Chapter 2

Decimals and other fractions

How to deal with the bits and pieces

We use fractions everyday; for example, we talk about three-quarters (3/4) of a cup of milk, or arranging to meet a friend in half an hour (1/2) for a coffee. When medications come from the manufacturer they are in doses to suit most adults. However, the very young or older weaker adults need smaller doses. You must be able to calculate the correct amount by taking part of, or using a fraction of, the standard dose. Therefore, it is vital you understand how to work out fractions.

When you have completed this chapter, you should be able to:

- Add, subtract, multiply and divide fractions
- Add, subtract, multiply and divide decimal fractions.

In Chapter 1 you got to grips with the four basic operations of arithmetic using whole numbers. This chapter takes you a step further in using these skills, tackling calculations involving parts of a whole number, known as fractions.

2.1 ADDITION OF FRACTIONS

YOUR STARTING POINT FOR ADDITION OF FRACTIONS

Without using a calculator, write down the answers to the following in their *simplest form*:

(a) 1/4 + 1/2 = ____________ (b) 1/4 + 2/3 = ____________

(c) 3/7 + 2/5 = ____________ (d) 5/8 + 3/6 = ____________

(e) 3/5 + 7/10 = ____________ (f) 3/4 + 5/6 = ____________

(g) $7\frac{1}{5} + 4\frac{1}{3}$ = ____________ (h) $2\frac{1}{7} + 3\frac{3}{8}$ = ____________

(i) $1\frac{2}{3} + 5\frac{5}{6}$ = ____________

Answers: (a) 3/4 (b) 11/12 (c) 29/35 (d) $1\frac{1}{8}$ (e) $1\frac{3}{10}$ (f) $1\frac{7}{12}$ (g) $11\frac{8}{15}$ (h) $5\frac{29}{56}$ (i) $7\frac{1}{2}$.

If you had all these correct, congratulations; now go to Section 2.2, the starting point for subtraction of fractions, page 40.

A fraction refers to parts of a whole. All fractions are written with one number over another, separated by a line. The number below the line is called the **denominator** and identifies how many parts into which the whole has been split. The number above the line is the **numerator** and identifies the number of parts of the whole number that are being used. If you remember Table 1.1, this was one way of indicating a number was divided by another.

You are probably very familiar with some fractions: for example, a half is written as 1/2, which also means one divided by two. Fractions can also be written as $\frac{1}{2}$.

Other examples are 1/4, 4/6, 3/8, and 5/11. These are known as proper fractions. Proper fractions are fractions where the numerator (the number on top) is less than the denominator (the number on the bottom).

For example if you have an apple pie and it is cut into five equal pieces, then each piece is $\frac{1}{5}$ (one-fifth) of the whole pie **(Figure 2.1)**.

If your brother, a friend and you each take a slice, then you will have two pieces left. This can be written as $\frac{2}{5}$ of the whole are left **(Figure 2.2)** and $\frac{3}{5}$ of the whole have been eaten.

If you add the fraction representing the number of pieces left to the number of pieces eaten, you will get

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

Figure 2.1 A pie cut into five equal pieces

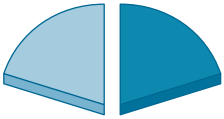

Figure 2.2 Two fifths of the pie is left

If you read this aloud, you will hear that the sum says ‘Two fifths plus three fifths’. The denominators of each fraction indicate the number of parts into which the whole has been divided. In this case they are the same, fifths, so these are not changed. If you add the numerators together then, again, you have 5 as the number on top.

Remember the meaning of the line between the two fives was another way of saying divide, so 5 ÷ 5 = 1. Back to the whole.

PRACTICE QUESTIONS

(a) $\frac{2}{3} + \frac{1}{3} =$ ______ (b) $\frac{5}{8} + \frac{3}{8} =$ ______ (c) $\frac{7}{11} + \frac{4}{11} =$ ______

(d) $\frac{3}{4} + \frac{1}{4} =$ ______ (e) $\frac{5}{10} + \frac{4}{10} =$ ______ (f) $\frac{6}{12} + \frac{5}{12} =$ ______

Answers: (a) 1 (b) 1 (c) 1 (d) 1 (e) 9/10 (f) 11/12.

If you need more practice; there are further examples at the end of the chapter.

APPLYING THE THEORY

Surveys and reports often use fractions to describe the results of the investigation being undertaken. It is really important you are able to check what is being claimed matches the data presented. This allows you to make well-structured arguments in your assignments. You may find when you add the fractions together, they do not add up to one. In this case you need to question the data.

KEY POINTS

- The denominator shows the number of parts into which the whole has been broken.
- The numerator tells you how many parts are being used.
- Proper fractions have a numerator that is less than the denominator.

You have seen examples where the denominators are the same for each fraction. The rule for adding these is just to add the numerators and place them over the denominator.

Equivalent fractions

Think about the following fractions:

$$\frac{2}{4} \quad \frac{3}{6} \quad \frac{4}{8} \quad \frac{5}{10}$$

These all have different denominators, but are **equivalent fractions**—they all have the same value of 1/2. Don't believe it? Look at **Figure 2.3**.

