Contents

Subtraction

There are at least two methods of subtraction. I will deal with both of them. If you have been taught subtraction and need to revise it, the best option is to keep with the system you know.

First you need to remember or be able to calculate quickly all the subtraction pairs up to 19.

19 – 1 = 18 and 19 – 18 = 1
19 – 2 = 17 and 19 – 17 = 2
19 – 3 = 16 and 19 – 16 = 3
19 – 4 = 15 and 19 – 15 = 4
etc.

8 – 1 = 7 and 8 – 7 = 1
8 – 2 = 6 and 8 – 6 = 2
8 – 3 = 5 and 8 – 5 = 3
8 – 4 = 4
etc

7 – 1 = 6 and 7 – 6 = 1
7 – 2 = 5 and 7 – 5 = 2
7 – 3 = 4 and 7 – 4 = 3

Try writing down some more yourself.

System 1 - Borrowing Method (Decomposition)

Note. Decomposition means to separate into its elements. In this method the first number is broken up although still retaining its value.

Example 1

22 – 6

$$\begin{array}{r} 22 \\ -\ 6 \\ \hline \end{array}$$

Change the 22 units into 10 + 12 by ‘borrowing’ 1

This gives

$$\begin{array}{r} {}^{1}\not{2}{}^{1}2 \\ -\ 6 \\ \hline \end{array}$$

Subtracting the units gives

$$\begin{array}{r} {}^{1}\not{2}{}^{1}2 \\ -\ 6 \\ \hline 6 \end{array}$$

Subtracting the tens gives

$$\begin{array}{r} {}^{1}\not{2}{}^{1}2 \\ -\ 06 \\ \hline 16 \end{array}$$

So 22 – 6 = 16

What have we done?
First, because we cannot do 2 – 6 in the units column, we change the 22 into 10 + 12. We have kept the total value of the number but written it down in a different way. Now we have 12 – 6 which we can do.

Example 2

237 – 53

Subtracting the 3 from the 7 can be done straight away

$$\begin{array}{r} 237 \\ -\ 53 \\ \hline 4 \end{array}$$

Subtracting the 5 from the 3 cannot be done so we have to say 230 = 100 + 130.

$$\begin{array}{r} {}^{1}\not{2}{}^{1}37 \\ -\ 053 \\ \hline 4 \end{array}$$

Now subtract the 5 from the 13 and 0 from the 1

$$\begin{array}{r} {}^{1}\not{2}{}^{1}37 \\ -\ 053 \\ \hline 184 \end{array}$$

Exercise 1

Use the method above to do these.

1) 14 – 7 2) 19 – 8
3) 26 – 4 4) 37 – 9
5) 53 – 6 6) 84 – 9
7) 27 – 16 8) 36 – 19

9) 83 – 37	10) 135 – 29
11) 256 – 142	12) 364 – 143
13) 362 – 248	14) 356 – 128
15) 284 – 125	16) 387 – 159
17) 756 – 427	18) 842 – 629
19) 3482 – 2146	20) 5753 – 3147

Example 3

437 – 381

Firstly subtract the 1 from the 7

$$\begin{array}{r} 437 \\ -381 \\ \hline 6 \end{array}$$

Since 8 cannot be taken from 3 we must borrow from the 4

$$\begin{array}{r} {\scriptstyle 3\ 1} \\ 437 \\ -381 \\ \hline 056 \end{array}$$

So 437 – 381 = 56

Note
437 on the top line has been changed to
300 + 13 (tens) + 7
or 300 + 130 + 7

Exercise 2

1) 347 – 54	2) 453 – 91
3) 641 – 150	4) 453 – 292
5) 867 – 393	6) 547 – 256
7) 543 – 292	8) 654 – 372

Example 4

147 – 58

Here we have to borrow twice

Borrow from the 4

$$\begin{array}{r} {\scriptstyle 3\ 1} \\ 147 \\ -\ 58 \\ \hline 9 \end{array}$$

Borrow from the 1

$$\begin{array}{r} {\scriptstyle 0\ 1\ 3\ 1} \\ 147 \\ -\ 58 \\ \hline 089 \end{array}$$

So 147 – 58 = 89

Exercise 3

1) 243 – 67	2) 542 – 77
3) 381 – 93	4) 227 – 69
5) 315 – 138	6) 427 – 339
7) 426 – 289	8) 432 – 257

Sometimes we don't have anything to borrow from.

