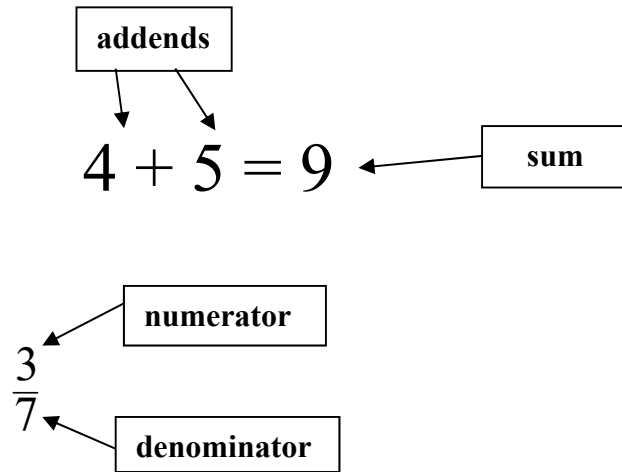


Unit 4

Adding & Subtracting Common Fractions

Topic A: Adding Common Fractions

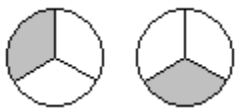
Vocabulary Review:



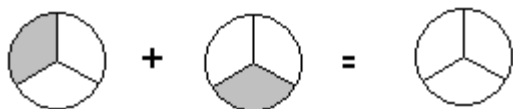
Like Fractions: Fractions that have the same denominator

Example: $\frac{1}{4}$ $\frac{2}{4}$ $\frac{3}{4}$ $\frac{4}{4}$ etc

Adding and subtracting fractions has some different rules from multiplying and dividing.



There are two cakes that are left over. There is 1 piece of each cake left. If you were to put all the pieces left onto one plate, how much cake would you have?



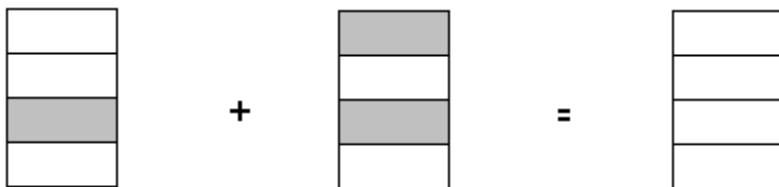
Shade in your answer here

If you made your plate like this:

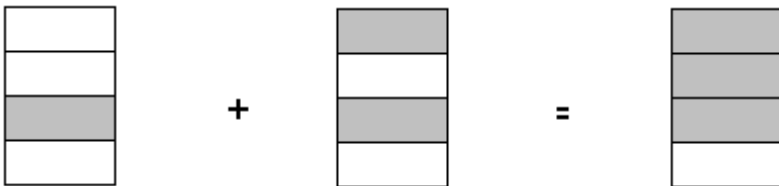


then you are right!

Try this example:



The answer is:



What you are doing is adding two like fractions.

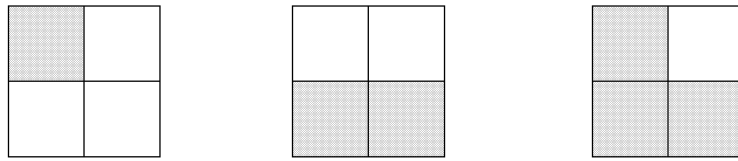
- You are moving pieces of fractions that are the same size into one whole shape. The pieces do not change size, so **the denominator must stay the same size**.
- When adding two fractions, your answer is a fraction.

Look back at the two examples.

When you add fractions, does the denominator or the numerator stay the same? _____

Common fractions must have the same denominator when you add them together.
Add the numerators and keep the denominators the same.

Look at the next two examples:



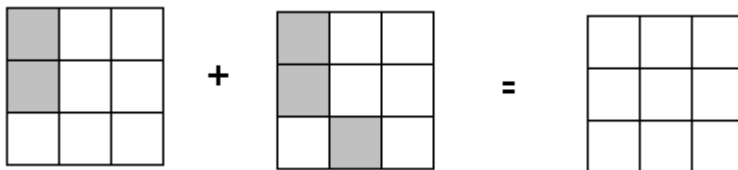
$$\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$$



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

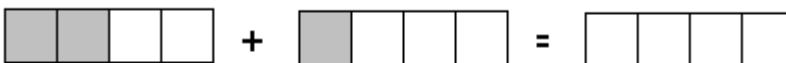
Exercise One Try a few for yourself

a)



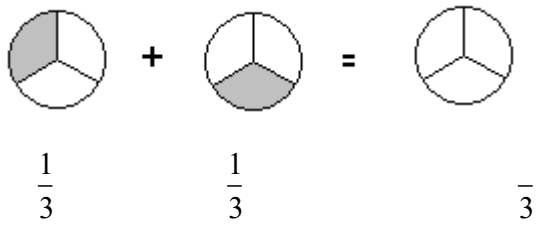
$$\frac{2}{9} + \frac{3}{9} = \frac{5}{9}$$

b)

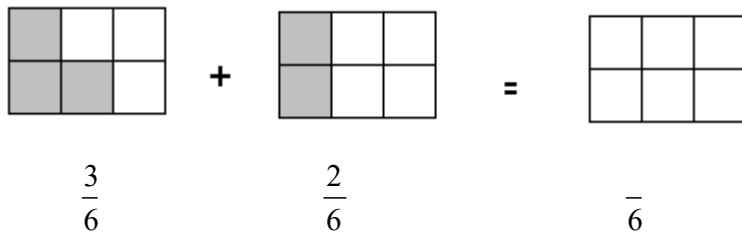


$$\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$$

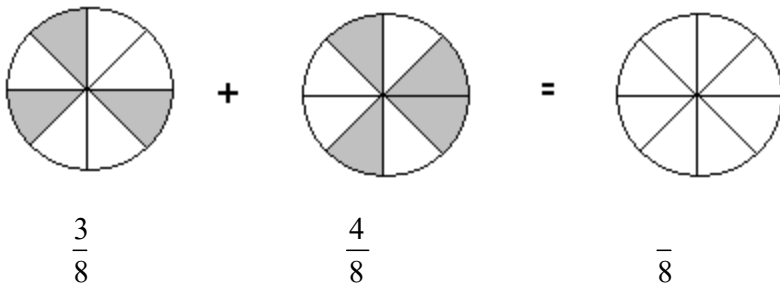
c)



d)



e)



Answers to Exercise One

a) $\frac{5}{9}$

b) $\frac{3}{4}$

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

d) $\frac{5}{6}$

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

Exercise Two

Now find the answers to the additions without diagrams.

$$\text{a) } \frac{2}{4} + \frac{1}{4} = \frac{\quad}{4}$$

$$\text{b) } \frac{3}{5} + \frac{1}{5} = \frac{\quad}{5}$$

$$\text{c) } \frac{1}{3} + \frac{1}{3} = \frac{\quad}{3}$$

$$\text{d) } \frac{1}{7} + \frac{3}{7} = \frac{\quad}{7}$$

$$\text{e) } \frac{1}{5} + \frac{1}{5} = \frac{\quad}{5}$$

$$\text{f) } \frac{3}{8} + \frac{4}{8} = \frac{\quad}{8}$$

$$\text{g) } \frac{2}{11} + \frac{7}{11} = \frac{\quad}{11}$$

$$\text{h) } \frac{3}{22} + \frac{4}{22} = \frac{\quad}{22}$$

Answers to Exercise Two

$$\text{a) } \frac{3}{4}$$

$$\text{b) } \frac{4}{5}$$

$$\text{c) } \frac{2}{3}$$

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

$$\text{e) } \frac{2}{5}$$

$$\text{f) } \frac{7}{8}$$

$$\text{g) } \frac{9}{11}$$

$$\text{h) } \frac{7}{22}$$

Exercise Three

Add these common fractions.

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

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

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

d) $\frac{3}{7} + \frac{2}{7} =$

e) $\frac{3}{10} + \frac{6}{10} =$

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

g) $\frac{14}{20} + \frac{3}{20} =$

h) $\frac{7}{37} + \frac{19}{37} =$

i) $\frac{1}{49} + \frac{42}{49} =$

j) $\frac{100}{123} + \frac{17}{123} =$

Answers to Exercise Three

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

b) $\frac{5}{6}$

c) $\frac{3}{4}$

d) $\frac{5}{7}$

e) $\frac{9}{10}$

f) $\frac{5}{9}$

g) $\frac{17}{20}$

h) $\frac{26}{37}$

i) $\frac{43}{49}$

j) $\frac{117}{123}$



Sometimes the sum of a fraction will need to be reduced (take a look at this example to remind yourself how to do this).

Example A: $\frac{2}{8} + \frac{2}{8} = \frac{4}{8} \longrightarrow \frac{4}{8} \left(\begin{smallmatrix} \div 4 \\ \div 4 \end{smallmatrix} \right) = \frac{1}{2}$

Example B: $\frac{3}{4} + \frac{3}{4} = \frac{6}{4} \longrightarrow \frac{6}{4} \left(\begin{smallmatrix} \div 2 \\ \div 2 \end{smallmatrix} \right) = \frac{3}{2} = 1\frac{1}{2}$

Exercise Four

Find the sums to the following additions. Make sure your answer is in the lowest terms.

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

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

c) $\frac{2}{8} + \frac{4}{8} =$

d) $\frac{3}{10} + \frac{2}{10} =$

e) $\frac{7}{25} + \frac{8}{25} =$

f) $\frac{1}{9} + \frac{2}{9} =$

g) $\frac{3}{5} + \frac{1}{5} =$

h) $\frac{9}{27} + \frac{12}{27} =$

i) $\frac{1}{6} + \frac{1}{6} =$

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

Answers to Exercise Four

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

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

c) $\frac{3}{4}$

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

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

f) $\frac{1}{3}$

g) $\frac{4}{5}$

h) $\frac{7}{9}$

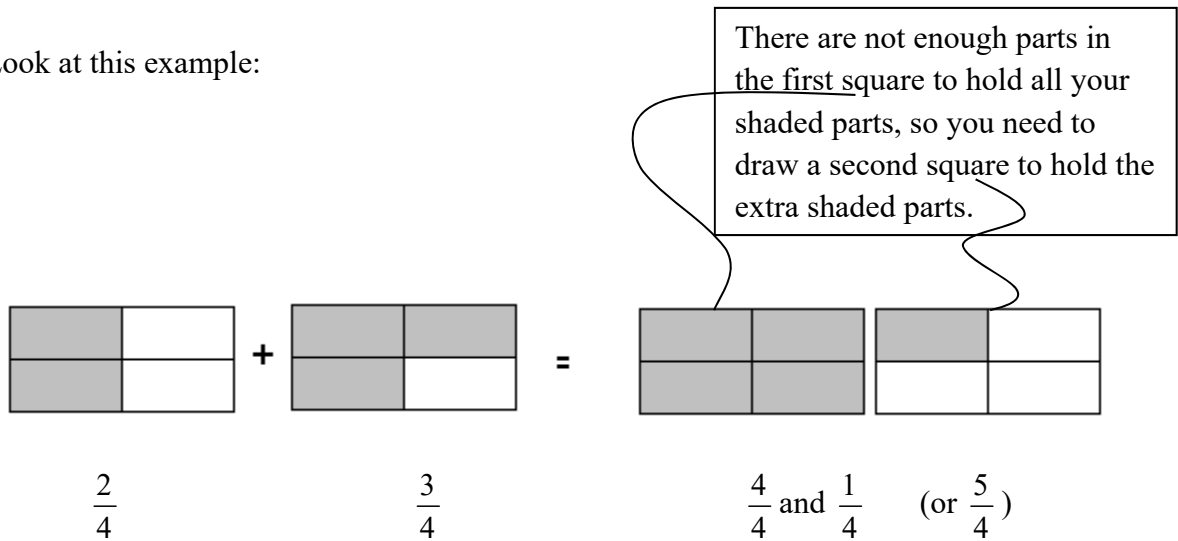
i) $\frac{1}{3}$

j) $\frac{3}{4}$



So far all your answers have been less than one (a proper fraction). Sometimes adding fractions can result in more than one whole.

