6}=\frac{3}{6}$
   $+$
   $9\frac{1}{3}=\frac{2}{6}$

   $\frac{3}{6}+\frac{2}{6}=\frac{5}{6}+19=19\frac{5}{6}$

3. $9\frac{3}{5}=\frac{18}{30}$
   $+$
   $4\frac{2}{6}=\frac{10}{30}$

   $\frac{18}{30}+\frac{10}{30}=\frac{22}{30}=1\frac{12}{30}+13=14\frac{12}{30}=14\frac{2}{5}$

4. $7\frac{7}{9}=\frac{21}{27}$
   $+$
   $2\frac{1}{27}=\frac{1}{27}$

   $\frac{21}{27}+\frac{1}{27}=\frac{22}{27}+9=9\frac{22}{7}$

5. $1\frac{3}{14}=\frac{6}{28}$
   $+$
   $\frac{2}{28}=\frac{2}{28}$

   $\frac{6}{28}+\frac{2}{28}=\frac{8}{28}+1=1\frac{8}{28}=1\frac{2}{7}$

6. $5\frac{5}{10}=\frac{10}{20}$
   $+$
   $8\frac{6}{20}=\frac{6}{20}$

   $\frac{10}{20}+\frac{6}{20}=\frac{16}{20}+13=13\frac{16}{20}=13\frac{4}{5}$

7. $6\frac{4}{30}=\frac{8}{60}$
+ $\frac{2}{60}=\frac{2}{60}$

$\frac{8}{60}+\frac{2}{60}=\frac{10}{60}+6=6\frac{10}{60}=6\frac{1}{6}$

8. $4\frac{2}{8}=\frac{6}{24}$
+ $3\frac{5}{6}=\frac{20}{24}$

$\frac{6}{24}+\frac{20}{24}=\frac{26}{24}=1\frac{2}{4}=1\frac{1}{2}+7=8\frac{1}{2}$

9) $10\frac{4}{8}=\frac{36}{72}$
+ $5\frac{5}{9}=\frac{40}{72}$

$\frac{36}{72}+\frac{40}{72}=1\frac{4}{72}+15=16\frac{4}{72}=16\frac{1}{18}$

10) $3\frac{3}{5}=\frac{27}{45}$
+ $9\frac{8}{9}=\frac{40}{45}$

$\frac{27}{45}+\frac{40}{45}=\frac{67}{45}=1\frac{22}{45}+12=13\frac{22}{45}$

11) $2\frac{2}{7}=\frac{12}{42}$
+ $11\frac{3}{6}=\frac{21}{42}$

$\frac{12}{42}+\frac{21}{42}=\frac{33}{42}+13=13\frac{33}{42}$

12) $\frac{6}{10}=\frac{60}{100}$
+ $3\frac{2}{100}=\frac{2}{100}$

$\frac{60}{100}+\frac{2}{100}=\frac{62}{100}+3=3\frac{62}{100}=3\frac{31}{50}$

13) $\frac{11}{12}=\frac{44}{48}$
+ $2\frac{12}{48}=\frac{12}{48}$

$\frac{44}{48}+\frac{12}{48}=\frac{56}{48}=1\frac{4}{48}+2=3\frac{8}{48}=3\frac{1}{6}$