Example 5

504 – 9

Because we cannot take 9 from 4 we must borrow. But since there is nothing we can borrow from the tens position, we must borrow from the hundreds position. So 500 becomes 400 + 10 (tens)

Now we can borrow from the tens position.

$$\begin{array}{r} {\scriptstyle 4\ 1} \\ 504 \\ -\ 9 \\ \hline \end{array}$$

Change the top line to 400 + 9 (tens) + 14 = 400 + 90 + 14 = 504

$$\begin{array}{r} {\scriptstyle 4\ 9\ 1} \\ 504 \\ -\ 9 \\ \hline 495 \end{array}$$

So 504 – 9 = 495

Where we have to borrow from zeros, we move along to the next position until we can borrow, then move back.

$$\begin{array}{r} 500 \\ -\ 53 \\ \hline \end{array} \longrightarrow \begin{array}{r} {\scriptstyle 4\ 1} \\ 500 \\ -\ 53 \\ \hline \end{array} \longrightarrow \begin{array}{r} {\scriptstyle 4\ 9\ 1} \\ 500 \\ -\ 53 \\ \hline 447 \end{array}$$

So 500 – 53 = 447

Exercise 4

1) 304 – 7	2) 805 – 17
3) 603 – 28	4) 900 – 32
5) 500 – 43	6) 700 – 152
7) 600 – 190	8) 308 – 197
9) 500 – 273	10) 1000 – 174
11) 2000 – 1342	12) 8000 – 3426

Now set yourself some more questions and use your calculator to check them.

System 2 - Paying back Method
(Equal addition)

Look at this.
6 – 2 = 4
16 – 12 = 4

37 – 22 = 15
47 – 32 = 15

If the same number is added to both the numbers in a subtraction, then the answer will be the same.
This is the basis of the Equal Addition method of subtraction.

Example 6

22 – 6

$\begin{array}{r} 22 \\ -\ 6 \\ \hline \end{array}$ Add 10 to the units column in the top line and 10 to the tens column in the second line.

$\begin{array}{r} 2\overset{1}{2} \\ -_1 6 \\ \hline 16 \end{array}$ Subtract the 6 from the 12 and the 1 from the 2

10 has been added to both the top and bottom numbers.
The top line has become 20 + 12 = 32
The bottom line has become 10 + 6 = 16
This gives 32 – 16, which gets the same answer as the original question of 22 – 6.
i.e.
22 – 6 is the same as 32 – 16

Example 7

237 – 53

Subtracting the 3 from the 7 can be done straight away

$\begin{array}{r} 237 \\ -\ 53 \\ \hline 4 \end{array}$

Now add 100 to both the lines. The top line now becomes 200 + 130 + 7 and the bottom line becomes 100 + 50 + 3.

$\begin{array}{r} 2\overset{1}{3}7 \\ -_1 53 \\ \hline 4 \end{array}$

Finally subtract 5 from 13 and 1 from 2.

$\begin{array}{r} 2\overset{1}{3}7 \\ -_1 53 \\ \hline 184 \end{array}$

Exercise 5
Do all the questions from exercise 1.

Example 8

437 – 381

Firstly subtract the 1 from the 7.

$\begin{array}{r} 437 \\ -381 \\ \hline 6 \end{array}$

Since 8 cannot be taken from 3 we must add 100 to both the top and the bottom. Now subtract the 8 from the 13 and the 4 from the 4.

$\begin{array}{r} 4\overset{1}{3}7 \\ -_4 381 \\ \hline 056 \end{array}$

So 437 – 381 = 56

Exercise 6
Do all the questions from exercise 2.

Example 9

147 – 58

Here we have to add 10 and then 100 to the top and bottom lines.

First add 10 to top and bottom then subtract the 8 from 17.

$\begin{array}{r} 14\overset{1}{7} \\ -_6 58 \\ \hline 9 \end{array}$

Finally add 100 to top and bottom, then subtract the 6 from the 14 and the 1 from 1.

$\begin{array}{r} \overset{1}{1}4\overset{1}{7} \\ -_1 58 \\ \hline 089 \end{array}$

So 147 – 58 = 89

Exercise 7
Do all the questions from exercise 3

Exercise 8
Do all the questions from exercise 4

Adding Fractions

Addition of fractions was touched on earlier in the book. For fractions to be added, their denominators must be the same (see pages 25 and 26)

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

$\frac{9}{15} + \frac{2}{15} = \frac{11}{15}$

and so on.

When the denominators are not the same, we have to make them the same. This is done by changing one or both the fractions into equivalent fractions.

Example 1

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

Look at the two denominators. 3 will divide into 9 exactly. So $\frac{1}{3}$ can be written as $\frac{3}{9}$.

So $\frac{1}{9} + \frac{1}{3} = \frac{1}{9} + \frac{3}{9} = \frac{4}{9}$

Example 2

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

Here 4 will not divide exactly into 5 so we have to look for a number that both 5 and 4 will go into. The smallest number that 5 and 4 will divide into exactly is 20. This is called the LCM (lowest common multiple) of 4 and 5.

So $\frac{2}{5} + \frac{1}{4} = \frac{8}{20} + \frac{5}{20} = \frac{13}{20}$

Example 3

$\frac{1}{4} + \frac{7}{12}$ LCM is 12

$\frac{3}{12} + \frac{7}{12} = \frac{10}{12}$

But $\frac{10}{12}$ is not in its lowest terms. It can be cancelled down by dividing the top and bottom by 2.

i.e. $\frac{10}{12} = \frac{5}{6}$ so $\frac{1}{4} + \frac{7}{12} = \frac{5}{6}$

Exercise

By first finding the LCM of the denominators, calculate each of the following. The first one has been done for you and the next four have their LCM given. Cancel down the answers wherever necessary.