Look at this example:

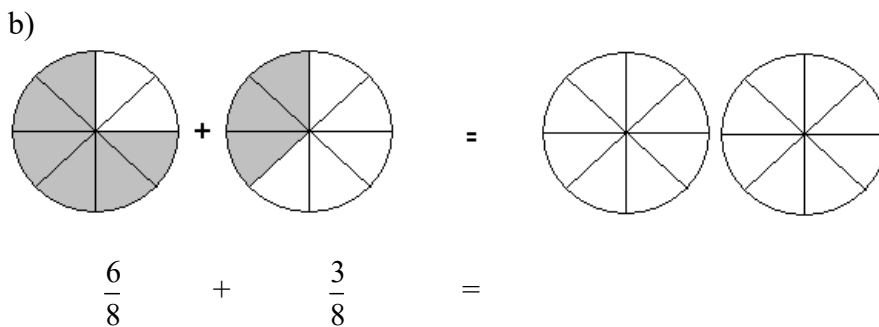
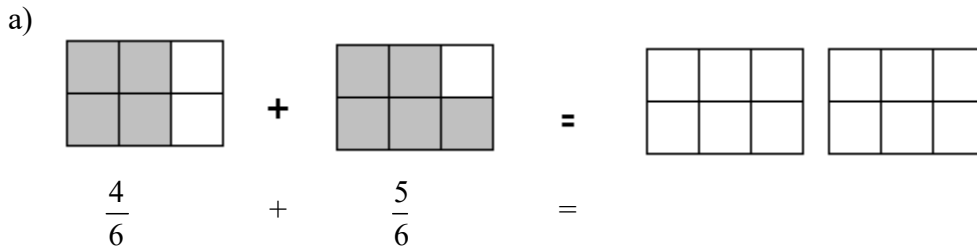


You would also have to convert this answer from an improper fraction to a mixed number:

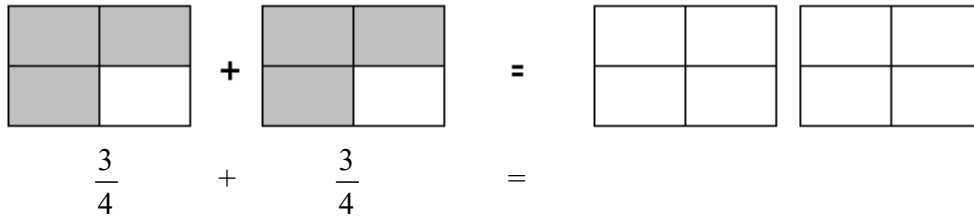
$$\frac{5}{4} = 1\frac{1}{4}$$

Exercise Five

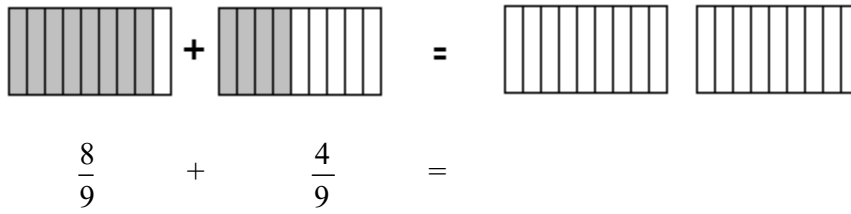
Try these additions (remember to always reduce your answer to lowest terms).



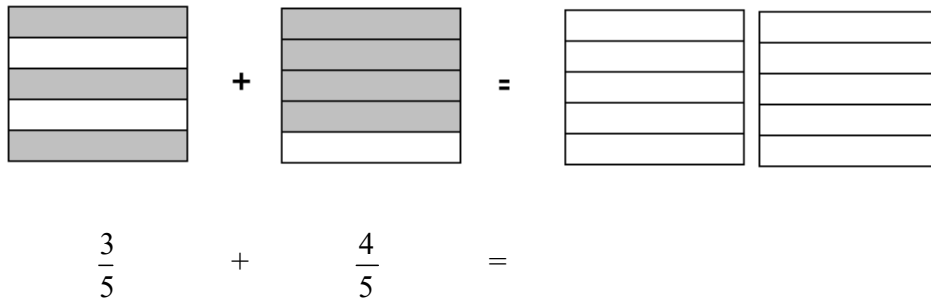
c)



d)



e)

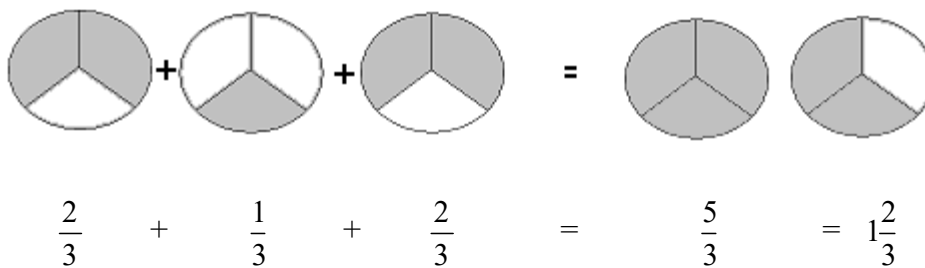


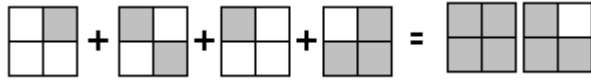
Answers to Exercise Five

a) $1\frac{1}{2}$ b) $1\frac{1}{8}$ c) $1\frac{1}{2}$ d) $1\frac{1}{3}$ e) $1\frac{2}{5}$

Sometimes you will have to add 3 or more fractions together.

Example A:



Example B:

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

Exercise Six

Add these common fractions. Be sure your answers are in lowest terms.

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

b) $\frac{3}{5} + \frac{4}{5} =$

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

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

e) $\frac{3}{5} + \frac{2}{5} =$

f) $\frac{3}{8} + \frac{2}{8} =$

g)
$$\begin{array}{r} \frac{3}{4} \\ + \frac{1}{4} \\ \hline \end{array}$$

h)
$$\begin{array}{r} \frac{5}{6} \\ + \frac{5}{6} \\ \hline \end{array}$$

i)
$$\begin{array}{r} \frac{3}{5} \\ + \frac{1}{5} \\ \hline \end{array}$$

$$\begin{array}{r} \text{j)} \quad \frac{4}{8} \\ + \frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{k)} \quad \frac{1}{2} \\ + \frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} \text{l)} \quad \frac{7}{9} \\ + \frac{4}{9} \\ \hline \end{array}$$

$$\begin{array}{r} \text{m)} \quad \frac{1}{8} \\ + \frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{n)} \quad \frac{2}{10} \\ + \frac{1}{10} \\ + \frac{3}{10} \\ \hline \end{array}$$

$$\begin{array}{r} \text{o)} \quad \frac{2}{8} \\ + \frac{3}{8} \\ + \frac{1}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{p)} \quad \frac{2}{5} \\ + \frac{3}{5} \\ \hline \end{array}$$

$$\begin{array}{r} \text{q)} \quad \frac{3}{6} \\ + \frac{1}{6} \\ \hline \end{array}$$

Answers to Exercise Six

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

$c) 1$

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

$e) 1$

$f) \frac{5}{8}$

$g) 1$

$h) 1 \frac{2}{3}$

$i) \frac{4}{5}$

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

$k) 1$

$l) 1 \frac{2}{9}$

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

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

$o) \frac{3}{4}$

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

$q) \frac{5}{6}$

Adding Mixed Numbers

To add mixed numbers

- Be sure the denominators are the same.
- Add the common fractions.
- Add the whole numbers.
- Simplify the common fraction.

Example A:

$$\begin{array}{r} 3\frac{1}{8} \\ + 2\frac{3}{8} \\ \hline \end{array}$$

$$5\frac{4}{8} = 5\frac{1}{2}$$

$$\frac{4}{8} = \frac{4}{8} \left(\frac{\div 4}{\div 4} \right) = \frac{1}{2}$$

Example B:

$$\begin{array}{r} 12\frac{1}{3} \\ + 6\frac{1}{3} \\ \hline 18\frac{2}{3} \end{array}$$

Exercise Seven

Add the following numbers. Reduce the answers to lowest terms.

a)

$$\begin{array}{r} 6\frac{1}{12} \\ + 8\frac{5}{12} \\ \hline \end{array}$$

$$14\frac{6}{12} = 14\frac{1}{2}$$

b)

$$\begin{array}{r} 3\frac{2}{9} \\ + 4\frac{4}{9} \\ \hline \end{array}$$

c)

$$\begin{array}{r} 22\frac{1}{6} \\ + 14\frac{1}{6} \\ \hline \end{array}$$

d)

$$\begin{array}{r} 7\frac{1}{8} \\ + 1\frac{1}{8} \\ \hline \end{array}$$

e)

$$\begin{array}{r} 8\frac{1}{4} \\ + 3\frac{1}{4} \\ \hline \end{array}$$

f)

$$\begin{array}{r} 3\frac{2}{5} \\ + \frac{1}{5} \\ \hline \end{array}$$

g)

$$\begin{array}{r} 18\frac{1}{2} \\ + 10 \\ \hline \end{array}$$

h)

$$\begin{array}{r} 4\frac{1}{10} \\ + \frac{3}{10} \\ \hline \end{array}$$

i)

$$\begin{array}{r} 7\frac{1}{8} \\ + 1\frac{1}{8} \\ \hline \end{array}$$

Answers to Exercise Seven

b) $7\frac{2}{3}$

c) $36\frac{1}{3}$

d) $8\frac{1}{4}$

e) $11\frac{1}{2}$

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

g) $28\frac{1}{2}$

h) $4\frac{2}{5}$

i) $8\frac{1}{4}$

Exercise Eight

Add these numbers. Give your answers in lowest terms.

a)

$$\begin{array}{r} 6\frac{4}{5} \\ + 3\frac{2}{5} \\ \hline \end{array}$$

$$9\frac{6}{5} = 10\frac{1}{5}$$

b)

$$\begin{array}{r} 9\frac{1}{3} \\ + 2\frac{2}{3} \\ \hline \end{array}$$

c)

$$\begin{array}{r} 3\frac{3}{8} \\ + 12\frac{7}{8} \\ \hline \end{array}$$

d)

$$\begin{array}{r} 1\frac{1}{2} \\ + 2\frac{1}{2} \\ \hline \end{array}$$

e)

$$\begin{array}{r} 100\frac{7}{10} \\ + 50\frac{5}{10} \\ \hline \end{array}$$

f)

$$\begin{array}{r} 10\frac{1}{4} \\ + 6\frac{3}{4} \\ \hline \end{array}$$

g)

$$\begin{array}{r} 3\frac{4}{7} \\ + 6\frac{5}{7} \\ \hline \end{array}$$

h)

$$\begin{array}{r} 8\frac{4}{5} \\ + 3\frac{4}{5} \\ \hline \end{array}$$

i)

$$\begin{array}{r} 8\frac{2}{4} \\ 9\frac{1}{4} \\ + 3\frac{1}{4} \\ \hline \end{array}$$

Answers to Exercise Eight

b) 12

c) $16\frac{1}{4}$

d) 4

e) $151\frac{1}{5}$

f) 17

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

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

i) 21



If you are not comfortable with this work so far, talk to your instructor and get some more practice before you go ahead.

The next question is:

What happens when two fractions in an addition (the addends) do not have the same denominator?

If the addends do not have a common denominator, you will need to find equivalent fractions to make the addends have a common denominator.

Read on to find out how!

Multiples and Least Common Multiples (L.C.M.)

When you learned the multiplication tables you learned the **multiples** of each number. Multiples are the answers when you multiply a whole number by 1, 2, 3, 4, 5, 6, 7, and so on.

The multiples of 2

$$2 \times 1 = 2$$

$$2 \times 2 = 4$$

$$2 \times 3 = 6$$

$$2 \times 4 = 8$$

$$2 \times 5 = 10$$

$$2 \times 6 = 12$$

$$2 \times 7 = 14$$

$$2 \times 8 = 16$$

$$2 \times 9 = 18$$

$$2 \times 10 = 20$$

$$2 \times 11 = 22$$

$$2 \times 12 = 24$$

The multiples of 6

$$6 \times 1 = 6$$

$$6 \times 2 = 12$$

$$6 \times 3 = 18$$

$$6 \times 4 = 24$$

$$6 \times 5 = 30$$

$$6 \times 6 = 36$$

$$6 \times 7 = 42$$

$$6 \times 8 = 48$$

$$6 \times 9 = 54$$

$$6 \times 10 = 60$$

$$6 \times 11 = 66$$

$$6 \times 12 = 72$$

and you can keep going as high as you want.

The multiples of 2 are **2, 4, 6, 8, 10, 12, 14**, and so on.

The multiples of 6 are **6, 12, 18, 24, 30, 36**, and so on.

Exercise Nine

List the first ten multiples of each number. This chart may be useful to you later.

	Number	Multiples
a)	2	2, 4, 6, 8, 10, 12, 14, 16, 18, 20
b)	3	
c)	4	
d)	5	
e)	6	
f)	7	
g)	8	
h)	9	
i)	10	
j)	11	
k)	12	

Answers to Exercise Nine

b) 3, 6, 9, 12, 15, 18, 21, 24, 27, 30

d) 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

f) 7, 14, 21, 28, 35, 42, 49, 56, 63, 70

h) 9, 18, 27, 36, 45, 54, 63, 72, 81, 90

j) 11, 22, 33, 44, 55, 66, 77, 88, 99, 110

c) 4, 8, 12, 16, 20, 24, 28, 32, 36, 40

e) 6, 12, 18, 24, 30, 36, 42, 48, 54, 60

g) 8, 16, 24, 32, 40, 48, 56, 64, 72, 80

i) 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

k) 12, 24, 36, 48, 60, 72, 84, 96, 108, 120

This is a quick method to find the **least common multiple (LCM)**.

least means **smallest**

common means **shared**

multiple means the **answers** when you **multiply** by 1, 2, 3, etc.

Example A: What is the **least common multiple (LCM)** of 3 and 5?

- Multiples:
Multiples of 3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30...
Multiples of 5: 5, 10, 15, 20, 25, 30...

• The **least common multiple** of 3 and 5 is **15**.

Example B: What is the LCM of 3 and 4?

- Multiples:
Multiples of 3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30...
Multiples of 4: 4, 8, 12, 16, 20, 24, 28, 32

• The **least common multiple** of 3 and 4 is **12**.