14) $3\frac{1}{4}=\frac{2}{8}$
+ $10\frac{5}{8}=\frac{5}{8}$

$\frac{2}{8}+\frac{5}{8}=\frac{7}{8}+13=13\frac{7}{8}$

15) $3\frac{7}{8}=\frac{35}{40}$
+ $4\frac{3}{10}=\frac{12}{40}$

$\frac{35}{40}+\frac{12}{40}=\frac{47}{40}=1\frac{7}{40}+7=8\frac{7}{40}$

16) $1\frac{1}{2}=\frac{5}{10}$
+ $6\frac{4}{10}=\frac{4}{10}$

$\frac{5}{10}+\frac{4}{10}=\frac{9}{10}+7=7\frac{9}{10}$

17) $7\frac{5}{7}=\frac{20}{28}$
+ $\frac{3}{4}=\frac{21}{28}$

$\frac{20}{28}+\frac{21}{28}=\frac{41}{28}=1\frac{13}{28}+7=8\frac{13}{28}$

18) $2\frac{3}{4}=\frac{24}{32}$
+ $9\frac{7}{32}=\frac{7}{32}$

$\frac{24}{32}+\frac{7}{32}=\frac{31}{32}+11=11\frac{31}{32}$

19) $6\frac{4}{10}=\frac{12}{30}$ + $7\frac{7}{30}=\frac{7}{30}$

$\frac{12}{30}+\frac{7}{30}=\frac{19}{30}+13=13\frac{19}{30}$

20) $9\frac{6}{9}=\frac{36}{54}$ + $1\frac{1}{6}=\frac{9}{54}$

$\frac{36}{54}+\frac{9}{54}=\frac{45}{54}+10=10\frac{45}{54}$

21) $2\frac{3}{4}=\frac{15}{20}$ + $\frac{8}{10}=\frac{16}{20}$

$\frac{15}{20}+\frac{16}{20}=\frac{31}{20}=1\frac{11}{20}+2=3\frac{11}{20}$

22) $2\frac{2}{5}=\frac{16}{40}$ + $10\frac{5}{8}=\frac{25}{40}$

$\frac{16}{40}+\frac{25}{40}=\frac{41}{40}=1\frac{1}{40}+12=13\frac{1}{40}$

23) $4\frac{5}{6}=\frac{40}{48}$ + $9\frac{4}{8}=\frac{24}{48}$

$\frac{40}{48}+\frac{24}{48}=\frac{64}{48}=1\frac{16}{48}+13=14\frac{16}{48}=14\frac{1}{3}$

24) $3\frac{1}{3}=\frac{4}{12}$ + $5\frac{2}{12}=\frac{2}{12}$

$\frac{4}{12}+\frac{2}{12}=\frac{6}{12}=\frac{1}{2}+8=8\frac{1}{2}$

25) $\frac{6}{12}=\frac{6}{12}$ + $4\frac{3}{4}=\frac{9}{12}$

$\frac{6}{12}+\frac{9}{12}=\frac{15}{12}=1\frac{3}{12}+4=5\frac{3}{12}=5\frac{1}{4}$

Exercise 18 page 29:

z. $\frac{8}{11}-\frac{5}{11}=\frac{3}{11}$

aa. $\frac{4}{9}-\frac{3}{9}=\frac{1}{9}$

bb. $\frac{7}{15}-\frac{5}{15}=\frac{2}{15}$

cc. $\frac{7}{10}-\frac{3}{10}=\frac{4}{10}=\frac{2}{5}$

dd. $\frac{7}{15}-\frac{2}{15}=\frac{5}{15}=\frac{1}{3}$

6) $\frac{2}{17}-\frac{1}{17}=\frac{1}{17}$

7) $\frac{14}{23}-\frac{9}{23}=\frac{5}{23}$

8) $\frac{9}{13}-\frac{7}{13}=\frac{2}{13}$

9) $\frac{21}{24}-\frac{9}{24}=\frac{12}{24}=\frac{1}{2}$

10) $\frac{12}{21}-\frac{5}{21}=\frac{7}{21}=\frac{1}{3}$

11) $\frac{2}{3}-\frac{1}{3}=\frac{1}{3}$

12) $\frac{4}{5}-\frac{2}{5}=\frac{2}{5}$

13) $\frac{23}{32}-\frac{5}{32}=\frac{18}{32}=\frac{9}{16}$

14) $\frac{15}{28}-\frac{13}{28}=\frac{2}{28}=\frac{1}{14}$

15) $\frac{19}{40}-\frac{3}{40}=\frac{16}{40}=\frac{2}{5}$

Exercise 19 page 29:

1) $\frac{2}{3}-\frac{1}{4}=\frac{8}{12}-\frac{3}{12}=\frac{5}{12}$

2) $\frac{6}{15}-\frac{1}{3}=\frac{6}{15}-\frac{5}{15}=\frac{1}{15}$

3) $\frac{7}{10}-\frac{2}{3}=\frac{21}{30}-\frac{20}{30}=\frac{1}{30}$

4) $\frac{15}{21}-\frac{2}{7}=\frac{15}{21}-\frac{6}{21}=\frac{9}{21}=\frac{3}{7}$

5) $\frac{14}{25}-\frac{2}{5}=\frac{14}{25}-\frac{10}{25}=\frac{4}{25}$

6) $\frac{9}{10}-\frac{24}{100}=\frac{90}{100}-\frac{24}{100}=\frac{66}{100}=\frac{33}{50}$

7) $\frac{5}{6}-\frac{2}{3}=\frac{15}{18}-\frac{12}{18}=\frac{3}{18}=\frac{1}{6}$

8) $\frac{7}{18}-\frac{1}{3}=\frac{7}{18}-\frac{6}{18}=\frac{1}{18}$

9) $\frac{9}{13}-\frac{8}{26}=\frac{18}{26}-\frac{8}{26}=\frac{10}{26}=\frac{5}{13}$

Exercise 20 page 31:

a. $18\frac{3}{18}-2\frac{1}{9}=18\frac{3}{18}-2\frac{2}{18}=16\frac{1}{18}$

b. $12\frac{9}{25}-11\frac{1}{5}=12\frac{9}{25}-11\frac{5}{25}=1\frac{4}{25}$

c. $43\frac{5}{9}-15\frac{2}{18}=43\frac{10}{18}-15\frac{2}{18}=28\frac{3}{18}=28\frac{1}{6}$

d. $7\frac{14}{15}-3\frac{3}{5}=7\frac{14}{15}-3\frac{9}{15}=4\frac{5}{15}=4\frac{1}{5}$