1) $\frac{1}{4} + \frac{1}{6} = \frac{3}{12} + \frac{2}{12} = \frac{5}{12}$

2) $\frac{2}{3} + \frac{1}{6}$ (LCM is 6)

3) $\frac{3}{4} + \frac{1}{12}$ (LCM is 12)

4) $\frac{1}{6} + \frac{1}{8}$ (LCM is 24)

5) $\frac{3}{10} + \frac{2}{15}$ (LCM is 30)

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

7) $\frac{2}{7} + \frac{3}{14}$

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

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

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

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

12) $\frac{5}{8} + \frac{1}{6}$

13) $\frac{3}{10} + \frac{1}{6}$

14) $\frac{7}{12} + \frac{3}{8}$

15) $\frac{4}{9} + \frac{5}{12}$

16) $\frac{4}{5} + \frac{1}{20}$

17) $\frac{3}{7} + \frac{5}{21}$

18) $\frac{3}{10} + \frac{5}{25}$

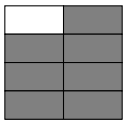
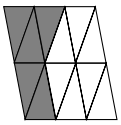
19) $\frac{5}{8} + \frac{7}{20}$

20) $\frac{3}{8} + \frac{5}{12}$

21) $\frac{5}{16} + \frac{5}{8}$

Recap Test 2 - Fractions

1) In these diagrams, say what fraction has been shaded in.

a)  b)  c) 

2) In an evening class, there are 12 male students and 13 female students. What fraction of the class are male?

3) Write down these fractions in order of size, smallest first.

$\frac{1}{2}$, $\frac{1}{7}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{12}$, $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{9}$

4) Calculate

a) $\frac{1}{4}$ of 40 b) $\frac{1}{10}$ of 70 c) $\frac{1}{6}$ of 36

d) $\frac{1}{9}$ of 54 e) $\frac{3}{4}$ of 24 f) $\frac{5}{7}$ of 42

g) $\frac{3}{5}$ of 40 h) $\frac{7}{10}$ of 70 i) $\frac{6}{7}$ of 42

5) Calculate

a) $\frac{5}{7} + \frac{1}{7}$ b) $\frac{3}{11} + \frac{4}{11}$ c) $\frac{3}{13} + \frac{7}{13}$

6) Put these fractions into their lowest terms

a) $\frac{3}{9}$ b) $\frac{4}{12}$ c) $\frac{6}{18}$ d) $\frac{9}{12}$

7) Change into mixed numbers

a) $\frac{7}{4}$ b) $\frac{9}{5}$ c) $\frac{13}{6}$ d) $\frac{25}{4}$

8) Change into improper fractions

a) $1\frac{1}{2}$ b) $3\frac{3}{4}$ c) $5\frac{1}{4}$ d) $6\frac{3}{5}$

9) What is the L.C.M. (lowest common multiple) of each of the following pairs of numbers?

a) 4 and 8 b) 8 and 12 c) 6 and 9

10) Calculate

a) $\frac{1}{7} + \frac{1}{21}$ b) $\frac{3}{5} + \frac{3}{10}$ c) $\frac{1}{6} + \frac{1}{12}$

11) Calculate

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

d) $1\frac{1}{2} + 2\frac{1}{4}$ e) $3\frac{1}{2} + 7\frac{1}{8}$ f) $2\frac{5}{6} + 3\frac{2}{3}$

12) Calculate

a) $\frac{3}{4} - \frac{1}{2}$ b) $\frac{9}{10} - \frac{1}{5}$ c) $\frac{3}{8} - \frac{1}{4}$

d) $2\frac{1}{4} - \frac{1}{2}$ e) $3\frac{3}{8} - \frac{1}{4}$ f) $4\frac{5}{8} - 1\frac{1}{4}$

g) $5\frac{3}{10} - 2\frac{2}{5}$ h) $6\frac{7}{8} - 1\frac{2}{5}$ i) $7\frac{3}{8} - 4\frac{3}{4}$

13) Calculate

a) $\frac{1}{2} \times 7$ b) $\frac{3}{4} \times 10$ c) $4\frac{1}{3} \times 10$

d) $\frac{3}{4} \times 1\frac{1}{2}$ e) $3\frac{1}{2} \times \frac{2}{5}$ f) $1\frac{1}{2} \times 2\frac{1}{2}$

g) $5\frac{1}{7} \times 3\frac{3}{5}$ h) $6\frac{1}{4} \times 2\frac{3}{8}$ i) $5\frac{1}{4} \times 7$

j) $3\frac{1}{2} \times 10$ k) $3\frac{1}{4} \times 100$ l) $6\frac{3}{4} \times 1000$

14) Calculate

a) $6\frac{1}{2} \div \frac{1}{4}$ b) $6\frac{1}{2} \div 4$ c) $\frac{5}{8} \div 2\frac{1}{2}$

15) By cancelling down, change these ratios into their lowest terms.

a) 8:4 b) 9:3 c) 12:8 d) 4:16

16) a) Divide £30 between two people in the ratio 3:2

b) Divide £16.20 between two people in the ratio 7:3.