The pies (a)–(d) are equal in size. You can see each fraction occupies the same amount of space as shown by the tinted area on the right of each diagram.

To prove they are equivalent, they can be made more user-friendly by simplifying or 'cancelling'.

The first step is to find a number that divides into both the top and bottom numbers. *Whatever you do to the top line you must do the same to the bottom.*

In all these fractions, the numerator can be divided by itself, making 1 on the top. The denominator can be divided by the numerator with the answer 2. All the fractions are reduced to 1/2. Although these all have different numerators and denominators, they are equivalent fractions—they all have the same value of 1/2.

These are straightforward examples and you probably saw the denominator is twice the numerator.

Look at the following examples.

$$\text{(a)}\ \frac{7}{21} \qquad \text{(b)}\ \frac{15}{45}$$

Find numbers that divide into both the top and bottom figures and cancel the original number and put in the new one:

(a) $\frac{\cancel{7}^{1}}{\cancel{21}^{3}}$ Seven divides into both numbers so the fraction is simplified to $\frac{1}{3}$

(b) $\frac{\cancel{15}^{3}}{\cancel{45}^{9}}$ Five divides into both numbers to give $\frac{3}{9}$ this can be simplified further as three divides into both numbers $\frac{\cancel{3}^{1}}{\cancel{9}^{3}}$ to give $\frac{1}{3}$

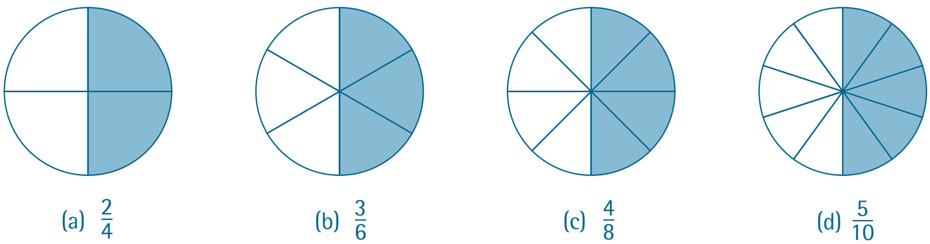

Figure 2.3 Equivalent fractions

You might also have noticed that both numbers could be divided by 15 and you would end up with the same answer. Just do the calculation in the way that makes you feel confident. Use as many stages as you need.

PRACTICE QUESTIONS

Which fraction in each of the following is not equivalent?

1. (a) 1/2 (b) 2/4 (c) 3/7 (d) 5/10
2. (a) 1/3 (b) 3/6 (c) 3/9 (d) 4/12
3. (a) 2/2 (b) 15/15 (c) 10/10 (d) 11/12
4. (a) 24/36 (b) 6/9 (c) 30/60 (d) 8/12

Answers: 1. (c) (the others = 1/2) 2. (b) (the others = 1/3) 3. (d) (the others = 1) 4. (c) (the others = 2/3).

APPLYING THE THEORY

During your clinical placement you are asked to apply a bandage to Mr Brown's leg. The registered nurse (RN) with whom you are working advises you the bandage needs the layers to overlap by 1/2. The next day another RN ask you to apply the bandage and to overlap it by 3/6. Are you confused about which is the correct way to put the bandage on Mr Brown's leg? You shouldn't be, because they are equivalent fractions: 3/6 can be simplified to 1/2.

KEY POINT

❖ When simplifying or cancelling fractions, you must divide both the denominator and the numerator by the same number.

Large numbers are just as straightforward. It doesn't matter how many steps you use to get to your answer as long as it is the correct one and, more importantly, that you understand the underlying principles.

Small steps make the sum more manageable, assisting you to understand what you are doing. The following example demonstrates you can use small divisors that are easier to use to get your answer. Find a number that divides into both the top and bottom numbers. Cancel the original number and replace it with the quotient.

Simplify this fraction:

$$\frac{1750}{7000}$$

Handy tips

Any number ending in 0 can be divided by 10, 5 or 2. You can choose which to do.

(a) If you divide each number by 2, your answer is:

$$\frac{\cancel{1750}^{875}}{\cancel{7000}^{3500}}$$

(b) If you decide to use 5, then the answer is:

$$\frac{\cancel{1750}^{350}}{\cancel{7000}^{1400}}$$

(c) Using 10 the answer is:

$$\frac{\cancel{1750}^{175}}{\cancel{7000}^{700}}$$

Each of these answers can be further simplified. Any number ending in 5 or 0 can be divided by 5. Divide the numerator and denominator in each of the answers above by 5. You should now have the following:

(a) $\frac{175}{700}$ (b) $\frac{70}{280}$ (c) $\frac{35}{140}$

You can see that they can each be divided by 5 again, so do this now. Your answers should be the following:

(a) $\frac{35}{140}$ (b) $\frac{14}{56}$ (c) $\frac{7}{28}$

Looking at these fractions again, you can see there is still room for further reduction. Fraction (a) can be divided by 5, (b) by 2 or 7 and (c) by 7. If you try this, you will get:

(a) $\frac{7}{28}$ (b) $\frac{7}{28}$ or $\frac{1}{4}$ (c) $\frac{1}{4}$

You should be able to see the answer to all of these will eventually be 1/4. It does not matter which steps you use to do the calculation, the answer will be the same. It is easier to think about doing a calculation using 1/4 rather than 1750/7000.

More handy tips

Dividing by 3 or 9

If the digits in a number are added together and the sum can be divided by 3, then the number can be as well, e.g. 1854.

Add the digits together: 1 + 8 + 5 + 4 = 18. Then 1 + 8 = 9 and 9 can be divided by 3, so 1854 can also be divided by 3.

Use the same method to see if a number can be divided by 9.

Dividing by 4

If the last two digits of a number are 00 or the number formed by the last two digits is divisible by 4, then the number itself can be divided by 4, e.g. 100 is divisible by 4. The number 3,783,640,512 ends in 12 and it is divisible by 4, so the whole number can be divided by 4. (This is also useful in working out which years are leap years.)

Prime numbers

There are some numbers that can only be divided by 1 and the number itself, with no remainder. This means there is no way to make them any simpler. These are called prime numbers **(Table 2.1)**.

Table 2.1 Prime numbers up to 101

2	3	5	7	11	13	17	19	23	29	31	37	41
43	47	53	59	61	67	71	73	79	83	89	97	101

PRACTICE QUESTIONS

Now look at these fractions and use the same method to reduce each to the smallest possible fraction. (Don't forget the handy tips to help choose your divisor.)

(a) $\frac{36}{108}$ (b) $\frac{125}{375}$ (c) $\frac{81}{243}$

These are also equivalent fractions and you should have cancelled them down to 1/3. You have a choice of numbers that will divide into both the numerator and denominator.

APPLYING THE THEORY

Fractions are often encountered in the calculation of drug doses so it is important to be able to calculate fractions accurately. Having confidence in your ability to carry out the calculations allows you to concentrate on other aspects of drug administration.

What if?

So far you have added fractions with the same denominator or have equivalent fractions that can be changed to the same by simplifying. What happens when the numbers of the denominator are not the same?

You change them to equivalent fractions so the denominators become the same. We say that they have a **common denominator**. Consider:

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

To do this you need to find a number that can be divided by both denominators. In this case, both 5 and 2 can divide into 10, so you can make both fractions into tenths.

To change fifths to tenths, the fraction has to be multiplied by 2.

You have already seen that one of the rules of arithmetic is whatever change is made to the denominator has to be applied to the numerator. *(Whatever you do on the top needs to be done on the bottom).*

Following this rule, both 2 and 5 are multiplied by 2 to give 4/10, equivalent to 2/5.

Halves can be changed to tenths by multiplying both parts of the fraction by 5, so 1/2 becomes the equivalent fraction 5/10.

Now both fractions are in tenths, they can be added easily:

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

Let's look at a couple more examples of adding fractions with different denominators:

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

First find the common denominator. What number can be divided by both 6 and 4?

The quickest way to find it is to multiply the denominators of the fractions together, which in this case is $6 \times 4 = 24$. This is not the lowest common denominator but is fine if the numbers involved are small. A better choice would be 12; however, it makes no difference to the answer.

Now set out the sum like this:

$$\frac{1}{6} + \frac{3}{4} = \frac{2 + 9}{12} = \frac{11}{12}$$

If you had chosen 24 as your common denominator, then the sum would be:

$$\frac{4 + 18}{24} = \frac{22}{24}$$

The answer can be simplified to 11/12, which is the same answer as before.

PRACTICE QUESTIONS

Remember to find the common denominator first.

(a) 1/3 + 1/4 = ______ (b) 2/7 + 1/2 = ______ (c) 1/5 + 2/3 = ______

(d) 3/8 + 1/2 = ______ (e) 4/7 + 1/3 = ______ (f) 1/10 + 4/5 = ______

Answers: (a) 7/12 (b) 11/14 (c) 13/15 (d) 7/8 (e) 19/21 (f) 9/10.

So far we have had fractions where the numerator is less than the denominator, but of course this cannot be the case all the time. A fraction with a numerator of greater value than the denominator is called an **improper fraction**.

When you are adding fractions, and the answer ends up as an improper fraction, the answer has to be simplified:

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

You will remember that 7/5 means 7 divided by 5 so you have 1 and 2/5 over.

The answer is written as $1\frac{2}{5}$. This number is called a **mixed number** because it is a combination of a whole number and a fraction. If you had an answer such as 11/5, then it would be simplified to $2\frac{1}{5}$.

You may also have calculations involving the addition of mixed numbers. For example,

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

The first thing to do is to change the mixed numbers into improper fractions. Multiply the whole number by the denominator of the fraction and then add the numerator of the fraction to the answer.

In the above sum $3 \times 4 = 12$ (12 quarters) and add the numerator $12 + 3$.

This makes the improper fraction 15/4 (you can check this by changing it back to a mixed number).