Example C: What is the LCM of 4 and 8?

- Multiples:
Multiples of 4: 4, 8, 12, 16, 20...
Multiples of 8: 8, 16, 24, 32, 40...

• The **least common multiple** of 4 and 8 is **8**.



Hint: Always check to see if the larger number is a multiple of the smaller number. If it is, then the larger number is the least common multiple.

LCM of 3 and 6 is 6

LCM of 2 and 4 is 4

LCM of 5 and 15 is 15

Exercise Ten

Find the least common multiple of these pairs of numbers. Use your chart from Exercise Nine to help you. You may want to add the multiples of other numbers to that chart.

- a) 3, 6 _____ b) 2, 5 _____ c) 4, 12 _____
- d) 12, 3 _____ e) 6, 12 _____ f) 8, 2 _____
- g) 5, 4 _____ h) 4, 8 _____ i) 8, 10 _____
- j) 8, 16 _____ k) 4, 7 _____ l) 8, 24 _____
- m) 25, 5 _____ n) 2, 9 _____ o) 3, 7 _____
- p) 6, 10 _____ q) 8, 12 _____ r) 7, 14 _____

Answers to Exercise Ten

- | | | | |
|-------|-------|-------|-------|
| a) 6 | b) 10 | c) 12 | d) 12 |
| e) 12 | f) 8 | g) 20 | h) 8 |
| i) 40 | j) 16 | k) 28 | l) 24 |
| m) 25 | n) 18 | o) 21 | p) 30 |
| q) 24 | r) 14 | | |

Now that you know how to find a LCM, we can apply this knowledge to adding and subtracting fractions.

Least Common Denominator (LCD)

To find the least common denominator of common fractions: **find the least common multiple of the denominators .**

Example A: What is the least common denominator of $\frac{1}{2}$ and $\frac{3}{4}$?

The denominators are 2 and 4.

The **least common multiple** of 2 and 4 is **4**.

So the **least common denominator** (LCD) for $\frac{1}{2}$ and $\frac{3}{4}$ is **4**.

Example B: What is the LCD of $\frac{3}{4}$ and $\frac{2}{3}$?

The denominators are 4 and 3.

The **least common multiple** of 4 and 3 is **12**.

So the **least common denominator** for $\frac{3}{4}$ and $\frac{2}{3}$ is **12**.

Exercise Eleven

Find the least common denominator for these pairs of fractions.

	Fractions	Denominators	Least Common Denominator
a)	$\frac{5}{8}$ $\frac{2}{3}$	8 3	24
b)	$\frac{1}{5}$ $\frac{1}{10}$		
c)	$\frac{1}{3}$ $\frac{3}{4}$		
d)	$\frac{1}{8}$ $\frac{3}{4}$		
e)	$\frac{2}{3}$ $\frac{1}{5}$		
f)	$\frac{1}{3}$ $\frac{1}{6}$		
g)	$\frac{5}{8}$ $\frac{1}{16}$		
h)	$\frac{1}{4}$ $\frac{5}{6}$		

Answers to Exercise Eleven (only least common denominator is given)

b) 10

c) 12

d) 8

e) 15

f) 6

g) 16

h) 12

You know how to find the least common denominator (LCD). The next step is to make **equivalent fractions** using the LCD

Step 1 Find the least common denominator

$$\begin{array}{r} \frac{3}{4} \\ + \frac{1}{3} \\ \hline \end{array} \quad \text{LCD of 4 and 3 is 12.}$$

Step 2 Write an = sign after each fraction, followed by the common denominator.

$$\begin{array}{r} \frac{3}{4} = \frac{?}{12} \\ + \frac{1}{3} = \frac{?}{12} \\ \hline \end{array}$$

Step 3 Rename the fractions as equivalent fractions with the L.C.D.

$$\frac{3}{4} = \frac{?}{12} \quad \text{4 times **what** = 12?}$$

$$4 \times \mathbf{3} = 12$$

If the denominator was multiplied by 3, the numerator must be multiplied by 3.

$$\frac{3 \text{ (x 3)}}{4 \text{ (x 3)}} = \frac{9}{12}$$

Now rename the other fraction.

$$\frac{1}{3} = \frac{?}{12} \quad \text{3 times **what** = 12?}$$

$$3 \times \mathbf{4} = 12$$

If this denominator was multiplied by 4, this numerator must be multiplied by 4.

$$\frac{1 \text{ (x 4)}}{3 \text{ (x 4)}} = \frac{4}{12}$$

Step 4 The question now looks like this and can be added.

$$\begin{array}{r} \frac{3}{4} = \frac{9}{12} \\ + \frac{1}{3} = \frac{4}{12} \\ \hline \frac{13}{12} = 1\frac{1}{12} \end{array}$$

Example A: $\frac{1}{4} + \frac{3}{8} = \square$

Step 1 and 2 Find the least common denominator.

$$\begin{array}{r} \frac{1}{4} = \frac{?}{8} \\ + \frac{3}{8} = \frac{?}{8} \\ \hline \end{array}$$

Step 3 Rename as equivalent fractions.

$$\begin{array}{r} \frac{1}{4} \left(\frac{\times 2}{\times 2} \right) = \frac{2}{8} \\ + \frac{3}{8} \left(\frac{\times 1}{\times 1} \right) = \frac{3}{8} \\ \hline \end{array}$$

Step 4 Add and simplify the answer.

$$\begin{array}{r} \frac{1}{4} \left(\frac{\times 2}{\times 2} \right) = \frac{2}{8} \\ + \frac{3}{8} \left(\frac{\times 1}{\times 1} \right) = \frac{3}{8} \\ \hline \frac{5}{8} \end{array}$$

Exercise Twelve

Add these common fractions. Express the answer in lowest terms.

a)

$$\begin{array}{r} \frac{1}{2} \left(\frac{\times 4}{\times 4} \right) = \frac{4}{8} \\ + \frac{3}{8} \left(\frac{\times 1}{\times 1} \right) = \frac{3}{8} \\ \hline \frac{7}{8} \end{array}$$

b)

$$\begin{array}{r} \frac{1}{4} \left(\frac{\times 2}{\times 2} \right) = \frac{2}{8} \\ + \frac{3}{8} \left(\frac{\times 1}{\times 1} \right) = \frac{3}{8} \\ \hline \frac{5}{8} \end{array}$$

c)

$$\begin{array}{r} \frac{1}{5} \\ + \frac{1}{10} \\ \hline \end{array}$$

d)

$$\begin{array}{r} \frac{5}{16} \\ + \frac{1}{4} \\ \hline \end{array}$$

e)

$$\begin{array}{r} \frac{1}{3} \\ + \frac{7}{12} \\ \hline \end{array}$$

f)

$$\begin{array}{r} \frac{1}{2} \\ + \frac{5}{8} \\ \hline \end{array}$$

g)

$$\begin{array}{r} \frac{2}{3} \\ + \frac{1}{6} \\ \hline \end{array}$$

h)

$$\begin{array}{r} \frac{1}{4} \\ + \frac{5}{8} \\ \hline \end{array}$$

i)

$$\begin{array}{r} \frac{3}{10} \\ + \frac{2}{5} \\ \hline \end{array}$$

j)

$$\begin{array}{r} \frac{1}{2} \\ + \frac{5}{6} \\ \hline \end{array}$$

k)

$$\begin{array}{r} \frac{1}{12} \\ + \frac{1}{4} \\ \hline \end{array}$$

l)

$$\begin{array}{r} \frac{1}{2} \\ + \frac{3}{8} \\ \hline \end{array}$$

m)

$$\begin{array}{r} \frac{1}{2} \\ + \frac{3}{10} \\ \hline \end{array}$$

n)

$$\begin{array}{r} \frac{5}{8} \\ + \frac{3}{4} \\ \hline \end{array}$$

o)

$$\begin{array}{r} \frac{1}{2} \\ + \frac{5}{12} \\ \hline \end{array}$$

p)

$$\begin{array}{r} \frac{1}{6} \\ + \frac{3}{4} \\ \hline \end{array}$$

q)

$$\begin{array}{r} \frac{1}{8} \\ + \frac{1}{5} \\ \hline \end{array}$$

r)

$$\begin{array}{r} \frac{1}{12} \\ + \frac{3}{8} \\ \hline \end{array}$$

s)

$$\begin{array}{r} \frac{3}{8} \\ + \frac{1}{6} \\ \hline \end{array}$$

t)

$$\begin{array}{r} \frac{5}{8} \\ + \frac{1}{5} \\ \hline \end{array}$$

u)

$$\begin{array}{r} \frac{3}{4} \\ + \frac{3}{8} \\ \hline \end{array}$$

v)

$$\begin{array}{r} \frac{1}{10} \\ + \frac{1}{2} \\ \hline \end{array}$$

w)

$$\begin{array}{r} \frac{2}{3} \\ + \frac{7}{8} \\ \hline \end{array}$$

x)

$$\begin{array}{r} \frac{1}{4} \\ + \frac{1}{5} \\ \hline \end{array}$$

Answers to Exercise Twelve

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

d) $\frac{9}{16}$

e) $\frac{11}{12}$

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

g) $\frac{5}{6}$

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

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

j) $1\frac{1}{3}$

k) $\frac{1}{3}$

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

m) $\frac{4}{5}$

n) $1\frac{3}{8}$

o) $\frac{11}{12}$

p) $\frac{11}{12}$

q) $\frac{13}{40}$

r) $\frac{11}{24}$

s) $\frac{13}{24}$

t) $\frac{33}{40}$

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

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

w) $1\frac{13}{24}$

x) $\frac{9}{20}$



How did you do? If you are struggling with this **process**, speak to your instructor for help.

Exercise Thirteen

More practice. Do only as many as you think you need.

a)

$$\frac{2}{3} \left(\frac{\times 4}{\times 4} \right) = \frac{8}{12}$$

$$\frac{1}{2} \left(\frac{\times 6}{\times 6} \right) = \frac{6}{12}$$

$$+ \frac{3}{4} \left(\frac{\times 3}{\times 3} \right) = \frac{9}{12}$$

$$\frac{23}{12} = 1\frac{11}{12}$$

b)

$$\frac{5}{24} \left(\frac{\times 1}{\times 1} \right) = \frac{5}{24}$$

$$\frac{1}{3} \left(\frac{\times 8}{\times 8} \right) = \frac{8}{24}$$

$$+ \frac{3}{8} \left(\frac{\times 3}{\times 3} \right) = \frac{9}{24}$$

$$\frac{22}{24} = \frac{11}{12}$$

c)

$$\begin{array}{r} \frac{5}{12} \\ \frac{5}{6} \\ + \frac{3}{4} \\ \hline \end{array}$$

d)

$$\begin{array}{r} \frac{3}{10} \\ \frac{3}{4} \\ + \frac{4}{5} \\ \hline \end{array}$$

e)

$$\begin{array}{r} \frac{1}{2} \\ \frac{2}{5} \\ + \frac{7}{10} \\ \hline \end{array}$$

f)

$$\begin{array}{r} \frac{5}{6} \\ \frac{3}{4} \\ + \frac{1}{3} \\ \hline \end{array}$$

g)

$$\begin{array}{r} \frac{7}{16} \\ + \frac{3}{4} \\ \hline \end{array}$$

h)

$$\begin{array}{r} \frac{4}{5} \\ + \frac{1}{3} \\ \hline \end{array}$$

i)

$$\begin{array}{r} \frac{7}{9} \\ + \frac{2}{5} \\ \hline \end{array}$$

j)

$$\begin{array}{r} \frac{1}{5} \\ + \frac{3}{4} \\ \hline \end{array}$$

k)

$$\begin{array}{r} \frac{1}{9} \\ + \frac{2}{3} \\ \hline \end{array}$$

l)

$$\begin{array}{r} \frac{1}{8} \\ + \frac{1}{4} \\ \hline \end{array}$$

Answers to Exercise Thirteen

c) 2

d) $1\frac{17}{20}$

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

f) $1\frac{11}{12}$

g) $1\frac{3}{16}$

h) $1\frac{2}{15}$

i) $1\frac{8}{45}$

j) $\frac{19}{20}$

k) $\frac{7}{9}$

l) $\frac{3}{8}$

Addition questions are often written with the fractions side by side instead of one fraction above the other. For example

$$\frac{2}{3} + \frac{5}{8} = \square$$

You may solve as shown in this example, **or** rewrite the question with the fractions one above the other.

$$\frac{2}{3} + \frac{5}{8} = \frac{2 \text{ (x 8)}}{3 \text{ (x 8)}} + \frac{5 \text{ (x 3)}}{8 \text{ (x 3)}} = \frac{16}{24} + \frac{15}{24} = \frac{31}{24} = 1\frac{7}{24}$$

or

$$\begin{array}{r} \frac{2}{3} \left(\frac{\times 8}{\times 8} \right) = \frac{16}{24} \\ + \frac{5}{8} \left(\frac{\times 3}{\times 3} \right) = \frac{15}{24} \\ \hline \frac{31}{24} = 1\frac{7}{24} \end{array}$$

Exercise Fourteen

Find the sum. Do enough questions to be confident in your skill.

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

$$\frac{1}{2} \left(\frac{\times 3}{\times 3} \right) + \frac{1}{6} =$$

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

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

c) $\frac{1}{5} + \frac{3}{5} =$

d) $\frac{1}{12} + \frac{2}{3} =$

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

f) $\frac{1}{6} + \frac{3}{8} =$

g) $\frac{1}{4} + \frac{1}{6} =$

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

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

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

k) $\frac{1}{4} + \frac{4}{5} =$

l) $\frac{1}{8} + \frac{3}{16} =$

Answers to Exercise Fourteen

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

c) $\frac{4}{5}$

d) $\frac{3}{4}$

e) 1

f) $\frac{13}{24}$

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

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

i) $1\frac{1}{4}$

j) $\frac{23}{24}$

k) $1\frac{1}{20}$

l) $\frac{5}{16}$

You already know how to add mixed numbers which have the same (like) denominators.

To add mixed numbers with different denominators, you must,

- Find the least common denominator (L.C.D.) for the fractions.
- Rename the fractions as equivalent fractions using the L.C.D.
- **Be sure to bring the whole number across the equal sign when you rename.**
- Add the fractions.
- Add the whole numbers.
- Simplify the answer.
- Remember that if the sum of the fractions is an improper fraction, you must rename it as a mixed number that is added to the whole number in your answer.

Example A:

$$\begin{array}{r} 3\frac{3}{4} \left(\frac{\times 5}{\times 5} \right) = 3\frac{15}{20} \\ + 6\frac{1}{5} \left(\frac{\times 4}{\times 4} \right) = 6\frac{4}{20} \\ \hline 9\frac{19}{20} \end{array}$$

Example B:

$$\begin{array}{r}
 3\frac{1}{4} \left(\frac{\times 3}{\times 3} \right) = 3\frac{3}{12} \\
 8\frac{2}{3} \left(\frac{\times 4}{\times 4} \right) = 8\frac{8}{12} \\
 + 2\frac{1}{2} \left(\frac{\times 6}{\times 6} \right) = 2\frac{6}{12} \\
 \hline
 \end{array}$$

$$13\frac{17}{12} = 13 + 1\frac{5}{12} = 14\frac{5}{12}$$

$\frac{17}{12}$ is an
improper
fraction:

$$\frac{17}{12} = 1\frac{5}{12}$$

Exercise Fifteen

Add. Express the sums in lowest terms. Pace yourself. Do no more than half of them today and do the rest next class.

a)

$$\begin{array}{r}
 1\frac{3}{8} \left(\frac{\times 1}{\times 1} \right) = 1\frac{3}{8} \\
 + 1\frac{1}{4} \left(\frac{\times 2}{\times 2} \right) = 1\frac{2}{8} \\
 \hline
 2\frac{5}{8}
 \end{array}$$

b)

$$\begin{array}{r}
 3\frac{1}{5} \\
 + 2\frac{3}{10} \\
 \hline
 \end{array}$$

c)

$$\begin{array}{r}
 6\frac{2}{15} \\
 + 1\frac{3}{5} \\
 \hline
 \end{array}$$

d)

$$\begin{array}{r}
 8\frac{1}{4} \\
 + 4\frac{1}{3} \\
 \hline
 \end{array}$$

e)

$$\begin{array}{r} 8\frac{2}{5} \\ + 4\frac{1}{3} \\ \hline \end{array}$$

f)

$$\begin{array}{r} 5\frac{2}{3} \\ + 6\frac{1}{4} \\ \hline \end{array}$$

g)

$$\begin{array}{r} 3\frac{2}{7} \\ + 4\frac{1}{14} \\ \hline \end{array}$$

h)

$$\begin{array}{r} 116\frac{5}{8} \\ + 9\frac{1}{24} \\ \hline \end{array}$$

i)

$$\begin{array}{r} 9\frac{4}{5} \\ + 2\frac{1}{15} \\ \hline \end{array}$$

Answers to Exercise Fifteen

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

c) $7\frac{11}{15}$

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

e) $12\frac{11}{15}$

f) $11\frac{11}{12}$

g) $7\frac{5}{14}$

h) $125\frac{2}{3}$

i) $11\frac{13}{15}$

Exercise Sixteen

Add. Express the sums in lowest terms. Save part of this exercise to do as review before the test.

a)

$$\begin{array}{r} 4\frac{1}{2} \left(\begin{array}{l} \times 6 \\ \times 6 \end{array} \right) = 4\frac{6}{12} \\ + 2\frac{1}{3} \left(\begin{array}{l} \times 4 \\ \times 4 \end{array} \right) = 2\frac{4}{12} \\ \hline 6\frac{10}{12} = 6\frac{5}{6} \end{array}$$

b)

$$\begin{array}{r} 3\frac{2}{3} \\ + 1\frac{1}{2} \\ \hline \end{array}$$

c)

$$\begin{array}{r} 6\frac{1}{2} \\ + 4\frac{1}{4} \\ \hline \end{array}$$

d)

$$\begin{array}{r} 2\frac{3}{4} \\ + 1\frac{1}{8} \\ \hline \end{array}$$

e)

$$\begin{array}{r} 2\frac{1}{8} \\ + 4\frac{3}{16} \\ \hline \end{array}$$

f)

$$\begin{array}{r} 9\frac{5}{6} \\ + 2\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r}
 \text{g)} \\
 5\frac{1}{2} \\
 3\frac{2}{3} \\
 + 4\frac{1}{4} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{h)} \\
 2\frac{1}{5} \\
 3\frac{2}{3} \\
 + 6\frac{3}{5} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{i)} \\
 7\frac{2}{3} \\
 4\frac{1}{4} \\
 + 2\frac{1}{8} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{j)} \\
 3\frac{3}{8} \\
 2\frac{3}{4} \\
 + 1\frac{1}{2} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{k)} \\
 5\frac{7}{10} \\
 4\frac{1}{5} \\
 + 2\frac{3}{5} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{l)} \\
 4\frac{3}{4} \\
 2\frac{1}{5} \\
 + 4\frac{1}{2} \\
 \hline
 \end{array}$$

Answers to Exercise Sixteen

b) $5\frac{1}{6}$

c) $10\frac{3}{4}$

d) $3\frac{7}{8}$

e) $6\frac{5}{16}$

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

g) $13\frac{5}{12}$

h) $12\frac{7}{15}$

i) $14\frac{1}{24}$

j) $7\frac{5}{8}$

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

l) $11\frac{9}{20}$

Problems Using Addition of Common Fractions

Exercise Seventeen

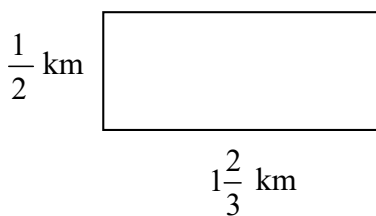
Solve these problems.

- a) The bathroom shelf is crowded with hand lotion bottles, each with a little lotion left inside. Everyone always likes to try the new bottle before the old one is emptied! One bottle is $\frac{1}{3}$ full, another is $\frac{1}{4}$ full, one is only $\frac{1}{8}$ full and one is still $\frac{1}{2}$ full. How much lotion is in the bottles altogether?
- b) Sometimes Joan thinks she will go crazy when she packs the lunches for her family. Little Sarah has decided she only wants $\frac{3}{4}$ of a sandwich, Megan wants $\frac{1}{4}$ of a sandwich, Joan's husband takes $1\frac{1}{2}$ sandwiches, and their son, who does heavy work, takes 3 sandwiches! How many sandwiches does Joan make?
- c) Dave paid the baby-sitter for the week. The sitter worked $3\frac{3}{4}$ hours on Monday, $4\frac{1}{4}$ hours on Tuesday and $6\frac{1}{2}$ hours on Friday. How many hours did the baby-sitter work looking after Dave's children that week?

d) Quite a lot of watermelon was left after the watermelon-eating contest: $1\frac{1}{2}$ watermelons on one table, $2\frac{3}{4}$ of a watermelon on another table and $\frac{5}{8}$ of a watermelon on the third table. The organizers want to know exactly how much was left over so they will not buy so much next year. Calculate the amount of watermelon left over.

e) Jeanette has a novel to read for English. She read $\frac{1}{2}$ of the book on the weekend, only had time to read $\frac{1}{8}$ of the book on Monday and another $\frac{1}{4}$ on Wednesday. How much of the book has she read?

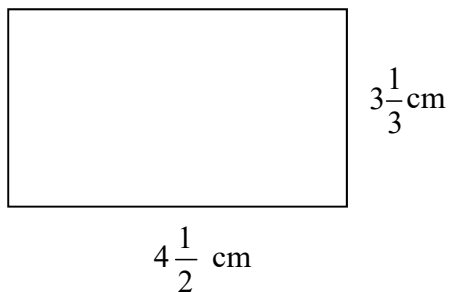
f) Dion walks around this route each day for exercise. How far does he walk each day?



g) How many metres of baseboard are needed for a rectangular room $4\frac{1}{2}$ m by $3\frac{1}{5}$ m?
Deduct 1 m for the doorway.

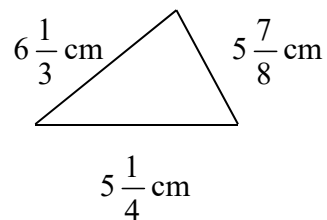
h) Sana is going to frame a large piece of art with a wooden frame. The art piece is $1\frac{1}{10}$ m by $\frac{3}{5}$ m. How much framing material should she buy?

i) Find the perimeter of the following figure.



j) Find the perimeter of a cd case if one side is $12\frac{1}{10}$ cm and the other side measures $14\frac{1}{5}$ cm.

k) Find the perimeter of this triangle.



Answers to Exercise Seventeen

- a) $1\frac{5}{24}$ bottles total b) $5\frac{1}{2}$ sandwiches c) $14\frac{1}{2}$ hours
d) $4\frac{7}{8}$ watermelons e) $\frac{7}{8}$ of the book f) He walks $4\frac{1}{3}$ km each day
g) $14\frac{2}{5}$ m of material h) $3\frac{2}{5}$ m of material i) $15\frac{2}{3}$ cm
j) $52\frac{3}{5}$ cm k) $17\frac{11}{24}$ cm

A. Add and express the answers in lowest terms.**6 marks**

a)

$$\begin{array}{r} \frac{1}{4} \\ + \frac{3}{4} \\ \hline \end{array}$$

b)

$$\begin{array}{r} 1\frac{3}{5} \\ + 3\frac{4}{5} \\ \hline \end{array}$$

c)

$$\begin{array}{r} \frac{3}{8} \\ + \frac{3}{4} \\ \hline \end{array}$$

d)

$$\begin{array}{r} 2\frac{1}{6} \\ + 3\frac{5}{12} \\ \hline \end{array}$$

e)

$$\begin{array}{r} 6\frac{3}{4} \\ + 2\frac{1}{2} \\ \hline \end{array}$$

f)

$$\begin{array}{r} 6\frac{7}{8} \\ + 9\frac{1}{3} \\ \hline \end{array}$$

B. Problems.**8 marks**

- a) The flight from Vancouver to Castlegar took $1\frac{1}{4}$ hours. The wait in Castlegar was $1\frac{1}{2}$ hours and the flight from there to Calgary was $\frac{3}{4}$ of an hour. How long did it take to make the trip from Vancouver to Calgary?
- b) Dave built $\frac{1}{8}$ of the fence around his house on Monday, $\frac{1}{4}$ of it on Tuesday and another $\frac{1}{4}$ on Wednesday. How much of the fence has he built?
- c) John bought snacks in bulk for the class party. His items weighed $\frac{2}{5}$ kg of chips, $\frac{3}{5}$ kg of peanuts, $\frac{1}{2}$ kg of cheese and $1\frac{1}{4}$ kg of fresh veggies. How much did all his snacks weigh?

- d) Clarence is making a frame for his favourite photo. The frame needs to be $\frac{1}{8}$ m by $\frac{5}{6}$ m.
How much material should he buy?

Answers to Topic A Self-Test

A.

- a) 1 b) $5\frac{2}{5}$ c) $1\frac{1}{8}$ d) $5\frac{7}{12}$
e) $9\frac{1}{4}$ f) $16\frac{5}{24}$

B.

- a) $3\frac{1}{2}$ hours b) $\frac{5}{8}$ of the fence c) $2\frac{3}{4}$ kg of food
d) $1\frac{11}{12}$ m of material

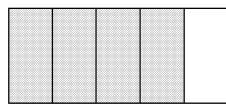
Topic B: Subtracting Common Fractions

Good News!

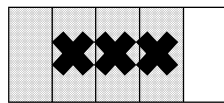
There is only **one new thing** to learn in this topic. Everything else uses skills and knowledge you already have.

Let's look at subtraction:

Example A:



The shaded part ($\frac{4}{5}$) is the amount that you are starting with. Now cross out (pretend you are *taking away*) 3 shaded parts ($\frac{3}{5}$)



$$\begin{array}{r} \frac{4}{5} \\ - \frac{3}{5} \\ \hline \frac{1}{5} \end{array}$$

You started with a shaded $\frac{4}{5}$ and crossed out a shaded $\frac{3}{5}$.

The shaded amount left is $\frac{1}{5}$.



Example B:

Draw a pizza.

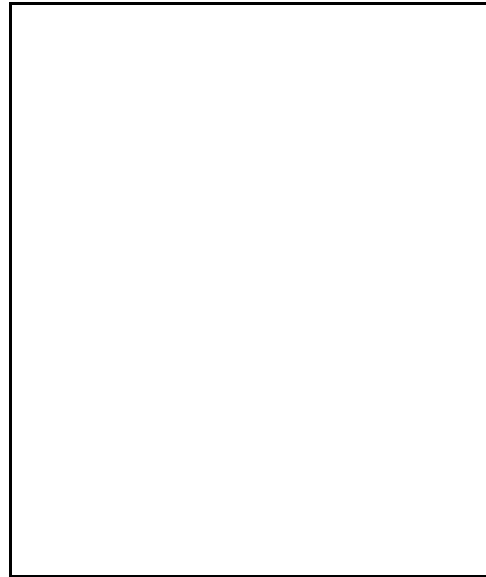
- Slice it into 8 equal pieces.
- Draw pieces of pineapple on 5 pieces.
- What fraction of the pizza has pineapple?

$$\frac{5}{8}$$

- Cross out 2 pineapple pieces to show they have been eaten.
- How much of the pineapple pizza is left?

$$\begin{array}{r} \frac{5}{8} \quad (\text{amount you started with}) \\ - \frac{2}{8} \quad (\text{amount eaten, "taken away"}) \\ \hline \frac{3}{8} \end{array}$$

of the pizza is left with pineapple on it.



Common fractions must have the same denominator when you subtract one from the other. **Subtract** the **numerators** and **keep** the same denominators.

Exercise One

Subtract to find the **difference**. Express the difference in lowest terms.

$$\begin{array}{r} \text{a) } \frac{3}{5} \\ - \frac{1}{5} \\ \hline \frac{2}{5} \end{array}$$

$$\begin{array}{r} \text{b) } \frac{7}{8} \\ - \frac{3}{8} \\ \hline \frac{4}{8} = \frac{1}{2} \end{array}$$

$$\begin{array}{r} \text{c) } \frac{2}{3} \\ - \frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} \text{d) } \frac{11}{16} \\ - \frac{5}{16} \\ \hline \end{array}$$

$$\begin{array}{r} \text{e) } \frac{7}{12} \\ - \frac{4}{12} \\ \hline \end{array}$$

$$\begin{array}{r} \text{f) } \frac{5}{7} \\ - \frac{1}{7} \\ \hline \end{array}$$

$$\begin{array}{r} \text{g) } \frac{5}{9} \\ - \frac{2}{9} \\ \hline \end{array}$$

$$\begin{array}{r} \text{h) } \frac{6}{5} \\ - \frac{4}{5} \\ \hline \end{array}$$

$$\begin{array}{r} \text{i) } \frac{5}{6} \\ - \frac{3}{6} \\ \hline \end{array}$$

$$\text{j) } \frac{6}{7} \\ - \frac{1}{7} \\ \hline$$

$$\text{k) } \frac{3}{4} \\ - \frac{1}{4} \\ \hline$$

$$\text{l) } \frac{3}{2} \\ - \frac{1}{2} \\ \hline$$

Answers to Exercise One

$$\text{c) } \frac{1}{3}$$

$$\text{d) } \frac{3}{8}$$

$$\text{e) } \frac{1}{4}$$

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

$$\text{g) } \frac{1}{3}$$

$$\text{h) } \frac{2}{5}$$

$$\text{i) } \frac{1}{3}$$

$$\text{j) } \frac{5}{7}$$

$$\text{k) } \frac{1}{2}$$

$$\text{l) } \frac{2}{2} = 1$$

You know how to find the **least common denominator (L.C.D.)** and to **rewrite fractions in an equivalent form** using the L.C.D..

You must use those skills when you wish to subtract fractions with different denominators.

Example A: $\frac{4}{5} - \frac{3}{10} = \square$

Denominators are 5 and 10. The least common multiple is 10, so the least common denominator is 10.

$$\frac{4(\times 2)}{5(\times 2)} = \frac{8}{10}$$

Write equivalent fractions using the L.C.D.

$$- \frac{3}{10} = \frac{3}{10}$$

Subtract the numerators.

$$= \frac{5(\div 5)}{10(\div 5)} = \frac{1}{2}$$

Simplify the answer.

Exercise Two

Subtract and simplify the answers.

$$\begin{array}{r} \text{a) } \frac{5}{6} = \frac{5}{6} \\ -\frac{2(\times 2)}{3(\times 2)} = \frac{4}{6} \\ \hline \frac{1}{6} \end{array}$$

$$\begin{array}{r} \text{b) } \frac{3}{4} = \frac{3}{4} \\ -\frac{1(\times 2)}{2(\times 2)} = \frac{2}{4} \\ \hline \frac{1}{4} \end{array}$$

$$\begin{array}{r} \text{c) } \frac{1}{4} \\ -\frac{1}{12} \\ \hline \end{array}$$

$$\begin{array}{r} \text{d) } \frac{7}{10} \\ -\frac{3}{5} \\ \hline \end{array}$$

$$\begin{array}{r} \text{e) } \frac{3}{4} \\ -\frac{5}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{f) } \frac{15}{16} \\ -\frac{5}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{g) } \frac{7}{16} \\ -\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{h) } \frac{2}{5} \\ -\frac{1}{10} \\ \hline \end{array}$$

$$\begin{array}{r} \text{i) } \frac{3}{8} \\ -\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{j) } \frac{5}{6} \\ -\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} \text{k) } \frac{2}{3} \\ -\frac{1}{12} \\ \hline \end{array}$$

$$\begin{array}{r} \text{l) } \frac{7}{8} \\ -\frac{1}{2} \\ \hline \end{array}$$

$$\text{m) } \frac{\frac{5}{8}}{-\frac{1}{3}}$$

$$\text{n) } \frac{\frac{2}{3}}{-\frac{1}{8}}$$

$$\text{o) } \frac{\frac{5}{12}}{-\frac{1}{4}}$$

$$\text{p) } \frac{1}{3} - \frac{1}{6} =$$

$$\text{q) } \frac{1}{2} - \frac{1}{6} =$$

$$\text{r) } \frac{1}{4} - \frac{1}{5} =$$

$$\text{s) } \frac{3}{4} - \frac{1}{10} =$$

$$\text{t) } \frac{5}{6} - \frac{5}{8} =$$

$$\text{u) } \frac{1}{8} - \frac{1}{16} =$$

$$\text{v) } \frac{3}{8} - \frac{1}{6} =$$

$$\text{w) } \frac{4}{5} - \frac{1}{2} =$$

Answers to Exercise Two

c) $\frac{1}{6}$

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

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

f) $\frac{5}{16}$

g) $\frac{3}{16}$

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

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

j) $\frac{1}{3}$

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

l) $\frac{3}{8}$

m) $\frac{7}{24}$

n) $\frac{13}{24}$

o) $\frac{1}{6}$

p) $\frac{1}{6}$

q) $\frac{1}{3}$

r) $\frac{1}{20}$

s) $\frac{13}{20}$

t) $\frac{5}{24}$

u) $\frac{1}{16}$

v) $\frac{5}{24}$

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

Subtracting mixed numbers is very similar to adding mixed numbers.

- Find the least common denominator if the fractions do not have the same denominator already.
- Rename the fractions as equivalent fractions using the L.C.D.. **Don't forget to keep whole number with the problem.**
- Subtract the second denominator from the first. Keep the same denominator.
- Subtract the whole numbers.
- Simplify the answer.

Example A:

$$\begin{array}{r}
 4\frac{1}{2} \left(\begin{array}{l} \times 3 \\ \times 3 \end{array} \right) = 4\frac{3}{6} \\
 - 3\frac{1}{6} \\
 \hline
 1\frac{2}{6} = 1\frac{1}{3}
 \end{array}$$

Example B:

$$\begin{array}{r} 12\frac{3}{4}\left(\frac{\times 3}{\times 3}\right) = 12\frac{9}{12} \\ -\frac{2}{3}\left(\frac{\times 4}{\times 4}\right) = \frac{8}{12} \\ \hline 12\frac{1}{12} \end{array}$$

Exercise Three

Work through all these questions carefully.

a)
$$\begin{array}{r} 16\frac{2}{3} = 16\frac{16}{24} \\ -4\frac{3}{8} = 4\frac{9}{24} \\ \hline 12\frac{7}{24} \end{array}$$

b)
$$\begin{array}{r} 9\frac{7}{12} \\ -9\frac{5}{12} \\ \hline \end{array}$$

c)
$$\begin{array}{r} 6\frac{3}{4} \\ -2\frac{1}{3} \\ \hline \end{array}$$

d)
$$\begin{array}{r} 22\frac{5}{6} \\ -18\frac{2}{5} \\ \hline \end{array}$$

e)
$$\begin{array}{r} 3\frac{7}{8} \\ -2\frac{3}{4} \\ \hline \end{array}$$

f)
$$\begin{array}{r} 1\frac{7}{10} \\ -\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} \text{g)} \quad 8 \frac{7}{12} \\ - 8 \frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{h)} \quad 12 \frac{9}{10} \\ - 10 \frac{1}{5} \\ \hline \end{array}$$

$$\begin{array}{r} \text{i)} \quad 5 \frac{7}{8} \\ - 3 \frac{5}{12} \\ \hline \end{array}$$

$$\begin{array}{r} \text{j)} \quad 9 \frac{1}{4} \\ - 7 \\ \hline \end{array}$$

$$\begin{array}{r} \text{k)} \quad 1 \frac{5}{8} \\ - \frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} \text{l)} \quad 19 \frac{5}{6} \\ - 11 \frac{5}{12} \\ \hline \end{array}$$

Answers to Exercise Three

b) $\frac{1}{6}$

c) $4 \frac{5}{12}$

d) $4 \frac{13}{30}$

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

f) $1 \frac{1}{5}$

g) $\frac{1}{3}$

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

i) $2 \frac{11}{24}$

j) $2 \frac{1}{4}$

k) $1 \frac{7}{24}$

l) $8 \frac{5}{12}$

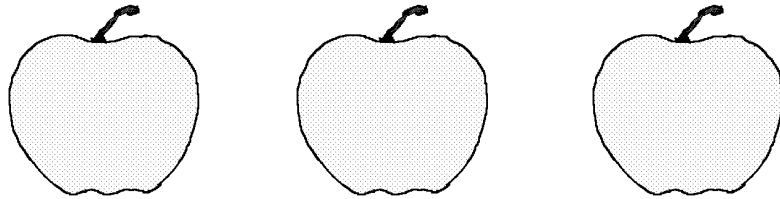
Subtracting Mixed Numbers from Whole Numbers

This is the start of a new process! You already have all the skills to do this, but the process is new.

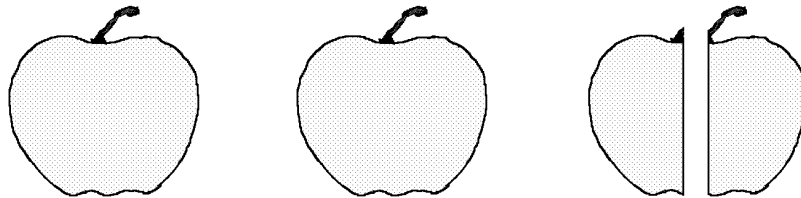
Example A:

Let's look at some apples.

You have 3 whole apples and you want to give your son 1 apple and your daughter half an apple. How will you do this?



Of course, you will cut one apple in half.



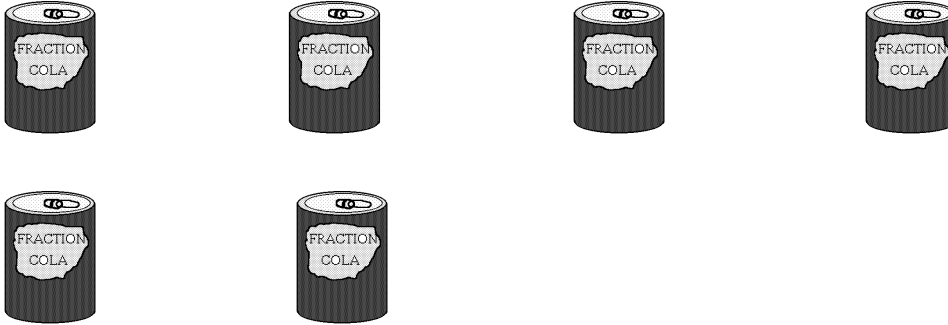
Now you have $2\frac{2}{2}$ apples! And you can easily give away $1\frac{1}{2}$ of them. Cross out $1\frac{1}{2}$ apples in the drawing. How much is left?

Here is the arithmetic for what you just did.

$$\begin{array}{r} 3 = 2\frac{2}{2} \\ -1\frac{1}{2} = 1\frac{1}{2} \\ \hline 1\frac{1}{2} \end{array}$$

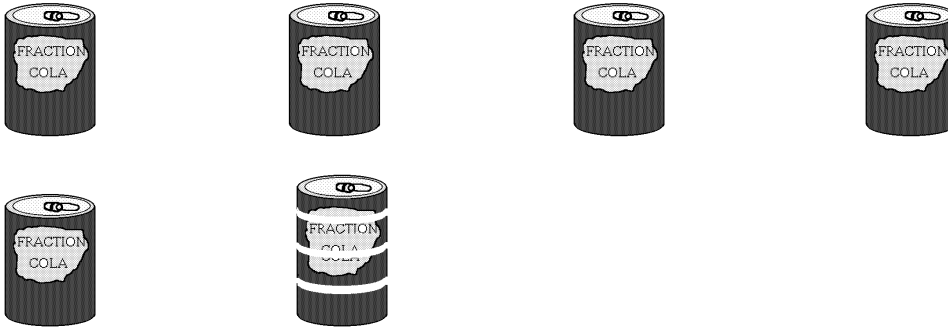
Example B:

Here are 6 cans of pop to share among your friends.



4 people want a whole can, but one gal is on a diet and only wants $\frac{1}{4}$ of a can. How much pop will be left?

What will you do? You will open a can and think of that can as $\frac{4}{4}$.



You have $5\frac{4}{4}$ cans of pop and you can give out 4 whole cans and $\frac{1}{4}$ can of pop. Cross out the 4 whole cans and $\frac{1}{4}$ of a can in the drawing.

How many cans are left?

Here is the arithmetic:

$$\begin{array}{r} 6 = 5\frac{4}{4} \\ - 4\frac{1}{4} \\ \hline 1\frac{3}{4} \end{array}$$

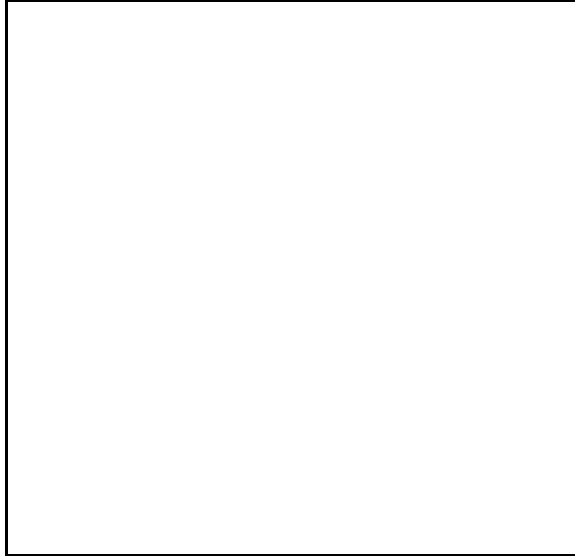
Example C:

Draw five apple pies. Plan to give away $3\frac{2}{3}$ of the pies. How many pies are left?

To do that, cut one pie into thirds. Then cross out 3 whole pies and $\frac{2}{3}$.

Here is the arithmetic:

$$\begin{array}{r} 5 = 4\frac{3}{3} \\ - 3\frac{2}{3} = 3\frac{2}{3} \\ \hline 1\frac{1}{3} \text{ pies left} \end{array}$$



⇒ Remember $1 = \frac{1}{1} = \frac{2}{2} = \frac{3}{3} = \frac{4}{4} = \frac{5}{5} = \frac{6}{6} = \frac{7}{7} = \frac{8}{8} = \frac{9}{9} = \frac{10}{10}$ and so on.

To subtract a mixed number from a whole number

Step 1 "Borrow" **one** from the whole number.

Step 2 Rename the one as an improper fraction with the same denominator as the fraction you are taking away. (Remember to change the whole number to one less.)

Step 3 Subtract the mixed numbers.

Example A: $18 - 12\frac{3}{4} = \square$

$$\begin{array}{r} 17\frac{4}{4} = 17\frac{4}{4} \\ - 12\frac{3}{4} = 12\frac{3}{4} \\ \hline 5\frac{1}{4} \end{array}$$

The one that was borrowed changes to $\frac{4}{4}$

Example B: $1 - \frac{4}{5} = \square$

$$\begin{array}{r} 1 = \frac{5}{5} \\ - \frac{4}{5} = \frac{4}{5} \\ \hline \frac{1}{5} \end{array}$$

Exercise Four

Subtract and express in lowest terms. (Remember to change your whole number to a mixed numeral).

$$\begin{array}{r} \text{a) } 5 = 4\frac{2}{2} \\ -1\frac{1}{2} = 1\frac{1}{2} \\ \hline 3\frac{1}{2} \end{array}$$

$$\begin{array}{r} \text{b) } 9 \\ -4\frac{3}{10} \\ \hline \end{array}$$

$$\begin{array}{r} \text{c) } 12 \\ -11\frac{5}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{d) } 25 \\ -20\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{e) } 3 \\ -2\frac{2}{3} \\ \hline \end{array}$$

$$\begin{array}{r} \text{f) } 8 \\ -\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{g) } 4 \\ -2\frac{2}{5} \\ \hline \end{array}$$

$$\begin{array}{r} \text{h) } 1 \\ -\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} \text{i) } 21 \\ -19\frac{2}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{j) } 32 \\ -28\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} \text{k) } 5 \\ -3\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} \text{l) } 8 \\ -4\frac{4}{9} \\ \hline \end{array}$$

Answers to Exercise Four

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

c) $\frac{3}{8}$

d) $4\frac{3}{4}$

e) $\frac{1}{3}$

f) $7\frac{1}{4}$

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

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

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

j) $3\frac{1}{2}$

k) $1\frac{2}{3}$

l) $3\frac{5}{9}$

Renaming to Subtract Mixed Numbers

Example A:

Look at the $3\frac{1}{4}$ chocolate bars.



You need to give $2\frac{3}{4}$ chocolate bars to the kids on the soccer team. How will you do this?

You will have to cut up one of the whole chocolate bars into 4 pieces, or $\frac{4}{4}$.



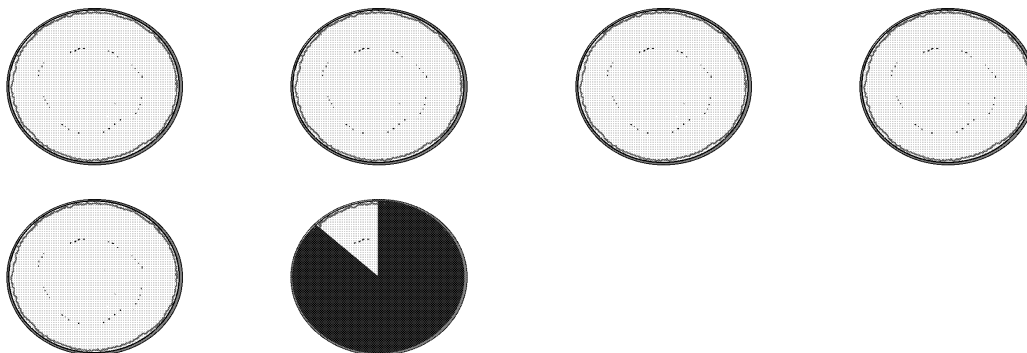
Now you have 2 whole bars, $\frac{4}{4}$ of a bar and $\frac{1}{4}$ of a bar which equals $2\frac{5}{4}$ of a bar. It will be easy to give away (subtract) $2\frac{3}{4}$ bars. Cross out $2\frac{3}{4}$ bars.

How much is left?

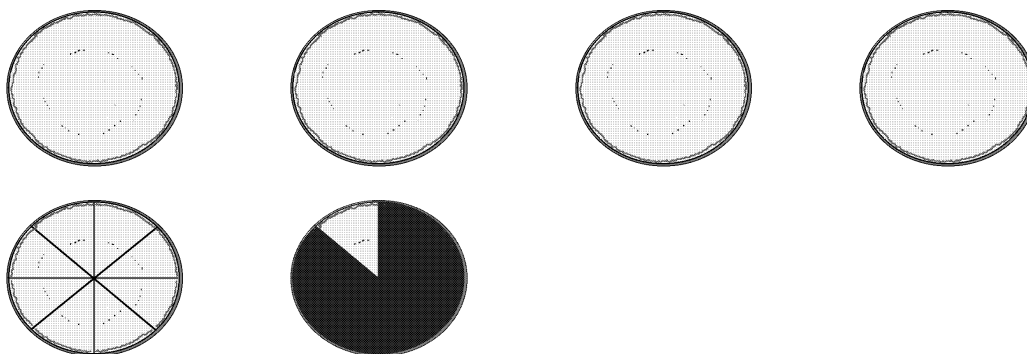
Here is the arithmetic: $3\frac{1}{4} - 2\frac{3}{4} = \square$

$$\begin{array}{r}
 3\frac{1}{4} = 2\frac{4}{4} + \frac{1}{4} = 2\frac{5}{4} \\
 - 2\frac{3}{4} \qquad \qquad \qquad = 2\frac{3}{4} \\
 \hline
 \qquad \qquad \qquad \qquad \qquad \frac{2}{4} = \frac{1}{2} \text{ chocolate bar left}
 \end{array}$$

Example B: Look at the $5\frac{1}{8}$ cherry pies.



You promised to send $3\frac{5}{8}$ pies to the spring party at the school. What will you do? Cut one of the pies into eighths.



Do that, and then cross out $3\frac{5}{8}$ pies. How much pie is left?

$$\begin{array}{r}
 5\frac{1}{8} = 4\frac{8}{8} + \frac{1}{8} = 4\frac{9}{8} \\
 - 3\frac{5}{8} \\
 \hline
 1\frac{4}{8} = 1\frac{1}{2} \text{ pies}
 \end{array}$$

Renaming a mixed number so you can subtract

Step 1 Check to see if renaming is needed. That is, check that the fraction in the mixed number you are starting with is **less** than the fraction you want to take away.

$$4\frac{1}{3} - 2\frac{2}{3} = \square \quad \left(\frac{1}{3} \text{ is less than } \frac{2}{3}\right)$$

Step 2 "Borrow" **one** from the whole number (**Remember to change the whole number to 1 less.**)

Step 3 **Rename** the "borrowed" **one** as an improper fraction with the same denominator as the other fractions.

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

This becomes the 1 that you borrowed from the four

Step 4 Add the renamed one to the fraction that is part of the same mixed number.

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

Step 5 Subtract as usual, expressing your answer in lowest terms.

$$\begin{array}{r} 4\frac{1}{3} = 3\frac{4}{3} \\ - 2\frac{2}{3} = 2\frac{2}{3} \\ \hline 1\frac{2}{3} \end{array}$$

Example A: $5\frac{2}{5} - 2\frac{4}{5} = \square$

Step 1 $\frac{2}{5}$ is less than $\frac{4}{5}$, so renaming is required.

Step 2 and 3 Borrow one.

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

Step 4 and 5

$$\begin{array}{r} 5\frac{2}{5} = 4\frac{5}{5} + \frac{2}{5} = 4\frac{7}{5} \\ - 2\frac{4}{5} = \qquad \qquad 2\frac{4}{5} \\ \hline 2\frac{3}{5} \end{array}$$

Example B: $1\frac{2}{4} - \frac{3}{4} = \square$

Step 1 $\frac{2}{4}$ is less than $\frac{3}{4}$, so we need to rename to subtract.

Step 2, 3, 4 and 5

$$\begin{array}{r} 1\frac{2}{4} = \frac{4}{4} + \frac{2}{4} = \frac{6}{4} \\ - \frac{3}{4} = \frac{3}{4} \\ \hline \frac{3}{4} \end{array}$$

Exercise Five

Subtract. Be sure the answers are in lowest terms.

a) $20\frac{1}{4} = 19\frac{5}{4}$
 $-10\frac{3}{4} = 10\frac{3}{4}$
 $\hline 9\frac{2}{4} = 9\frac{1}{2}$

b) $3\frac{1}{3}$
 $-1\frac{2}{3}$
 \hline

c) $56\frac{2}{5}$
 $-20\frac{4}{5}$
 \hline

d) $8\frac{1}{3}$
 $-4\frac{2}{3}$
 \hline

e) $4\frac{1}{5}$
 $-2\frac{3}{5}$
 \hline

f) $5\frac{2}{7}$
 $-1\frac{3}{7}$
 \hline

g) $12\frac{5}{9}$
 $-10\frac{7}{9}$
 \hline

h) $2\frac{3}{11}$
 $-1\frac{5}{11}$
 \hline

i) $5\frac{1}{6}$
 $-\frac{5}{6}$
 \hline

$$\begin{array}{r} \text{j) } 9\frac{3}{5} \\ - 4\frac{4}{5} \\ \hline \end{array}$$

$$\begin{array}{r} \text{k) } 4\frac{1}{4} \\ - 1\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{l) } 15\frac{3}{8} \\ - 14\frac{7}{8} \\ \hline \end{array}$$

Answers to Exercise Five

$$\text{b) } 1\frac{2}{3}$$

$$\text{c) } 35\frac{3}{5}$$

$$\text{d) } 3\frac{2}{3}$$

$$\text{e) } 1\frac{3}{5}$$

$$\text{f) } 3\frac{6}{7}$$

$$\text{g) } 1\frac{7}{9}$$

$$\text{h) } \frac{9}{11}$$

$$\text{i) } 4\frac{1}{3}$$

$$\text{j) } 8\frac{4}{5}$$

$$\text{k) } 2\frac{1}{2}$$

$$\text{l) } \frac{1}{2}$$

Here is the last step for subtraction of fractions.

Mixed numbers to be subtracted often do not have the same denominators—they are **unlike fractions**.

You must

- Write equivalent fractions using the L.C.D.
- Decide if you need to "borrow" or rename before you subtract.
- Subtract and simplify the answer.

$$\text{Example A: } 4\frac{1}{3} - 2\frac{5}{6} = \square$$

$$\begin{array}{r} 4\frac{1}{3} = 4\frac{2}{6} = 3\frac{6}{6} + \frac{2}{6} = 3\frac{8}{6} \\ - 2\frac{5}{6} \\ \hline 1\frac{3}{6} = 1\frac{1}{2} \end{array}$$

Example B: $9\frac{1}{10} - 4\frac{1}{4} = \square$

$$\begin{array}{r} 9\frac{1}{10} = 9\frac{2}{20} = 8\frac{20}{20} + \frac{2}{20} = 8\frac{22}{20} \\ -4\frac{1}{4} = 4\frac{5}{20} \\ \hline 4\frac{17}{20} \end{array}$$

Exercise Six

Subtract. Be sure the answers are in lowest terms.

a)
$$\begin{array}{r} 9\frac{3}{8} = 9\frac{3}{8} = 8\frac{11}{8} \\ -7\frac{1}{2} = 7\frac{4}{8} = 7\frac{4}{8} \\ \hline 1\frac{7}{8} \end{array}$$

b)
$$\begin{array}{r} 7\frac{1}{16} \\ -4\frac{1}{8} \\ \hline \end{array}$$

c)
$$\begin{array}{r} 15\frac{1}{6} \\ -12\frac{7}{8} \\ \hline \end{array}$$

d)
$$\begin{array}{r} 20\frac{2}{6} \\ -16\frac{2}{3} \\ \hline \end{array}$$

e)
$$\begin{array}{r} 6\frac{3}{5} \\ -4\frac{1}{4} \\ \hline \end{array}$$

f)
$$\begin{array}{r} 9\frac{1}{4} \\ -7\frac{3}{8} \\ \hline \end{array}$$

$$\text{g) } \begin{array}{r} 15\frac{1}{2} \\ -12\frac{3}{4} \\ \hline \end{array}$$

$$\text{h) } \begin{array}{r} 19\frac{1}{8} \\ -14\frac{1}{2} \\ \hline \end{array}$$

$$\text{i) } \begin{array}{r} 8\frac{3}{10} \\ -5\frac{1}{2} \\ \hline \end{array}$$

$$\text{j) } \begin{array}{r} 4\frac{5}{12} \\ -3\frac{3}{4} \\ \hline \end{array}$$

$$\text{k) } \begin{array}{r} 5\frac{1}{3} \\ -2\frac{1}{2} \\ \hline \end{array}$$

$$\text{l) } \begin{array}{r} 18\frac{1}{6} \\ -12\frac{2}{3} \\ \hline \end{array}$$

Answers to Exercise Six

$$\text{b) } 2\frac{15}{16}$$

$$\text{c) } 2\frac{7}{24}$$

$$\text{d) } 3\frac{2}{3}$$

$$\text{e) } 2\frac{7}{20}$$

$$\text{f) } 1\frac{7}{8}$$

$$\text{g) } 2\frac{3}{4}$$

$$\text{h) } 4\frac{5}{8}$$

$$\text{i) } 2\frac{4}{5}$$

$$\text{j) } \frac{2}{3}$$

$$\text{k) } 2\frac{5}{6}$$

$$\text{l) } 5\frac{1}{2}$$

Exercise Seven

A Subtraction Review

$$\begin{array}{r} \text{a) } \frac{5}{8} \\ -\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{b) } 8\frac{3}{4} \\ -4\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} \text{c) } 13\frac{1}{3} \\ -12\frac{5}{6} \\ \hline \end{array}$$

$$\begin{array}{r} \text{d) } 7\frac{1}{3} \\ -4\frac{5}{6} \\ \hline \end{array}$$

$$\begin{array}{r} \text{e) } 8\frac{3}{10} \\ -\frac{9}{10} \\ \hline \end{array}$$

$$\begin{array}{r} \text{f) } 3\frac{1}{4} \\ -\frac{5}{6} \\ \hline \end{array}$$

$$\begin{array}{r} \text{g) } 9\frac{1}{5} \\ -6\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} \text{h) } 7 \\ -1\frac{7}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{i) } 9\frac{1}{4} \\ -5\frac{2}{3} \\ \hline \end{array}$$

$$\begin{array}{r} \text{j) } 6\frac{4}{5} \\ -\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} \text{k) } 19\frac{2}{3} \\ -18 \\ \hline \end{array}$$

$$\begin{array}{r} \text{l) } \frac{5}{8} \\ -\frac{1}{2} \\ \hline \end{array}$$

Answers to Exercise Seven

a) $\frac{3}{8}$

b) $4\frac{5}{12}$

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

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

e) $7\frac{2}{5}$

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

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

h) $5\frac{1}{8}$

i) $3\frac{7}{12}$

j) $6\frac{3}{10}$

k) $1\frac{2}{3}$

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

Problems Using Subtraction of Common Fractions

Subtraction problems may ask you to

- find the difference between two amounts.
 - "how much more is..."
 - "how much less is..."
- take away, give away, or lose.
- decide how much is left or how much remains.

Read over the subtraction problems that you did in Unit Two with decimals. The wording and problem situations will be similar.

Drawing a sketch and estimating the answer using whole numbers may also be helpful.

Exercise Eight

Solve these problems.

- a) The New Earth Diaper Company stocks went from $5\frac{7}{8}$ to $7\frac{3}{8}$ this week.
How much did the stocks increase in value?

- b) Jean is knitting an afghan which will be made from 5 long pieces. She has finished $3\frac{2}{3}$ of the pieces. How many pieces does she still have to knit?

- c) Dave said he worked in the garden for $6\frac{1}{4}$ hours, but his wife saw him snoozing under a tree for $1\frac{1}{2}$ hours! How long did Dave really work?
- d) Maureen left $\frac{2}{3}$ of a big lasagne casserole in the fridge hoping it would be enough for a quick dinner that night. But alas, when she got home, only $\frac{1}{4}$ of the big lasagne casserole remained. How much of the lasagne was eaten while she was out?
- e) In the first half of 1992 the Bank of Canada Prime Rate dropped steadily. It started the year at $8\frac{1}{2}\%$ and was at a low $6\frac{3}{4}\%$ in July. How many percentage points did the prime rate drop? (Note: treat the % just like a unit in this problem.)

f) Mark is $1\frac{3}{4}$ meters tall. His partner is $1\frac{1}{3}$ meters tall. How much taller is Mark than his partner?

g) A teenager can drink $3\frac{3}{4}$ litres of milk each day. If this teenager drinks $2\frac{1}{2}$ litres by lunch, how much more milk will he drink in the day?

h) Joan bought $13\frac{1}{2}$ metres to do her sewing project. She has used $8\frac{1}{5}$ metres so far. How much material does she have left?

Answers to Exercise Eight

a) $1\frac{1}{2}$ or \$1.50

b) $1\frac{1}{3}$ pieces

c) $4\frac{3}{4}$ hours

d) $\frac{5}{12}$ of the lasagna

e) $1\frac{3}{4}$ percentage points

f) $\frac{5}{12}$ metres taller

g) $1\frac{1}{4}$ litres left to drink

h) $5\frac{3}{10}$ metres left

Topic B Self-Test

Mark /15 Aim 12/15

A. Subtract these fractions. Simplify the answers when necessary.

15 marks

a)
$$\begin{array}{r} \frac{7}{8} \\ - \frac{1}{8} \\ \hline \end{array}$$

b)
$$\begin{array}{r} \frac{11}{15} \\ - \frac{4}{15} \\ \hline \end{array}$$

c)
$$\begin{array}{r} \frac{7}{8} \\ - \frac{3}{16} \\ \hline \end{array}$$

d)
$$\begin{array}{r} \frac{2}{3} \\ - \frac{1}{6} \\ \hline \end{array}$$

e)
$$\begin{array}{r} \frac{4}{7} \\ - \frac{1}{14} \\ \hline \end{array}$$

f)
$$\begin{array}{r} \frac{4}{5} \\ - \frac{3}{8} \\ \hline \end{array}$$

g)
$$\begin{array}{r} 4 \\ - 2\frac{1}{2} \\ \hline \end{array}$$

h)
$$\begin{array}{r} 5 \\ - 4\frac{7}{8} \\ \hline \end{array}$$

i)
$$\begin{array}{r} 10\frac{3}{5} \\ - 3\frac{3}{10} \\ \hline \end{array}$$

j)
$$\begin{array}{r} 7\frac{1}{5} \\ - 3\frac{4}{5} \\ \hline \end{array}$$

k)
$$\begin{array}{r} 12\frac{1}{8} \\ - 11 \\ \hline \end{array}$$

l)
$$\begin{array}{r} 9\frac{1}{5} \\ - \frac{1}{4} \\ \hline \end{array}$$

m)
$$\begin{array}{r} 5\frac{1}{4} \\ - 1\frac{2}{3} \\ \hline \end{array}$$

n)
$$\begin{array}{r} 10\frac{1}{2} \\ - 2\frac{2}{5} \\ \hline \end{array}$$

o)
$$\begin{array}{r} 6\frac{2}{3} \\ - 4\frac{3}{8} \\ \hline \end{array}$$

Answers to Topic B Self-Test
Part A

a) $\frac{3}{4}$

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

c) $\frac{11}{16}$

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

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

f) $\frac{17}{40}$

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

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

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

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

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

l) $8\frac{19}{20}$

m) $3\frac{7}{12}$

n) $8\frac{1}{10}$

o) $2\frac{7}{24}$

Topic C: Problems Using Common Fractions

Review again the **five steps for problem solving**.

- Step 1** **Read, find the question.**
- Step 2** Get the **necessary information** from the problem.
- Step 3** **Decide on the arithmetic operation.**
- Step 4** **Estimate** the answer, using rounded numbers. **Does the answer to the problem seem sensible?**
- Step 5** **Solve** the problem using the **actual numbers**. Check. Is the answer close to the estimate?

Fraction problems with mixed numbers are easily estimated by rounding the fraction to the nearest whole number.

If the problem uses **proper fractions** it is **harder to estimate the answer** using a rounded number because proper fractions will round off to either 0 or 1, which isn't too useful. However, to figure out the operation to use (Step 3), it sometimes helps to **substitute whole numbers** for the proper fraction; this may help you to make sense of the problem. Drawing a sketch might also be helpful.

Exercise One

- a) The following recipe for **Macaroni and Cheese** is very tasty. It feeds six people. Look at the recipe and then complete the chart according to these questions.
 - i) You want to make enough macaroni and cheese for 9 people. That is $\frac{9}{6}$ ($1\frac{1}{2}$) of the recipe. Figure out all the quantities.
 - ii) Figure out the quantities for $\frac{1}{2}$ the recipe, so it is the right amount for 3 people.

Tasty Macaroni and Cheese

Ingredients for 6 people	Quantities for 9 people ($1\frac{1}{2}$ x)	Quantities for 3 people ($\frac{1}{2}$ x)
$1\frac{3}{4}$ cup elbow macaroni	$2\frac{5}{8}$ cups	$\frac{7}{8}$ cup
$\frac{3}{4}$ cup chopped onion		
$\frac{1}{2}$ cup chopped green pepper		
10 sliced mushrooms		
3 tbsp. butter or margarine		
$1\frac{1}{2}$ tbsp. flour		
1 tsp. dry mustard		
$\frac{3}{4}$ tsp. salt		
$\frac{1}{4}$ tsp. oregano		
$2\frac{1}{2}$ cups milk		
$2\frac{1}{2}$ cups shredded cheddar cheese		
$\frac{1}{2}$ cup fine dry breadcrumbs		

Cook and drain macaroni. Turn into a casserole dish. Saute onion, green pepper, and mushrooms in butter until tender. Blend in flour, mustard, salt, and oregano. Gradually stir in milk and cook over medium heat until thick. Add four-fifths of the cheese and stir until melted. Pour over macaroni and stir gently. Combine remaining cheese and breadcrumbs and sprinkle on top. Bake at 350° F for 30 to 40 minutes. Serve with a green vegetable or salad.

- b) Jack spent his school day this way: $1\frac{1}{4}$ hours on English, $1\frac{3}{4}$ hours on math, $\frac{1}{2}$ hour on science and 2 hours on lunch and coffee breaks. How long was his school day?
- c) The canoe trip usually takes $4\frac{1}{4}$ hours for the 34 kilometre trip. What is the average time per kilometre?
- d) The "Walkyerbunsoff" Club members walk $4\frac{3}{4}$ kilometres around the shopping mall six mornings a week.
- i) How far do they walk each week?
- ii) How far do they walk in one year if they keep the same schedule?
(52 weeks = 1 year)

- e) The test has 30 multiple choice questions to be completed in $\frac{3}{4}$ of an hour. How much time can be spent on each question? (It might be easier to work with minutes. 1 hour = 60 minutes, so $\frac{3}{4}$ of an hour = ? minutes.)
- f) The gas tank was filled before the family left Radium Hot Springs. When they pulled into Salmon Arm that afternoon, the gas gauge showed they had used $\frac{5}{8}$ of the gas.
- i) What fraction of the gas was left?
- ii) The full gas tank holds 54 litres. How many litres of gas did they use in the trip from Radium Hot Springs to Salmon Arm?
- g) About $\frac{2}{5}$ of the population of our city has an Italian background. The population is 6500. How many people in our city have an Italian background?

h) The four children carefully planted 3 rows of corn together and promised to share the work and the corn. Only $2\frac{1}{4}$ rows of corn came up. How much of a row does each child need to look after?

i) Gail was supposed to babysit for $2\frac{3}{4}$ hours, but she didn't feel well so her sister Debbie said she would come for $\frac{1}{2}$ of the time. How long did each girl babysit?

j) The WP stocks closed at $6\frac{1}{8}$ on Monday. On Tuesday they fell $\frac{1}{4}$. What was the value of the stocks at closing on Tuesday?

k) The same WP stocks had a good day on Wednesday. They rose $\frac{3}{4}$ from the Tuesday closing price (see question j). What was the value of the WP stocks at closing on Wednesday?

- l) Victor and his family heat their house with wood. Last year they cut and hauled $12\frac{1}{2}$ cords of wood from the bush. At $\frac{1}{2}$ cord per pick-up truck load, how many trips did they have to make with their one truck?
- m) Bankers suggest that when you buy a home, the cost of the house should be no more than $2\frac{1}{2}$ times your annual income. Between them, John and Pam Miller have a gross annual income of \$68 000. About how much would the bankers say they should spend on a house?
- n) The loaded logging trucks cover 38.5 km from the logging site down the steep logging roads to the highway in $1\frac{1}{4}$ hours. What is their average speed in kilometres per hour?

Answers to Exercise One

a)

Tasty Macaroni and Cheese

Ingredients for 6 people	Quantities for 9 people ($1\frac{1}{2}\times$)	Quantities for 3 people ($\frac{1}{2}\times$)
$1\frac{3}{4}$ cup elbow macaroni	$2\frac{5}{8}$ cups	$\frac{7}{8}$ cup
$\frac{3}{4}$ cup chopped onion	$1\frac{1}{8}$ cup	$\frac{3}{8}$ cup
$\frac{1}{2}$ cup chopped green pepper	$\frac{3}{4}$ cup	$\frac{1}{4}$ cup
10 sliced mushrooms	15	5
3 tbsp. butter or margarine	$4\frac{1}{2}$ tbsp.	$1\frac{1}{2}$ tbsp.
$1\frac{1}{2}$ tbsp. flour	$2\frac{1}{4}$ tbsp.	$\frac{3}{4}$ tbsp.
1 tsp. dry mustard	$1\frac{1}{2}$ tsp.	$\frac{1}{2}$ tsp.
$\frac{3}{4}$ tsp. salt	$1\frac{1}{8}$ tsp.	$\frac{3}{8}$ tsp.
$\frac{1}{4}$ tsp. oregano	$\frac{3}{8}$ tsp.	$\frac{1}{8}$ tsp.
$2\frac{1}{2}$ cups milk	$3\frac{3}{4}$ cups	$1\frac{1}{4}$ cups
$2\frac{1}{2}$ cups shredded cheddar cheese	$3\frac{3}{4}$ cups	$1\frac{1}{4}$ cups
$\frac{1}{2}$ cup fine dry breadcrumbs	$\frac{3}{4}$ cup	$\frac{1}{4}$ cup

b) $5\frac{1}{2}$ hours

c) $\frac{1}{8}$ hours/km or $7\frac{1}{2}$ min/km

d) i) $28\frac{1}{2}$ km ii) 1482 km

e) $1\frac{1}{2}$ minutes/question

f) i) $\frac{3}{8}$ tank ii) $33\frac{3}{4}$ L

g) 2 600 people

h) $\frac{9}{16}$ of a row

i) $1\frac{3}{8}$ hours

j) $5\frac{7}{8}$

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

l) 25 trips

m) \$170 000

n) $30\frac{2}{5}$ km/h

Unit 4 Review

1. Add these common fractions, make sure to reduce your answer to the lowest terms.

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

b) $\frac{3}{7} + \frac{2}{7} =$

c) $\frac{4}{5} + \frac{1}{5} =$

d) $\frac{3}{8} + \frac{1}{8} =$

e) $\frac{4}{8} + \frac{2}{8} =$

f) $\frac{1}{12} + \frac{3}{12} =$

g) $\frac{3}{7} + \frac{5}{7} =$

h) $\frac{7}{21} + \frac{7}{21} =$

2. Add these common fractions, make sure to reduce your answer.

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

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

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

d) $\frac{3}{5} + \frac{3}{4} =$

e) $\frac{3}{7} + \frac{6}{8} =$

f) $\frac{1}{2} + \frac{13}{16} =$

$$\text{g) } \frac{1}{8} + \frac{1}{3} =$$

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

$$\text{i) } \frac{4}{7} + \frac{8}{9} =$$

$$\text{j) } \frac{1}{30} + \frac{3}{4} =$$

3. Add. Express the sum in lowest terms

$$\text{a) } 6\frac{3}{5} + 2\frac{3}{7} =$$

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

$$\text{c) } 3\frac{3}{8} + 4\frac{1}{4} =$$

$$\text{d) } 8\frac{1}{5} + 1\frac{2}{7} =$$

$$\text{e) } 1\frac{14}{15} + 3\frac{1}{3} =$$

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

$$\text{g) } 12\frac{1}{2} + 1\frac{1}{3} =$$

$$\text{h) } 9\frac{2}{5} + 1\frac{7}{10} =$$

$$\text{i) } 9\frac{4}{5} + 3\frac{1}{7} =$$

$$\text{j) } 2\frac{1}{5} + 7\frac{4}{15} =$$

4. Subtract. Express your answers in lowest terms.

$$\text{a) } \begin{array}{r} \frac{2}{5} \\ - \frac{1}{5} \\ \hline \end{array}$$

$$\text{b) } \begin{array}{r} \frac{5}{8} \\ - \frac{1}{8} \\ \hline \end{array}$$

$$\text{c) } \begin{array}{r} \frac{2}{3} \\ - \frac{1}{3} \\ \hline \end{array}$$

$$\text{d) } \begin{array}{r} \frac{5}{12} \\ - \frac{3}{12} \\ \hline \end{array}$$

$$\text{e) } \begin{array}{r} \frac{17}{22} \\ - \frac{6}{22} \\ \hline \end{array}$$

$$\text{f) } \begin{array}{r} \frac{8}{9} \\ - \frac{5}{9} \\ \hline \end{array}$$

5. Subtract and simplify the answer.

$$\text{a) } \begin{array}{r} \frac{5}{6} \\ - \frac{2}{3} \\ \hline \end{array}$$

$$\text{b) } \begin{array}{r} \frac{3}{4} \\ - \frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} \text{c) } \frac{3}{4} \\ - \frac{1}{12} \\ \hline \end{array}$$

$$\begin{array}{r} \text{d) } \frac{9}{10} \\ - \frac{4}{5} \\ \hline \end{array}$$

$$\begin{array}{r} \text{e) } \frac{1}{2} \\ - \frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{f) } \frac{15}{16} \\ - \frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{g) } \frac{9}{16} \\ - \frac{1}{8} \\ \hline \end{array}$$

$$\begin{array}{r} \text{h) } \frac{1}{6} \\ - \frac{1}{12} \\ \hline \end{array}$$

$$\begin{array}{r} \text{i) } \frac{4}{5} \\ - \frac{1}{10} \\ \hline \end{array}$$

6. Subtract. Be sure to reduce your answers to lowest terms.

$$\begin{array}{r} \text{a) } 20\frac{2}{4} \\ - 10\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} \text{b) } 1\frac{2}{3} \\ - \frac{5}{6} \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \text{c) } - \frac{1}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 4\frac{1}{5} \\ \text{d) } - 1\frac{2}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 5\frac{1}{3} \\ \text{e) } - \frac{2}{3} \\ \hline \end{array}$$

$$\begin{array}{r} 9\frac{3}{5} \\ \text{f) } - 4\frac{4}{5} \\ \hline \end{array}$$

7. Subtract the following fractions. Reduce your answer.

$$\begin{array}{r} 15\frac{1}{6} \\ \text{a) } - 3\frac{2}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \text{b) } - 4\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} 9\frac{1}{4} \\ \text{c) } - 7\frac{5}{8} \\ \hline \end{array}$$

$$\begin{array}{r} 13\frac{1}{4} \\ \text{d) } - 3\frac{4}{9} \\ \hline \end{array}$$

$$\begin{array}{r} 13 \\ \text{e) } - 1\frac{1}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 7\frac{1}{3} \\ \text{f) } - 4\frac{5}{6} \\ \hline \end{array}$$

$$\begin{array}{r} 18\frac{1}{6} \\ \text{g) } - 14\frac{2}{9} \\ \hline \end{array}$$

$$\begin{array}{r} 4\frac{3}{5} \\ \text{h) } - 3\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 22 \\ \text{i) } - 1\frac{7}{12} \\ \hline \end{array}$$

$$\begin{array}{r} 19\frac{1}{8} \\ \text{j) } - 14\frac{1}{3} \\ \hline \end{array}$$

8. Solve the following problems.

- a) Cheryl walks for $\frac{1}{2}$ of an hour on Tuesdays and Thursdays, and $\frac{2}{3}$ of an hour on Mondays and Wednesdays. On Fridays, Saturdays and Sundays, she walks for $1\frac{1}{4}$ hours each day. How much time does she walk each week?

b) The car trip took $2\frac{2}{3}$ hours for 300 km. What was the average speed (in km per hour)?

c) The kids spent each day of their summer vacation in the lake! They would play in the water for $\frac{3}{4}$ of an hour in the morning, $\frac{2}{3}$ of an hour after lunch, and then $1\frac{1}{2}$ hours before dinner. How many hours did they spend in the water during their 14 day vacation?

d) A freight truck has $26\frac{1}{4}$ kg of paper, $4\frac{3}{6}$ kg of pencils, $37\frac{1}{3}$ kg of file folders. How much weight was it carrying?

e) A flight from Fort Nelson to Vancouver takes $2\frac{5}{6}$ of an hour. If the plane has been flying for $1\frac{1}{4}$ of an hour, how much longer will the flight be?

f) If Henderson Lake's annual rain fall is $650\frac{6}{25}$ cm, and Ashcroft's is $15\frac{1}{4}$ cm, how much more rain does Henderson Lake get than Ashcroft each year?

g) A park is $12\frac{1}{2}$ km wide and $25\frac{1}{3}$ km long. What is the area of the park?

Answers to Unit 4 Review

1.

- a) $\frac{2}{3}$ b) $\frac{5}{7}$ c) 1 d) $\frac{1}{2}$ e) $\frac{3}{4}$ f) $\frac{1}{3}$
g) $1\frac{1}{7}$ h) $\frac{2}{3}$

2.

- a) $\frac{5}{6}$ b) $\frac{9}{10}$ c) $\frac{7}{12}$ d) $1\frac{7}{20}$ e) $1\frac{5}{28}$ f) $1\frac{5}{16}$
g) $\frac{11}{24}$ h) $\frac{59}{72}$ i) $1\frac{29}{63}$ j) $\frac{47}{60}$

3.

- a) $9\frac{1}{35}$ b) $7\frac{3}{4}$ c) $7\frac{5}{8}$ d) $9\frac{17}{35}$ e) $5\frac{4}{15}$ f) $5\frac{11}{12}$
g) $13\frac{5}{6}$ h) $11\frac{1}{10}$ i) $12\frac{33}{35}$ j) $9\frac{7}{15}$

4.

- a) $\frac{1}{5}$ b) $\frac{1}{2}$ c) $\frac{1}{3}$ d) $\frac{1}{6}$ e) $\frac{1}{2}$ f) $\frac{1}{3}$

5.

- a) $\frac{1}{6}$ b) $\frac{1}{4}$ c) $\frac{2}{3}$ d) $\frac{1}{10}$ e) $\frac{1}{8}$ f) $\frac{9}{16}$
g) $\frac{7}{16}$ h) $\frac{1}{12}$ i) $\frac{7}{10}$

6.

- a) $9\frac{3}{4}$ b) $\frac{5}{6}$ c) $3\frac{4}{5}$ d) $2\frac{4}{5}$ e) $4\frac{2}{3}$ f) $4\frac{4}{5}$

7.

- a) $11\frac{23}{30}$ b) $2\frac{2}{3}$ c) $1\frac{5}{8}$ d) $9\frac{29}{36}$ e) $11\frac{4}{5}$ f) $2\frac{1}{2}$
g) $3\frac{17}{18}$ h) $\frac{17}{20}$ i) $20\frac{5}{12}$ j) $4\frac{19}{24}$

8.

- a) Cheryl walked $6\frac{1}{12}$ hours each week.
b) The average was $112\frac{1}{2}$ km/hour
c) $40\frac{5}{6}$ hours in the lake
d) $68\frac{1}{12}$ kg
e) $1\frac{7}{12}$ hours left on the flight
f) Henderson Lake gets $634\frac{99}{100}$ cm more rain per year than Ashcroft.
g) $316\frac{2}{3}$ km²

It is now test time!

Please get the practice test from your instructor.

Once you are ready, you can get the
unit 4 test from your instructor.

Good luck!