Multiplying decimals by whole numbers

Carry this out using the same method as you did for whole numbers. (see page 17)

Example1

2.56×3

$$\begin{array}{r} 2.56 \\ \times\ 3 \\ \hline 7.68 \\ {\scriptstyle 1\ 1} \end{array}$$

Notice that there are 2 places after the decimal point in the question (2.56) and 2 places after the decimal point in the answer (7.68)
Don't put the decimal point in until you have completed the answer line.

Exercise 1

1) 2.4×7	2) 5.4×9	3) 6.13×5
4) 4.312×6	5) 3.4×5	6) 5.4×7
7) 4.31×4	8) 18.6×9	9) 37.4×8
10) 3.87×5	11) 15.3×7	12) 23.9×3

Multiplying a decimal by a decimal

Example 2

4.3×0.6

First multiply as if they were both whole numbers.

$$\begin{array}{r} 4.3 \\ \times\ 0.6 \\ \hline 2.58 \\ {\scriptstyle 1}\uparrow\uparrow \end{array}$$

There are two places behind the decimal points in the question.
So there have to be two places behind the decimal point in the answer.
two places

So $4.3 \times 0.6 = 2.58$

Example 3

4.8×5.3

$$\begin{array}{r} {\scriptstyle 4\ 2} \\ 4.8 \\ \times\ 5.3 \\ \hline 144 \\ 2400 \\ \hline 25.44 \\ \uparrow\uparrow \end{array}$$

Carry over numbers
There are two places behind the decimal points in the question.
Don't put any decimal points in here. They will just cause confusion.
two places after the decimal point

Example 4

4.38×4.5

$$\begin{array}{r} {\scriptstyle 1\ 3} \\ {\scriptstyle 1\ 4} \\ 4.38 \\ \times\ 4.5 \\ \hline 2190 \\ 17520 \\ \hline 19.710 \\ {\scriptstyle 1} \\ \uparrow\uparrow\uparrow \end{array}$$

Notice how the numbers are laid out. There is no need to keep the decimal points under each other.
three places after the decimal point

Example 5

27×0.02

$$\begin{array}{r} 27 \\ \times\ 0.02 \\ \hline 0.54 \\ {\scriptstyle 1} \end{array}$$

Two places behind the decimal point.
Two places behind the decimal point.

Example 6

12.41×5.3

$$\begin{array}{r} {\scriptstyle 1\ 2} \\ {\scriptstyle 1} \\ 12.41 \\ \times\ 5.3 \\ \hline 3723 \\ 62050 \\ \hline 65.773 \end{array}$$

Exercise 2

1) 4.2×5.3	2) 9.8×2.5
3) 8.6×4.1	4) 9.21×0.7
5) 6.83×0.9	6) 14.1×0.6
7) 24.1×3.2	8) 5.83×7.2
9) 44.3×8.4	10) 7.8×0.05
11) 12.6×0.04	12) 37.3×0.15
13) 84.3×0.28	14) 77.6×5.7
15) 0.45×0.63	16) 0.4×0.316
17) 0.45×0.814	18) 7.3×0.044

More Examples.

Example 7

$$0.3 \times 0.04$$

When dealing with a number like this, first multiply the figures together.

$$\begin{array}{r} 0.3 \\ \times 0.04 \\ \hline 12 \end{array}$$

The position of the decimal point is found by counting three positions from the right. As there are only two positions in the answer, an extra 0 is introduced to indicate the three positions.

$$\begin{array}{r} 0.3 \\ \times 0.04 \\ \hline 0.012 \end{array}$$

Example 8

$$0.0034 \times 12$$

$$\begin{array}{rl} 0.0034 \\ \times 12 \end{array}\Big\}\text{Four places after the decimal point}$$

$$\begin{array}{r} 68 \\ 340 \\ \hline 0.0408 \end{array}\ \text{Four places after the decimal point}$$

$$\begin{smallmatrix} & & & 1 \end{smallmatrix}$$

Example 9

$$0.015 \times 0.0053$$

$$\begin{smallmatrix} & & 2 \\ & & 1 \end{smallmatrix}$$

$$\begin{array}{rl} 0.015 \\ \times 0.0053 \end{array}\Big\}\text{Seven places}$$

$$\begin{array}{rl} 45 \\ 750 \end{array}\Big\}\begin{array}{l}\text{No decimal point is needed} \\ \text{in the calculation part}\end{array}$$

$$\underline{0.0000795}\ \text{Seven places}$$

Example 10

$$27.4 \times 0.0036$$

$$\begin{smallmatrix} & & 2 & 1 \\ & & 4 & 2 \end{smallmatrix}$$

$$\begin{array}{rl} 27.4 \\ \times 0.0036 \end{array}\Big\}\text{Five places}$$

$$\begin{array}{rl} 1644 \\ 8220 \end{array}\Big\}\text{Calculation part}$$

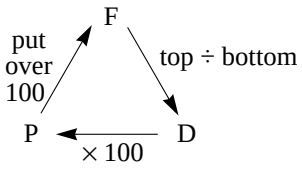
$$\underline{0.09864}\ \text{Five places}$$

Exercise 3

1) 0.03×0.7	2) 0.41×0.3
3) 0.861×0.9	4) 0.14×0.32
5) 0.62×0.48	6) 0.531×0.04
7) 0.61×0.82	8) 0.9×0.681
9) 0.013×0.045	10) 0.021×0.0031
11) 3.4×0.014	12) 8.6×0.003
13) 14×0.006	14) 18.6×0.0014

(see also changing fractions into decimals on page 47)

This diagram represents the steps involved in changing from one type of fraction to another.



To change a fraction into a decimal, divide the numerator by the denominator.
To change a decimal into a percentage, multiply by 100.
To change a percentage into a fraction, write it as a fraction over 100, then cancel down.

Example 1

Change $\frac{3}{5}$ into a decimal F ⟶ D

$3 \div 5 = 0.6$

Example 2

Change $\frac{4}{5}$ into a percentage

F ⟶ D ⟶ P

$4 \div 5 = 0.8$

$0.8 \times 100 = 80\%$

Example 3

Change 0.825 into a percentage

D ⟶ P

$0.825 \times 100 = 82.5\%$

Example 4

Change 73% into a fraction

P ⟶ F

$73\% = \frac{73}{100}$

Example 5

Change 85% into a fraction

P ⟶ F

$85\% = \frac{85}{100}$

Divide numerator and denominator by 5

$\frac{85}{100} = \frac{17}{20}$

So 85% is $\frac{17}{20}$

Example 6

Change 0.71 into a fraction

D ⟶ P ⟶ F

$0.71 \times 100 = 71\%$

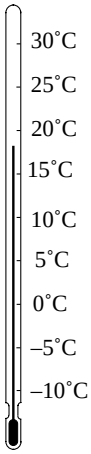
$71\% = \frac{71}{100}$

Exercise

Change each of the following

1) $\frac{2}{5}$ into a decimal
2) 0.31 into a percentage
3) 70% into a fraction
4) 90% into a fraction
5) 95% into a fraction
6) $\frac{7}{8}$ into a percentage
7) 25% into a fraction
8) 0.85 into a percentage
9) 0.725 into a percentage
10) $\frac{3}{10}$ into a percentage
11) $\frac{3}{4}$ into a decimal
12) 62% into a fraction
13) 0.45 into a percentage
14) 45% into a fraction
15) 0.83 into a fraction
16) $\frac{4}{5}$ into a percentage
17) 0.35 into a fraction
18) $\frac{7}{10}$ into a percentage
19) 0.82 into a fraction
20) 0.875 into a percentage

Thermometer Scale (Negative Numbers)



This is a thermometer for measuring the temperature of the air outside. 0˚C is the freezing point of water.
Winter temperatures are towards the bottom of the thermometer and summer ones are towards the top.

–5˚C is a cold winters day
25˚C is a hot summers day
(Note that ˚C means degrees Celsius or degrees Centigrade)

Increasing temperatures

Use the diagram to understand these

a) The temperature is 5˚C and rises by 10˚C.
The new temperature is 5 + 10 = 15˚C.

b) The temperature is 0˚C and rises by 10˚C.
The new temperature is 0 + 10 = 10˚C.

c) The temperature is –5˚C and rises by10˚C.
The new temperature is –5 + 10 = 5˚C.

d) The temperature is –10˚C and rises by 10˚C.
The new temperature is –10 + 10 = 0˚C.

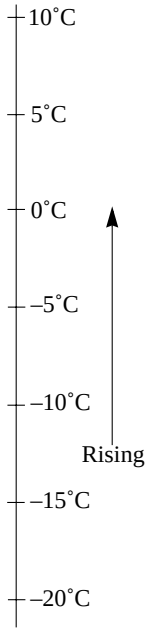
e) The temperature is –10˚C and rises by 5˚C.
The new temperature is –10 + 5 = –5˚C.

f) The temperature is –10˚C and rises by 15˚C.
The new temperature is –10 + 15 = 5˚C.

Exercise 1

Use the number line to help you.

1) 4˚C rises by 7˚C
2) 0˚C rises by 8˚C
3) –3˚C rises by 5˚C
4) –7˚C rises by 10˚C
5) –8˚C rises by 8˚C
6) –11˚C rises by 21˚C
7) –7˚C rises by 3˚C
8) –12˚C rises by 9˚C
9) –12˚C rises by 15˚C
10) –6˚C rises by 1˚C
11) –5 + 14
12) –10 + 14
13) –20 + 16
14) –6 + 8
15) –2 + 10
16) –7 + 4
17) –5 + 12
18) –6 + 12
19) –6 + 6
20) –8 + 7



Falling temperatures

Again use the diagram to do these

a) The temperature is 15˚C and falls by 10˚C.
The new temperature is 15 – 10 = 5˚C.

b) The temperature is 10˚C and falls by 10˚C.
The new temperature is 10 – 10 = 0˚C.

c) The temperature is 5˚C and falls by 10˚C.
The new temperature is 5 – 10 = –5˚C.

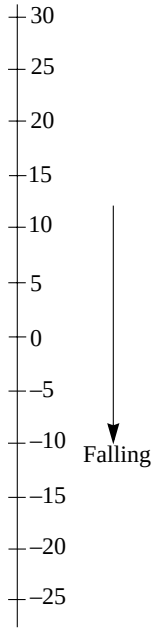
d) The temperature is 0˚C and falls by 10˚C.
The new temperature is 0 – 10 = –10˚C.

e) The temperature is –5˚C and falls by 10˚C.
The new temperature is –5 – 10 = –15˚C.

Exercise 2

Use the number line to help you.

1) 24˚C falls by 15˚C
2) 12˚C falls by 12˚C
3) 8˚C falls by 10˚C
4) 3˚C falls by 11˚C
5) 2˚C falls by 20˚C
6) 5˚C falls by 10˚C
7) 6˚C falls by 2˚C
8) –6˚C falls by 8˚C
9) –10˚C falls by 15˚C
10) 9˚C falls by 17˚C
11) 6 – 10
12) 2 – 15
13) 6 – 7
14) –10 – 5
15) –8 – 5
16) –3 – 7
17) 4 – 6
18) –7 – 12
19) –5 – 14
20) –6 – 9



Exercise 3 - Mixed

1) On a summer day, the temperature is 22˚C at midday and falls 8˚C by midnight.
   What is the midnight temperature?
2) On a winters day the temperature is –4˚C at midday and falls 8˚C by midnight.
   What is the midnight temperature?
3) During the night the temperature falls to –10˚C. If it then rises by 6˚C, what is the new temperature?
4) On a day in summer the midday temperature is 22˚C. If the midnight temperature is 12˚C what is the temperature change?
5) On a day in winter the midday temperature is 2˚C and the midnight temperature is –5˚C. What is the fall in temperature?
6) If the temperature is 6˚C and then falls by 12˚C, what is the new temperature?
7) If the temperature is –7˚C and rises by 10˚C, what is the new temperature?
8) A bag of peas has a temperature of –18˚C in the freezer. If they are heated up to 40˚C, what is the change in temperature?
9) Copy this table and fill in the spaces.

Temperature of the peas in the freezer	Temperature of the peas outside of the freezer	Change of temperature
–8˚C	40˚C	
–5˚C	5˚C	
–12˚C	6˚C	
–6˚C		12˚C
–4˚C		15˚C
	10˚C	15˚C
	12˚C	20˚C
	8˚C	15˚C
–3˚C		20˚C
–7˚C		13˚C

Information Tables

There are many types of tables used to show information. Here are just a sample.

Example 1

In order to save space, some tables do not have all the information written in, but expect the user to fill in the blanks.

Below is shown a part of a bus timetable. It gives some of the departure times from the Town Hall and Apple Way. But since some of the times are every 30 minutes, these have been left out. You have to work these out yourself.

Town Hall	0800	0815	0830	0845	0900	Then every 30 minutes until	1800	1900
Apple Way	0822	0837	0852	0907	0922		1822	1922

Here are some of the important points.

a) The first bus of the day is the 0800 from the Town Hall and the last bus is at 1900.

b) Each bus takes 22 minutes to get from the Town Hall to Apple Way.

c) After 0900 the busses run at 30 minute intervals, until 1800. So the next bus after 0900 is at 0930, the next is at 1000, the next is at 1030 and so on until 1800.

Questions

a) At what time does the 0815 from the Town Hall arrive at Apple Way?

b) At what time will the 0930 from the Town Hall arrive at Apple Way?

c) How long will the 1200 from the Town Hall take to get to Apple Way?

d) If the 1630 from the Town Hall is late by 16 minutes because of a traffic hold up, at what time will it arrive at Apple Way?

Example 2

Information is selected from the next type of table by reading across the top row and down the left hand column. The information required is then shown within the table. For example, the highlighted box shows the cost of a 1 week holiday in a 4 star hotel beginning between 1st July and 31st August.

Type of accommodation		2 star	3 star	4 star	5 star
Starting date on or between	20 Mar - 30 Apr	849	889	999	1109
	01 May - 30 Jun	959	965	1119	1229
	01 Jul - 31 Aug	1039	1099	1209	1319
	01 Sep - 31 Oct	969	1019	1129	1239
	01 Nov - 12 Dec	859	899	1009	1119
	13 Dec - 24 Dec	1059	1119	1229	1339
	25 Dec - 31 Dec	859	899	1009	1119

Questions

a) What is the cost of a holiday for 1 person in a 5 star hotel starting on 2nd July?

b) Calculate the cost of a holiday for 2 people in a 4 star hotel starting on 2nd December.

c) Calculate the cost of a holiday for a family of 4 in a 2 star hotel starting on 17th August.

Example 3 Distance Tables

	Birmingham	Cardiff	Edinburgh	Glasgow	London	Manchester	Newcastle
Cardiff	99						
Edinburgh	289	373					
Glasgow	290	370	45				
London	113	**154**	386	403			
Manchester	81	172	213	214	189		
Newcastle	205	298	105	142	281	132	
Swansea	125	45	380	381	192	183	314

This table shows the distances between some cities in Britain.

The distance between London and Cardiff is highlighted as 154 miles.

Questions

a) What is the distance between Swansea and Glasgow?

b) What is the distance between Newcastle and London?

c) Which towns are the closest?

d) Which towns are furthest from each other?

The Fraction Key

To do this you will need a scientific calculator

There are two buttons on the calculator which allow you to work directly with fractions.These are labelled

[a b/c] and [d/c]

In some cases one button is used for both functions. One of the functions uses only the button, the other function uses the shift key (sometimes called the second function key) followed by the button. Refer to your calculator instruction booklet for more information about this.

The first button [a b/c]

This allows you to put in a fraction such as $3\frac{4}{9}$ (the 'a' refers to the 3, the 'b' refers to the 4 and the 'c' refers to the 9)

Example 1

To put $3\frac{4}{9}$ into the calculator.

Press these buttons in order

[3] [a b/c] [4] [a b/c] [9]

This shows 3⌟4⌟9 which is the calculator representation of $3\frac{4}{9}$

Example 2

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

[AC] [1] [a b/c] [1] [a b/c] [4] [+]

[2] [a b/c] [1] [a b/c] [4] [=]

This gives the answer 3⌟1⌟2 which is the calculator representation of $3\frac{1}{2}$

Example 3

$3\frac{3}{13} - 1\frac{2}{5}$

[AC] [3] [a b/c] [3] [a b/c] [1] [3]

[−] [1] [a b/c] [2] [a b/c] [5] [=]

This gives the answer 1⌟54⌟65

i.e. $1\frac{54}{65}$

Exercise 1

Use the calculator to find the answer to each of the following

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

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

5) $14\frac{2}{3} + 1\frac{7}{8}$ 6) $5\frac{3}{5} + 6\frac{3}{11}$

7) $4\frac{5}{13} - 3\frac{1}{2}$ 8) $6\frac{7}{8} - 4\frac{9}{11}$

9) $6\frac{1}{3} + 5\frac{13}{15}$ 10) $4\frac{5}{6} + 6\frac{7}{15}$

11) $3\frac{1}{2} + 2\frac{1}{5} + 1\frac{7}{8}$ 12) $5\frac{2}{9} + 6\frac{4}{5} - 1\frac{4}{9}$

When using fractions by themselves, rather than mixed numbers, they are entered as follows.

$\frac{1}{2}$ is entered as [1] [a b/c] [2] and shows up on the calculator as 1⌟2

Example 4

$$\frac{7}{8} + \frac{5}{9}$$

[AC] [7] [a b/c] [8] [+] [5] [a b/c] [9] [=]

Which gives 1⌟31⌟72 which means $1\frac{31}{72}$

Exercise 2

Calculate each of the following

1) $\frac{3}{4} + \frac{9}{10}$ 2) $\frac{3}{4} + \frac{3}{5}$ 3) $\frac{9}{14} + \frac{3}{8}$

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

7) $\frac{4}{7} - \frac{1}{6}$ 8) $\frac{5}{9} - \frac{2}{5}$ 9) $1\frac{1}{2} + \frac{9}{13}$

10) $2\frac{1}{4} + \frac{9}{11}$ 11) $3\frac{7}{8} - \frac{5}{9}$ 12) $2\frac{1}{2} - \frac{12}{13}$

Using the function [d/c]

This is used to change a mixed number into an improper fraction. This is why both functions have a 'c' underneath ($a\frac{b}{c}$ and $\frac{d}{c}$)

Note. The [d/c] button is the same button as the [a b/c] button but you will have to press the [INV] or [2ndF] or [SHIFT] key first, depending on the calculator you are using.

Example 5

$3\frac{1}{2}$ as an improper fraction is $\frac{7}{2}$.

On the calculator

[AC] [3] [a b/c] [1] [a b/c] [2] ([=]) [d/c]

gives 7⌟2

or $\frac{7}{2}$

Note that the "=" button is sometimes not needed, depending on the type of calculator you use.

Exercise 3

Change into improper fractions and decimal fractions, correct to 2 decimal places

1) $3\frac{7}{8}$ 2) $4\frac{3}{4}$ 3) $5\frac{3}{5}$

4) $6\frac{7}{8}$ 5) $4\frac{9}{10}$ 6) $8\frac{7}{13}$

7) $7\frac{3}{11}$ 8) $6\frac{9}{19}$ 9) $5\frac{4}{11}$

10) $6\frac{8}{17}$ 11) $10\frac{4}{21}$ 12) $6\frac{3}{19}$

Converting from fractions to decimals

This is achieved by pressing the [a b/c] button a second time.

Example 6

$3\frac{1}{2}$ is equal to 3.5

[AC] [3] [a b/c] [1] [a b/c] [2] [=]

gives 3⌟1⌟2

However if you press the [a b/c] button again you will get 3.5

Exercise 4

Change each of the following into a decimal number by using the [a b/c] button.

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

4) $6\frac{7}{8}$ 5) $9\frac{7}{40}$ 6) $12\frac{8}{25}$

7) $14\frac{7}{16}$ 8) $22\frac{7}{25}$ 9) $16\frac{7}{50}$

10) $15\frac{5}{16}$ 11) $28\frac{1}{32}$ 12) $19\frac{7}{32}$

Roman Numerals

Roman numerals are still used today but in a very limited way. Compared with todays decimal system it would be very difficult to do calculations with them. They are used to show years, usually at the end of films, on old buildings etc. They are also sometimes used as page numbers. For example a film made in 1963 might have MCMLXIII on its credits, and a building from 1880 might have MDCCCLXXX. Page lxvi can be used instead of page 66.
The Romans used the following letters.

I represented 1
V represented 5
X represented 10
L represented 50
C represented 100
D represented 500
M represented 1000

To obtain other numbers between these, the letters were added together.
For example

III means 3 (1+1+1)
VI means 6 (5 + 1)
XI means 11 (10 + 1)
XV means 15 (10 + 5)
LX means 60 (50 +10)
LXI means 61 (50 + 10 + 1)
MDC means 1600 (1000 + 500 + 100)
and so on

Exercise 1

Say what each of the following represent.

i) XXI	ii) VII
iii) XVI	iv) XXXVI
v) LXV	vi) CXVII
vii) CXXVII	viii) CLXVIII
ix) CCCLXVI	x) DXXVII
xi) DCXV	xii) DCCLXV
xiii) MXXX	xiv) MDCXV

This method relies entirely on adding numbers together and can get quite complicated. In order to ease this the Romans began to write down numbers as subtractions.

Example
MDCCCC represents 1900
(1000 + 500 + 400)
but this can be done more economically by saying 1000 + 900
i.e. MCM (CM means 100 before 1000)
Other numbers that can be simplified in this way

4 becomes IV and not IIII (1 before 5)
9 becomes IX and not VIIII (1 before 10)
14 becomes XIV and not XIIII
(10 and 1 before 5)
and so on

Exercise 2

Say what numbers each of the following represent.

i) XC	ii) CXC	iii) XD
iv) XM	v) MXM	vi) MCMIII
vii) MCML	viii) XLV	ix) CM
x) CDV	xi) CMIX	xii) XMV

Exercise 3

The following dates have appeared on buildings or at the end of film credits, indicating the year they were built or produced. In each case write down the year and put them in order, oldest first.

i) MDCCLIV	ii) MDCCCLXXXIV
iii) MCM	iv) MCMLXIX
v) MCMXLIII	vi) MCMLXXXIV
vii) MDCXLIII	viii) MDCCCLXIII
ix) MDCCI	x) MDCCXXXVII
xi) MCMXCV	xii) MDCLXXXVII
xiii) MDCCCVI	xiv) MCMXXVII

Recap Test 6

1) Change 57 inches into feet and inches.

2) Change $10'6''$ into yards, feet and inches.

3) Change 2 yards 2 feet into inches.

4) Add together 6ft 4ins and 1yd 2ft.

5) Subtract 13 inches from $2'7''$.

6) If 1 inch is equal to 2.54 centimetres, change;
a) 26 inches into centimetres.
b) 30 centimetres into inches.

7) Change 53 fluid ounces into pints and fluid ounces.

8) Change 25 pints into gallons and pints.

9) Add together 4 pints and 27 fluid ounces, giving your answer as pints and fluid ounces.

10) Subtract $3\frac{1}{2}$ gallons from 50 pints.

11) If 1 gallon is approximately equal to $4\frac{1}{2}$ litres, change;
a) 6 gallons into litres.
b) 36 litres into gallons.

12) Change 57 ounces into pounds and ounces.

13) Change $3\frac{1}{2}$ stones into pounds.

14) Subtract $5\frac{1}{2}$ stones from 7 stones 12 pounds.

15) If 1 kilogram is approximately equal to 2.2lbs, change;
a) 7kg into lbs.
b) 30lbs into kg.

16) What numbers do the following Roman numerals represent?
a) XVII b) XL c) CLX d) MCXI

17) Write down the following numbers as Roman numerals;
a) 79 b) 156 c) 453 d) 1941

18) A bag contains 10 snooker balls, all similar to the touch. 7 are red, 1 is black, 1 is blue and 1 is pink. If 1 ball is withdrawn from the bag, what is the probability that it is
a) red b) not red c) blue?