The other mixed number is treated in the same way: $2 \times 3 = 6$ and $6 + 2 = 8$, so the other improper fraction is 8/3.

We can now add the two improper fractions together in the usual way by finding the common denominator:

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

$$\frac{(3 \times 15) + (4 \times 8)}{12}$$

$$= \frac{45 + 32}{12}$$

$$= \frac{77}{12}$$

Simplify this improper fraction to a mixed number by dividing 77 by 12, which gives the answer $6\frac{5}{12}$.

PRACTICE QUESTIONS

(a) $2\frac{1}{4} + 1\frac{1}{2} =$ ______ (b) $3\frac{1}{8} + 2\frac{1}{4} =$ ______ (c) $1\frac{5}{8} + 4\frac{1}{2} =$ ______

(d) $5\frac{3}{5} + 3\frac{7}{10} =$ ______ (e) $1\frac{1}{3} + 6\frac{1}{6} =$ ______ (f) $7\frac{1}{3} + 2\frac{5}{9} =$ ______

Answers: (a) $3\frac{3}{4}$ (b) $5\frac{3}{8}$ (c) $6\frac{1}{8}$ (d) $9\frac{3}{10}$ (e) $7\frac{1}{2}$ (f) $9\frac{8}{9}$.

2.2 SUBTRACTION OF FRACTIONS

Now you have mastered addition of fractions, subtraction is easy.

YOUR STARTING POINT FOR SUBTRACTION OF FRACTIONS

Without using a calculator, write down the answers to the following in their *simplest form.*

(a) 3/4 – 1/2 = ______ (b) 2/3 – 1/6 = ______ (c) 3/8 – 1/4 = ______

(d) 5/12 – 1/3 = ______ (e) 3/10 – 1/6 = ______ (f) 4/5 – 1/5 = ______

(g) $2\frac{1}{3} - 1\frac{5}{8}$ = ______ (h) $3\frac{3}{4} - 2\frac{2}{3}$ = ______ (i) $6\frac{1}{9} - 5\frac{2}{5}$ = ______

Answers: (a) 1/4 (b) 1/2 (c) 1/8 (d) 1/12 (e) 2/15 (f) 3/5 (g) 17/24 (h) $1\frac{1}{12}$ (i) 32/45.

If you had all these correct answers, go to Section 2.3, the starting point for multiplication and division of fractions, page 47. If you struggled with these or need to be more confident, then work through the parts of the following section that you feel you need.

The principles of finding a common denominator are used again when subtracting fractions. Also remember the rules from Chapter 1 about which number is subtracted from which.

If you look at a simple example, you will see that the layout is familiar:

$$\frac{1}{2} - \frac{1}{4}$$

You may be able to do this in your head and get the answer 1/4, but it is a good place to start so that you can see the way in which you can tackle calculations when the answer is not immediately obvious. Don't panic when the numbers look too big to handle. Write down this simple sum and then work out the one that may be a problem beside it and follow the steps.

Just as you did with the addition, you first need to find a common denominator, which in this case is 4. Now divide the denominator of each fraction in turn into the common denominator so that you can make equivalent fractions, just as you did when adding fractions. You then subtract the results.

$$\frac{1}{2} - \frac{1}{4}$$

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

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

Subtraction of any proper fraction is done in the same way.

PRACTICE QUESTIONS

Give the answers to the following in the simplest form.

(a) 3/4 – 1/2 = ___________ (b) 1/2 – 1/3 = ___________

(c) 4/9 – 1/4 = ___________ (d) 3/5 – 1/10 = ___________

(e) 21/24 – 5/12 = ___________ (f) 7/10 – 3/5 = ___________

Answers: (a) 1/4 (b) 1/6 (c) 7/36 (d) 1/2 (e) 11/24 (f) 1/10.

If you have mixed numbers, you treat them in the same way as you did when you added them. First, change the mixed numbers to improper fractions, then find the common denominator and work from there as in this example:

$$3\frac{2}{3} - 2\frac{1}{9} = \frac{11}{3} - \frac{19}{9} = \frac{33-19}{9}$$

Now simplify to a mixed number

$$= \frac{14}{9} = 1\frac{5}{9}$$

PRACTICE QUESTIONS

(a) $1\frac{2}{3} - 1\frac{1}{4}$ = ______ (b) $3\frac{1}{2} - 2\frac{7}{8}$ = ______ (c) $9\frac{1}{4} - 4\frac{3}{5}$ = ______

(d) $5\frac{9}{10} - 3\frac{1}{2}$ = ______ (e) $4\frac{1}{9} - 3\frac{2}{3}$ = ______ (f) $6\frac{5}{7} - 3\frac{1}{4}$ = ______

Answers: (a) 5/12 (b) 5/8 (c) $4\frac{13}{20}$ (d) $2\frac{2}{5}$ (e) 4/9 (f) $3\frac{13}{28}$.

Hopefully you have found subtraction and addition of fractions is straightforward if you remember the key points.

KEY POINTS

When adding or subtracting fractions:

- First, change any mixed numbers to improper fractions.
- Find the common denominator.
- Give the answer in its simplest form.

2.3 MULTIPLICATION AND DIVISION OF FRACTIONS

YOUR STARTING POINT FOR MULTIPLICATION AND DIVISION OF FRACTIONS

Without using a calculator, write down the answers to the following in their *simplest form.*

(a) $1/2 \times 2/5 =$ ______ (b) $1/7 \times 3/4 =$ ______ (c) $2/3 \times 3/5 =$ ______

(d) $2/5 \times 3/4 =$ ______ (e) $9/10 \times 2/5 =$ ______ (f) $2\frac{1}{3} \times 1\frac{3}{5} =$ ______

(g) $2/3 \div 1/2 =$ ______ (h) $4/5 \div 1/4 =$ ______ (i) $3/5 \div 3/4 =$ ______

(j) $1/2 \div 1/4 =$ ______ (k) $3/4 \div 2/7 =$ ______ (l) $3\frac{1}{3} \div 2\frac{2}{5} =$ ______

Answers: (a) 1/5 (b) 3/28 (c) 6/15 (d) 3/10 (e) 9/25 (f) $3\frac{11}{15}$ (g) $1\frac{1}{3}$ (h) $3\frac{1}{5}$ (i) 4/5 (j) 2 (k) $2\frac{5}{8}$ (l) $1\frac{7}{18}$.

If you had all these correct, congratulations; now go to Section 2.4 for the starting point of addition and subtraction of decimal fractions, page 44.

Multiplication of fractions

Multiplication of fractions is straightforward—honestly. You just multiply the numerators together, then multiply the denominators together and simplify the answer, if necessary.

Look at this example:

$$\frac{1}{2} \times \frac{2}{3} = \frac{2}{6}$$

The answer can be simplified to 1/3.

If the calculation involves mixed numbers, then you do as you did in the addition and subtraction sections. Change the numbers to improper fractions, and then multiply.

Work through this example:

$$2\frac{2}{3} \times 1\frac{3}{8}$$

Change these mixed numbers to improper fractions:

$$\frac{8}{3} \times \frac{11}{8}$$

Multiply the numerators together
Multiply the denominators together $\quad \dfrac{8 \times 11}{3 \times 8} = \dfrac{88}{24}$

Simplify the answer by dividing the numerator and denominator by 8:

$$\frac{\cancel{88}^{11}}{\cancel{24}^{3}} = \frac{11}{3} = 3\frac{2}{3}$$

If you are multiplying a fraction by a whole number on its own, it is safer to put 1 as the denominator so that you do not mistakenly use it as a numerator. (Remember any number divided or multiplied by 1 remains unchanged?) For example,

$$3 \times \frac{4}{5} = \frac{3}{1} \times \frac{4}{5} = \frac{12}{5} = 2\frac{2}{5}$$

PRACTICE QUESTIONS

(a) $2/5 \times 4/7 =$ ____________

(b) $1/3 \times 3/5 =$ ____________

(c) $7/10 \times 3/7 =$ ____________

(d) $2\frac{1}{2} \times 4\frac{1}{4} =$ ____________

(e) $2\frac{2}{3} \times 1\frac{1}{10} =$ ____________

(f) $4\frac{2}{5} \times 10/11 =$ ____________

Answers: (a) 8/35 (b) 1/5 (c) 3/10 (d) $10\frac{5}{8}$ (e) $2\frac{14}{15}$ (f) 4.

KEY POINTS

When multiplying fractions you need to:

- First change any mixed numbers to improper fractions.
- Multiply the numerators together.
- Multiply the denominators.
- Simplify the answer.

Division of fractions

You already came across division of fractions at the beginning of the chapter. Fractions are already a division of a whole. You saw one cake divided into five parts called fifths and written as 1/5.

Division of fractions is carried out in a similar way to multiplication except that the second fraction is **inverted** (turned upside down) then the fractions multiplied.

After inverting the second fraction, you can simplify before multiplying. Smaller numbers are easier to use, but, again, use the method that suits you best.

EXAMPLE 1

$$\frac{2}{3} \div \frac{1}{2}$$

This could also be written as

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

This is quite clumsy but demonstrates the reason for inverting the dividing fraction (see website at the end of the chapter).

First, invert the second fraction and replace the division sign with a multiplication one:

$$\frac{2}{3} \times \frac{2}{1}$$

Multiply the numerators and denominators $= \frac{4}{3}$

Now simplify to a mixed number $= 1\frac{1}{3}$

You can apply the method that you used for multiplying mixed numbers to division problems.

EXAMPLE 2

$$3\frac{1}{3} \div 2\frac{2}{7}$$

Change to improper fractions

$$= \frac{10}{3} \div \frac{16}{7}$$

Invert the second fraction and replace the division sign with a multiplication one

$$= \frac{\cancel{10}^{5}}{3} \times \frac{7}{\cancel{16}^{8}}$$

$$= \frac{35}{24} = 1\frac{11}{24}$$

In this case you can simplify the sum to make multiplication easier. Remember that whatever you do to the denominator is done to the numerator. It doesn't matter which denominator or numerator is simplified.

PRACTICE QUESTIONS

(a) 3/7 ÷ 1/3 = ___________ (b) 1/5 ÷ 1/4 = ___________

(c) 11/10 ÷ 1/20 = ___________ (d) $2\frac{1}{2} \div 1\frac{1}{4}$ = ___________

(e) $3\frac{1}{3} \div 2\frac{2}{3}$ = ___________ (f) $3\frac{5}{7} \div 2\frac{1}{6}$ = ___________

Answers: (a) $1\frac{2}{7}$ (b) 4/5 (c) 22 (d) 2 (e) $1\frac{1}{4}$ (f) $1\frac{5}{7}$.

2.4 ADDITION AND SUBTRACTION OF DECIMAL FRACTIONS

YOUR STARTING POINT FOR ADDITION AND SUBTRACTION OF DECIMAL FRACTIONS

Add the following decimal fractions.

(a) 0.28 + 0.74 = _____ (b) 2.62 + 0.77 = _____ (c) 1.725 + 2.15 = _____

Subtract the following fractions.

(d) 3.25 − 1.34 = ______ (e) 3.55 − 2.49 = ______ (f) 9.543 − 3.45 = ______

Answers: (a) 1.02 (b) 3.39 (c) 3.875 (d) 1.19 (e) 1.06 (f) 6.093.

If you had all these correct, congratulations; now go to Section 2.5, the starting point of multiplication and division of fractions, page 47.

Decimal fractions

You are already very familiar with **decimal fractions** since you use them every time you go shopping. One dollar and thirty-one cents is written as $1.31. Cents are a decimal fraction of a dollar. Decimal fractions are fractions with denominators with powers of 10.

In Chapter 1 you saw the importance of place value and used columns to indicate units, tens, hundreds, thousands and so on.

The decimal point marks the division between whole numbers and decimal fractions. These fractions are tenths, hundredths, thousandths and so on.

It is vital you are clear about the placement of the decimal point in the number.

There is only one decimal place difference between $1.31 and $13.10 but you have 10 times as much money when you have $13.10.

CAUTION

You must ensure when you are administering medication you are certain of the position of the decimal point, otherwise you can give an individual 10 times the prescribed dose.

Writing and saying decimal fractions

In the number 3214.759, you can see from **Table 2.2** the figures to the left of the decimal point are the whole numbers and those to the right are the decimal fractions. This number represents 3000 + 200 + 10 + 4 before, or to the left of, the decimal point and 7/10, 5/100 and 9/1000 after, or to the right, of the decimal point.

Table 2.2

Thousands	Hundreds	Tens	Units	Decimal point	Tenths	Hundredths	Thousandths
3	2	1	4	•	7	5	9

It is accepted practice when saying the decimal part of the number to say each individual figure rather than saying seven hundred and fifty-nine, so there is no confusion with whole numbers.

When writing whole numbers the decimal point is not used; however, you should remember it is there in theory to the right of the figure, e.g. we write 5 or 17 rather than 5.0 or 17.0.

APPLYING THE THEORY

Many clinical measurements and calculations involve decimal fractions. Body temperature is measured in degrees Celsius. Normal temperature is 37 °C but there is a significant difference between 37 °C and 38 °C so each degree is divided into tenths so a temperature is recorded more accurately, e.g. 37.6 °C.

Adding and subtracting decimals

Addition and subtraction of decimals is little different from addition and subtraction of whole numbers you did in Chapter 1.

It is important to align the decimal points under each other. Just as you did with whole numbers, you start the sum from the figure furthest to the right.

EXAMPLES

(a) 2.23 + 0.65

$$\begin{array}{r} 2.23 \\ +0.65 \\ \hline 2.88 \\ \hline \end{array}$$

(b) 1.735 + 2.3

$$\begin{array}{r} 1.735 \\ +2.300 \\ \hline 4.035 \\ \hline \end{array}$$

You may find it helpful to put zeros in spaces to keep decimal columns aligned as in 2.3 in example (b) above.

Subtraction of decimal fractions is also similar to the subtraction of whole numbers. As with addition, you need to make sure the decimal points are kept under each other.

EXAMPLES

(a) 2.39 − 1.27

$$\begin{array}{r} 2.39 \\ -1.27 \\ \hline 1.12 \\ \hline \end{array}$$

(b) 4.35 − 3.72

$$\begin{array}{r} {}^{3}4.{}^{1}36 \\ -3.72 \\ \hline 0.64 \\ \hline \end{array}$$

PRACTICE QUESTIONS

(a) 3.51 + 2.38 = ____________
(b) 7.87 + 2.34 = ____________
(c) 21.045 + 10.945 = ____________
(d) 2.25 − 1.13 = ____________
(e) 3.63 − 1.42 = ____________
(f) 12.43 − 9.58 = ____________

Answers: (a) 5.89 (b) 10.21 (c) 31.99 (d) 1.12 (e) 2.21 (f) 2.85.

Answers to the following questions can be found at the end of the chapter.

WHAT DID YOU LEARN?

(a) Add the following fractions, giving the answer in its simplest form.

(i) 1/3 + 1/3 = ______ (ii) 1/2 + 1/4 = ______

(iii) 1/4 + 1/8 = ______ (iv) 2/3 + 1/6 = ______

(v) 1/5 + 3/10 = ______ (vi) 1/7 + 4/21 = ______

(b) I divide a cake into 12 equal slices and eat 3 slices. What fraction of the cake is left? Write the answer as a fraction in its simplest form. ______

(c) Mrs Green has 2 jugs of juice of equal volume. Mrs Green uses a glass holding 1/5 of a jug's volume. Mrs Green drinks eight full glasses during the course of the day. What fraction of the second jug is left at the end of the day? ______

(d) Make a survey of the number of times the staff in the department wash their hands. You find that 1/4 wash their hands three times during the shift, 1/3 four times and the remainder five times. If there is a total of 12 staff, how many people washed their hands five times? ______

(e) Mr White's temperature is 39.1 °C. You are asked to monitor it regularly after Mr White is administered an antipyretic medication to reduce his temperature. You are asked report to the RN when it has been reduced by 1.5 °C because Mr White's condition needs to be reviewed. What temperature will be recorded when that point is reached? ______

(f) You work 11.25 hours per week as an assistant in nursing at a residential care facility. The hourly rate is $15.45. How much do you earn per week, to the nearest cent? ______

MORE PRACTICE QUESTIONS

Addition of fractions

(a) 3/7 + 3/7 = ______ (b) 1/5 + 3/5 = ______

(c) 6/15 + 5/15 = ______ (d) 2/4 + 1/4 = ______

(e) 5/17 + 12/17 = ______ (f) 3/11 + 5/11 = ______

Equivalent fractions

Which fraction in each of the following is not equivalent?

1. (a) 2/3 (b) 1/7 (c) 4/28 (d) 2/14
2. (a) 1/3 (b) 3/6 (c) 2/4 (d) 9/18
3. (a) 2/3 (b) 10/15 (c) 11/12 (d) 4/6
4. (a) 9/36 (b) 1/6 (c) 3/12 (d) 1/4

Equivalent fractions

Reduce each of these to the smallest possible fraction.

(a) 45/135 = ______
(b) 80/420 = ______
(c) 42/192 = ______
(d) 144/156 = ______
(e) 14/126 = ______
(f) 39/117 = ______

Equivalent fractions

(a) 1/4 + 1/3 = ______
(b) 1/2 + 2/7 = ______
(c) 1/6 + 2/3 = ______
(d) 1/8 + 1/2 = ______
(e) 2/7 + 1/3 = ______
(f) 1/10 + 1/5 = ______

Mixed numbers

(a) $1\frac{1}{4} + 3\frac{1}{5}$ = ______
(b) $2\frac{5}{8} + 1\frac{1}{4}$ = ______
(c) $3\frac{5}{9} + 3\frac{2}{3}$ = ______
(d) $5\frac{3}{10} + 2\frac{1}{5}$ = ______
(e) $6\frac{5}{12} + 1\frac{1}{3}$ = ______
(f) $4\frac{7}{9} + 2\frac{2}{3}$ = ______

Subtraction of fractions

Give the answers to the following in the simplest form.

(a) 1/4 – 1/5 = ______
(b) 2/3 – 1/2 = ______
(c) 5/9 – 1/6 = ______
(d) 3/10 – 1/5 = ______
(e) 7/12 – 1/36 = ______
(f) 9/20 – 2/5 = ______

Mixed numbers

(a) $2\frac{1}{3} - 1\frac{1}{4}$ = ______
(b) $2\frac{2}{3} - 1\frac{5}{6}$ = ______
(c) $5\frac{1}{4} - 2\frac{3}{5}$ = ______
(d) $7\frac{3}{10} - 5\frac{1}{2}$ = ______
(e) $4\frac{1}{9} - 3\frac{2}{3}$ = ______
(f) $3\frac{2}{5} - 2\frac{1}{3}$ = ______

Multiplication of fractions

(a) 3/5 × 1/4 = ______
(b) 1/3 × 3/4 = ______
(c) 3/10 × 2/3 = ______
(d) $3\frac{1}{3} \times 2\frac{1}{4}$ = ______
(e) $2\frac{1}{7} \times 1\frac{1}{3}$ = ______
(f) $2\frac{2}{5}$ × 3/10 = ______

Division of fractions

(a) 5/7 ÷ 1/5 = ______
(b) 1/4 ÷ 1/2 = ______
(c) 11/10 ÷ 1/5 = ______
(d) $3\frac{1}{2} \div 1\frac{1}{3}$ = ______
(e) $3\frac{2}{5} \div 1\frac{2}{3}$ = ______
(f) $2\frac{1}{7} \div 3\frac{1}{3}$ = ______

Addition and subtraction of decimal fractions

(a) 1.72 + 2.14 = ______
(b) 8.15 + 2.86 = ______
(c) 15.387 + 10.035 = ______
(d) 2.28 – 1.15 = ______
(e) 4.54 – 1.66 = ______
(f) 11.27 – 7.38 = ______

Multiplication of decimal fractions

(a) 3.5 × 10 = ______
(b) 5.7 × 1000 = ______
(c) 3.142 × 100 = ______
(d) 1.49 × 10,000 = ______
(e) 34.5 × 1,000,000 = ______
(f) 1.753 × 100 = ______

Multiplication of decimal fractions

(a) 2.4 × 1.7 = ______
(b) 4.8 × 5.4 = ______
(c) 1.79 × 3.45 = ______
(d) 6.34 × 2.8 = ______
(e) 3.62 × 4.19 = ______
(f) 2.72 × 3.1 = ______

Division of decimal fractions

(a) 42.3 ÷ 10 = ______
(b) 3676.1 ÷ 1000 = ______
(c) 3.46 ÷ 100 = ______
(d) 16,522 ÷ 10,000 = ______
(e) 4,302,225 ÷ 1,000,000 = ______
(f) 2008 ÷ 100 = ______

Division of decimal fractions

Calculate the following, correct to two decimal places.

(a) 2.5 ÷ 1.25 = ______
(b) 4.86 ÷ 2.4 = ______
(c) 81.92 ÷ 3.2 = ______
(d) 461.16 ÷ 36.6 = ______
(e) 0.75 ÷ 1.5 = ______
(f) 93.704 ÷ 3.4 = ______

WEB RESOURCES

<www.helpwithfractions.com>

This site covers all aspects of playing with fractions. In the division section there is an explanation of the reason for inverting the divisor when fractions are divided—if you feel strong.

<www.mathsisfun.com/fractions_multiplication.html>

A step-by-step animated website with plenty of examples for you to do.

<http://primes.utm.edu/lists/small/1000.txt>

A list of prime numbers that might be useful in finding factors.

<www.bbc.co.uk/schools/gcsebitesize/maths/number/>

Choose the sections on fractions, although this site is useful for all aspects of maths.

ANSWERS

WHAT DID YOU LEARN?

(a) (i) 2/3 (ii) 3/4 (iii) 3/8 (iv) 5/6 (v) 1/2 (vi) 1/3

(b) 3/4 (1 – 3/12)

(c) 2/5

(d) 5 (find 1/4 and 1/3 of 12, then subtract the total from 12)

(e) 37.6 °C (39.1 – 1.5)

(f) $173.81 (11.25 × 15.45)

MORE PRACTICE QUESTIONS

Addition of fractions

(a) 6/7 (b) 4/5 (c) 11/15 (d) 3/4 (e) 1 (f) 8/11.

Equivalent fractions

1. (a) (the others = 1/7) **2.** (a) (the others = 1/2)

3. (c) (the others = 2/3) **4.** (b) (the others = 1/4).

Equivalent fractions

(a) 1/3 (b) 4/21 (c) 7/32 (d) 12/13 (e) 1/9 (f) 1/3.

Equivalent fractions

(a) 7/12 (b) 11/14 (c) 5/6 (d) 5/8 (e) 13/21 (f) 3/10.

Mixed numbers

(a) $4\frac{9}{20}$ (b) $3\frac{7}{8}$ (c) $7\frac{2}{9}$ (d) $7\frac{1}{2}$ (e) $7\frac{3}{4}$ (f) $7\frac{4}{9}$.

Subtraction of fractions

(a) 1/20 (b) 1/6 (c) 7/18 (d) 1/10 (e) 5/9 (f) 1/20.

Mixed numbers

(a) $1\frac{1}{12}$ (b) 5/6 (c) $2\frac{13}{20}$ (d) $1\frac{2}{5}$ (e) 4/9 (f) $1\frac{1}{15}$.

Multiplication of fractions

(a) 3/20 (b) 1/4 (c) 1/5 (d) $7\frac{1}{2}$ (e) $2\frac{6}{7}$ (f) 18/25.

Division of fractions

(a) $3\frac{4}{7}$ (b) 1/2 (c) $5\frac{1}{2}$ (d) $2\frac{5}{8}$ (e) $2\frac{1}{25}$ (f) 9/14.

Addition and subtraction of decimal fractions

(a) 3.86 (b) 11.01 (c) 25.422 (d) 1.13 (e) 2.88 (f) 3.89.

Multiplication of decimal fractions

(a) 35 (b) 5700 (c) 314.2 (d) 14,900 (e) 34,500,000 (f) 175.3.

Multiplication of decimal fractions

(a) 4.08 (b) 25.92 (c) 6.1755 (d) 17.752 (e) 15.1678 (f) 8.432.

Division of decimal fractions

(a) 4.23 (b) 3.6761 (c) 0.0346 (d) 1.6522 (e) 4.302,225 (f) 20.08.

Division of decimal fractions

(a) 2.00 (b) 2.03 (c) 25.60 (d) 12.60 (e) 0.50 (f) 27.56.