5) $92\frac{20}{30}-81\frac{1}{2}=92\frac{20}{30}-81\frac{15}{30}=11\frac{5}{30}=11\frac{1}{6}$

6) $10\frac{3}{4}-2\frac{2}{3}=10\frac{9}{12}-2\frac{8}{12}=8\frac{1}{12}$

7) $42\frac{2}{3}-18\frac{1}{2}=42\frac{4}{6}-18\frac{3}{6}=24\frac{1}{6}$

8) $101\frac{4}{20}-57\frac{2}{50}=101\frac{20}{100}-57\frac{4}{100}=44\frac{16}{100}=44\frac{4}{25}$

Exercise 21 page 33:

a. $14\frac{3}{16}-10\frac{5}{16}=13\frac{19}{16}-10\frac{5}{16}=3\frac{14}{16}=3\frac{7}{8}$

b. $3\frac{1}{3}-2\frac{2}{3}=2\frac{4}{3}-2\frac{2}{3}=\frac{2}{3}$

c. $41\frac{18}{51}-39\frac{19}{51}=40\frac{69}{51}-39\frac{19}{51}=1\frac{50}{51}$

d. $34\frac{1}{4}-5\frac{2}{3}=34\frac{3}{12}-5\frac{8}{12}=33\frac{15}{12}-5\frac{8}{12}=28\frac{7}{12}$

e. $78\frac{2}{5}-18\frac{5}{6}=78\frac{12}{30}-18\frac{25}{30}=77\frac{42}{30}-18\frac{25}{30}=59\frac{7}{30}$

f. $5\frac{3}{20}-\frac{19}{20}=4\frac{23}{20}-\frac{19}{20}=4\frac{4}{20}=4\frac{1}{5}$

g. $2\frac{1}{2}-1\frac{2}{3}=2\frac{3}{6}-1\frac{4}{6}=1\frac{9}{6}-1\frac{4}{6}=$

h. $17\frac{1}{6}-15\frac{5}{7}=17\frac{7}{42}-15\frac{30}{42}=16\frac{49}{42}-15\frac{30}{42}=1\frac{19}{42}$

i. $14\frac{3}{5}-3\frac{7}{8}=\ 14\frac{24}{40}-3\frac{35}{40}=13\frac{64}{40}-3\frac{35}{40}=10\frac{29}{40}$

j. $3\frac{7}{15}-1\frac{2}{3}=3\frac{14}{30}-1\frac{20}{30}=2\frac{44}{30}-1\frac{20}{30}=1\frac{24}{30}=1\frac{4}{5}$

11) $50\frac{4}{7}-10\frac{9}{10}=50\frac{40}{70}-10\frac{63}{70}=49\frac{110}{70}-10\frac{63}{70}=39\frac{47}{70}$

12) $100\frac{2}{25}-99\frac{3}{4}=100\frac{8}{100}-99\frac{75}{100}=99\frac{108}{100}-99\frac{75}{100}=\frac{33}{100}$

13) $15\frac{3}{50}-\frac{2}{25}=15\frac{3}{50}-\frac{4}{50}=14\frac{53}{50}-\frac{4}{50}=14\frac{49}{50}$

14) $73\frac{1}{2} - 43\frac{7}{10} = 73\frac{5}{10} - 43\frac{7}{10} = 72\frac{15}{10} - 43\frac{7}{10} = 29\frac{8}{10} = 29\frac{4}{5}$

15) $1\frac{1}{5} - \frac{2}{5} = \frac{6}{5} - \frac{2}{5} = \frac{4}{5}$

16) $24\frac{7}{25} - 5\frac{4}{5} = 24\frac{7}{25} - 5\frac{20}{25} = 23\frac{32}{25} - 5\frac{20}{25} = 18\frac{12}{25}$

17) $4\frac{3}{7} - \frac{8}{9} = 4\frac{27}{63} - \frac{56}{63} = 3\frac{90}{63} - \frac{56}{63} = 3\frac{34}{63}$

18) $1\frac{8}{75} - \frac{29}{50} = 1\frac{16}{150} - \frac{87}{150} = \frac{166}{150} - \frac{87}{150} = \frac{79}{150}$

19) $84\frac{8}{19} - 43\frac{1}{2} = 84\frac{16}{38} - 43\frac{19}{38} = 83\frac{54}{38} - 43\frac{19}{38} = 40\frac{35}{38}$

20) $5\frac{3}{5} - \frac{7}{10} = 5\frac{6}{10} - \frac{7}{10} = 4\frac{16}{10} - \frac{7}{10} = 4\frac{9}{10}$

Exercise 22 page 34:

a. $\frac{25}{10} = 2\frac{5}{10} = 2\frac{1}{2}$

b. $\frac{18}{5} = 3\frac{3}{5}$

c. $\frac{4}{4} = 1$

d. $3\frac{21}{14} = 4\frac{7}{21} = 4\frac{1}{3}$

e. $\frac{6}{5} = 1\frac{1}{5}$

f. $\frac{51}{3} = 17$

g. $5\frac{8}{3} = 7\frac{2}{3}$

h. $\frac{125}{25} = 5$

i. $18\frac{13}{2} = 24\frac{1}{2}$

j. $6\frac{72}{3} = 30$

11) $\frac{50}{6} = 8\frac{2}{6} = 8\frac{1}{3}$

12) $\frac{321}{321} = 1$

13) $\frac{15}{2} = 7\frac{1}{2}$

14) $\frac{6}{6} = 1$

15) $2\frac{3}{3} = 3$

16) $\frac{14}{14} = 1$

17) $4\frac{16}{6} = 6\frac{4}{6} = 6\frac{2}{3}$

18) $\frac{10}{10} = 1$

19) $45\frac{16}{16} = 46$

20) $7\frac{67}{5} = 20\frac{2}{5}$

Exercise 23 page 36:

a. $5-\frac{3}{4}=4\frac{4}{4}-\frac{3}{4}=1\frac{1}{4}$

b. $15\text{-}3\frac{4}{17}=14\frac{17}{17}-3\frac{4}{17}=11\frac{13}{17}$

c. $43-5\frac{3}{5}=42\frac{5}{5}-5\frac{3}{5}=37\frac{2}{5}$

d. $38-\frac{43}{50}=37\frac{50}{50}-\frac{43}{50}=37\frac{7}{50}$

e. $22\text{-}4\frac{3}{8}=21\frac{8}{8}-4\frac{3}{8}=17\frac{5}{8}$

f. $32\text{-}14\frac{2}{3}=31\frac{3}{3}-14\frac{2}{3}=17\frac{1}{3}$

g. $45\text{-}21\frac{4}{17}=44\frac{17}{17}-21\frac{4}{17}=23\frac{13}{17}$

h. $8\text{-}\frac{1}{2}=7\frac{2}{2}-\frac{1}{2}=7\frac{1}{2}$

i. $36\text{-}5\frac{3}{8}=35\frac{8}{8}-5\frac{3}{8}=30\frac{5}{8}$

j. $100\text{-}57\frac{8}{9}=99\frac{9}{9}-57\frac{8}{9}=42\frac{1}{9}$

11) $92\text{-}47\frac{1}{9}=91\frac{9}{9}-47\frac{1}{9}=44\frac{8}{9}$

12) $57-3\frac{4}{7}=56\frac{7}{7}-3\frac{4}{7}=53\frac{3}{7}$

13) $10\text{-}5\frac{4}{5}=9\frac{5}{5}-5\frac{4}{5}=4\frac{1}{5}$

14) $18-2\frac{16}{17}=17\frac{17}{17}-2\frac{16}{17}=15\frac{1}{17}$

15) $70-35\frac{8}{15}=69\frac{15}{15}-35\frac{8}{15}=34\frac{7}{15}$

16) $26\text{-}\frac{4}{25}=25\frac{25}{25}-\frac{4}{25}=25\frac{21}{25}$

17) $68\text{-}42\frac{5}{21} = 67\frac{21}{21} - 42\frac{5}{21} = 25\frac{16}{21}$

18) $92\text{-}3\frac{2}{19} = 91\frac{19}{19} - 3\frac{2}{19} = 88\frac{17}{19}$

19) $5\text{-}4\frac{25}{26} = 4\frac{26}{26} - 4\frac{25}{26} = \frac{1}{26}$

20) $71\text{-}1\frac{3}{100} = 70\frac{100}{100} - 1\frac{3}{100} = 69\frac{97}{100}$

FEEDBACK PROCESS

For feedback, please forward your comments to:

New Brunswick Community College - Woodstock
100 Broadway Street
Woodstock, NB
E7M 5C5

Attention: Kay Curtis
Tel.: 506-325-4866 Fax.: 506-328-8426

* In case of errors due to typing, spelling, punctuation or any proofreading errors, please use the enclosed page to make the proposed correction using red ink and send it to us.

* For feedback regarding the following items, please use the form below:

  - insufficient explanations;
  - insufficient examples;
  - ambiguity or wordiness of text;
  - relevancy of the provided examples;
  - others...

Page number	**Nature of the problem**	**Proposed solution** (**include your text if possible**)

FEEDBACK PROCESS

Page number	Nature of the problem	Proposed solution (include your text if possible)

Comments: