Nelson International Mathematics
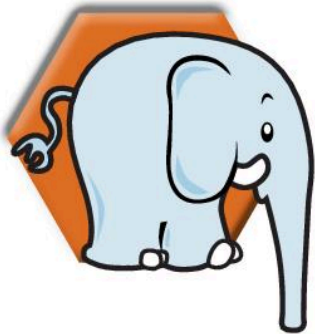
Student Book 6

2nd edition

Karen Morrison

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Contents

Contents

We can write any number using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 using the decimal place value system. Each digit has a value that depends on its place in the number.

Here is a place value table that shows the value of each digit in the number eight hundred and seventy-six thousand, two hundred and thirty-five, or 876 235.

Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Units
8	7	6	2	3	5

876 235 can also be written in expanded form like this:

$800\,000 + 70\,000 + 6000 + 200 + 30 + 5$

1 Say each number, then write it using numerals:

a thirty-nine

b three hundred and fifty-seven

c nine thousand, four hundred and twenty-one

d eighty-eight thousand and twelve

e six hundred and forty-three thousand, nine hundred and ninety-four.

2 Write the number that is made up of:

a 5 units and 9 tens

b 7 hundreds and 4 units

c 2 units, 2 tens and 23 thousands

d 2 units, 5 hundreds and 943 thousands.

3 What is the value of the red 5 in each of these numbers?

a 35   b 534   c 157   d 1500

e 395 346   f 12 456   g 504 674   h 154 236

i 454 987   j 125 098   k 999 995   l 543 244

4 What is the largest number you can make with the digits 1, 0, 2, 4, 5 and 6?

5 What is the smallest number you can make with the digits 8, 1, 1, 2, 4 and 7?

Comparing and ordering numbers

1 Arrange each set of numbers in order from smallest to largest.
  a   412, 416, 148, 124, 143
  b   8641, 8614, 8416, 8164, 8461
  c   15151, 15551, 15515, 15115
  d   900 000, 919 900, 999 000, 990 000
  e   234 444, 324 444, 432 444, 243 444

2 Arrange each set of numbers in order from largest to smallest.
  a   123, 1231, 312, 1321, 231
  b   12 700, 12 098, 12 345, 12 999
  c   145 231, 145 321, 145 123, 145 213
  d   239 430, 423 320, 324 430, 342 340
  e   324 000, 342 000, 234 000, 432 000

3 Look at the number line. What are the values of the numbers marked with arrows?

0   1000

a   b   c
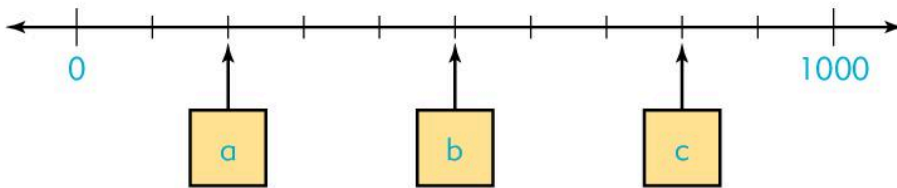
4 Estimate the value of each of the numbers marked with an arrow.

0   1000

a   b   c   d   e   f
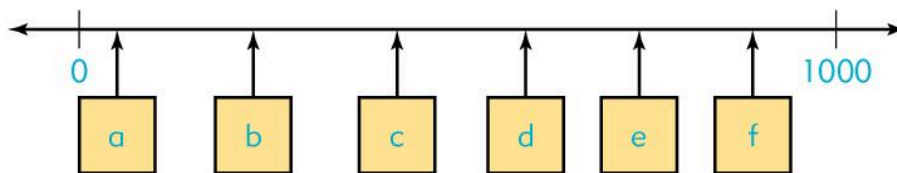
5 Fill in < or > to show which number is greater in each pair.
  a   234 542 ☐ 36 542   b   52 809 ☐ 123 008
  c   234 543 ☐ 253 899   d   990 000 ☐ 990 009
  e   206 523 ☐ 259 999   f   107 345 ☐ 107 421
  g   329 108 ☐ 329 128   h   109 789 ☐ 109 098

Rounding numbers

Do you remember how to round numbers to the nearest ten, hundred or thousand?

To round to tens, look at the units digit. If it is less than 5, the tens stay the same. If it is 5 or more, then add 1 to the tens digit. Write 0 in place of the units.

These numbers are rounded to the nearest ten:

123 → 120   125 → 130   129 → 130

To round to hundreds or thousands you work in the same way, looking at the digit to the right of the one you are rounding to each time.

These numbers are rounded to the nearest hundred:

3412 → 3400   3452 → 3500   3491 → 3500

These numbers are rounded to the nearest thousand:

3456 → 3000   3512 → 4000   3991 → 4000

1 Round each number to the nearest ten.
- **a** 64
- **b** 457
- **c** 123 456
- **d** 4004
- **e** 211 112
- **f** 8045
- **g** 34 760
- **h** 980 653

2 Round each number to the nearest hundred.
- **a** 432
- **b** 123
- **c** 606
- **d** 12 765
- **e** 7278
- **f** 12 131
- **g** 15 834
- **h** 524 620

3 Rewrite each number rounded to the nearest thousand.
- **a** 1567
- **b** 5607
- **c** 53 097
- **d** 567
- **e** 91 032
- **f** 6094
- **g** 567 214
- **h** 346 912

4 Here are the prices of five cars:

a $8765	**b** $3456	**c** $9050	**d** $12 999	**e** $10 500

The salesman estimates the prices for a customer.
Are his estimates correct?
- **a** about $8000
- **b** about $3000
- **c** about $9000
- **d** about $12 000
- **e** about $10 000

you can use Workbook page 8

1.2 and 5.99 are decimal fractions. In a decimal fraction, the digits after the decimal point represent parts of a whole.

1.2 is 1 whole and 2 tenths.

5.99 is five wholes and 99 hundredths.
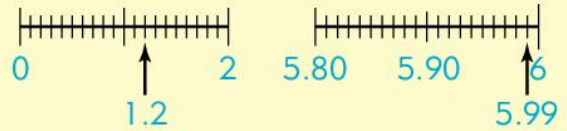
We can extend the place value table to show tenths and hundredths like this.

Ten thousands	Thousands	Hundreds	Tens	Units	.	Tenths (1/10)	Hundredths (1/100)
		3	1	2	.	2	
	1	2	6	4	.	4	5
4	5	9	3	0	.	0	9

312.2 is three hundred and twelve and 2 tenths

1264.45 is one thousand, two hundred and sixty-four and 45 hundredths

45 930.09 is forty-five thousand, nine hundred and thirty and 9 hundredths.

The number 45 930.09 has no units and no tenths. We use a 0 as a place holder in these positions to make sure that the other digits are written in their correct decimal places.

1 Each large block represents one whole. What number is represented in each picture?
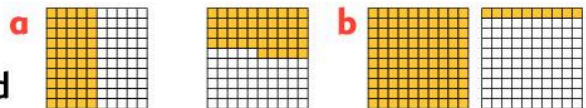
2 What is the value of the red digit in each of these numbers?
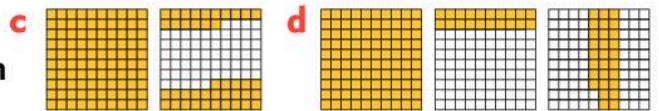
a 25.**9**9   b 29.5**9**   c 3**4**.5   d 102.0**3**

e 234.**5**9   f **4**6.99   g 18**7**8.21   h 45 098.0**1**

3 Write as decimal fractions.

a $\frac{4}{10}$ b $\frac{12}{100}$ c $\frac{7}{100}$ d $\frac{15}{100}$

e $2\frac{5}{10}$ f $10\frac{5}{100}$ g $213\frac{30}{100}$ h $128\frac{33}{100}$

4 Write each of these money amounts in dollars using a decimal place to show parts of a dollar.

a Four dollars and twenty-five cents   b Ten dollars and ninety-nine cents

c Two hundred dollars and fifty cents   d Twenty-nine dollars and three cents

Numbers below 0

In very cold places, the temperature sometimes falls below 0°C. When the temperature is less than zero we use a minus sign to show the temperature. This thermometer shows a temperature of minus 4°C or –4°C.

We call any number that is less than zero a **negative number** and we write it with a minus sign to show that it is negative. If a number has no sign, then we accept that it is above 0 or positive.

Negative numbers can be shown on a number line to the left of zero like this:

–6 –5 –4 –3 –2 –1 0 1 2 3 4 5 6

°C
50
40
30
20
10
0   –4°C
–10
–20
–30
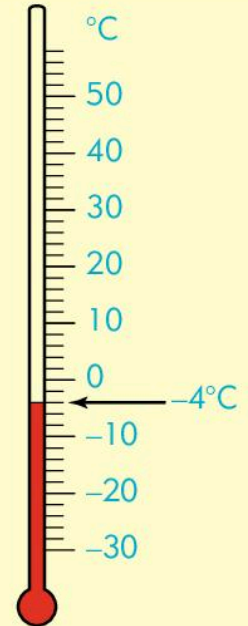
1 Write down the temperatures indicated on the thermometer at a–h.

a   b   c d   e   f   g   h

–30   –20   –10   0   10   20   30   40   50   °C
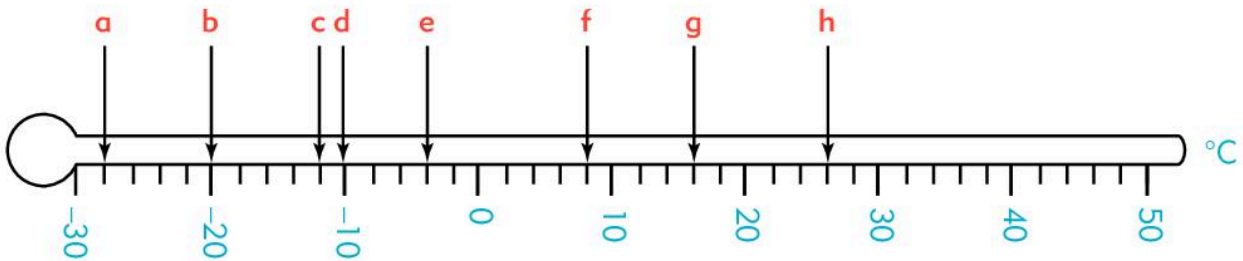
2 On Friday the temperature on a thermometer was 15°C. Write what the temperature would be if it were:

a 3 degrees hotter   b 3 degrees colder
c 10 degrees colder   d 15 degrees colder
e 15 degrees hotter   f 16 degrees colder
g 20 degrees colder   h 18 degrees colder.

3 Copy these pairs of temperatures. Write < or > to show which is hotter in each pair.

a –2°C ☐ 2°C   b 0°C ☐ –5°C   c –3°C ☐ 3°C

d –5°C ☐ –3°C   e –10°C ☐ –12°C   f 8°C ☐ –8°C

you can use Workbook page 9

Temperature differences

Pete lives in Canada where it gets very cold in the winter months. One morning, the thermometer showed a temperature of –6°C.
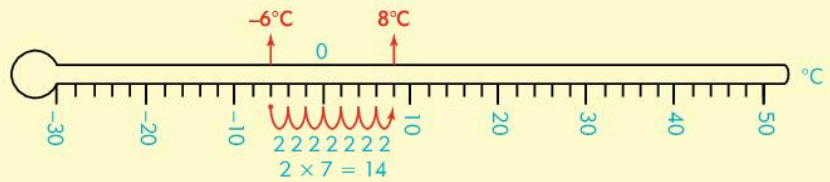
At lunchtime, the temperature was 8°C. What was the difference in temperature?

You can work out the difference easily if you use the scale on the thermometer like a number line.
- Start at –6°C.
- Move towards 8°C counting the degrees as you go.
- Remember each division represents two degrees, so count in twos.
- There is a 14 degree difference in temperature.

1 **Use the thermometer above to help you work out the difference in temperature between:**

a	5°C and 25°C	**b**	38°C and 9°C	**c**	12°C and –2°C
d	–6°C and 8°C	**e**	–12°C and 15°C	**f**	–1°C and –11°C
g	–20°C and –6°C	**h**	–2°C and 28°C	**i**	0°C and 23°C
j	0°C and –14°C	**k**	–10°C and 10°C	**l**	17°C and –3°C.

2 **The weather service reported that the temperature in New York in the USA was –3°C and the temperature in Mumbai in India was 27°C. How much warmer is Mumbai than New York?**

3 **The temperature in a walk-in freezer is –25°C. Outside it is 28°C. How much colder is it in the freezer than it is outside?**

4 **Look at this extract from Mrs Patel's bank statement.**

a How does the bank show that she has taken money out of her account?

b How does the bank show that she has put money into her account?

c Work out the closing balance. This is how much money she has at the end of the statement period.

```
Opening balance   +897.00    This is how much
Withdrawal          -50.00    money she starts with
Withdrawal         -100.00    Withdraw means
Withdrawal          -75.00    'take out'
Deposit            +180.00    Deposit means 'put in'
Withdrawal          -75.00    This is how much
Closing balance               money she has left
```

Days, weeks, months and years

Do you remember these time facts?

1 day = 24 hours
1 week = 7 days
1 month = About 4 weeks
1 year = 12 months
1 year = 52 weeks
1 normal year = 365 days
1 leap year = 366 days

1 decade = 10 years
1 century = 100 years

30 days has September
April, June and November
All the rest have 31
Except for February alone
Which has but 28 days clear
And 29 in each leap year.

1 **Copy and complete these tables.**

Number of weeks	1	2	3	4		
Number of days					35	420

Number of months	12	24	36			
Number of years				10	15	100

Use your completed tables to help you find the answers to these problems.

2 **How many days are there in:**
a 5 weeks
b 8 weeks
c 3 weeks and 2 days
d 10 weeks and 6 days.

3 **How many weeks are there in:**
a 35 days
b 42 days
c 70 days
d 707 days.

4 **How many months are there in:**
a 5 years
b 10 years
c $12\frac{1}{2}$ years
d 100 years.

5 **How many years are there in:**
a 36 months
b 60 months
c 240 months
d 126 months.

6 **How many weeks and days are there in 109 days? Show how you worked this out.**

Here is a calendar for a full year. Discuss with your partner how to read and make sense of a calendar like this one.

January							February							March							April						
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
	1	2	3	4	5	6				1	2	3				1	2	3	4	5	6	7
7	8	9	10	11	12	13	4	5	6	7	8	9	10	4	5	6	7	8	9	10	8	9	10	11	12	13	14
14	15	16	17	18	19	20	11	12	13	14	15	16	17	11	12	13	14	15	16	17	15	16	17	18	19	20	21
21	22	23	24	25	26	27	18	19	20	21	22	23	24	18	19	20	21	22	23	24	22	23	24	25	26	27	28
28	29	30	31				25	26	27	28				25	26	27	28	29	30	31	29	30

May							June							July							August						
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5						1	2	1	2	3	4	5	6	7				1	2	3	4
6	7	8	9	10	11	12	3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	8	9	10	11
13	14	15	16	17	18	19	10	11	12	13	14	15	16	15	16	17	18	19	20	21	12	13	14	15	16	17	18
20	21	22	23	24	25	26	17	18	19	20	21	22	23	22	23	24	25	26	27	28	19	20	21	22	23	24	25
27	28	29	30	31			24	25	26	27	28	29	30	29	30	31					26	27	28	29	30	31

September							October							November							December						
M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
						1		1	2	3	4	5	6					1	2	3							1
2	3	4	5	6	7	8	7	8	9	10	11	12	13	4	5	6	7	8	9	10	2	3	4	5	6	7	8
9	10	11	12	13	14	15	14	15	16	17	18	19	20	11	12	13	14	15	16	17	9	10	11	12	13	14	15
16	17	18	19	20	21	22	21	22	23	24	25	26	27	18	19	20	21	22	23	24	16	17	18	19	20	21	22
23	24	25	26	27	28	29	28	29	30	31				25	26	27	28	29	30		23	24	25	26	27	28	29
30																					30	31

1 Find 3 November on this calendar.

a On which day of the week did this date fall in this year?

b What is the date one week later?

c What was the date 28 days earlier?

2 How many days are there from:

a 3 November to 11 December

b 2 February to 9 March

c 3 June to 15 July

d 1 May to the end of August?

3 Salma's birthday is on 25 January. Nurudin's birthday is on 25 November. How many months later is Nurudin's birthday.

4 Mika started art classes at the beginning of March. He had his first painting in the school exhibition at the end of October.

a For how many months did he attend classes before his first exhibition?

b Mika attended classes twice a week. How many classes did he attend altogether?

5 If the 10th of August falls on a Sunday, what day of the week will it be:

a 5 days later

b 28 days later

c on 31 August?

you can use Workbook page 10

You already know that each day is broken into smaller units of time called hours, minutes and seconds. These are the units we use when we tell the time on clocks and watches.

60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day (from midnight to the next midnight)

The digital clock shows a time of 9:15 in the morning. Times between midnight and 12 midday are a.m. times.

The analogue clock shows the same time, but this is a quarter past nine p.m. Times between midday and midnight are p.m. times.

You can write times using the 24-hour clock system. When you do this, you do not use a.m. and p.m. In the 24-hour clock system, times are written using four digits e.g. 06:25. The first two digits tell you the hour and the last two digits tell you minutes past the hour.

06:25 is 25 minutes past 6 in the morning.
18:25 is 25 minutes past 6 in the evening.

If the first two digits make a number greater than 12, then you have to subtract 12 to find the time after midday (p.m. time).
18 − 12 = 6 p.m.
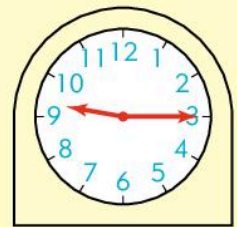
1 Write these a.m. and p.m. times using the 24-hour clock system.

| a | 3 p.m. | b | 9.30 a.m. | c | 5.30 p.m. |
| d | 3.05 a.m. | e | 10.15 p.m. | f | 12.45 a.m. |

2 Write a time that is 20 minutes later than each time in question 1.

3 Write a time that is 10 minutes earlier than each time in question 1.

4 Work with a partner.
a Talk about where 24-hour clock times are used.
Try to give three examples.
b What is the main advantage of using 24-hour clock time?

you can use Workbook page 11

More about 24-hour time

1 These digital clocks show 24-hour time. Rewrite each time using a.m. and p.m.

a `08:45` **b** `12:30` **c** `14:20` **d** `02:45`

e `23:20` **f** `16:35` **g** `19:10` **h** `21:15`
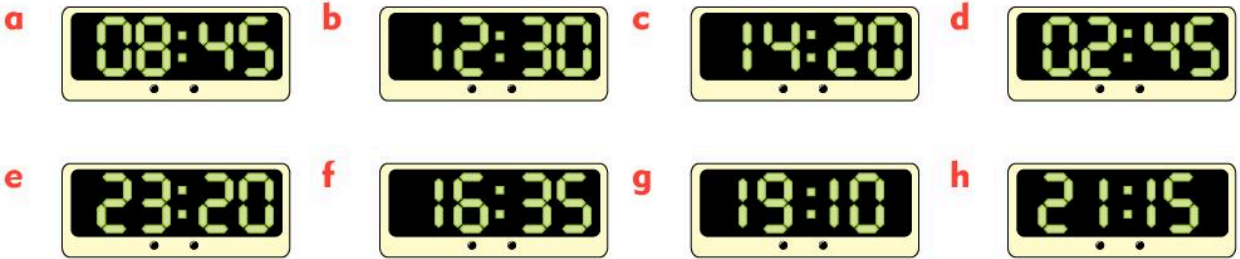
2 Write each of these times using the 24-hour clock system.

a 6.32 a.m.	**b** 3.45 p.m.	**c** 10.10 a.m.
d 8.15 a.m.	**e** 8.15 p.m.	**f** 11.40 a.m.
g 11.40 p.m.	**h** 12.00 a.m.	**i** 12.00 p.m.

3 How would each of these times appear on a 24-hour clock?

a half past four in the morning

b a quarter to five in the evening

c 10 past 6 at night

d 20 to 7 in the morning

4 Sanjay wants to programme his DVD player to record four different programmes. The programme times are given in a.m. and p.m. times, but the DVD player timer uses the 24-hour system. What timer settings should Sanjay use to record each of these programmes?

a 9.30 a.m. to 10.00 a.m.

b half past three to half past four in the afternoon

c from 6 to 7 o'clock at night

d 7.45 p.m. to 9 p.m.

5 Sanjay recorded all his programmes.

a How long was each programme? Give the answers in hours.

b How many hours of TV did he record altogether?

c How many minutes is this?

d Is this more or less than 15 000 seconds?

Different times in different places

Suresh lives in India. He wants to watch the Indian cricket team play a match in England. The match is played from 10 a.m. in the morning in England, but it only starts at 3 p.m. on Indian TV. His mother tells him this is because of the time difference between the two countries. She shows him this map to help him understand time differences:

Each line represents a time difference of 1 hour

10 am 11 am 12 pm 1 pm 2 pm 3 pm

England 10 am   5 hrs   India 3 pm

Hours behind England time
"Earlier than England"

Hours ahead of England time
"Later than England"
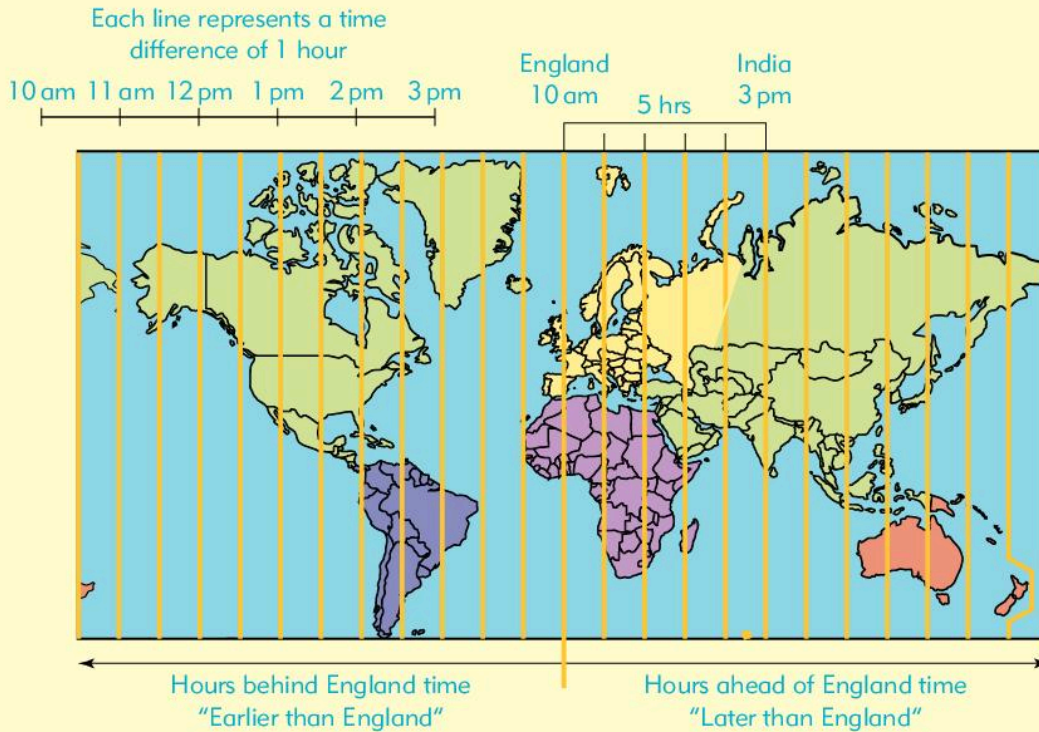
1 **London (in England) hosted the 2012 Olympic Games. If the opening ceremony took place at 5.15 p.m. in London, what time was it at the following places?**
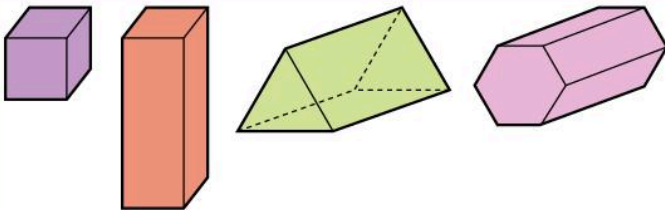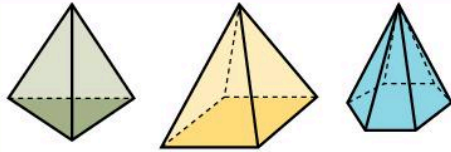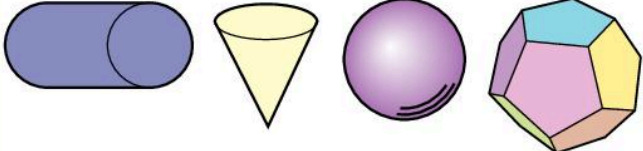
a Kingston, Jamaica (5 hrs behind)   b Colombo, Sri Lanka (5½ hrs ahead)

c Helsinki, Finland (2 hrs ahead)   d Havana, Cuba (5 hrs behind)

e Mexico City, Mexico (6 hrs behind) f Tokyo, Japan (9 hrs ahead)

g Canberra, Australia (10 hrs ahead) h Nairobi, Kenya (3 hrs ahead)

i Los Angeles, USA (8 hrs behind)   j Dacca, Bangladesh (6 hrs ahead)

2 **Tell your partner how you worked to solve these problems.**

Revising 3D shapes

There are three main types of 3D shape. You can see some examples of each type in the table.

Type of solid	Examples
Prisms – shapes with two identical parallel end faces. Prisms can be named using the shape of their end faces.	
Pyramids – shapes with triangular faces that meet at a vertex. The base of a pyramid can be any shape. Pyramids are named according to the shape of their base.	
Other solids – solids that are not prisms or pyramids; they may have one or more curved faces.	

When we talk about solid shapes we need to use the correct names for the parts of the shapes. Make sure you know the names of each part.
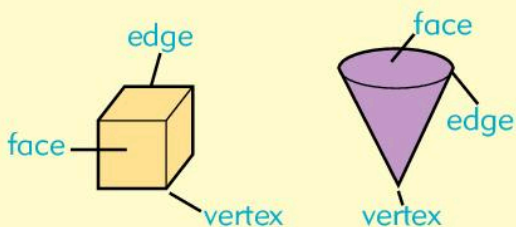
Face – a surface of the solid. In some solids the surface is curved

Edge – the boundary between faces

Vertex – a point where the faces meet

1 **Work in a small group. Walk around the classroom and find as many examples of solid shapes as you can in five minutes. Say the name of each shape when you find it.**

A **B** **C** **D**

E **F** **G** **H** **I**
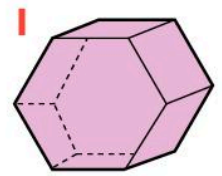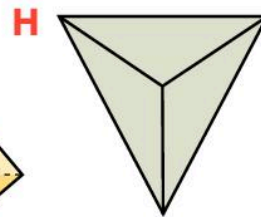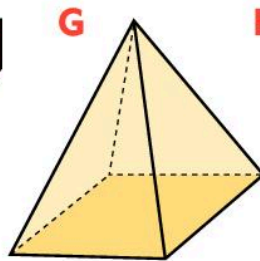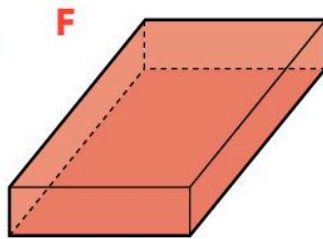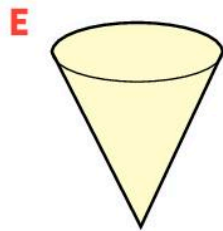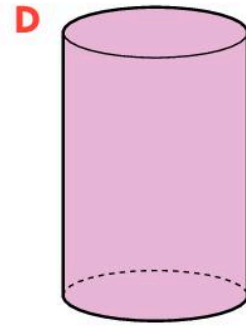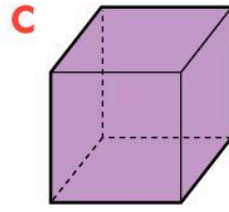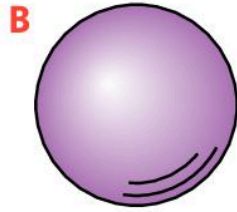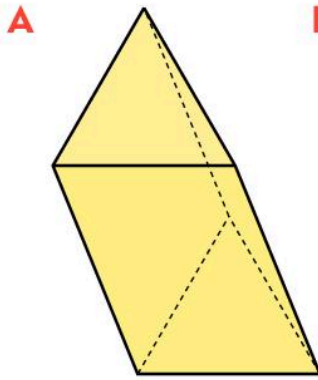
1 Write the letter of the shape that matches each name.

  a cube   **b** cuboid

  c sphere   **d** cylinder

2 Which of these shapes have only flat faces?

3 Which shapes have one or more curved surfaces?

4 Which shapes have at least one face that is a square?

5 Which shapes have no vertices?

6 Which shapes can roll?

7 Which shapes are prisms?

8 Which shapes are pyramids?

9 Which shapes are neither pyramids nor prisms?

3D shapes and their nets

You can make models of 3D shapes from flat shapes called **nets**. Here is the net of a cuboid.

The net of a 3D shape shows the faces of the shape and how these are joined to each other.

To make the shape, you have to fold the net along the edges of the faces and stick them together.
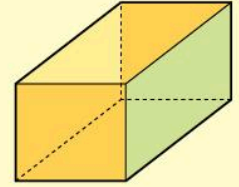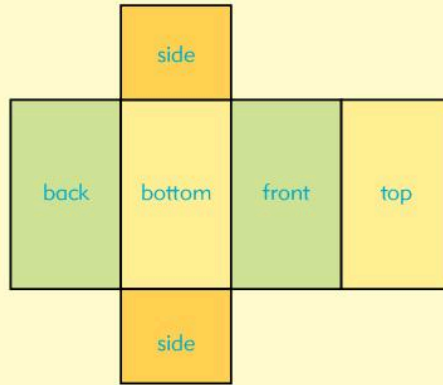
1 Write the name of each shape **a–f** in the left-hand column of a table.

2 Write the letter of the net **A–F** you could use to make each shape next to its name.

A teacher asked her class to cut open a cereal box and draw its net.

Sanjita and Trish drew these two different nets.
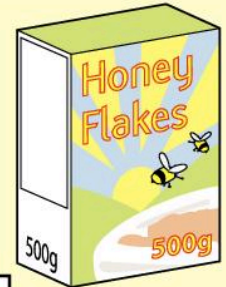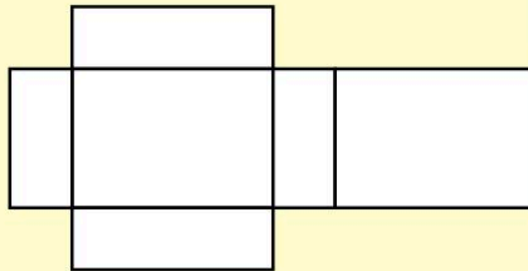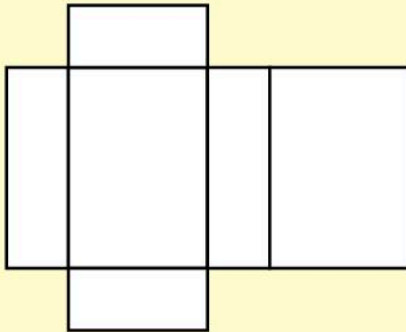
Both these nets are correct. If you cut them out and fold along the lines you will be able to make a model of the box.

Many solids have more than one possible net.

1 Draw two more possible nets for the cereal box. If you need to, find a real box and cut it open to help you.

2 A teacher asked her class to draw nets for a cube. These are the nets they drew. Nine of these are incorrect because they don't fold up to make a cube.

A   B   C   D

E   F   G   H

I   J   K   L

M   N   O   P

Q   R   S   T
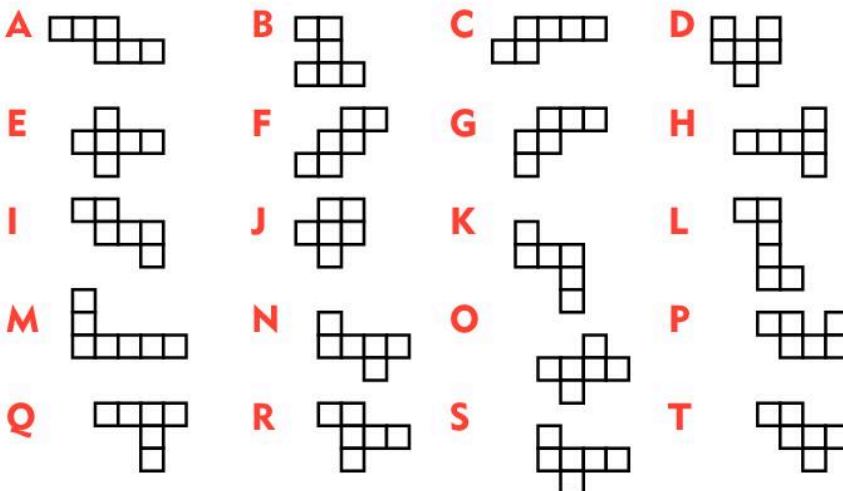
a Which of these nets will make a cube?

b Tell a partner why the other nets will not fold up to make a cube.

you can use Workbook page 14

19

Use the addition and subtraction facts that you know to do all the calculations on this page mentally.

Remember

$1 + 9 = 10$
$2 + 8 = 10$
$3 + 7 = 10$
$4 + 6 = 10$
$5 + 5 = 10$

Finding tens can help you add and subtract larger amounts mentally.

$16 + 4 = 30$ (with 10 and 10 making 10)

$47 + 53 = 100$
$40 + 50 + 10 = 100$

$8 + 26 + 2$ (8 + 2 = 10)
$10 + 26 = 36$

$100 - 47 = 53$
$100 - 40 = 60$
$\rightarrow 60 - 7 = 53$

1 Find the sum of:

a $16 + 4$ b $17 + 3$ c $11 + 9$
d $15 + 5$ e $12 + 8$ f $6 + 14$
g $21 + 9$ h $8 + 32$ i $19 + 11$

2 Add.

a $16 + 7 + 13 + 14$ b $15 + 17 + 3 + 5$ c $18 + 8 + 12 + 2$
d $27 + 2 + 38 + 3$ e $6 + 7 + 74 + 13$ f $1 + 17 + 39 + 33$

3 Which pairs of decimals make 1?

| 0.2 | 0.1 | 0.4 | 0.8 | 0.7 | 0.5 | 0.5 | 0.6 | 0.3 | 0.9 |

4 Find each missing number.

a $1 - 0.4 = \square$ b $1 - 0.7 = \square$ c $1 - 0.5 = \square$
d $1 - \square = 0.8$ e $1 - \square = 0.1$ f $1 - \square = 0.6$

5 Copy and complete.

$42 + 58 = \square$	$4.2 + \square = 10$	$0.42 + 0.58 = \square$
$39 + \square = 100$	$\square + 6.1 = 10$	$0.39 + \square = 1$
$73 + \square = 100$	$\square + 2.7 = 10$	$\square + 0.27 = 1$
$100 - 54 = \square$	$10 - 5.4 = \square$	$1 - 0.54 = \square$
$100 - 19 = \square$	$10 - 1.9 = \square$	$1 - \square = 0.81$

you can use Workbook page 15

Adding whole numbers

You already know how to add whole numbers. Read through the examples to remind you of some of the methods you can use to add 49 and 213.

Counting on using a number line.

$+40$ $+7$ $+2$

213   253 260 262

start with the larger number
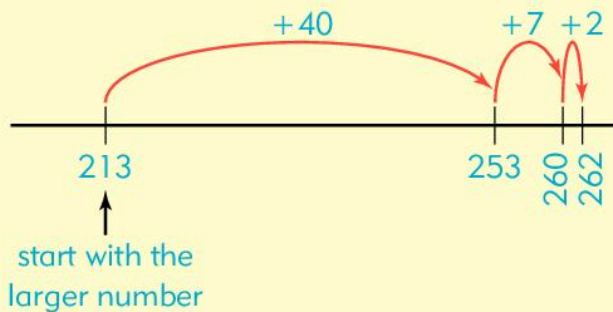
Using a number line, compensating as necessary.

$+50$

213   262 263

-1
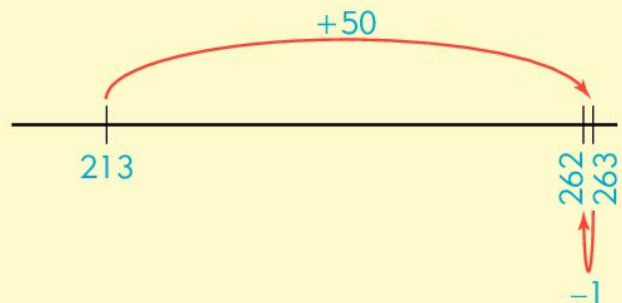
Using place value and number facts.
$49 + 213$
$= (40 + 9) + (210 + 3)$
$= (40 + 210) + (9 + 3)$
$= 250 + 12$
$= 262$

Compensation using multiples of 10.
$49 + 213$
$= (50 - 1) + 213$
$= (50 + 213) - 1$
$= 263 - 1$
$= 262$

Expanded addition.
$49 + 213$
$= (40 + 9) + (200 + 10 + 3)$
$= 200 + (40 + 10) + (9 + 3)$
$= 200 + 50 + 12$
$= 262$

Vertical format stage 1: column addition adding the most significant digit first.

```
  2  1  3
     4  9  +
  2  0  0
     5  0   (10 + 40)
     1  2   (3 + 9)
  2  6  2
```

Vertical format stage 2: column addition adding the least significant digit first.

```
  2  1  3
     4  9  +
     1  2   (3 + 9)
     5  0   (10 + 40)
  2  0  0
  2  6  2
```

Vertical format stage 3: compact format with 'carry figures' below the answer line.

```
  2  1  3
     4  9  +
  2  6  2
      1
```

Always look at the numbers you have to add. This will help you choose the most appropriate method.

1 **Add using the method you find easiest.**

a 743 + 26   b 254 + 317   c 408 + 97
d 994 + 586   e 909 + 211   f 3006 + 579

you can use Workbook page 16

More addition

Before you add it is useful to estimate what the answer will be before you do the calculation. You can use rounding to do this.

What is 256 + 320?

Estimate by rounding each number to the nearest 100 (300 + 300 = 600).

Then add and check that your answer is close to your estimate.

1 **Estimate and then add.**

a 143 + 52	**b** 242 + 143	**c** 615 + 270
d 830 + 236	**e** 44 + 950	**f** 67 + 119
g 4009 + 86	**h** 3089 + 732	**i** 423 + 9865

2 **Copy these calculations and work out the totals.**
Remember to estimate before you add.

a 123 + 2312	**b** 2345 + 129	**c** 3123 + 1985
d 2009 + 2366	**e** 1234 + 3456 + 567	**f** 1987 + 3423 + 6543

3 **Calculate the answers to these questions.**

a What is the sum of 1234 and 3256?

b What is the sum of 1924 and 435?

c What is total distance travelled if you fly 1765 km on one day and 2456 km on another?

d What is 1456 plus 5067 plus 1209?

4 **Crowd attendance at three soccer matches was 9034, 7654 and 8976. What was the total attendance?**

5 **A postman delivers 418 letters in one suburb, 1607 in another and 988 in a third suburb. How many does he deliver altogether?**

6 **Jamielah has accidentally rubbed out some of the numbers in her workbook. Copy the problems and find the missing numbers.**

a	**b**	**c**
384	32▮	257
+ 1▮3	+4▮2	+▮▮▮
50▮	▮86	539

Subtracting whole numbers

When you subtract you take one number away from another number. Subtraction is the opposite, or **inverse**, of addition.

The order of the numbers matters in subtraction: $9 - 3 \neq 3 - 9$

When you subtract you should also estimate what the answer will be before you do the calculation. You can do this by rounding numbers.

> What is $681 - 234$?
> Estimate by rounding each number to the nearest 100 ($700 - 200 = 500$).
> Then subtract and check that your answer is close to 500
>
> As with addition, you can use different methods for subtraction. Here are two methods you could use:
>
> Using expanded notation
>
> $$\begin{array}{rrr} 600 & + \ 70 & + \ 11 \\ 200 & \ \ 30 & \ \ \ 4 \ - \\ \hline 400 & + \ 40 & + \ \ 7 \end{array}$$
>
> Using compact notation
>
> $$\begin{array}{rrr} 6 & {}^{7}\cancel{8} & {}^{1}\cancel{1} \\ 2 & 3 & 4 \ - \\ \hline 4 & 4 & 7 \end{array}$$

In some questions you may be asked to find the difference between two whole numbers. When this happens you subtract the smaller number from the larger number.

✏️ **1** **Estimate. Then subtract.**

a $884 - 213$	**b** $486 - 55$	**c** $516 - 295$
d $621 - 435$	**e** $569 - 204$	**f** $6777 - 150$
g $8250 - 97$	**h** $400 - 194$	**i** $567 - 345$

2 **Find the difference between 1345 and 9876.**

3 **Take 345 away from 2000.**

4 **What is the difference between 1345 and 876?**

❓ 5 **Sandile's younger brother has smeared paint on his work. Copy the subtractions and work out the missing numbers.**

a
$$\begin{array}{r} 384 \\ - \ \blacktriangle\blacktriangle 3 \\ \hline 241 \end{array}$$

b
$$\begin{array}{r} 835 \\ - \ \blacktriangle\blacktriangle\blacktriangle \\ \hline 411 \end{array}$$

c
$$\begin{array}{r} 687 \\ - \ \blacktriangle\blacktriangle\blacktriangle \\ \hline 299 \end{array}$$

you can use Workbook page 17

Subtraction is the inverse of addition.
You can use addition to check that a subtraction is correct.

$$456 - 215 = 241$$
$$215 + 241 = 456 ✓$$

1 **Subtract. Check your answer by doing the inverse operation.**

a $653 - 278$ b $853 - 369$ c $2000 - 1876$

d $1415 - 365$ e $1352 - 1345$ f $5876 - 2199$

g $20\,101 - 5876$ h $12\,987 - 7653$ i $20\,804 - 17\,450$

2 **What is the difference between 910 and 345?**

3 **The boxes on the shelf each contained 5000 small spare parts for computers. Sammy did a stock take and counted the number of spare parts left in each box. He wrote the number on the front of each box.**
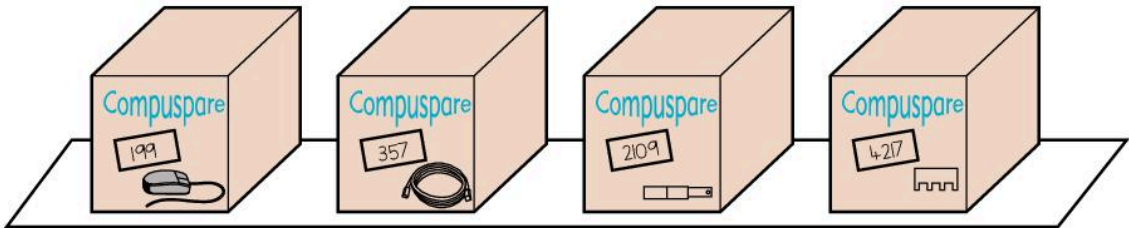
a Altogether, how many spare parts were there to start with?

b Work out how many spare parts have been sold from each box.

c Calculate how many spare parts have been sold in total.

4 **Sammy sold 689 spare parts in June and 908 spare parts in July.**

a How many spare parts did he sell altogether?

b How many more parts did he sell in July?

5 **Parvati finds the difference between two numbers. Her answer is a number between 80 and 85. Which two numbers could she have used?**

you can use Workbook page 18

'Multiplication' means *times*.

4×8 means '4 times 8'. This is the same as: $4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 32$

You can multiply numbers in any order: $4 \times 8 = 8 \times 4$

When you multiply two numbers you get a **multiple**.

$4 \times 8 = 32$, so 32 is a multiple of 4 and a multiple of 8.

We can also say that 32 is the product of 4 and 8. **Product** is another word for the answer to a multiplication.

You will need:
- a ruler
- coloured pencils.

1 **Make a multiplication grid for the 2 to 10 times tables. Start like this:**

Step 1:
Draw a 10×10 grid of squares
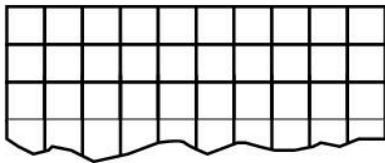
Step 2:
Label each row and column
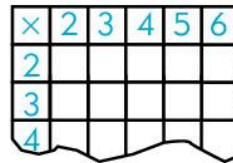
Step 3:
Fill in the answers!

2 **List:**

a the first ten multiples of 3

b multiples of 4 up to 50

c the multiples of 6 that are less than 40

d the first eight multiples of 9.

3 **Find five mistakes in this multiplication table.**

×	3	5	7	9
2	5	10	14	18
4	12	9	28	36
6	18	35	42	54
8	24	40	56	72
10	30	40	77	90

4 **Here are four different symbols:** ♡ ✤ ✳ ◉

Here are four multiplications using these symbols.

| ♡ × ✤ = 8 | ✤ × ✳ = 24 | ✤ × ◉ = 12 | ◉ × ♡ = ✳ |

Work out the value in numbers of each symbol.

Further multiplication facts

You can use the 2× to 10× table facts that you already know to work out multiplication facts for higher times tables.

Look at these multiplications.

10 × 1 = 10	8 × 1 = 8	18 × 1 = 18
10 × 2 = 20	8 × 2 = 16	18 × 2 = 36
10 × 3 = 30	8 × 3 = 24	18 × 3 = 54
10 × 4 = 40	8 × 4 = 32	18 × 4 = 72

Can you see how to use the 10× and 8× times tables to work out the answers for the 18× table?

You can use the times table grid you made (on page 25) to find the multiplication facts for bigger numbers. Look at these examples to see how to do this.

$2 \times 3 = 6$
$10 \times 3 = 30$
So, $12 \times 3 = 6 + 30 = 36$

$5 \times 7 = 35$
$10 \times 7 = 70$
So, $15 \times 7 = 35 + 70 = 105$

×	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

1 Find these products using your times tables grid.

a   13 × 3   13 × 4   13 × 5   13 × 6
b   14 × 4   14 × 5   14 × 6   14 × 7
c   15 × 6   15 × 7   15 × 8   15 × 9
d   16 × 3   16 × 5   16 × 7   16 × 9
e   17 × 4   17 × 6   17 × 8   17 × 10

2 Make up a test with 10 questions to test multiplication facts for the 11× to 19× tables. Exchange tests with a partner. Complete your partner's test as quickly and accurately as you can. Check each other's answers using a calculator.

you can use Workbook page 20

Multiplying by 10, 100 and 1000

Each place on the place value table is 10× the value of the place to the right of it. This means that you can use a place value table to find quick methods of multiplying by 10, 100 or 1000.

T th	Th	H	T	U
			4	7
		4	7	0
	4	7	0	0
4	7	0	0	0

47 × 10 – move the digits one place left, fill in one zero as a place holder

47 × 100 – move the digits two places left, fill in two zeros as place holders

47 × 1000 – move the digits three places left, fill in three zeros as place holders

To divide a number by 10, you move the digits one place to the right on the place value table. Your answer might be a decimal fraction.

$83 ÷ 10 = 8.3$

Tens	Units	·	Tenths (1/10)
8	3		
	8	·	3

Move the digits one place to the right. Remember to write the decimal point in your answer

1 Try to do these in your head. Write the answers only.

a 9 × 10	**b** 12 × 10	**c** 18 ÷ 10
d 23 × 10	**e** 39 × 10	**f** 48 ÷ 10
g 123 × 10	**h** 456 × 10	**i** 987 ÷ 10
j 1234 × 10	**k** 3456 × 10	**l** 6770 ÷ 10

2 Try to do these in your head. Write the answers only.

a 9 × 100	**b** 12 × 100	**c** 18 ÷ 100
d 23 × 100	**e** 39 × 100	**f** 48 ÷ 100
g 123 × 100	**h** 456 × 100	**i** 987 ÷ 100
j 1234 × 100	**k** 3456 × 100	**l** 6770 ÷ 100

3 Try to do these in your head. Write the answers only.

a 9 × 1000	**b** 12 × 1000	**c** 18 × 1000
d 23 × 1000	**e** 39 × 1000	**f** 48 × 1000
g 123 × 1000	**h** 456 ×1000	**i** 987 × 1000
j 1234 ÷ 1000	**k** 3456 ÷ 1000	**l** 6770 ÷ 1000

you can use Workbook page 21

You already know how to multiply whole numbers.
Do you remember how to use these methods to multiply 346 by 9?

By partitioning numbers

$= (300 + 40 + 6) \times 9$
$= (300 \times 9) + (40 \times 9) + (6 \times 9)$
$= 2700 + 360 + 54$
$= 3114$

Grid method

×	9
300	2700
40	360
6	54
	3114

Vertical method showing the expanded layout

300 + 40 + 6	
× 9	
2700	300 × 9
360	40 × 9
54	6 × 9
3114	

Vertical method showing the most significant digit first

346
× 9
2700
360
54
3114

Vertical method showing the least significant digit first

346
× 9
54
360
2700
3114

Compact vertical method

```
    3  4  6
          9  ×
  3  1  1  4
     4  5
```

1 **Multiply. Use the method that is easiest for you.**

a 79×6 b 28×4 c 36×7 d 97×5
e 56×9 f 43×8 g 6×87 h 5×98

2 **Estimate. Then multiply.**

a 124×8 b 432×9 c 199×8 d 487×6
e 133×6 f 877×3 g 986×4 h 8×409
i 1234×6 j 9117×3 k 8762×5 l 9045×2

Multiplication methods can be extended to larger numbers, for example to find the product of 56 and 27

×	20	7	
50	1000	350	1350
6	120	42	162
	1120	392	1512

$$50 + 6$$
$$\times\ 20 + 7$$

1000	50×20
120	6×20
350	50×7
42	6×7
1512	

$$56$$
$$\times\ 27$$

1120	56×20
392	56×7
1512	

Always look at the numbers you have to multiply. This will help you choose the most appropriate method.

1 Multiply. Use the method that is easiest for you.

a 23×45 **b** 38×79 **c** 65×32 **d** 74×19

e 92×39 **f** 18×83 **g** 58×29 **h** 52×34

2 An exercise book has 112 pages. How many pages will there be in 54 exercise books?

3 A shop sells 45 newspapers every week. How many will it sell in 18 weeks?

4 Peter has 98 stickers in his collection. Jasper has 13 times as many.

a How many stickers does Jasper have?

b How many stickers do they have together?

Division can be modelled as repeated subtraction by counting jumps on a number line. For example, 'how many fours make 24?' can be worked out either by counting on or back 6 jumps of 4.
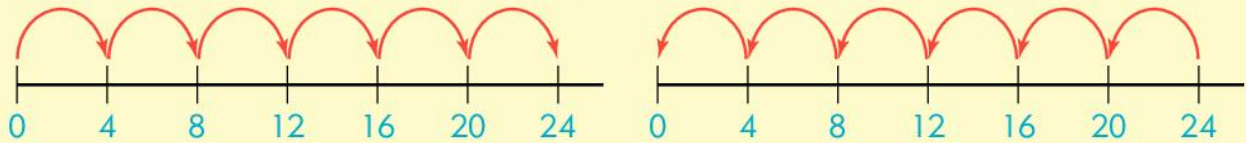
Some division calculations have a remainder, for example
$13 \div 4 = 3$ remainder 1.

The order of the numbers matters in division: $24 \div 4 \neq 4 \div 24$

Division is the inverse of multiplication. You can check the answer to a division by multiplying.

$144 \div 12 = 12$ .... Check $12 \times 12 = 144$

You already know how to divide whole numbers. Read through the examples to remind you of some of the methods you can use to divide 196 by 6.

Repeated subtraction

$$6\overline{)196}$$

$$\begin{array}{ll} -60 & 6 \times 10 \\ \hline 136 & \\ -60 & 6 \times 10 \\ \hline -76 & \\ -60 & 6 \times 10 \\ \hline 16 & \\ -12 & 6 \times \dfrac{2}{32} \\ \hline 4 & \end{array}$$

Answer 32 r 4

Moving towards a compact method

$$6\overline{)196}$$

$$\begin{array}{ll} -180 & 6 \times 30 \\ \hline 16 & \\ -12 & 6 \times \dfrac{2}{32} \\ \hline 4 & \end{array}$$

Answer 32 r 4

Using a compact method

$$6\overline{)1\,9\,{}^16}\quad \begin{array}{l} 3\;2\;\;r\,4 \end{array}$$

✏️ **1** Do these divisions. Check your answers by multiplying.

  a $576 \div 4$ **b** $655 \div 5$ **c** $732 \div 3$ **d** $889 \div 7$

  e $440 \div 8$ **f** $360 \div 3$ **g** $847 \div 7$ **h** $528 \div 6$

2 Divide and write the remainder with the answer.

  a $849 \div 7$ **b** $574 \div 9$ **c** $717 \div 4$ **d** $558 \div 8$

❓❓ **3** I used 1715 ml of water to fill 7 identical containers. How much did I pour into each container?

you can use Workbook pages 22 and 23

Multiplication and division problems

Steps to solve a problem

- Read the problem carefully.
- Decide which operation you need.
- Estimate the answer.
- Do the calculation.
- Write an answer.
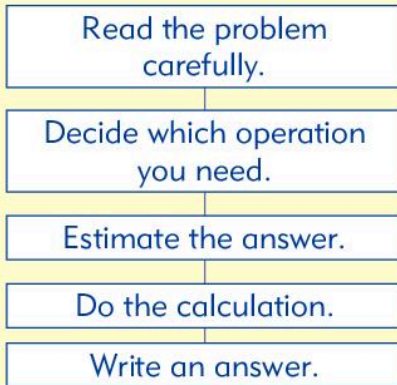
Clue words to help you decide whether to multiply or divide

Write the answer.

Multiplication
- Product of
- Double
- Twice as many
- How many times bigger/ longer/taller
- How many altogether

Division
- Half
- Share equally/evenly
- How many will each get?
- Halve
- Equal groups/pieces
- Cut/split/each/every/per

1 Mrs Jones packed 80 cakes into boxes of 5. How many boxes did she need?

2 Sandile is paid $23 per week for babysitting his cousin. How much will he receive in 12 weeks?

3 Josh has 98 marbles. Peter has twice as many.
  a How many marbles does Peter have?
  b Ned has half as many as Peter and Josh. How many does he have?

4 150 chairs are arranged into 10 equal rows. How many chairs are in each row?

5 Mrs September wants to give 46 students 25 counters each. How many counters will she need altogether?

6 Nadia earns $588 per week. How much is this per day?

7 Jenny works out that it costs her $13 per week to feed her pets. How much will it cost her for:
  a four weeks?   b ten weeks?   c one year?

8 Pete wants to cut an 85 cm long piece of wire into 9 cm lengths.
  a How many 9 cm long pieces can he make?
  b How much wire will be left over?

9 A class is raising money for charity. This month they raised three times as much money as they did last month. Last month, they raised $34.00. How much money did they raise this month?

You can work out in advance whether a division sum will have a remainder if you know the rules of divisibility. Try to remember these rules.

Dividing by …	Rule	Example
2	All even numbers can be divided by 2. We can divide 2 exactly into any number that ends in 0, 2, 4, 6 or 8.	Is 43 divisible by 2? No, it has a 3 in the last digit.
4	If the last two digits of a number can be divided by 4, then 4 will divide exactly into that number.	Is 148 divisible by 4? $48 \div 4 = 12$, so 148 can be divided by 4.
8	If the last three digits of a number can be divided by 8, then 8 will divide exactly into the number.	Is 2148 divisible by 8? $148 \div 8 = 18$ r. 4 2148 is not divisible by 8.
5	If a number ends in 5 or 0 it can be divided exactly by 5.	Is 234 565 divisible by 5? Yes, it ends in 5.
10	Any number that ends in 0 can be divided exactly by 10.	Is 450 divisible by 10? Yes, it ends in 0.
25	Any number that ends in 00, 25, 50 or 75 can be divided by 25.	Is 330 divisible by 25? No, the number doesn't end with 00, 25, 50 or 75.
100	Any number that ends with 00 can be divided exactly by 100.	Is 450 divisible by 100? No, it has only one 0 at the end. It needs two to be divisible.

1 **Copy the table. Decide whether the numbers are divisible by 2, 4, 5, 10 or 25. Tick if the number is divisible, put a cross if it not. The first row has been done as an example.**

Number	2	4	5	10	25
40	✓	✓	✓	✓	✗
125					
93					
96					
300					
208					
225					
250					
510					

Using the divisibility rules

1 **Work with a partner.**

a Without doing any division, decide which of these numbers are exactly divisible by 2.

23	19	46	64	88	90	95	124
136	128	139	456	763	909	1234	
1435	1546	4654	9800	8754	9341		

b Now decide which of the numbers is exactly divisible by 4.

2 **Look at these numbers.**

8514	3640	7665	8765	5555	1245
2468	3740	54 000	63 000		

a Which numbers can be divided by 2 with no remainder?

b Will 4 divide exactly into any of these numbers? Which ones?

c Which numbers are not exactly divisible by 5?

d Which numbers can be divided by 10 with no remainder?

3 **Here is another set of numbers.**

6142   8400   9360   5730   7845   8000   6612   2709

a Which numbers are divisible by 4?

b Which numbers are divisible by 25?

c Which numbers can be divided by both 5 and 10 with no remainder?

d Which numbers can be divided by both 4 and 100?

e Which numbers are not exactly divisible by 100?

4 **Here are five number cards:** 0 5 4 8 1

Use the number cards to make:

a four numbers that can be divided exactly by 5

b four numbers that can be divided exactly by 10

c four numbers that are divisible by 4

d four numbers that are divisible by 2

e two numbers that are divisible by 25.

you can use Workbook page 24

Units of measurement

Most countries today use the **metric system** of measurement. The metric system has base units of length (the metre), mass (the gram) and capacity (the litre).

Other units are smaller or larger than the base units. For example:

Centimetres are $\frac{1}{100}$ th of a metre.

Millilitres are $\frac{1}{1000}$ th of a litre.

Kilograms are 1000 times larger than a gram.

The table shows the units you will use most often when you measure length, mass and capacity.

	Smaller units	Base unit	Larger units
Length	centimetre (cm) millimetre (mm)	metre (m)	kilometre (km)
Mass	milligrams (mg)	gram (g)	kilogram (kg)
Capacity	centilitres (cl) millilitres (ml)	litre (l)	kilolitre (kl)

Make sure you know the names of the units and the abbreviation for each unit.

1 **For each of these, say whether you are measuring length, mass or capacity and say which unit you would use.**

   a   The height of a skyscraper building.
   b   The length of the Nile River in Africa.
   c   The amount of water you need to fill a bucket.
   d   How heavy a tray of peaches is.
   e   The distance from your home to your school.
   f   The width of a soccer field.
   g   The mass of a sack of potatoes.
   h   How much milk you need to bake a cake.
   i   The thickness of your maths book.
   j   The depth of a dam.

Choosing units

1 **Which unit (mm, cm, m or km) would you use to measure:**

a the width of a matchstick? b the thickness of a computer screen?

c the height of a tree? d the length of a bus?

2 **Choose the correct measurement from those in brackets.**

a A big room is about (8 cm/8 m/8 km) long.

b A new baby weighs about (3 g/3 kg/3 mg).

c The water in the deep end of a swimming pool is about (4 m/4 kg/4 kl) deep.

d A packet of breakfast cereal weighs about (300 mg/300 g/300 kg).

e A tea cup holds about (250 ml/250 l/250 grams) of liquid.

3 **Which units of mass would you use to measure these things?**

a

b

c

d

e

f
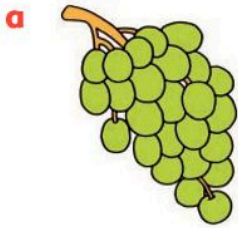
4 **Work with a partner. Look at the items in the pictures above.**

a What measuring instruments would you use to measure the mass of each item?

b What problems might you have measuring the mass of a yacht or a truck? Why?

you can use Workbook page 25

Changing from one unit to another

The metric system uses decimal numbers. This means that you can convert measurements from one unit to another by dividing or multiplying by powers of 10.

- Changing from a larger unit to a smaller unit will result in a greater amount of units, so you have to multiply by 10, 100 or 1000.
- Changing from a smaller unit to a larger unit will result in a smaller amount of units, so you have to divide by 10, 100 or 1000.

This diagram will help you convert between metric units.

Here are two examples to show you how to work.

$\div$ to change to a larger unit

$\div 10$ $\div 100$ $\div 1000$

mm	cm	m	km
mg	cg	g	kg
ml	cl	l	kl

$\times 10$ $\times 100$ $\times 1000$

$\times$ to change to a smaller unit
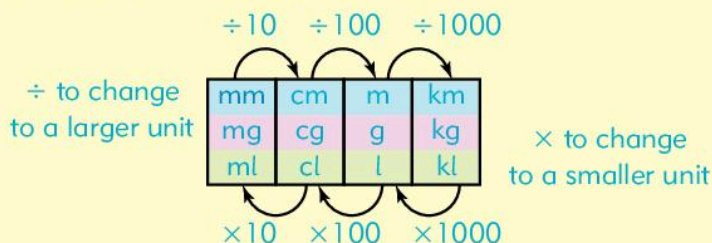
Change 5 kg to grams. 5 kg = 5 × 1000 g 5 kg = 5000 g	You are changing to a smaller unit, so × There are 1000 g in a kilogram, so × by 1000.
Change 87 cm to metres. 87 cm = 87 ÷ 100 m 87 cm = 0.87 m	You are changing to a larger unit so ÷ There are 100 cm in a metre so ÷ by 100.

1 Write each of these millimetre measurements in centimetres.
  - **a** 10 mm
  - **b** 37 mm
  - **c** 145 mm
  - **d** 3245 mm

2 Write each of these kilogram measurements in grams.
  - **a** 1 kg
  - **b** 29 kg
  - **c** 480 kg
  - **d** 138.5 kg

3 How many litres are there in:
  - **a** 1000 ml
  - **b** 5000 ml
  - **c** 12 500 ml
  - **d** 500 ml?

4 A small juice carton holds 250 ml. How much juice would there be in 8 small cartons? Give your answer in litres.

5 9 kg of fruit was shared equally between 20 families. How many grams of fruit did each family receive?

6 24 children each ran 300 metres in a charity race. How many kilometres did the children cover altogether?

you can use Workbook page 26

Working with units of length

You have already seen that you can change measurements from one unit to another. We can read and write lengths in different units and in different ways depending on how we need to use them.

Read the measurements. Write each one in three different ways.

cm	1	2	3	4	5	6	7	8	9	10	11	12
mm	10	20	30	40	50	60	70	80	90	100	110	120

3 cm and 9 mm = 39 mm = 3.9 cm
10 cm and 2 mm = 102 mm = 10.2 cm

Show a partner where these measurements would be on the ruler.

a 4 cm and 7 mm   **b** 12.1 cm   **c** 72.5 mm

What measurements are shown on this section of a builder's tape measure?

200	201	202	203	204	205	206	207
2000	2010	2020	2030	2040	2050	2060	2070

The arrow at 201 means 201 cm.
This is 2 m and 1 cm = 2.01 m = 2010 mm.

The arrow between 206 and 207 is on the 4 mm mark.
It shows 206 cm and 0.4 cm.
This is 2 m and 6 cm and 4 mm = 2 m and 6.4 cm = 2.064 m

1 This is a section of a measuring tape marked in centimetres.
Write each measurement shown in centimetres, millimetres and metres.

a)↓   b)↓   c)↓   d)↓ e)↓
109 110 111 112 113 114 115 116 117 118 119 **120** 121
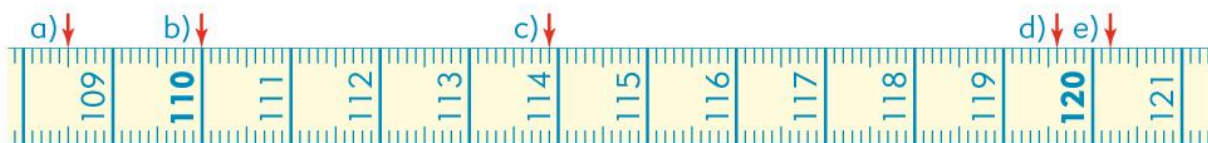
2 Show a partner where these measurements would be on the measuring tape.

a 1100 mm   **b** 1.15 m   **c** 119.5 cm   **d** 1.125 m

e 1.5 cm less than 111 cm   **f** 29 mm less than 120 cm

g 25 mm more than 1.17 m   **h** 0.09 m more than 109.5 cm

Working with kilometres

Kilometres are used when you measure longer distances or lengths.

1 km = 1000 m

1 Convert these metre distances to kilometres.

a 2000 m   **b** 5000 m   **c** 6500 m   **d** 12 000 m

2 This table shows the distances in kilometres between six places (A to F). To read the table you have to read across from one place and down from the other.

					A
				B	535
			C	998	463
		D	779	216	316
	E	195	811	384	348
F	806	881	1660	667	1225

Use the table to find the distances between these places.

a A to C   **b** A to D   **c** B to D   **d** D to F

e A to F   **f** E to A   **g** F to B   **h** C to E

3 Write the distance from A to C in metres.

4 Here is a different table. It shows the distance from Town X to five other places in kilometres.

Place	M	N	O	P	Q
Distance from Town X	170	190	200	235	300

Use the information in the table to work out the distances between these places.

a Q and M   **b** P and N   **c** M and P   **d** N and Q

5 If a car travels at a speed of 50 km/h, how long will it take to travel from Town X to Q?

More converting units

Remember you can express measurements in different ways.

$1.575\,m = 1\,m$ and $57.5\,cm = 100\,cm + 57.5\,cm = 157.5\,cm = 1575\,mm$

$1.456\,l = 1$ litre and $456\,ml = 1000\,ml + 456\,ml = 1456\,ml$

1 Nick measured the length of various pieces of wood in metres. Copy the table and fill in the measurements in metres and centimetres, centimetres only and millimetres only.

Nick's measurement	Metres and centimetres	Centimetres only	Millimetres only
15 m			
12.6 m			
23.8 m			
13.45 m			
20.89 m			
17.09 m			
12.245 m			
30.075 m			

2 How many grams in:

a $1.9\,kg$ **b** $3\frac{1}{2}\,kg$ **c** $12\frac{3}{4}\,kg$ **d** $9.05\,kg$

3 How many ml in:

a $12.25\,l$ **b** $5\frac{1}{2}\,l$ **c** $12\frac{1}{4}\,l$ **d** $100.065\,l$

How many different ways can you find to make a total of 1 metre using one measurement from each box? Try to find at least five ways.

0.2 m		35 cm		500 mm
12 cm		0.5 m		0.3 m
0.25 m	+	0.25 m	+	53 cm
300 mm		30 cm		0.5 m
50 cm		200 mm		200 mm

Other measuring systems

Today almost all of the countries in the world have adopted the metric system of measurement. However, some countries use an older system called the Imperial system and many people still give measurements in these older units. The table shows some units that you may have heard of and their equivalents in metric units.

Inch	1 inch is approximately 2.2 cm.
Foot (plural feet)	There are 12 inches in 1 foot, which is approximately 30 cm 3 feet is about 1 metre.
Mile	1 mile is approximately 1.6 km.
Pint	1 pint is 0.57 litres. There are just over 2 pints in one litre.
Gallon	1 gallon is approximately 4.5 litres.

1 **How far is each of these distances in kilometres?**

  a 10 miles   **b** 100 miles   **c** 41 miles

2 **Say which measurement is greater in each pair.**

  a 3 ft 8 in or 1.6 m   **b** 2 m or 6 and $\frac{1}{4}$ foot   **c** 2 ft or 560 mm

  d 89.2 cm or 4 feet   **e** 4 gallons or 20 l   **f** 450 litres or 10 gallons

  g 4 litres or 4 pints   **h** 90 pints or 45 litres

3 **Approximately how many 1 pint bottles could you fill using each of these amounts?**

a 1 l   **b** 1.5 l   **c** 10 l   **d** 2.5 l   **e** 2 l   **f** 1.25 l   **g** 2.25 l   **h** 3.5 l
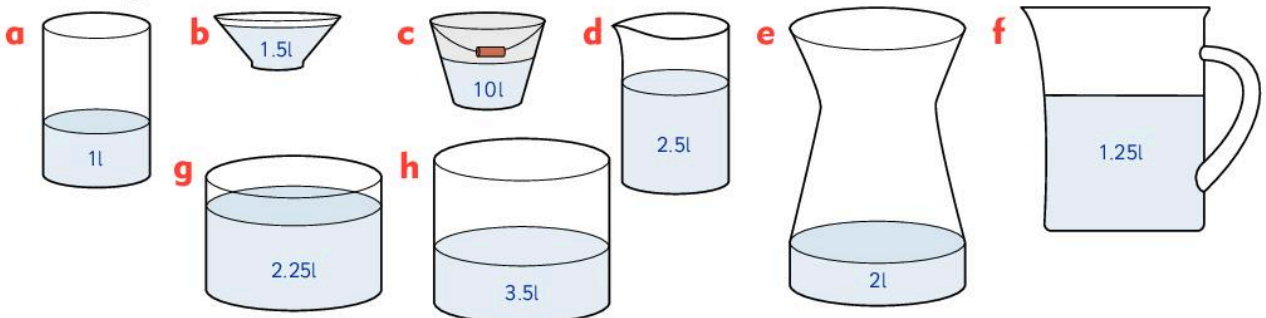
4 **Approximately how many gallons would you have if you combined all the amounts in the containers above?**

5 **What other non-metric measurements do people in your community use? Tell your group about the measurements and estimate their equivalents in the metric system.**

Revising fractions

These rectangles have been divided into equal parts.

Some of the parts have been shaded.

The bottom number in a fraction is called the **denominator**. The denominator tells you how many equal parts the whole is divided into.

The top number in each fraction is called the **numerator**. The numerator tells you how many parts of the whole you are working with.
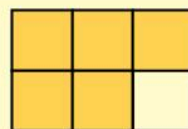
$\frac{5}{6}$ of this rectangle is shaded.
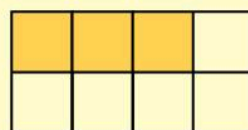
$\frac{3}{8}$ of this rectangle is shaded.
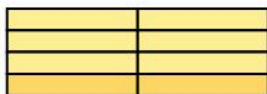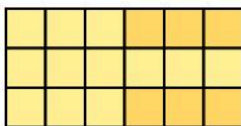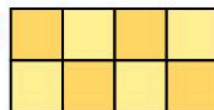
1 A   B   C   D
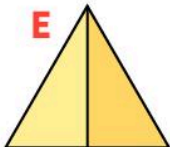
E   F   G   H
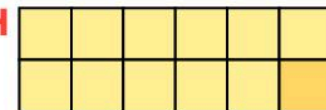
Write the letters A–H in your book.

a Next to each letter, write the fraction of the shape that has been shaded yellow.

b What fraction of each shape is shaded orange?

2 **Make a table to show the fraction of each group that is:**

a shaded blue   **b** shaded pink.

A   B   C

D   E   F
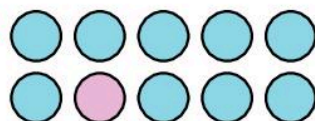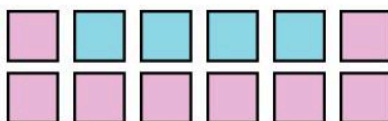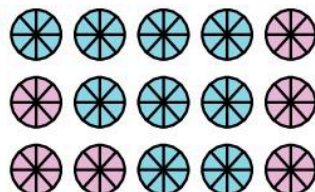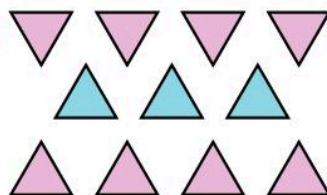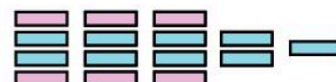
Mixed numbers and improper fractions

What fraction of these three shapes is shaded green?
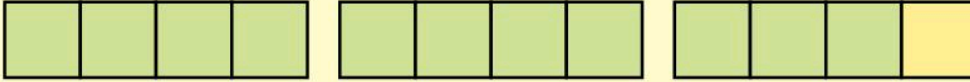
We can see that 2 whole shapes and $\frac{3}{4}$ of a shape have been shaded green. We write this as $2\frac{3}{4}$.

$2\frac{3}{4}$ is a **mixed number**. A mixed number has a whole number and a proper fraction.

Each shape is divided into quarters, so we can say that $\frac{11}{4}$ have been shaded.

$\frac{11}{4}$ is an **improper fraction**. An improper fraction has a numerator which is bigger than the denominator.

1 Write the green shaded portion of each set of shapes as a mixed number and its equivalent improper fraction. The first one has been done for you as an example.

a

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

b

c

d

e

f
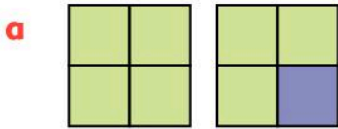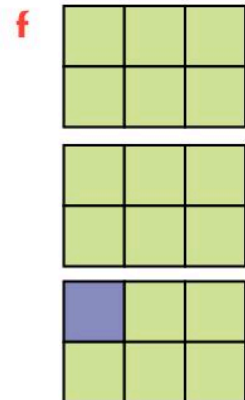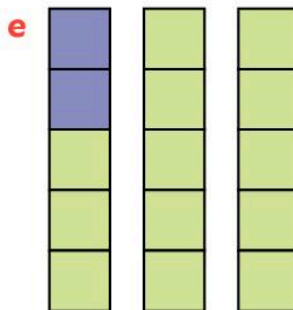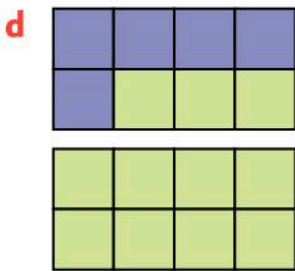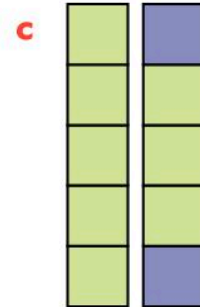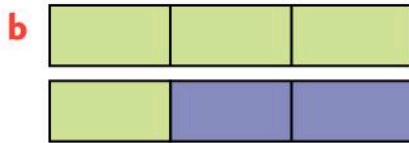
2 Work with a partner. Use Unifix cubes or draw diagrams to model these improper fractions and mixed numbers.

a $\frac{6}{5}$ b $\frac{12}{5}$ c $3\frac{2}{5}$ d $2\frac{1}{5}$

e $\frac{7}{3}$ f $3\frac{4}{5}$ g $\frac{11}{4}$ h $\frac{8}{3}$

Sometimes you need to write mixed numbers as improper fractions.
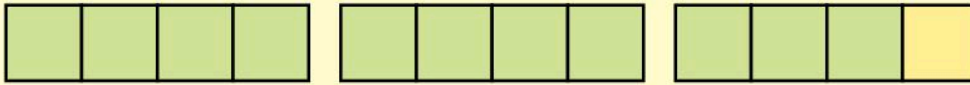
$2\frac{3}{4}$ is the same as 2 wholes $+ \frac{3}{4}$

A whole is equal to $\frac{4}{4}$

So, $2\frac{3}{4} = \frac{4}{4} + \frac{4}{4} + \frac{3}{4} = \frac{11}{4}$

Improper fractions can also be written as mixed numbers.

You can work this out by dividing.

$\frac{11}{4} = 11 \div 4 = 2 \text{ r}3 = 2\frac{3}{4}$

The whole number is the whole number part of the mixed number. The remainder is the number of parts in the proper fraction.

If there is no remainder, the improper fraction is written as a whole number. For example, $\frac{20}{5} = 20 \div 5 = 4$

1 **Change these mixed numbers to improper fractions.**

a $1\frac{2}{3}$ **b** $4\frac{1}{7}$ **c** $5\frac{4}{7}$ **d** $1\frac{1}{2}$

e $4\frac{3}{5}$ **f** $2\frac{4}{9}$ **g** $3\frac{11}{12}$ **h** $9\frac{1}{5}$

2 **Change these improper fractions to mixed numbers.**

a $\frac{5}{3}$ **b** $\frac{7}{5}$ **c** $\frac{9}{4}$ **d** $\frac{9}{8}$

e $\frac{15}{8}$ **f** $\frac{7}{6}$ **g** $\frac{9}{5}$ **h** $\frac{17}{11}$

i $\frac{11}{9}$ **j** $\frac{12}{5}$ **k** $\frac{17}{12}$ **l** $\frac{17}{6}$

3 **Copy the fractions. Fill in <, = or >. Use the number line to help you.**
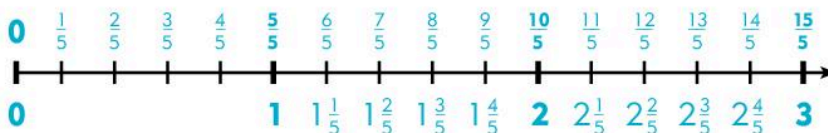
a $1\frac{4}{5}$ ☐ $\frac{9}{5}$ **b** $\frac{8}{5}$ ☐ $1\frac{2}{5}$ **c** $\frac{13}{5}$ ☐ $2\frac{1}{5}$ **d** $\frac{7}{5}$ ☐ $1\frac{2}{5}$

e $2\frac{1}{5}$ ☐ $\frac{10}{5}$ **f** $\frac{14}{5}$ ☐ $2\frac{3}{5}$ **g** $\frac{4}{5}$ ☐ $\frac{5}{4}$ **h** $\frac{12}{5}$ ☐ 2

Equivalent fractions

Equivalent fractions have the same value.

1 whole											
$\frac{1}{2}$						$\frac{1}{2}$					
$\frac{1}{3}$				$\frac{1}{3}$				$\frac{1}{3}$			
$\frac{1}{4}$			$\frac{1}{4}$			$\frac{1}{4}$			$\frac{1}{4}$		
$\frac{1}{5}$		$\frac{1}{5}$		$\frac{1}{5}$		$\frac{1}{5}$		$\frac{1}{5}$			
$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$	
$\frac{1}{7}$	$\frac{1}{7}$		$\frac{1}{7}$		$\frac{1}{7}$		$\frac{1}{7}$		$\frac{1}{7}$		$\frac{1}{7}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$		$\frac{1}{8}$
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$			
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$		
$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	$\frac{1}{11}$	
$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$
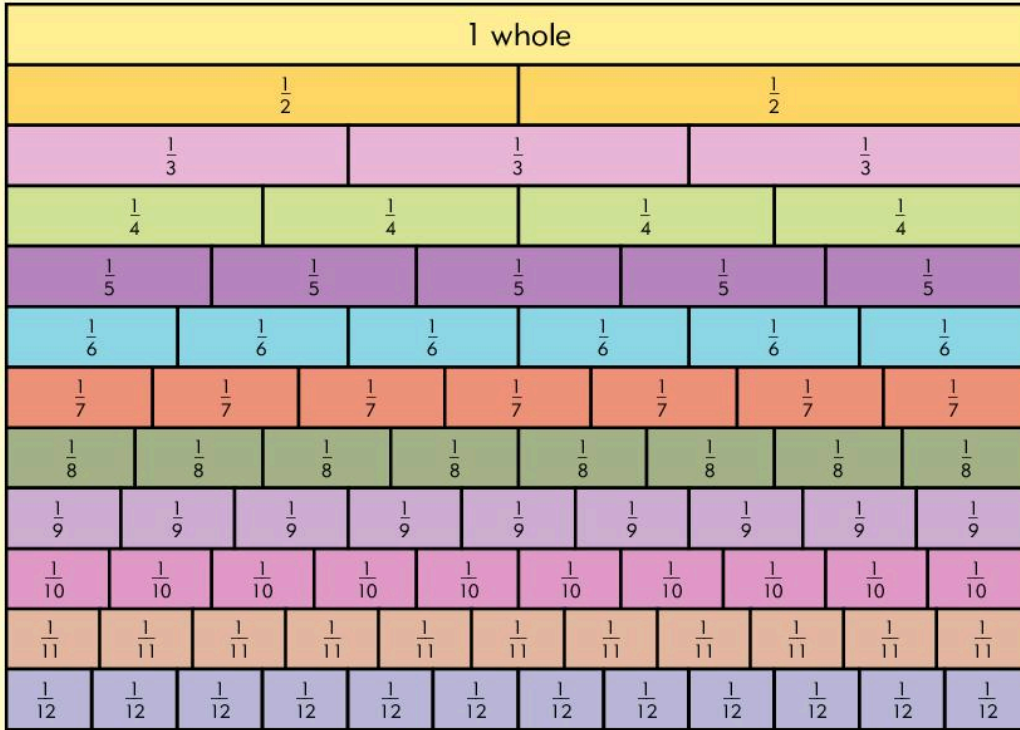
Look at the fraction wall.
Can you can see that $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10} = \frac{6}{12}$?
Can you also see that $\frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \frac{4}{12}$?

1 Work with a partner. Use the fraction wall. Find as many fractions as you can that are equivalent to:

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

2 Which of these fractions are equivalent to $\frac{6}{12}$?

a $\frac{1}{3}$　　**b** $\frac{2}{4}$　　**c** $\frac{4}{8}$　　**d** $\frac{3}{8}$　　**e** $\frac{1}{2}$

3 Copy these number sentences. Fill in the missing numbers.

a $\frac{1}{2} = \frac{\square}{10}$　　**b** $\frac{1}{2} = \frac{\square}{8}$　　**c** $\frac{1}{2} = \frac{3}{\square}$　　**d** $\frac{1}{2} = \frac{\square}{4}$

e $\frac{3}{4} = \frac{\square}{12}$　　**f** $\frac{6}{8} = \frac{\square}{4}$　　**g** $\frac{4}{6} = \frac{\square}{3}$　　**h** $\frac{2}{3} = \frac{\square}{12}$

i $\frac{2}{5} = \frac{4}{\square}$　　**j** $\frac{1}{3} = \frac{2}{\square}$　　**k** $\frac{6}{9} = \frac{\square}{3}$　　**l** $\frac{3}{12} = \frac{1}{\square}$

Making equivalent fractions

Equivalent fractions are fractions that have equal value but different numerators and denominators, for example $\frac{1}{2}$ and $\frac{3}{6}$ are equivalent.

You can find equivalent fractions by multiplying or dividing the numerator and denominator by the same number.

$$\overset{\times 3}{\frac{1}{2}} = \underset{\times 3}{\frac{3}{6}} \qquad \overset{\div 3}{\frac{6}{9}} = \underset{\div 3}{\frac{2}{3}}$$

$$\overset{\div 3}{\frac{6}{9}} = \underset{\div 3}{\frac{2}{3}} \quad \text{or} \quad \frac{\cancel{6}^{2}}{\cancel{9}_{3}} = \frac{2}{3}$$

You can **simplify** fractions by **cancelling**. Divide the numerator and denominator by a common factor.

A fraction is in its **lowest terms** when it has been cancelled down to its **simplest form**.

1 Copy these pairs of equivalent fractions and work out the missing number.

a $\frac{1}{2} = \frac{\square}{6}$ b $\frac{3}{4} = \frac{\square}{12}$ c $\frac{3}{5} = \frac{\square}{10}$ d $\frac{7}{8} = \frac{\square}{16}$

e $\frac{7}{12} = \frac{\square}{48}$ f $\frac{3}{5} = \frac{\square}{100}$ g $\frac{4}{5} = \frac{\square}{10}$ h $\frac{4}{7} = \frac{\square}{35}$

i $\frac{3}{5} = \frac{6}{\square}$ j $\frac{5}{8} = \frac{15}{\square}$ k $\frac{2}{3} = \frac{4}{\square}$ l $\frac{5}{12} = \frac{10}{\square}$

2 Find an equivalent fraction with a denominator of 12 for each of these.

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

f $\frac{2}{3}$ g $\frac{5}{6}$ h $\frac{4}{24}$ i $\frac{8}{24}$ j $\frac{16}{24}$

3 Write each fraction in its simplest form.

a $\frac{5}{10}$ b $\frac{2}{10}$ c $\frac{2}{12}$ d $\frac{3}{12}$ e $\frac{6}{8}$

f $\frac{2}{4}$ g $\frac{10}{12}$ h $\frac{9}{18}$ i $\frac{12}{16}$ j $\frac{4}{12}$

k $\frac{15}{20}$ l $\frac{8}{12}$ m $\frac{16}{24}$ n $\frac{7}{21}$ o $\frac{10}{2}$

p $\frac{8}{10}$ q $\frac{30}{100}$ r $\frac{17}{51}$ s $\frac{48}{96}$ t $\frac{25}{100}$

u $\frac{16}{28}$ v $\frac{35}{100}$ w $\frac{95}{100}$ x $\frac{42}{6}$ y $\frac{48}{42}$

When you compare fractions it is easier if you write them with the same denominator. When fractions have the same denominator, we say they have a **common denominator**.

You can convert fractions so that they have a common denominator using equivalent fractions.

Read this example carefully to make sure you understand how to do this.

Arrange these fractions in order from smallest to largest:

$$\frac{1}{2} \qquad \frac{2}{3} \qquad \frac{1}{4} \qquad \frac{5}{6}$$

Look at the denominators and choose a number that has all these numbers as factors. In this case it 12.

Write each fraction as an equivalent fraction with a denominator of 12.

$$\frac{1}{2} = \frac{6}{12} \qquad \frac{2}{3} = \frac{8}{12} \qquad \frac{1}{4} = \frac{3}{12} \qquad \frac{5}{6} = \frac{10}{12}$$

Now you can put the fractions in size order.

$$\frac{1}{4} \qquad \frac{1}{2} \qquad \frac{2}{3} \qquad \frac{5}{6}$$
$$\left(\frac{3}{12}\right) \quad \left(\frac{6}{12}\right) \quad \left(\frac{8}{12}\right) \quad \left(\frac{10}{12}\right)$$

1 Rewrite each pair of fractions with a common denominator then circle the larger fraction in each pair.

a $\frac{3}{5}$ $\frac{2}{5}$ **b** $\frac{1}{2}$ $\frac{8}{12}$ **c** $\frac{1}{4}$ $\frac{3}{10}$ **d** $\frac{5}{8}$ $\frac{3}{4}$

e $\frac{2}{3}$ $\frac{3}{4}$ **f** $\frac{3}{5}$ $\frac{5}{8}$ **g** $\frac{3}{4}$ $\frac{4}{5}$ **h** $\frac{2}{3}$ $\frac{7}{12}$

2 Rewrite each set of fractions in order from smallest to largest.

a $\frac{2}{5}$ $\frac{3}{5}$ $\frac{4}{15}$ $\frac{3}{15}$ **b** $\frac{5}{9}$ $\frac{2}{3}$ $\frac{7}{9}$ $\frac{2}{18}$ **c** $\frac{5}{18}$ $\frac{5}{9}$ $\frac{5}{6}$ $\frac{1}{2}$

3 Jan has spent $\frac{5}{8}$ of his pocket money and James has spent $\frac{7}{12}$ of his. Which boy has spent the larger part of his money? Show how you worked out the answers.

Comparing and ordering mixed numbers

To compare improper fractions with different denominators it is easier to change them to mixed numbers and show them on a number line.

For example, which is greater: $\frac{13}{10}$ or $\frac{18}{12}$?

$\frac{13}{10} = 1\frac{3}{10}$

$\frac{18}{12} = 1\frac{6}{12} = 1\frac{1}{2}$
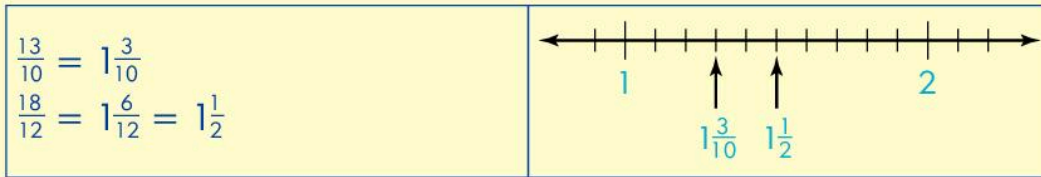
You can see from the number line that $\frac{18}{12}$ is greater than $\frac{13}{10}$.

1. **Here are three fractions:**

   $\frac{7}{4}$ $\frac{4}{2}$ $\frac{7}{7}$

   Write them in order of size starting with the smallest.

   You might find it helpful to draw a number line like the one shown here then place the fractions in the correct position on the line.
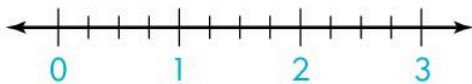
2. **Rewrite each set of fractions in order from smallest to greatest.**

   a $\frac{12}{10}$ $\frac{10}{8}$

   b $1\frac{1}{3}$ $1\frac{2}{5}$

3. **Rewrite each set of fractions in order from smallest to greatest.**

   a $\frac{5}{3}$ $\frac{5}{4}$ $\frac{5}{12}$ $\frac{5}{24}$

   b $2\frac{1}{2}$ $3\frac{1}{4}$ $2\frac{3}{4}$ $3\frac{1}{2}$

4. **If the whole numbers in a set of mixed numbers are different you may not need to compare the fraction parts. Explain why.**

Place value to thousandths

In August 2009, Usain Bolt broke the world record by running 100 m in 9.58 seconds.

The fastest time for a downhill race on a special sled, called a 'luge', is 52.293 seconds.

These times are **decimal fractions**. The digits to the right of the decimal point are fractions of a second.

$9.58 = 9$ seconds $+ \frac{58}{100}$ ths of a second.

$52.293 = 52$ seconds $+ \frac{293}{1000}$ ths of a second.

We can show the decimal times on a place value table like this:

Tens	Units	.	Tenths	Hundredths	Thousandths
	9	.	5	8	
5	2	.	2	9	3

1 Write the amount shown on each abacus as a decimal fraction.

a
T U • t h th

b
T U • t h th

c
T U • t h th

d
T U • t h th

e
T U • t h th

f
T U • t h th

g
T U • t h th

h
T U • t h th

i
T U • t h th
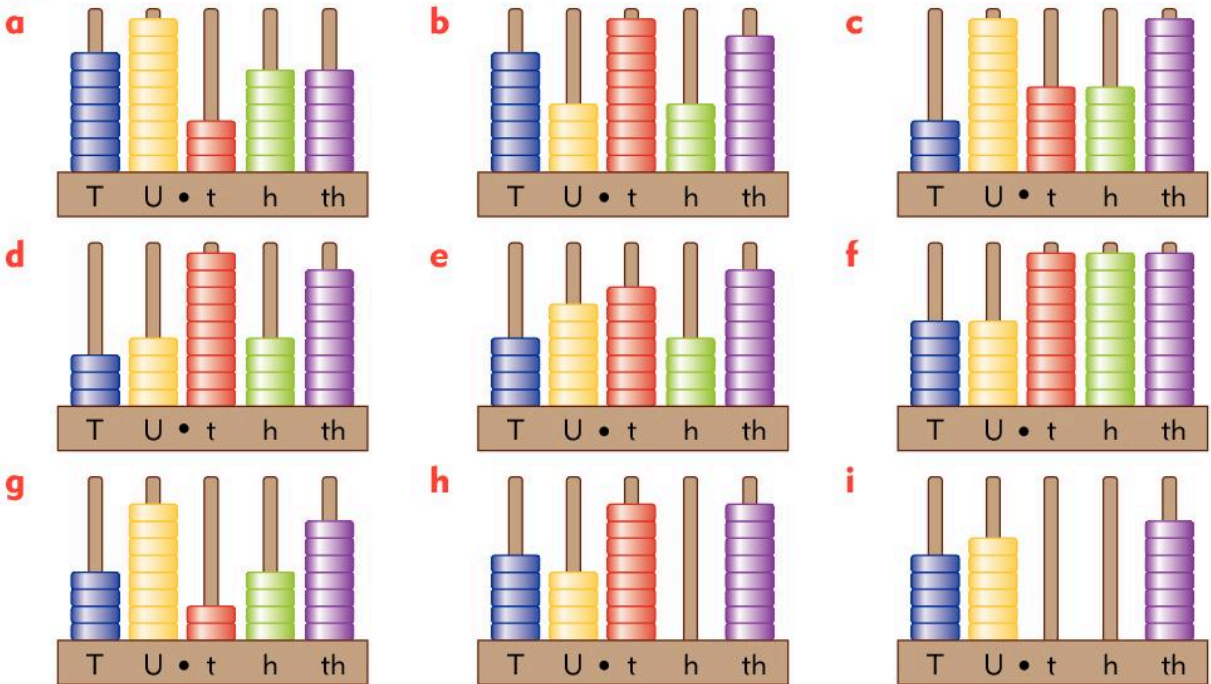
2 What is the value of the red digit in each of these decimals?

a 4.543   **b** 73.342   **c** 345.9   **d** 12.087

e 42.32   **f** 27.13   **g** 0.04   **h** 30.234

you can use Workbook page 32

48

Comparing and ordering decimals

Look at the place value chart. Two numbers are shaded.

100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

To compare the numbers 0.4 and 0.05 we need to look at the value of the digits.
The digit 4 is worth 4 tenths.
The digit 5 is worth 5 hundredths.
$0.4 > 0.05$

Look at the number line marked in tenths.
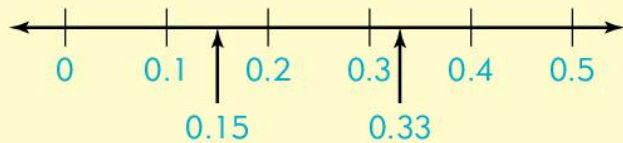
To compare decimals with two decimal places imagine them placed on the number line.
$0.33 > 0.15$

Remember that 0.1 can be written as 0.10 so to compare 0.1 and 0.15 it is helpful to think of them with the same number of decimal places.
$0.15 > 0.10$ so $0.15 > 0.1$

---

1 Copy these pairs of decimals. Fill in < or >.

  a 0.48 ☐ 0.71   **b** 0.06 ☐ 0.31   **c** 0.8 ☐ 0.36

  d 0.4 ☐ 0.04   **e** 0.1 ☐ 0.99   **f** 1.2 ☐ 0.9

2 Write down the smallest decimal in each of these sets.

  a 0.07, 0.7, 7   **b** 0.35, 0.27, 0.49   **c** 0.41, 0.48, 0.4

  d 0.39, 1.39, 0.9   **e** 0.01, 0.08, 0.11   **f** 0.2, 0.25, 0.52

3 Write each of these sets of decimals in order from largest to smallest.

  a 0.24, 0.42, 2.4   **b** 0.3, 0.03, 3.3   **c** 0.5, 0.05, 0.55

  d 0.9, 9.0, 0.99   **e** 0.67, 0.76, 6.70   **f** 8.0, 0.8, 8.08

Rounding decimals

To round decimals to the nearest whole number imagine them positioned on a number line between two consecutive whole numbers.
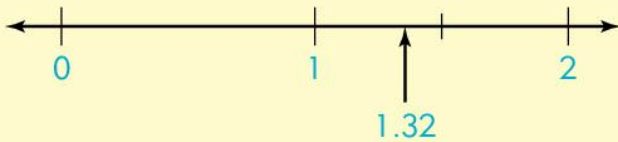
1.32 is closer to 1 than to 2 so it rounds to 1

To round decimals to the nearest tenth, or to one decimal place, imagine them positioned on a number line between two consecutive decimals in tenths. Remember that 1.2 can be written as 1.20.
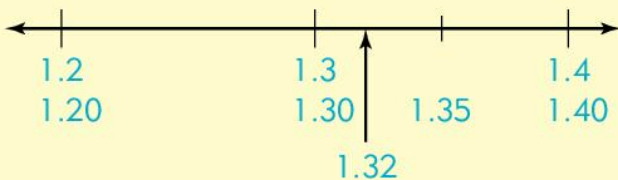
1.32 is closer to 1.3 than to 1.4 so it rounds to 1.3

Remember if the **digit** is less than 5 round **down**. If the digit is 5 or more round **up**.

1 Round these numbers to the nearest whole number.
  a 1.7   **b** 18.49   **c** 5.18   **d** 0.05   **e** 0.73

2 Round these numbers to one decimal place.
  a 0.35   **b** 3.84   **c** 6.55   **d** 9.05   **e** 0.49

3 Here are the times, in seconds, recorded by the top ten runners in a road race.

53.08	59.97	49.27	48.12	50.01
51.17	56.76	51.72	50.55	49.36

  a What was the winning time?
  b What was the slowest time?
  c Write the times in order from fastest to slowest.
  d Rewrite the times rounded to one decimal place.

you can use Workbook page 33

More rounding

Remember.

When you round amounts of money you need to use 0 as a place holder so that there is never only one decimal place.

$1.83 rounded to the nearest 10 cents is $1.80
$3.99 rounded to the nearest 10 cents is $4.00 or $4

Remember that you can check a calculation by rounding the original numbers and making an estimate before doing the calculation.

1 Write each amount of money correct to the nearest 10 cents.

  a $3.53   **b** $12.39   **c** $4.49

  d $9.23   **e** $19.99   **f** $50.05

2 Use rounding to estimate the answer to these calculations.

  a $15.40 + $12.71   **b** $49.20 − $9.89

  c $3.65 × 13   **d** $63.99 ÷ 4

Find the exact answer using a calculator and compare your results.

3 The prices of some stationery items are given below:

$2.50 per set $3.49 each $4.15 each $10.20 for 4 $1.00 each $1.20 each $12.99 each $5.25 each

  Use rounding to estimate whether $50 is enough to buy:

  a 1 of each item

  b 25 rolls of tape and 25 bottles of glue

  c 4 staplers, 4 sets of colouring pencils, 4 notebooks and 4 files

  d 4 calculators

  e 5 notebooks, 12 files and 2 calculators.

4 Maria worked out $5.67 plus 54 cents on her calculator. The display showed $59.67. What had she done wrong?

Sorting data

Do you remember how to make a frequency table to sort data?

This frequency table shows how many of each shape there are in the collection.

Shape	Tally	Frequency
Circle	JHT JHT JHT	15
Square	JHT JHT IIII	14
Triangle	JHT JHT JHT	15
Total		44

A frequency table like this one shows how many there are of each item of data. When you count the items you can make tallies to help you. When you are done, you add up the tallies to get a frequency.

Finally you add up all the frequencies to get a total. This helps you check that you have counted all the items.
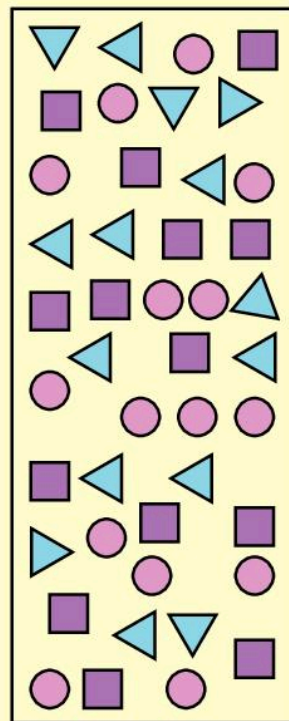
1 Copy the frequency table. Use it to record how many there are of each 3D shape.

Shape	Tally	Frequency
Cube		
Cylinder		
Sphere		
Pyramid		
Total		
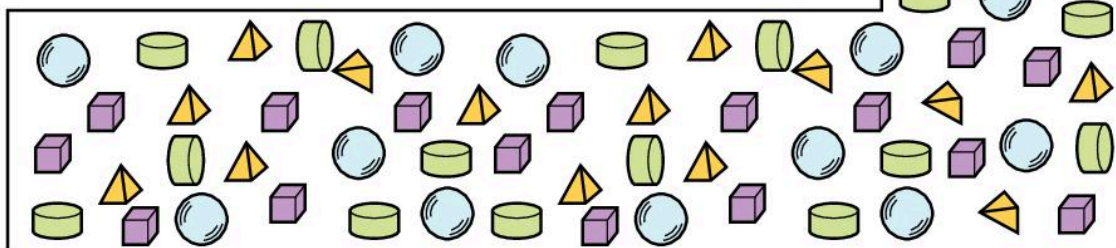
Grouped data

Sometimes the data you collect has many different values. For example, if you measured the mass (to the nearest kilogram) of every student in your school you might end up with a frequency table with values from 20 kg to over 60 kg. That would be a very long table!

When you have many different values, it is easier to sort the data into groups. For example, you could record the mass of different students in a school in groups of 5 or 10 kilograms like this:

Mass in kilograms	Frequency
20–24	
25–29	
30–34	
35–39	
40–44	
45–49	
50–54	
55–59	
60 and over	

Mass in kilograms	Frequency
20–29	
30–39	
40–49	
50–59	
60 and over	

When you group the values you are making a grouped frequency table.

1 **Mrs Smith made this grouped frequency table to show the scores that her class got in their maths tests.**

Score	Frequency
10–12	8
13–15	5
16–18	6
19–21	7
22–24	9
Total	35

a How many students are in her class?

b How many students got between 13 and 15 marks?

c How many students got 22 or more marks?

d What marks did most students get?

e If your score was in the 16–18 range, what marks could you have scored for the test?

More grouped data

Suzanne made a list of 50 car registration numbers.

E29 AKN	D336 WMY	H658 FPH	H71 JBA
H513 GLX	C50 XCD	G456 FKJ	J605 NLE
D90 APL	C237 VDD	J225 PGL	E175 HPC
C549 BUL	C555 PPG	G690 EPE	POG 913V
B21 MPJ	E989 VHF	J501 PHB	F505 FAN
C668 FFB	YON 190W	P177 WOK	D113 OGL
J198 SPB6	A443 NUM	MOM 156D	PEG 142F
TOM 786S	A741 CPK	F629 ROX	J284 HMS
B803 XHM	G106 NGO	G312 BAP	POS 395Y
D512 OKL	G710 KOP	C157 COW	YUM 629D
F914 HOT	C938 HOW	A503 GUM	H77 HOP
E175 HOB	H257 BOB	G693 BOP	J950 FOO
LUM 564P	H895 OLE		

1 Make a grouped frequency table to show how many car registrations there are in different number ranges. Use 1–99, 100–199, 200–299, and so on.

2 Which number range has most registrations?

3 Which number range has least registrations?

4 Work with a partner.
  a Write down the numbers on 20 car number plates.
  b Make your own grouped frequency table to sort the data you collect. You will need to decide what number range to use for your groups.

Graphs from tables

You can draw a bar graph to show the data in a grouped frequency table.

The frequency is shown on the vertical axis.

The groups you used to sort the data are shown on the horizontal axis.

Here is a frequency table with a matching bar graph to show the number of letters in each word of a song.

Number of letters	Frequency
1–3	45
4–6	29
7–9	11
10 or more	4

Letters in words of a song
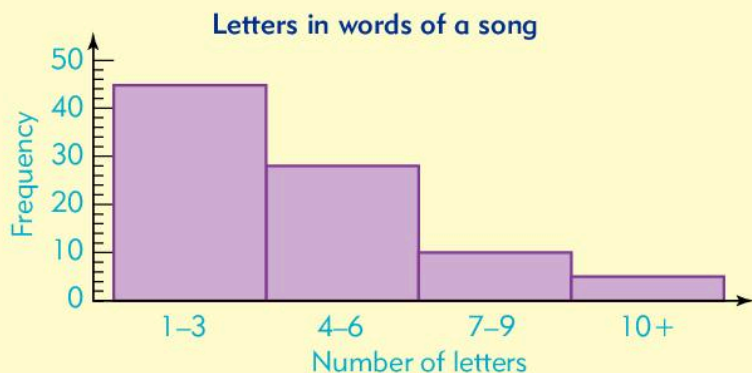
1 Isaac did a survey to find out how many people there were in each family in his community. Here are his results.

Complete the bar graph on page 36 of your Workbook to show this information.

Number of people in family	Frequency
0–2	25
3–5	22
6–8	13

2 Aisha did a survey to find out how much money different customers spent at the local shop. She drew up a table to show her results.

Complete the bar graph on page 36 of your Workbook to show this information.

| Amount spent	Frequency
$0.00–$9.99	13
$10.00–$19.99	25
$20.00–$29.99	52
$30.00–$39.99	47
$40.00–$49.99	10
More than $50	3

you can use Workbook page 36

Line graphs

Line graphs are normally used to show changes in data over a certain period of time. For example, how temperature in a place changes from month to month, or how the height of a plant changes as it grows.

The time periods are shown along the horizontal axis.

Temperature in our classroom

The vertical axis is used to show the data being measured.

Here is a line graph showing how the temperature inside a classroom changed during the school day.

When you draw a line graph you make points to show the data and then join them up. You read a line graph in the same way as you read a bar graph.
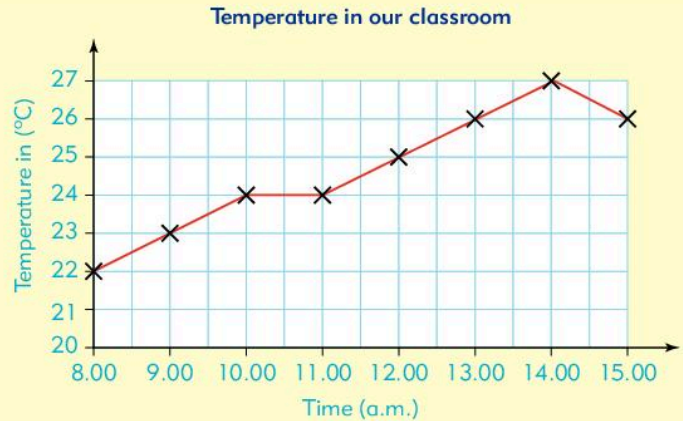
This line graph shows the number of children in the school yard from 6.45 a.m. when the school opens. The bell rings at 8.00 a.m. and classes start at 8.15 a.m.

Children in school yard

1 How many children were in the school yard at these times?

  a 7.00 a.m. **b** 7.45 a.m.

  c 8.00 a.m. **d** 8.15 a.m.
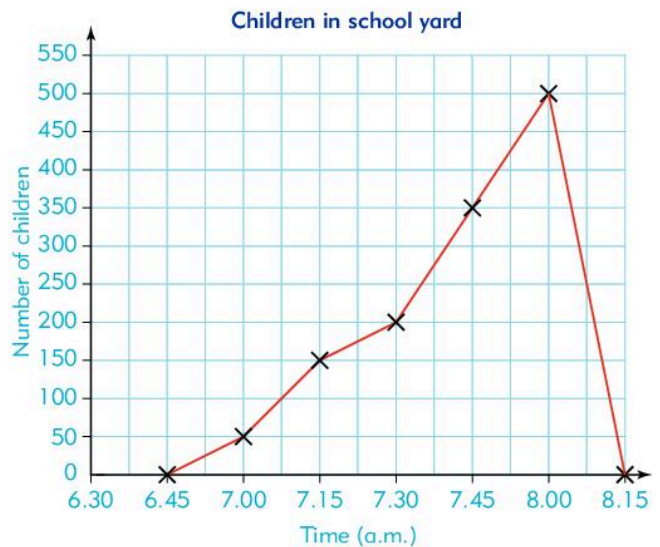
2 How many children entered the school yard between 6.45 a.m. and 7.00 a.m.?

3 How many children arrived in the fifteen minutes before the bell rang at 8.00 a.m.?

4 At what time were there 150 children in the school yard?
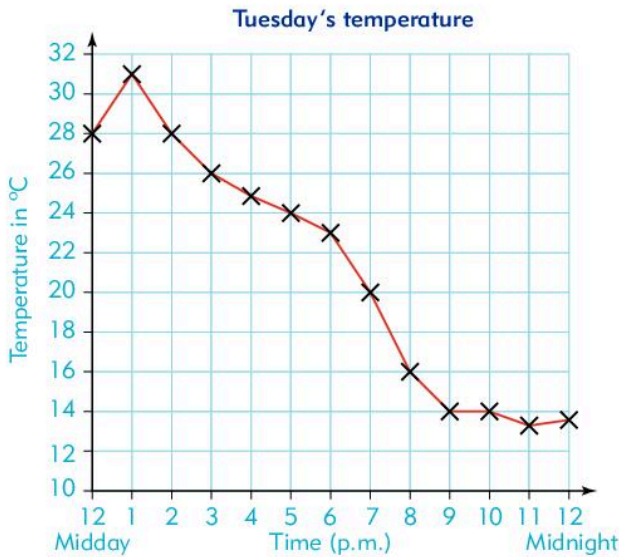
5 What do you think happened between 8.00 and 8.15 to cause this big drop in the number of children in the school yard?

you can use Workbook page 37

More line graphs

This line graph shows the change in temperature in a large city from midday to midnight on one day.

Tuesday's temperature

1 How often was the temperature recorded?

2 What was the temperature at these times?
   a 12 p.m.   **b** 3 p.m.   **c** 8 p.m.   **d** 11 p.m.

3 What was the warmest temperature recorded? At what time was it recorded?

4 What was the coolest temperature recorded? At what time was it recorded?

5 At what time was each of these temperatures recorded?
   a 28°C   **b** 25°C   **c** 20°C   **d** 23°C

6 Use the graph to estimate what temperature it was at these times.
   a 14:30   **b** 19:30   **c** 20:30   **d** 22:30

7 Tell your partner what the graph shows about the pattern of temperature on that day.
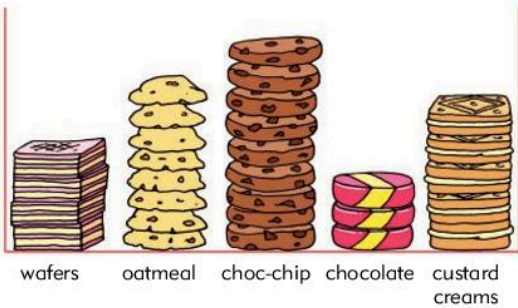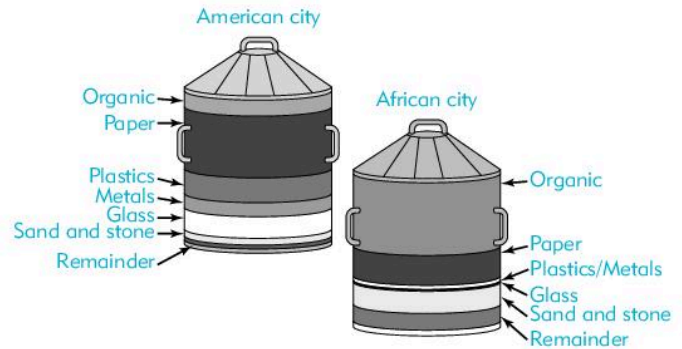
Unusual graphs

1 **Work with a partner. Look at the graphs on this page. Talk about:**

a What makes the graph unusual?

b What information can you get from the graph?

c Is the graph easy to understand?

d How could you show this information on a graph in a more usual way?

A Types of cookies in a box

wafers   oatmeal   choc-chip   chocolate   custard creams

B What's in our rubbish?

American city

Organic
Paper
Plastics
Metals
Glass
Sand and stone
Remainder

African city

Organic
Paper
Plastics/Metals
Glass
Sand and stone
Remainder

C The future of tourism

Where tourists will go:

China 137 million
France 93 million
USA 102 million
UK 53 million
Spain 71 million
Mexico 49 million
Hong Kong 59 million
Russia 47 million
Czech Republic 44 million
Italy 53 million
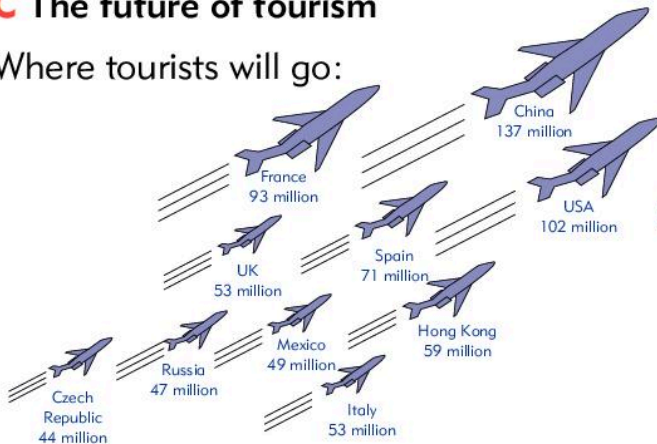
Where tourists will come from:

Germany 164 million
Japan 142 million
USA 123 million
China 100 million
UK 96 million
France 38 million
Netherlands 35 million
Canada 31 million
Russia 31 million
Italy 30 million
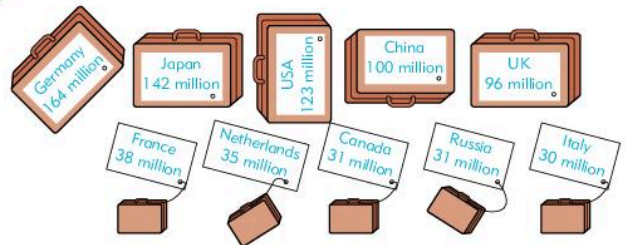
D % of replanted forests (5 years)

America, Ireland, Uzbekistan 2.7%
Greece 2.3%
Kazakhstan 1.9%
France 1.1%
Belarus, Estonia 1%
Latvia, Portugal 0.9%
Lithuania, New Zealand 0.6%
Hungary, UK 0.5%
USA 0.3%
Norway 0.2%
Canada, Italy, Poland, Slovakia, Ukraine 0.1%
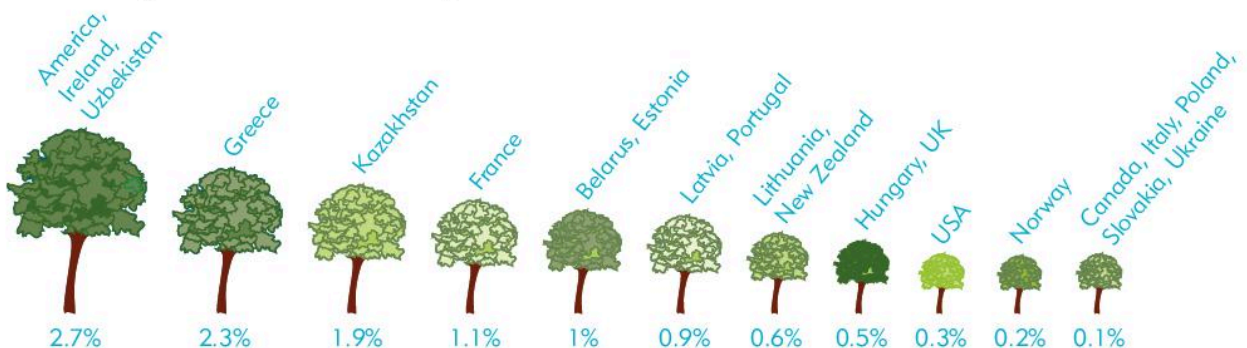
More unusual graphs

This graph shows the heights of some of the tallest buildings in the world in 2012. The graph looks more interesting than a normal bar graph because it shows the shapes of the buildings.
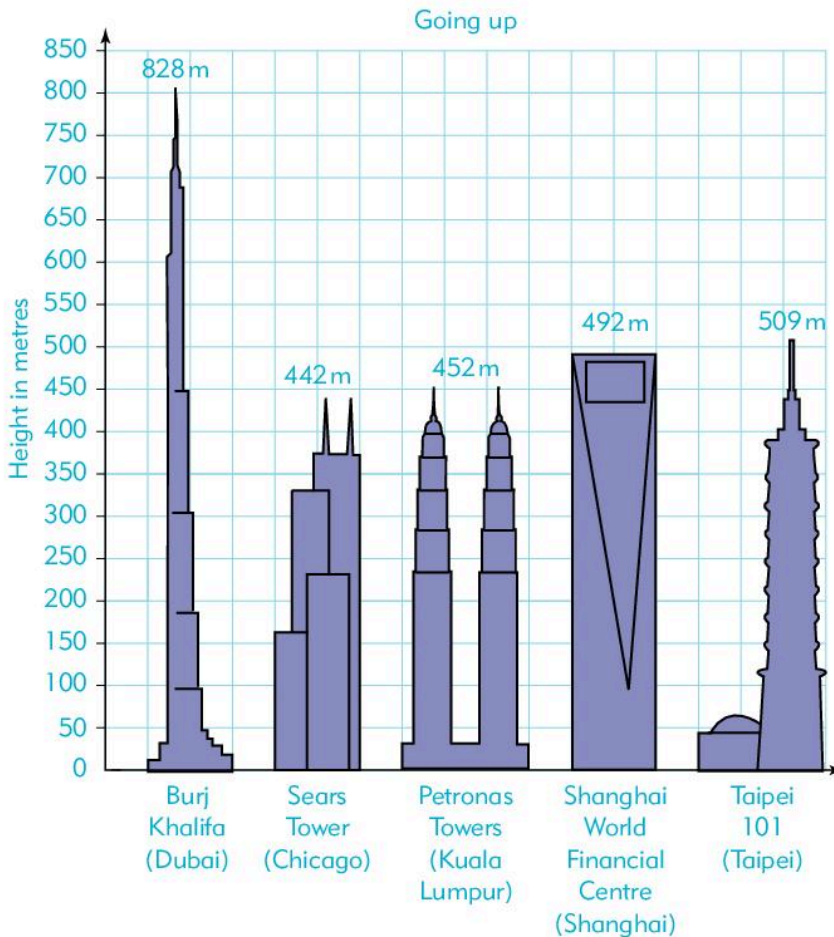
1. List the names of the five tallest buildings from tallest to shortest.

2. What is the height of the tallest building in metres?

3. How much taller is Burj Khalifa than Taipei 101?

4. How tall are the Petronas Twin Towers?

5. In 1926 the tallest building in the world was 319 metres tall. How much shorter is this than the Burj Khalifa?

6. How do you think people measure or work out the height of a very tall building?

Multiplying and dividing decimals by 10 and 100

You will need a calculator for this investigation.

1 Enter 20 000 on your calculator. Divide this by 10 and record the answer. Keep dividing the result by 10 and record the answers until you get to 0.002.

2 Do this again but divide by 100 each time.

3 Look at your answers. What happened each time you divided by 10 and 100?

4 Enter 0.005 on your calculator. Multiply this by 10 and record the answer. Keep multiplying your result by 10 and recording the answer until you get to 50 000.

5 Do this again but multiply by 100 each time.

6 Look at your answers. What happened each time you multiplied by 10 and 100?

In your investigation you saw that the digits in a decimal fraction move to the left or right on the place value table just like whole numbers do when you multiply or divide them by 10 or 100.

This fact allows you to find quick methods of multiplying and dividing decimals by 10 and 100.

$2.45 \times 10 = 24.5$
The digits move one place to the left.

$2.45 \times 100 = 245$
The digits move two places to the left. You don't write the decimal point or use 0 as a place holder because you have made a whole number.

$5 \div 10 = 0.5$ and $5.5 \div 10 = 0.55$
The digits move one place to the right. You write 0 as a place holder to show there are no units in the decimal fraction.

$55 \div 100 = 0.55$
The digits move two places to the right. You write 0 as a place holder to show there are no units in the decimal fraction.

More operations with 10 and 100

1 Try to do these in your head. Write the answers only.

a 0.345×10 b 0.345×100 c 123.45×10

d 123.45×100 e 12.34×10 f 12.34×100

g 1.56×10 h 1.56×100

2 Calculate and write the answers.

a 1.45×10 b 34.234×10 c 2.345×10

d 34.124×100 e 342.7×100 f 1.99×100

g 3.4×100 h 14.45×10 i 12.9×100

j 0.24×10 k 0.24×100 l 19.1×100

3 Try to do these divisions in your head. Write the answers only.

a $23.4 \div 10$ b $2345 \div 100$ c $1.2 \div 10$

d $4.8 \div 10$ e $488 \div 100$ f $127.8 \div 10$

g $3.6 \div 10$ h $3675 \div 100$ i $427.3 \div 10$

4 Jess has $45.50 in her savings account. LeeAn has 10 times more.

a How much does LeeAn have?

b How much do the two girls have together?

5 Sam needs to buy 100 m of fabric for a school play. The fabric costs $4.66 per metre. What will the total cost be?

**6** Peter earns $12.50 per hour. How much will he earn in a ten-hour shift?

7 Divide $19.99 equally among ten children. How much will each child get?

8 Sonja needs to buy 3000 paper plates for the school fete. The plates cost $0.45 for 10. What is the total cost of 3000 plates?

9 Make up two problems of your own. Swap with a partner and try to solve each other's problems.

you can use Workbook page 42

You already know a range of number facts for whole numbers. These facts help you work out decimal facts, though you must be careful that the place value is correct.

I know that $2 \times 4 = 8$	
So I know $0.2 \times 8 = 0.8$	
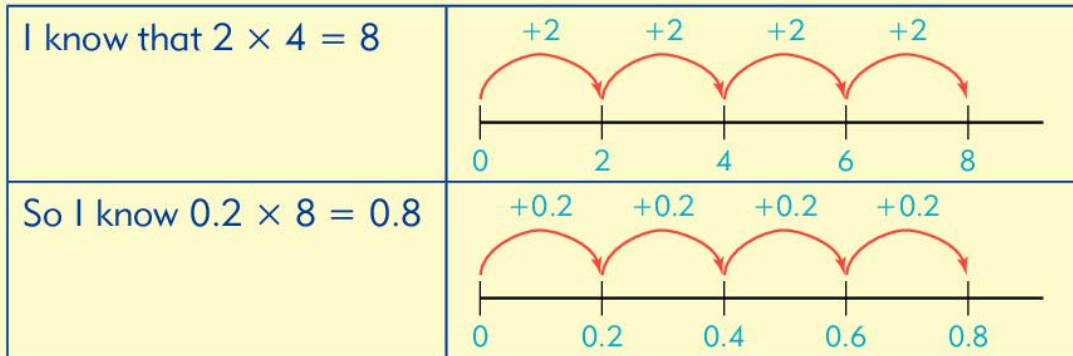
You can also do this calculation by thinking of 0.2 as $2 \div 10$

$$
\begin{aligned}
0.2 \times 4 \quad &= (2 \div 10) \times 4 \\
&= (2 \times 4) \div 10 \\
&= 8 \div 10 \\
&= 0.8
\end{aligned}
$$

Place value and division facts also help you to divide mentally.

$32 \div 8 = 4$
So $3.2 \div 8 = 0.4$ (3.2 is one tenth of 32 so 0.4 must be one tenth of 4)

1 **Try to do the following calculations mentally. Use a calculator to check any answers you are unsure of.**

4×7	4×0.7	$2.4 \div 7$	$2.4 \div 4$	4×9
0.4×9	$3.6 \div 9$	$3.6 \div 4$	6×8	6×0.8
$4.8 \div 6$	$4.8 \div 8$	6×7	0.6×7	$4.2 \div 6$
$4.2 \div 7$	7×8	7×0.8	$5.6 \div 7$	$5.6 \div 8$
7×9	0.7×9	$6.3 \div 7$	$6.3 \div 9$	8×9
8×0.9	$7.2 \div 8$	$72 \div 9$	9×6	0.9×6
$5.4 \div 9$	$5.4 \div 6$			

Comparing common fractions and decimals

A common fraction has a numerator and a denominator.

It is easy to change a decimal to a common fraction by placing it over 10 or 100 using place value.

$0.5 = 5 \text{ tenths} = \frac{5}{10}$

$0.12 = 12 \text{ hundredths} = \frac{12}{100}$

These fractions can be simplified further.

$\frac{5}{10} \div \frac{5}{5} = \frac{1}{2}$ $\qquad$ $\frac{12}{100} \div \frac{4}{4} = \frac{3}{25}$

$$\frac{5}{10} \xrightarrow{\div 5} = \frac{1}{2} \xleftarrow{\div 5} \qquad \frac{12}{100} \xrightarrow{\div 4} = \frac{3}{25} \xleftarrow{\div 4}$$

A decimal with a whole number in front of the decimal place can be changed into a mixed number.

$2.75 = 2 + \frac{75}{100} = 2\frac{75}{100} = 2\frac{3}{4}$

You can change common fractions to decimals by writing them as equivalent fractions with a denominator of 10 or 100.

$\frac{1}{4} \times \frac{25}{25} = \frac{25}{100} = 0.25$ $\qquad$ $\frac{3}{5} \times \frac{2}{2} = \frac{6}{10} = 0.6$
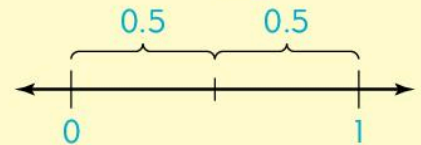
$$\frac{1}{4} \xrightarrow{\times 25} = \frac{25}{100} = 0.25 \xleftarrow{\times 25} \qquad \frac{3}{5} \xrightarrow{\times 2} = \frac{6}{10} = 0.6 \xleftarrow{\times 2}$$

You can also change common fractions to decimals by dividing the numerator by the denominator.

$\frac{1}{2}$ can be written as: $1 \div 2$

If you do this on your calculator you will see that $1 \div 2 = 0.5$

1 Write these decimals as common fractions in their simplest form.

a	0.9	**b**	0.4	**c**	0.2	**d**	0.5
e	0.34	**f**	0.7	**g**	0.125	**h**	0.15
i	0.28	**j**	0.250	**k**	0.01	**l**	0.008

2 Write the common fractions as decimals.

a $\frac{1}{2}$		**b** $\frac{1}{4}$		**c** $\frac{3}{4}$		**d** $\frac{1}{5}$		**e** $\frac{2}{5}$		**f** $\frac{3}{5}$	
g $\frac{4}{5}$		**h** $\frac{2}{10}$		**i** $\frac{1}{8}$		**j** $\frac{3}{8}$		**k** $\frac{5}{8}$		**l** $\frac{12}{20}$	

3 Write these mixed numbers as decimal fractions.

a $2\frac{1}{2}$		**b** $3\frac{1}{4}$		**c** $10\frac{3}{4}$		**d** $12\frac{2}{5}$	
e $1\frac{1}{5}$		**f** $3\frac{1}{4}$		**g** $4\frac{3}{10}$		**h** $2\frac{4}{5}$	
i $4\frac{3}{8}$		**j** $1\frac{4}{20}$		**k** $1\frac{8}{50}$		**l** $5\frac{1}{20}$	

Repeating decimals

A strange thing happens when you divide some fractions to make decimals.

This is what you will see on a calculator if you try to convert $\frac{1}{3}$, $\frac{1}{6}$, $\frac{4}{9}$ and $\frac{1}{11}$ to decimals by dividing:

$1 \div 3 = \boxed{0.33333333}$ $\qquad 4 \div 9 = \boxed{0.44444444}$

$1 \div 6 = \boxed{0.16666666}$ $\qquad 1 \div 11 = \boxed{0.09090909}$

These decimals are called **recurring decimals** because the same digits keep repeating over and over. In maths, we write a dot above a digit that repeats endlessly. If two numbers repeat you put a dot above both of them. If a set of three or more numbers repeat you put a dot on the first digit and the last digit that repeats.

$0.33333333 = 0.\dot{3}$
$0.16666666 = 0.1\dot{6}$
$0.44444444 = 0.\dot{4}$
$0.09090909 = 0.\dot{0}\dot{9}$

Work with a partner. You will need a calculator.

1 Which denominators less than 10 will give you recurring decimals?

2 Write a few sentences explaining how you worked out the answer.

3 Write these recurring decimals using the correct symbols.

a 0.333333333   b 0.7777777777   c 0.99999999999

d 0.3131313131   e 0.222222222   f 0.451451451

g 1.245245245   h 3.272727272   i 9.7474747474

4 Convert these fractions to decimals.

a $\frac{1}{6}$ b $\frac{5}{6}$ c $\frac{1}{7}$ d $\frac{2}{7}$ e $\frac{3}{7}$

f $\frac{4}{7}$ g $\frac{5}{7}$ h $\frac{6}{7}$ i $\frac{1}{9}$ j $\frac{4}{9}$

k $\frac{1}{11}$ l $\frac{3}{11}$ m $\frac{7}{12}$ n $\frac{4}{15}$ o $\frac{2}{3}$

Adding and subtracting decimals

You already know a range of number facts for whole numbers. You can use these facts to derive decimal facts but you need to ensure the place value is correct.

I know that $1 + 9 = 10$ so $0.1 + 0.9 = 1$

I know that $23 + 77 = 100$ so $2.3 + 7.7 = 10$ and $0.23 + 0.77 = 1$

You can also use the relationship between addition and subtraction to help you solve problems.

I know that $4 + 6 = 10$ so $6 + 4 = 10$

                              and $10 - 4 = 6$ and $10 - 6 = 4$

Then $0.4 + 0.6 = 1$ so $0.6 + 0.4 = 1$

                              and $1 - 0.4 = 0.6$ and $1 - 0.6 = 0.4$

Addition and subtraction are inverse operations.

1 **Copy and complete.**

a $3 + 7 = 10$ $0.3 + \boxed{} = 1$ $1 - 0.7 = \boxed{}$

b $10 - 2 = 8$ $0.2 + \boxed{} = 1$ $1 - \boxed{} = 0.8$

c $45 + \boxed{} = 100$ $4.5 + 5.5 = \boxed{}$ $10 - 4.5 = \boxed{}$

d $34 + 66 = \boxed{}$ $0.34 + \boxed{} = 1$ $1 - 0.34 = \boxed{}$

e $73 + \boxed{} = 100$ $10 - 7.3 = \boxed{}$ $0.73 + \boxed{} = 1$

2 **Find pairs of numbers that make 1.**

0.4	0.55	0.01	0.65	0.99	0.75	0.7
0.01	0.65	0.01	0.65	0.5	0.45	0.35
0.83	0.17	0.8	0.5	0.6	0.25	

3 **Find the missing numbers.**

a $0.45 + \boxed{} = 1$ b $\boxed{} - 0.58 = 0.42$ c $1 - \boxed{} = 0.28$

d $\boxed{} + 0.81 = 0.19$ e $1 - 0.05 = \boxed{}$ f $0.99 + \boxed{} = 1$

4 **Use the digits 1, 2, 7 and 9 to make this calculation correct.**

$$\boxed{} \cdot \boxed{} + \boxed{} \cdot \boxed{} = 10$$

you can use Workbook page 43

You can apply the written methods you have learned for whole numbers to decimals, for example:

Using place value and number facts	Using a number line
Add 5.6 and 3.7 $5.6 + 3.7 = 5 + 0.6 + 3 + 0.7$ $\quad\quad\quad = (5 + 3) + (0.6 + 0.7)$ $\quad\quad\quad = 8 + 1.3$ $\quad\quad\quad = 9.3$	What is 1.3 less than 6? −1.3 4 5 6
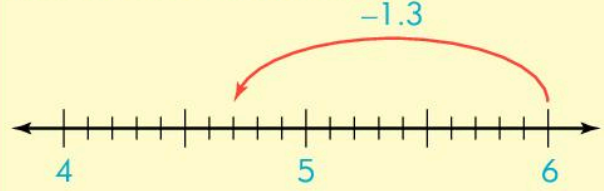
You can add or subtract decimals in columns. The important thing is to write the decimal points under each other to make sure the tenths, hundredths and thousandths are all above each other.

$$
\begin{array}{r}
32.145 \\
12.98 \\
+\ \ 3.08 \\
\hline
48.205 \\
\end{array}
\quad\quad
\begin{array}{r}
^2{}^{1}3^{1}4^{1}5.\overset{1}{3}5 \\
-\ \ 45.72 \\
\hline
299.63 \\
\end{array}
$$

You can add zeros at the end of decimals without changing their value.

$2.1 = 2.10 = 2.100$

Fill in zeros to help you keep the place value correct when you add or subtract decimals.

$$
\begin{array}{r}
96.5 \\
-\ 38.42 \\
\hline
\end{array}
\quad \rightarrow \quad
\begin{array}{r}
9^{8}6.^{4}\overset{1}{5}0 \\
-\ 38.42 \\
\hline
58.08 \\
\end{array}
$$

1 Use the number line to find the number that is:
- a 2.1 more than 3.5
- b 1.8 less than 5.2
- c 3.5 less than 7.8
- d 1.6 more than 4.1
- e 2.9 more than 4.3
- f 1.3 less than 5.2

2 Complete the following. Show any working you do.
- a 12.54 + 23.23
- b 124.9 + 9.25
- c 501.3 + 0.71
- d 324.9 – 8.25
- e 13.24 – 9.7
- f 5.82 – 0.79

3 Complete the following calculations.
- a $8.95 – $4.83
- b $5.21 + $3.97
- c $6.72 + $18.56
- d $19.42 – $6.78
- e $91.01 + $1.98
- f $72.50 – $0.99

Calculating with decimals

Work with a partner. Read through each problem and talk about how you will solve it.

1 Amanda has $10.50. She spends $2.85 on a bus ticket. How much does she have left?

2 Sandy has a piece of ribbon 6 m long. She cuts two 1.15 m sections from it. How much does she have left?

3 Three parcels weigh 16.13 g, 155.98 g and 250.45 g. What is their total mass?

4 In the morning, the temperature was 23.4 °C. In the afternoon, the temperature increased by 3.5 °C. What was the temperature after the increase?

5 What number is 100 more than 234.098?

6 Mrs Smith's petrol tank has a capacity of 55 l. When she fills up the tank the petrol pump says she needed 39.456 l. How much petrol was left in the tank before she filled up?

7 Usain Bolt's fastest time over 100 m is 9.58 seconds. His previous best was 9.72 seconds. What is the difference between these times?

8 Winston earns money doing chores. In one week he earned $10.50, $16.45, $5.50 and $12.65.

  a How much did he earn altogether this week?

  b If he spends $19.75 of this, how much will he have left?

9 A meal in a restaurant costs $29.85.

  a If you pay with two $20 notes, how much change will you get?

  b How much change will you get if you pay with a $50 note?

10 The masses of five fish caught in a competition are 5.234 kg, 5.432 kg, 4.56 kg, 5.05 kg and 4.9 kg.

  a Which fish was the heaviest?

  b What is the total mass of fish caught?

  c The lightest fish is thrown back. What is the total mass of the remaining fish?

When an item marked $4.50 is sold at half price what do you pay?

$4.50 is $4 and 50c.
Half of $4 is $2.
Half of 50c is 25 c.
You will pay $2.25.

Due to price increases in the ingredients, a baker has to double the price of home-baked cakes to cover her costs.

A cake used to cost $5.80. What will the new price be?

$5.80 is $5 and 80c.
Double $5 is $10.
Double 80c is 160c. This is the same as $1.60.
The new price will be $10 + $1.60 = $11.60.

1 Sanjay finds a very old poster of prices. Since the poster was printed, the prices have doubled.

a Work out the new price of each item in the poster.

b A school orders 100 books at the new price. What will it pay?

c Marie buys 10 erasers and 10 pencils at the new price. What will she pay?

Sanjay's Stationery

crayons
$2.99

pencils
$0.45

erasers
$0.65

books
$1.27

pens
$1.35

2 Work out the new price of each item if they are being sold at half price.

$2.10

$1.65

3 for $1.79

$8.94 for 6

$5.85

$2.35

$1.99 each or 2 for $3.50

$1.50 each or pack of 3 for $4.30

you can use Workbook page 44

Mixed decimal problems

1 Here are the times of the top five men's and women's relay teams at the 2008 Olympic Games.

Men's 4 × 100 m relay		Women's 4 × 100 m relay	
Country	**Time (seconds)**	**Country**	**Time (seconds)**
Canada	38.66	Germany	43.28
Trinidad and Tobago	38.06	Belgium	42.54
Japan	38.24	Nigeria	43.03
Jamaica	37.10	Russia	42.31
Germany	38.58	Brazil	43.14

a Arrange the times for the men's relay race in order from fastest to slowest.

b What was the difference in time between the winning men's team and the team that came fifth?

c Which team won the women's relay? How do you know this?

d How much faster did the German men's team run than the German women's team?

e The halfway mark in a relay is at 200 m. Work out the time it took each men's team to cover the first 200 m of the race.

f Each of the four members of a relay team run 100 m. Estimate how long it took each member of the winning men's and women's teams to run 100 m. Show all your working.

2 Which of the following items cost less than $1.00 each?

10 pencils for $9.99

25 erasers for $11.25

100 boxes of staples for $29.00

4 files for $3.60

5 rolls of tape for $6.00.

3 Using the digits 3, 4, 5 and 6 once each, replace the blocks to make the greatest possible product.

☐ • ☐ ☐ × ☐

Show your solution to your partner. Tell each other how you found the answer.
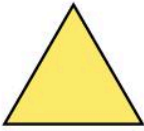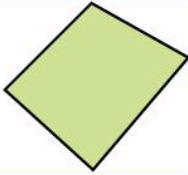
Revising 2D shapes

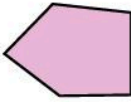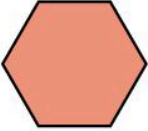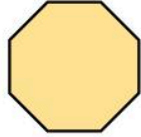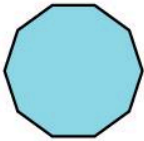Flat shapes that are drawn on paper are called 2D shapes.

Shapes with straight sides are called **polygons**. Polygons are named according to the number of sides they have.

Circles and ovals are 2D shapes but they are not polygons because they have curved sides.
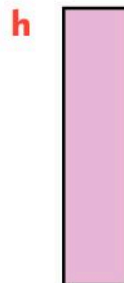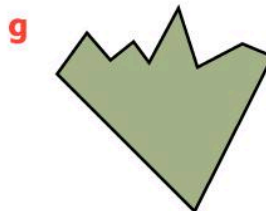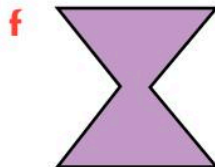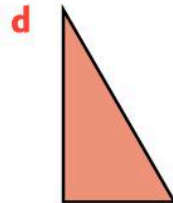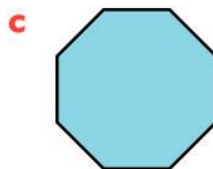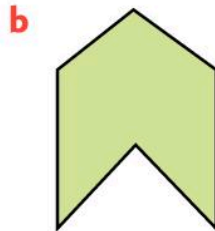
Do you remember these names?

Triangle, 3 sides	Quadrilateral, 4 sides	Pentagon, 5 sides	Hexagon, 6 sides	Octagon, 8 sides	Decagon, 10 sides

When all the sides are the same length, we say the polygon is a **regular polygon**. Equilateral triangles and squares are regular polygons.

1 Write the correct name for each of these polygons.
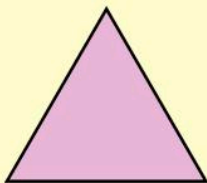
a   b   c   d

e   f   g   h
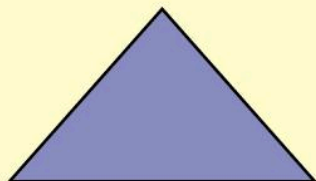
Triangles and their properties

Triangles are three-sided polygons.

Triangles can be named using the lengths of their sides or by the sizes of their angles.

Make sure you remember these triangle names.

Equilateral – three sides the same length

Isosceles – two sides the same length

Scalene – no sides the same length

<90°
<90° <90°
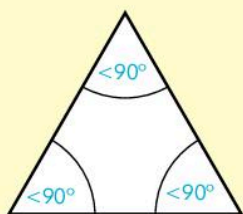
Acute – three angles smaller than 90°

<90° <90°
>90°
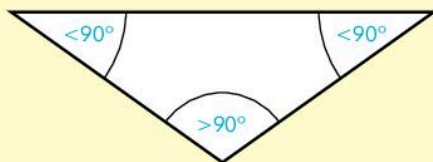
Obtuse – one angle is greater than 90°

<90°
<90°
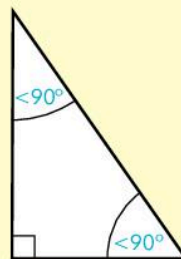
Right-angled – one angle is 90°

1 Here are three triangles. Measure the sides. What type of triangle is each one?

a △ABC

b △ACD

c △DCE

2 Use straws and sticky-putty to build:

a an acute-angled triangle

b a right-angled, isosceles triangle

c an obtuse-angled, scalene triangle.

71

Properties of quadrilaterals

All 2D shapes with four sides are called **quadrilaterals**.

Some quadrilaterals have special properties. We use the properties of their sides and angles to name different quadrilaterals.

Squares, rectangles, parallelograms, rhombuses, trapeziums and kites are all quadrilaterals with special properties.
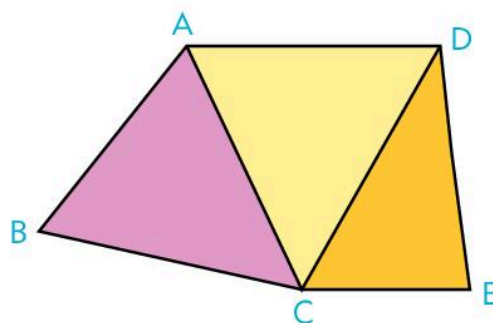
You will need a ruler and a protractor to do this activity.
Work with a partner to answer these questions about the shapes below.

1 Which shapes have opposite sides equal in length?

2 Which shapes have opposite sides that are parallel?

3 Which shapes have four sides that are the same length?

4 Which shapes have only right angles?

5 Measure the angles of the parallelogram and the rhombus. What do you notice?

6 Measure the lengths of the sides of the kite. What do you notice?

rectangle

parallelogram

square

trapezium

kite

rhombus
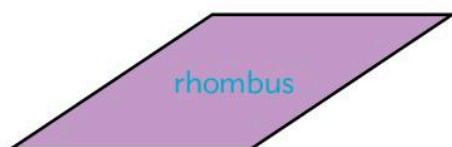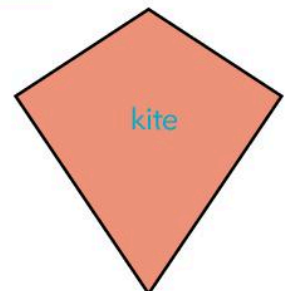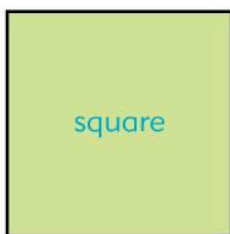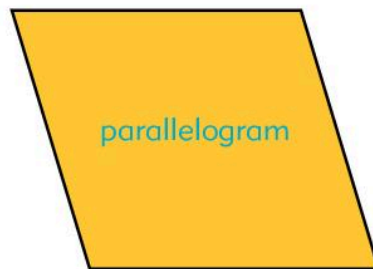
you can use Workbook page 45

Naming quadrilaterals

1 Write the letters A to S in your book. Write the correct name for each shape next to its letter.

A

B

C

D

E

F

G

H

J

I

K

L

O

P

S

M

N

Q

R
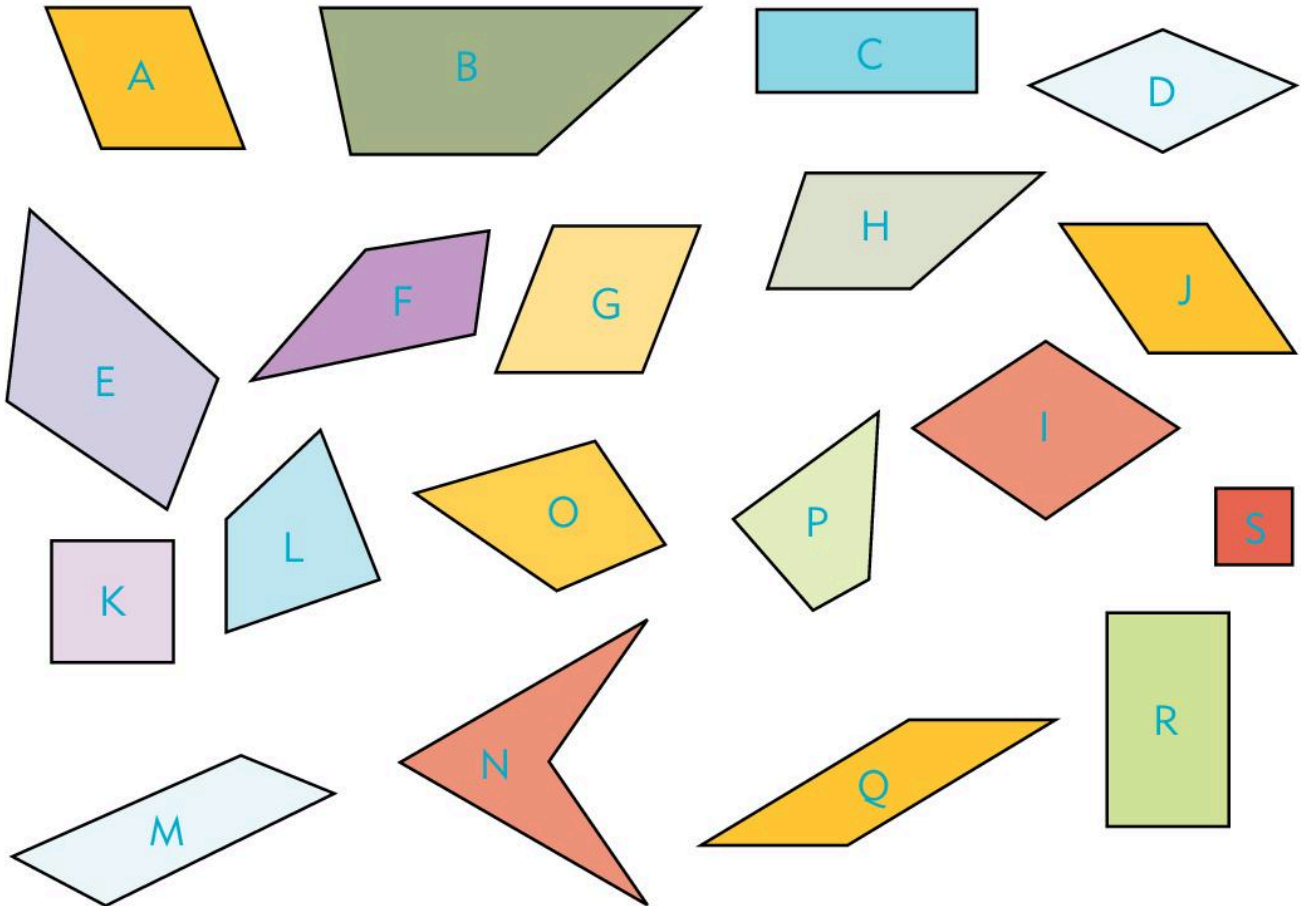
2 Measure the lengths of the sides of each shape. Record these in your book like this in mm.

A: 19 mm   20 mm   19 mm   20 mm

3 **a** Convert each side length in question 2 to centimetres.
    b Add the side lengths to find the total distance around each shape. Give each answer to the closest whole centimetre.

you can use Workbook page 46

Special parallelograms

You already know that a parallelogram is a quadrilateral with two pairs of parallel sides.

Some parallelograms have special properties so they get their own names. Here are some special parallelograms.
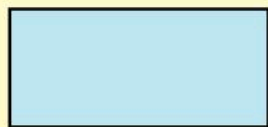
When the four angles of a parallelogram are right angles, we call the parallelogram a **rectangle**.
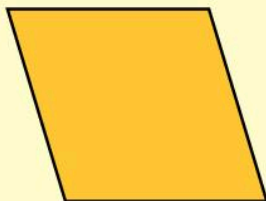
When the four sides of a parallelogram are equal in length, we call the parallelogram a **rhombus**.

When the four sides are equal in length and the four angles are right angles, we call the parallelogram a **square**.

1 **Use a ruler and a protractor to draw these shapes:**

  a a square and a rhombus with side lengths of 5 cm

  b a rectangle and another parallelogram with side lengths of 3 cm and 5 cm

  c a rhombus with sides lengths of 4 cm and internal angles of 50° and 130°

  d a parallelogram with side lengths of 6.5 cm and 3.5 cm and angles of 60° and 120°.

2 **Use your ruler and protractor to make an accurate drawing of this shape.**

3.6 cm
6 cm
3 cm
3.6 cm
2 cm
8 cm
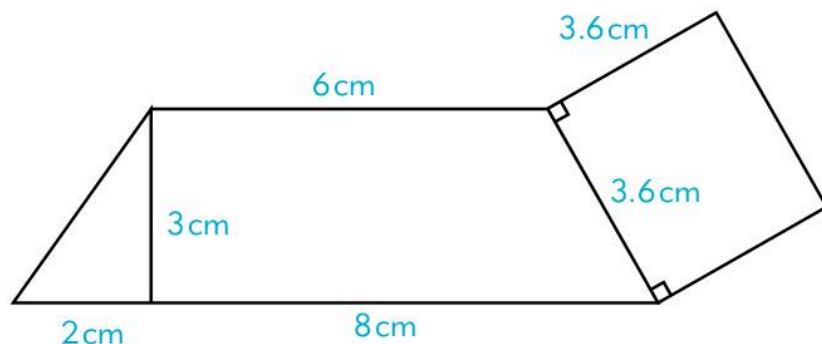
3 **Measure and fill in the lengths of the missing sides.**

More about quadrilaterals

✂ You will need:

- a piece of card
- a pair of scissors.

1 Copy this 5-piece tangram onto card and cut out the pieces.

Use 2 pieces to make:

a a square

b a parallelogram

c a trapezium.

2 Use 3 pieces to make:

a a square

b a rectangle whose length is twice its width

c a trapezium.

3 Draw the shapes you have made to show which pieces you used.

4 What other quadrilaterals can you make with the tangram pieces? Draw the shapes you make.

5 Work with a partner. Discuss whether each statement is true or false and explain how you decided.

a All rectangles are parallelograms.

b All rhombuses are parallelograms.

c All rhombuses are squares.

d All squares are rectangles.

e All trapeziums are parallelograms.

f All squares are rhombuses.

g All kites are parallelograms.

h All rectangles are squares.
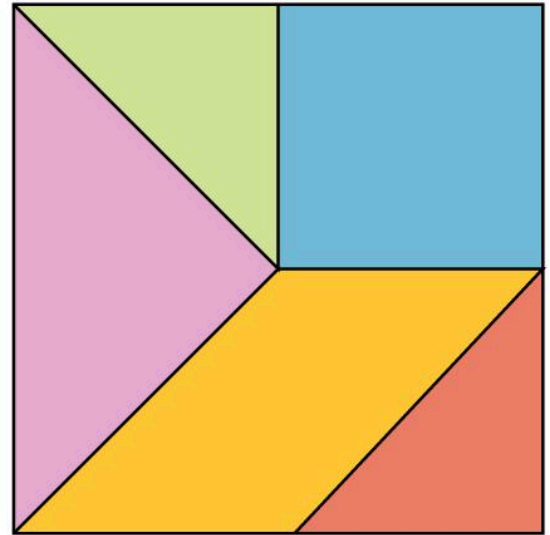
1 Read the description of each shape. Draw an example to match each description. Write the name of the shape below it.

a two sets of parallel sides, four equal sides and four right angles

b one set of parallel sides, no equal sides, no right angles

c two sets of parallel sides, four equal sides, no right angles

d no parallel sides, two equal sides, one right angle

2 Use a ruler and a protractor to make an accurate copy of each of these quadrilaterals.

a
6 cm
6 cm

b
6 cm
3 cm

c
3 cm
3 cm
5 cm

d
2 cm
2 cm
5 cm
2 cm
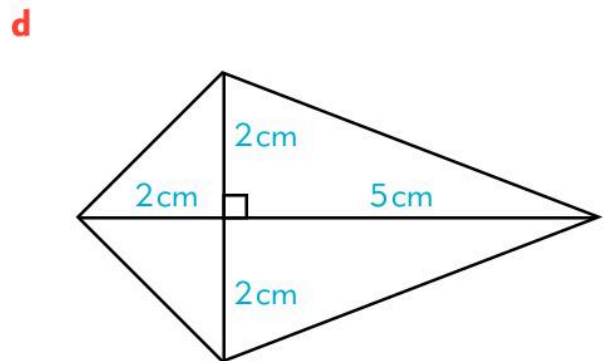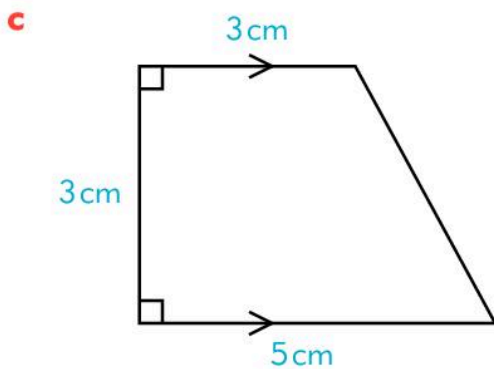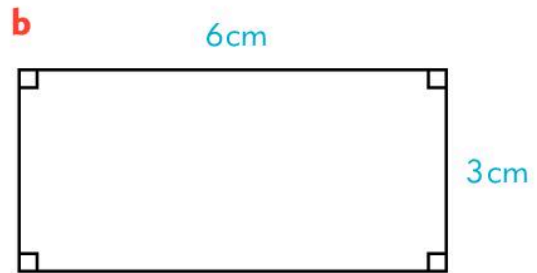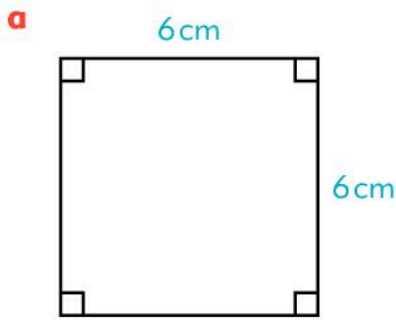
3 a Write down the correct name of each shape (a–d).

b Next to each one, write down two of its properties.

Perimeter

Perimeter is the distance around a shape. You can calculate the perimeter of any shape by adding the lengths of the sides.

You can also use a formula for finding the perimeter of rectangles. Do you remember the formula?

$P = 2 \times (L + B)$
$\quad = 2 \times (4\,cm + 2\,cm)$
$\quad = 2 \times (6\,cm)$
$\quad = 12\,cm$

When you have to find the perimeter of a shape, it is important to make sure that the lengths of the sides are all in the same units.

4 cm
2 cm
2 cm
4 cm
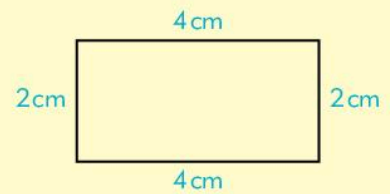
1 Find the perimeter of each of these shapes. The measurements are given, but the shapes are not to scale.

a
10 cm
8 cm
6 cm

b
4 cm
3 cm
5 cm

c
6 cm
6 cm
6 cm
6 cm

d
11 m
13 m
12 m
16 m

e
8.2 cm
8.2 cm
8.2 cm
8.2 cm
8.2 cm

f
7 cm
15 cm
7 cm
15 cm

g
5 cm
3 cm
3 cm
5 cm

h
12.4 m
6.3 m
6.3 m
12.4 m

i
1.3 m
4.6 m
4.6 m
1.3 m
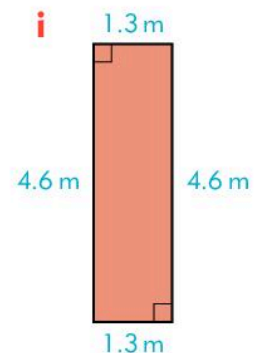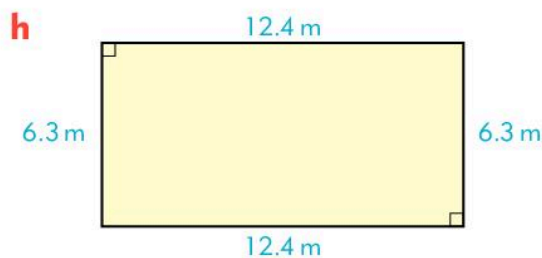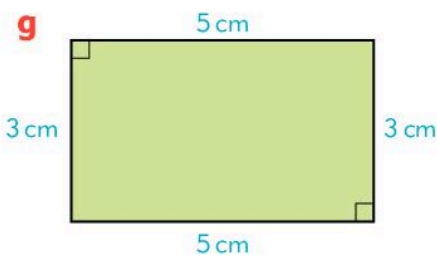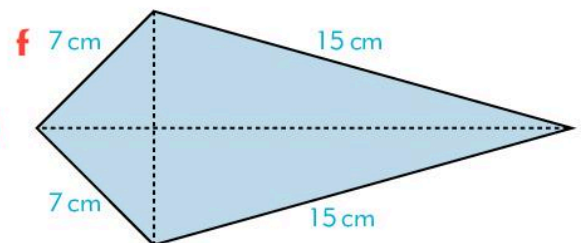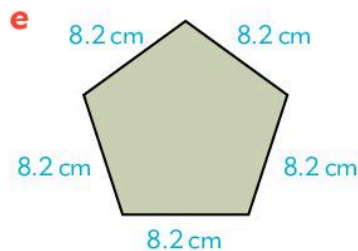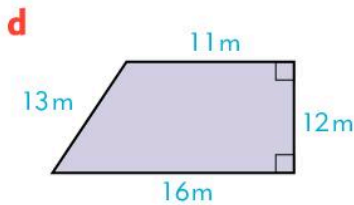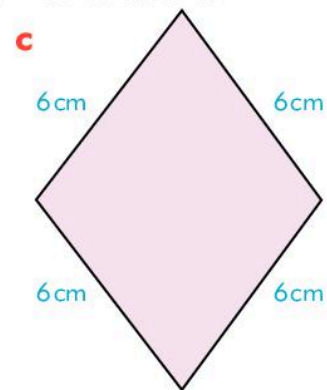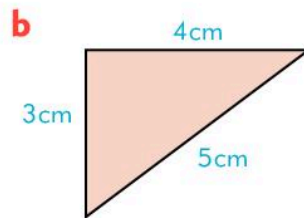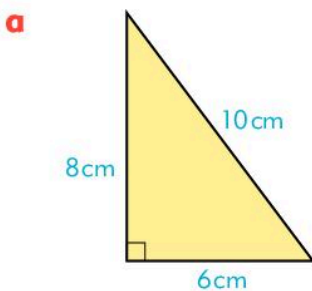
More perimeter

1 Find the perimeter of each shape. Work out the lengths of any unmarked sides before you start.

a
21 m
9 m
11 m
20 m

b
26 mm
14 mm

c
25 mm
25 mm

d
16 m
14.5 m
14 m
13.8 m

e
10 m
3 cm
4 cm
2 cm   2 cm
3 cm

f
6 m
1.5 m
3 m
1.5 m
1 m
6 m
2 m

g
17 cm
15 cm
17 cm
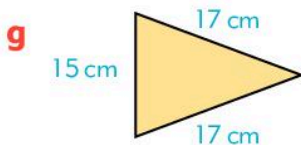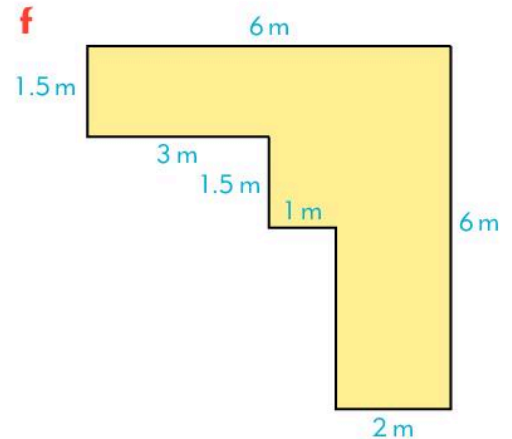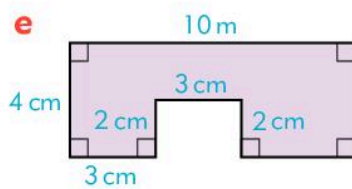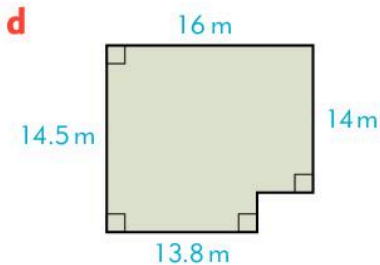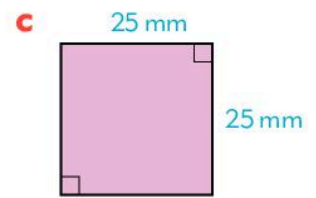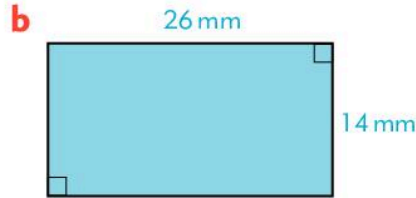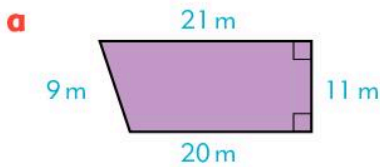
2 Work out the perimeter of each shape. Remember a regular shape has all sides equal in length.

a a square with sides of 6.5 cm

b a regular hexagon with one side equal to 10.4 cm

c a regular pentagon of side 14.9 mm

d a regular octagon with sides of 3.25 m

e a rhombus with one side of 130 mm

3 A rectangle has one side that is 10.75 cm long and a perimeter of 35 cm. What are the lengths of the other sides?

4 The shorter side of a parallelogram is 2.8 m long. The parallelogram has a perimeter of 15 m. What is the length of the longer side in metres?

you can use Workbook page 48

More about multiples

You already know that when you multiply two numbers you get a multiple.

Here are the first ten multiples of 4 and the first ten multiples of 6.

Multiples of 4:   4   8   12   16   20   24   28   32   36   40

Multiples of 6:   6   12   18   24   30   36   42   48   54   60

Can you see that 12, 24 and 36 are multiples of 4 and multiples of 6? We say that these are **common multiples** of these two numbers.

1 List the first six multiples of each number.

a	2	b	3	c	9	d	10	e	6
f	4	g	12	h	5	i	7	j	8

2 List these sets of numbers.

a   the multiples of 4 between 19 and 45

b   the multiples of 6 greater than 40 but less than 70

c   multiples of 100 to 1000

3 Find the first three common multiples of each of these sets of numbers.

a   2 and 3   b   5 and 10   c   6 and 8

4 What is the lowest number that is a common multiple of each of these sets of numbers? You will have to list their multiples to work this out.

a   4 and 5   b   3 and 8   c   3 and 7

d   5, 10 and 15   e   2, 9 and 18   f   12, 15 and 20

g   5, 6 and 9   h   2, 3 and 8   i   2, 3, 4 and 5

5 Find a number less than 50 that is a multiple of 9 and a multiple of 12.

6 Find a number whose digits add up to 10 that is a common multiple of 2, 4 and 7. Can you find another common multiple of these numbers whose digits add up to 11?

Factors

A number that divides exactly into another number without a remainder is called a **factor** of that number. This grid shows the factors of 12 arranged in pairs.

12	
1	12
2	6
3	4

You can find the original number by multiplying each pair of factors.

$1 \times 12 = 12$ $2 \times 6 = 12$ $3 \times 4 = 12$

Here are the factors of 12 and the factors of 20:

Factors of 12:   1   2   3   4   6   12

Factors of 20:   1   2   4   5   10   20

1, 2 and 4 are factors of both numbers. We say they are **common factors**.

1 Find all the factors of each number.

  a 16   **b** 30   **c** 28   **d** 36   **e** 40

2 List all the pairs of factors that can be multiplied to get each of these numbers.

  a 8   **b** 15   **c** 22   **d** 44   **e** 30
  f 90   **g** 56   **h** 27   **i** 110   **j** 200

3 Find a number other than 1 that is a common factor of each of the numbers in these sets?

  a 2 and 6   **b** 4 and 20   **c** 6 and 18
  d 11 and 44   **e** 16 and 24   **f** 32 and 40
  g 30 and 100   **h** 3, 9 and 12   **i** 36, 72 and 84

4 Which number is a factor of every other number?

5 Which number is a factor of every even number?

6 What is the highest factor of any number?

you can use Workbook page 49

Prime numbers

Here are the factors of 7, 11 and 17.

Factors of 7:   1 and 7
Factors of 11:   1 and 11
Factors of 17:   1 and 17

Each of these numbers has only two factors. The factors are 1 and the number itself.

A number with only two factors is called a **prime number**.

The number 1 is not a prime number because it only has one factor.

1 One number in each set is not a prime number. Use the rules of divisibility on page 32 to help you find this number, and list its factors to show that it is not a prime number.

a   2 3 5 9

b   1 3 5 7

c   17 19 23 30

d   41 43 47 48

e   2   7   3
    5   11   21

f   71 73 75 79

g   97 95 89 83

h   13 17 18 19

i   89 91 97 99

2 Look at a calendar for this month. Write the dates that are prime numbers. For example 2nd, 3rd, 5th, …

3 Goldbach's conjecture says that all even numbers > 2 can be written as the sum of two prime numbers.

Write these numbers as the sum of two prime numbers.

10   16   24   30   36

Prime factors

Every number can be factorised to find its prime factors. Once you have found the prime factors you can write the number as the product of its prime factors.

To find the prime factors of a number you can use a **factor tree**. Here are two different factor trees for the number 12.

$$12 = 2 \times 3 \times 2$$

$$12 = 3 \times 2 \times 2$$
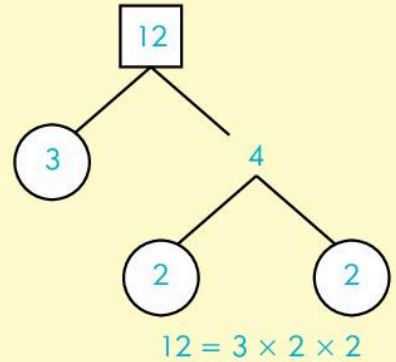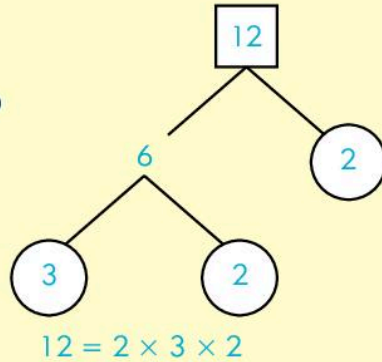
- Start your factor tree with any pair of multiples.
- If one of the factors is prime, circle it.
- Break any factors that are not prime into another factor pair.
- Keep going until you have only prime factors.
- Write the number as a product of all the prime factors in the factor tree.

Here are two examples for the number 36.

$$36 = 3 \times 3 \times 2 \times 2$$

$$36 = 2 \times 3 \times 2 \times 3$$
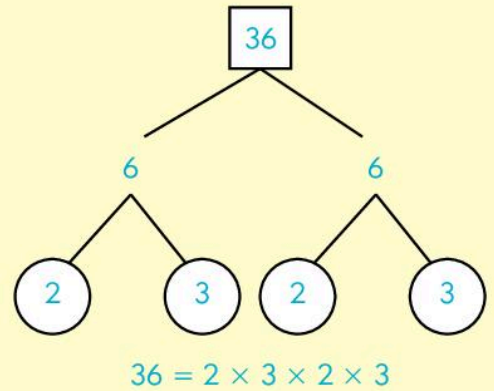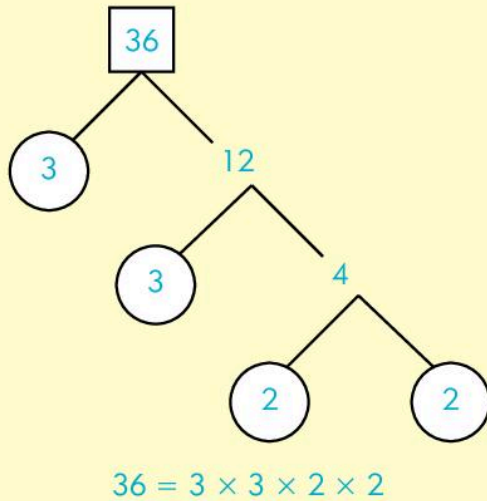
1 Factorise these numbers into prime factors.

a 10	**b** 30	**c** 16	**d** 24
e 48	**f** 60	**g** 64	**h** 33

Multiplication by multiples of 10

You already know multiplication facts and tables.

You also know how to multiply quickly by 10, 100 and 1000 working with place value.

Remember:

$4 \times 10 = 40$ $4 \times 100 = 400$ $4 \times 1000 = 4000$

You can combine these facts to find rules that make multiplication with any numbers ending in 0 easier.

1 **Work with a partner. Try to find the answers to these multiplications without doing any working out. Tell your partner how you found each answer.**

a 36×10 b 74×100 c $10 \times 10 \times 10$

d 9×1000 e 19×1000 f $10 \times 10 \times 10 \times 10$

g 30×100 h 60×1000 i 50×1000

2 **Find the missing numbers in these number sentences.**

a $7 \times \boxed{} = 7000$ b $\boxed{} \times 100 = 3200$ c $47 \times \boxed{} = 47\,000$

d $\boxed{} \times 10 = 960$ e $89 \times \boxed{} = 8900$ f $120 \times \boxed{} = 12\,000$

3 **Copy and complete this multiplication table. Write the answers only.**

	13	26	49	123	150	459	550	990
×10								
×100								
×1000								

4 **Now try these.**

a 3×20 b 4×20 c 5×20 d 8×20

e 8×30 f 8×40 g 12×20 h 12×30

i 12×40 j 20×20 k 20×30 l 20×40

you can use Workbook page 51

You can combine the multiplication facts that you already know with what you know about place value to quickly find the product of two or more multiples of ten and a hundred.

The examples show you how this works.

$30 \times 40 = 3 \times 10 \times 4 \times 10 = 3 \times 4 \times 10 \times 10 = 12 \times 100 = 1200$

$40 \times 800 = 4 \times 10 \times 8 \times 100 = 4 \times 8 \times 10 \times 100 = 32 \times 1000 = 32\,000$

Once you understand how this works you can do multiplications like these mentally.

1 **Copy and complete the table.**

2 **Find the product. Try to write the answers only.**

5×8	50×80	50×800
6×7	60×70	60×700
7×5	70×50	700×50
8×9	80×90	800×90
9×5	90×50	900×50
6×3	60×30	60×300
9×7	90×70	900×70
9×10	90×10	90×100

a 30×50

b 30×80

c 30×90

d 40×20

e 40×50

f 40×80

g 90×20

h 90×60

i 90×90

3 **Find the missing number in each multiplication.**

a $30 \times \boxed{} = 240$

b $40 \times \boxed{} = 24\,000$

c $50 \times \boxed{} = 35\,000$

d $\boxed{} \times 70 = 420$

e $\boxed{} \times 700 = 42\,000$

f $\boxed{} \times 700 = 49\,000$

g $\boxed{} \times 90 = 360$

h $\boxed{} \times 900 = 27\,000$

i $\boxed{} \times 30 = 3000$

4 **An athlete runs 30 km per week for 40 weeks. How far does she run in total?**

5 **A box of 20 tiles costs $30. How much will it cost for 80 boxes?**

Multiplying by near multiples of 10

You already know some methods for multiplying by multiples of ten. Read through the examples. Think about which method you find easier.

46×30	46×30
$= 46 \times (3 \times 10)$	$\rightarrow 46 \times 3 = 138$
$= (46 \times 3) \times 10$	$\rightarrow 138 \times 10 = 1380$
$= 138 \times 10$	
$= 1380$	

These methods can also help you find quick methods of multiplying by numbers that are nearly multiples of ten by rounding them up or down and then compensating by subtracting or adding to get the actual answer.

Here is an example using rounding up and then subtracting.

25×39 39 rounds up to 40

$25 \times 40 = 25 \times 4 \times 10 = 100 \times 10 = 1000$

But we only need 39 times 25.

$1000 - 25 = 975$ Check with a calculator: $25 \times 39 = 975$

Here is an example using rounding down and then adding.

400×91 91 rounds down to 90

$400 \times 90 = 4 \times 9 \times 100 \times 10 = 36 \times 100 \times 10 = 36\,000$

But we need 91 times 400.

$36\,000 + 91 = 36\,091$ Check with a calculator: $400 \times 91 = 36\,091$

1 **Use the method you prefer to find the answers.**

  a 41×30 **b** 33×30 **c** 64×40

  d 49×90 **e** 83×50 **f** 145×30

  g 456×200 **h** 198×400 **i** 234×3000

2 **Calculate. Show your methods.**

  a 119×20 **b** 379×80 **c** 136×300

  d 86×70 **e** 32×400 **f** 499×800

3 **Calculate. Use a calculator to check your answers.**

  a 20×39 **b** 80×61 **c** 52×80

  d 200×39 **e** 900×42 **f** 800×79

  g 400×202 **h** 309×600 **i** 900×201

  j 320×201 **k** 301×220 **l** 401×450

Division by multiples of 10

Remember division is the inverse of multiplication.

$10 ÷ 10 = 1$ $100 ÷ 10 = 10$ $1000 ÷ 10 = 100$

When you divide by 10 the digits move one place to the right on the place value table.

When you divide by 100 the digits move two places to the right on the place value table.

When you have to divide by a multiple of 10 (such as 30 or 200) it may help to write the multiple as its factors. For example to divide by 20:

$4500 ÷ 20$ $20 = 10 × 2$

$4500 ÷ 20 = 4500 ÷ 10 ÷ 2$

$4500 ÷ 10 = 450$

$450 ÷ 2 = 225$

1 **Divide.**
  a $90 ÷ 10$
  b $900 ÷ 100$
  c $9000 ÷ 1000$
  d $25\,000 ÷ 10$
  e $660\,000 ÷ 100$
  f $9600 ÷ 1000$

2 **Rewrite the number sentences and fill in the missing numbers.**
  a $6500 ÷ \underline{} = 65$
  b $800 ÷ \underline{} = 8$
  c $\underline{} ÷ 1000 = 320$
  d $40\,300 ÷ \underline{} = 4030$

3 **Divide. Show your working.**
  a $8000 ÷ 20$
  b $180 ÷ 30$
  c $3300 ÷ 30$
  d $35\,000 ÷ 700$
  e $6600 ÷ 600$
  f $10\,500 ÷ 500$

4 **Work with a partner. Decide how you could do these divisions quickly.**
  a $412 ÷ 10$
  b $3104 ÷ 10$
  c $4532 ÷ 100$
  d $4907 ÷ 70$
  e $1122 ÷ 60$
  f $1044 ÷ 40$

Mixed calculations

1 Fill in the correct operation in the following number sentences. Choose from:

$$\boxed{\times 10} \quad \boxed{\times 100} \quad \boxed{\div 10} \quad \boxed{\div 100}$$

a $36 \bigcirc = 360$ **b** $480 \bigcirc = 48$ **c** $960 \bigcirc = 9600$

d $4.5 \bigcirc = 4500$ **e** $390 \bigcirc = 3.9$ **f** $39 \bigcirc = 0.39$

g $1.2 \bigcirc = 1200$ **h** $3.45 \bigcirc = 345$ **i** $83 \bigcirc = 8.3$

2 Copy the number sentences. Think about what strategy is being used and fill in the missing values. Calculate the answer.

a $18 \times 63 = (63 \times 10) + (\boxed{} \times \boxed{})$

b $99 \times 33 = (100 \times 33) - (\boxed{} \times \boxed{})$

c $85 \times 101 = (85 \times \boxed{}) + (\boxed{} \times \boxed{})$

d $42 \times 50 = 42 \times 100 \div \boxed{}$

e $480 \times 60 = (400 \times 60) + (\boxed{} \times \boxed{})$

f $392 \times 30 = 3920 \times \boxed{}$

3 Which is greater? Copy the number sentences and fill in < or >.

a $99 \times 87 \ \boxed{} \ 101 \times 74$ **b** $99 \times 51 \ \boxed{} \ 101 \times 48$

c $101 \times 27 \ \boxed{} \ 99 \times 33$ **d** $102 \times 53 \ \boxed{} \ 100 \times 54$

4 There are five incorrect answers in this division table. Find the mistakes and work out the correct answers. The numbers in the top row are divided by the numbers in the first column.

÷	100	150	200	500
1	100	1.5	200	500
2	50	75	100	2500
10	10	1.5	20	50
50	2	3	40	10
100	1	1.5	0.5	5

5 How many times does 10 go into each of these numbers?

a 200   **b** 500   **c** 900   **d** 8000

e 210   **f** 340   **g** 456   **h** 987

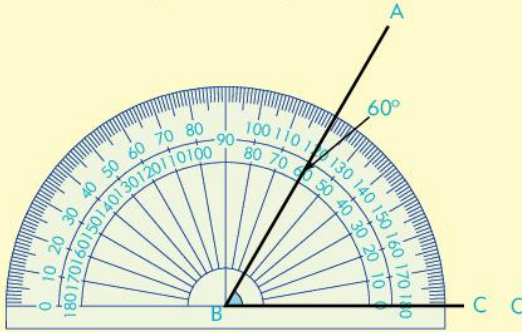**i** 12 400   **j** 13 245   **k** 9076   **l** 456.9

6 Find one-hundredth of each number.

a 12 000   **b** 9500   **c** 12 345   **d** 9

Do you remember how to use your protractor to measure and draw angles?

Measuring an angle   Drawing an angle

Read the size in degrees. Start at 0 to make sure you read the correct scale. ∠ABC = 60°
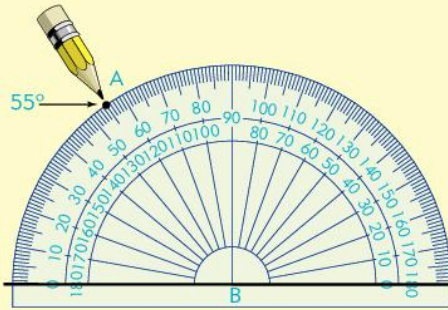
1. Put the protractor on the line. Mark the size of the angle.

2. Draw in the other arm of the angle.
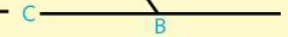
1 Look at the pictures above carefully. Tell your partner how you would:

a use a protractor to measure a right angle

b use a protractor to draw an angle of 60 degrees.

2 Estimate the size of each angle. Write down your estimate.

3 Measure each angle to the closest degree. Write your measurements next to your estimates.

a

b

c

d

e

f
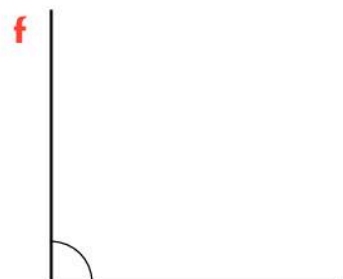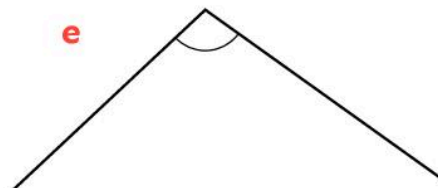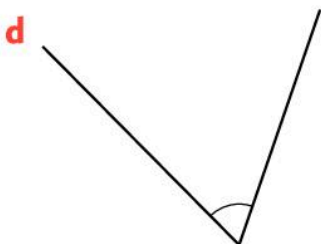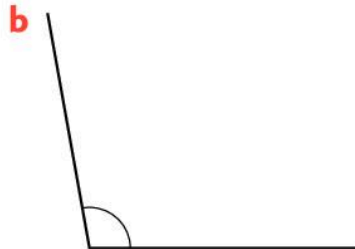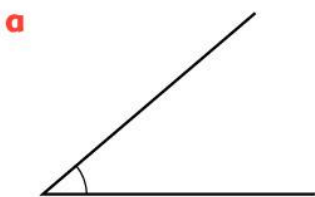
Calculating the size of angles
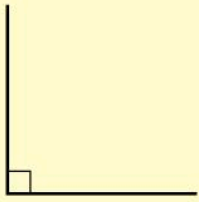
You already know that a right angle measures 90°.
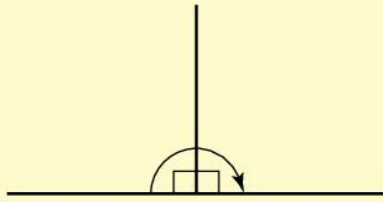
If you put two right angles together, they make a straight angle of 180°. All straight lines measure 180°.
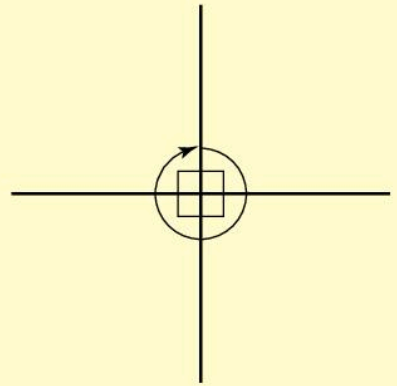
If you put two straight angles together, they make a complete turn of 360°. All complete turns measure 360°.

We can use these facts to work out the size of unknown angles without measuring. Look at these examples carefully to see how to do this.

A

50°

B   C
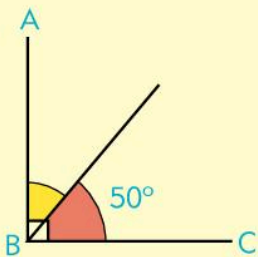
Angle ABC is a right angle.
The red angle is 50°.
90° − 50° = 40°
So, the yellow angle must be 40°.

120°

D   E
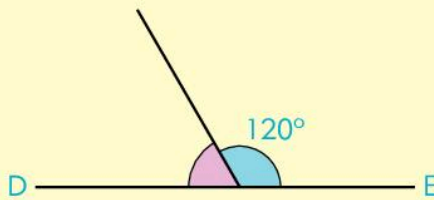
DE is a straight line.
The blue angle is 120°.
180° − 120° = 60°
So, the pink angle must be 60°.

80°

160°
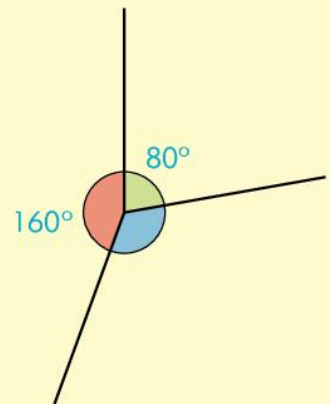
These three angles make a complete turn.
The green angle is 80°.
The red angle is 160°.
Together 80° + 160° = 240°

360° − 240° = 120°
So, the blue angle must be 120°.

✏️ **1** Work out the size of the green angle in each of these.

a

25°

b

72°

c

40°
185°
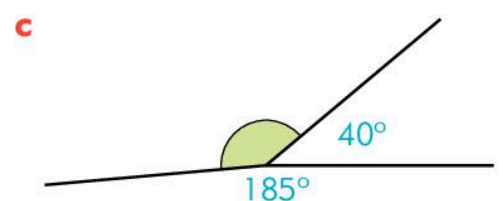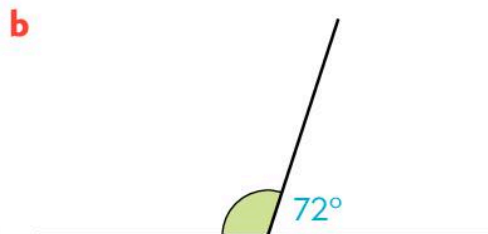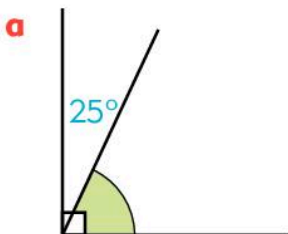
Missing angles

When two straight lines cross each other the opposite angles are equal.

The red angles are equal.

The green angles are equal.

One red angle plus one green angle is equal to 180°.

You can check this for yourself by drawing any two straight lines that cross each other. Measure one angle, then measure the angle opposite to it. You will find that they are always equal.
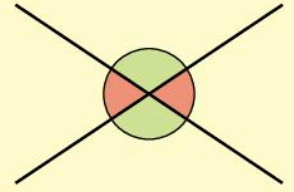
Calculate the unknown angles x and y in these diagrams.

1

$x°$
$33°$

2

$61°$
$x°$

3

$x°$ $115°$

4

$x°$ $145°$

5

$94°$ $y°$
$x°$

6

$x°$
$y°$

7

$x°$ $30°$
$y°$

8

$120°$ $x°$
$y°$

9

$70°$
$x°$ $150°$
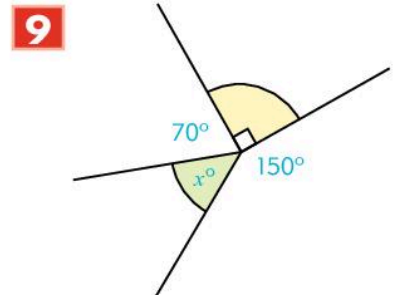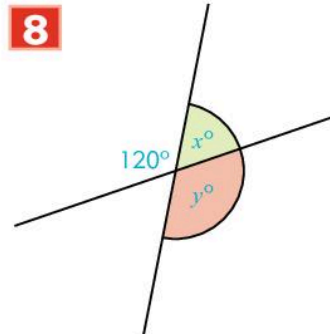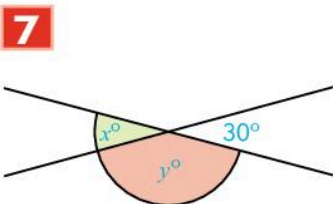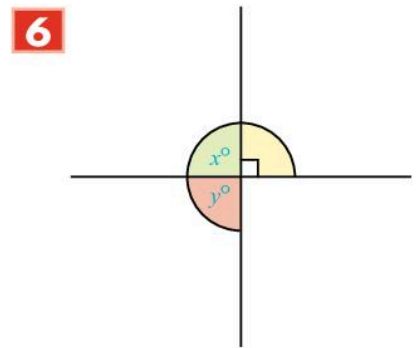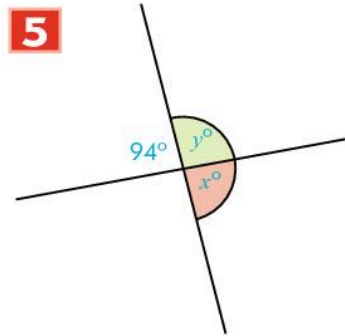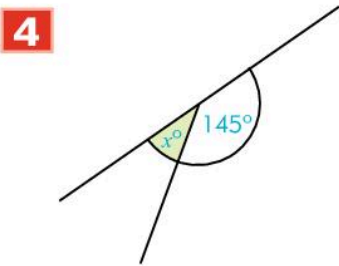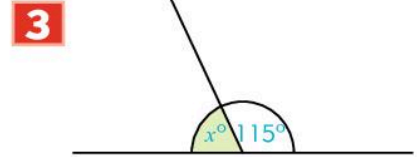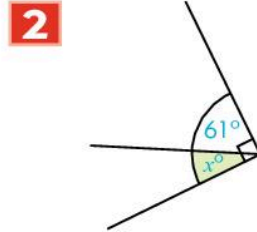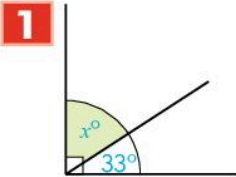
you can use Workbook page 54

Angles in a triangle

1 Copy this table into your book.

Triangle	Size of angle a	Size of angle b	Size of angle c	$a + b + c$
A				
B				
C				
D				
E				
F				

2 Measure the size of each angle in the triangles below. Record the results in your table.

3 Add up the sizes of the three angles in each triangle. Write the totals in the table.

4 What do you notice about the sum of the angles in a triangle?

A

B

C

D

E

F

you can use Workbook page 55
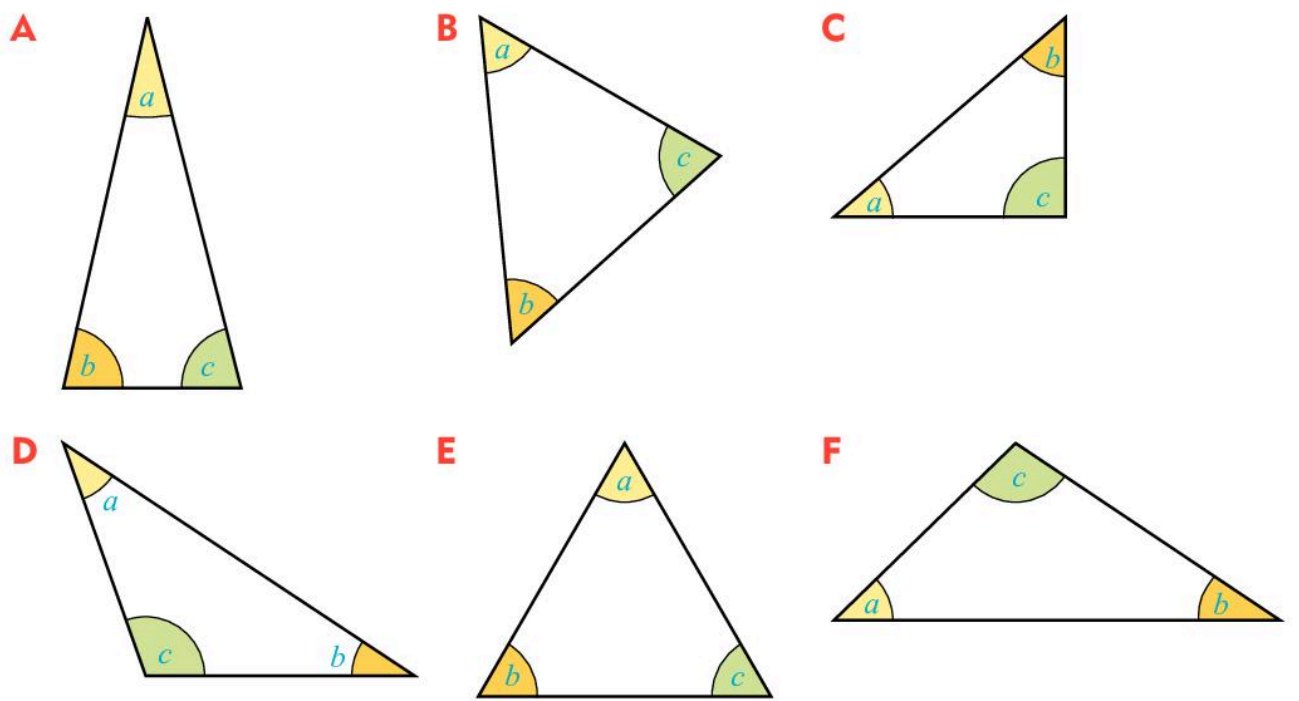
You can write a number sentence to find the missing angle in a triangle. Read this example carefully to see how to do this.

Find the size of angle x.

$$50° + 80° + x = 180°$$
$$130° + x = 180°$$
$$x = 180° - 130°$$
$$x = 50°$$
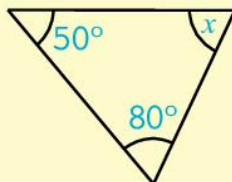
1 Make number sentences to find the missing angles in each of these triangles.

a

b

c

d
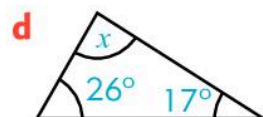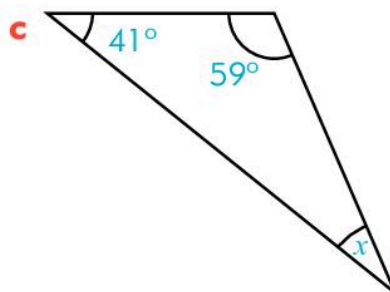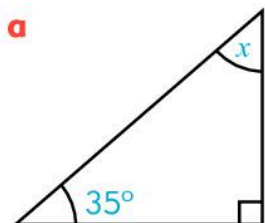
2 Here are two of the angles in three different triangles. Make a number sentence and work out what the third angle is in each triangle.

a 20°   110°

b 45°   90°

c 32°   74°

3 a Find the sizes of angles a, b and c in this diagram.
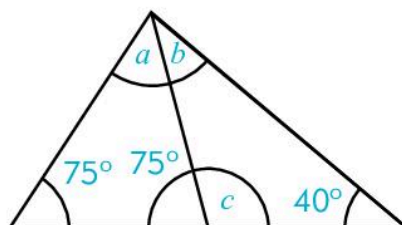
b Tell your partner how you worked to solve this problem.

you can use Workbook page 56

Angles of rotation

An angle of 360° is called a **full rotation**. If a shape turns 360° it will end up back in the same position. Look at this shape to see how it moves about point A in a full rotation.
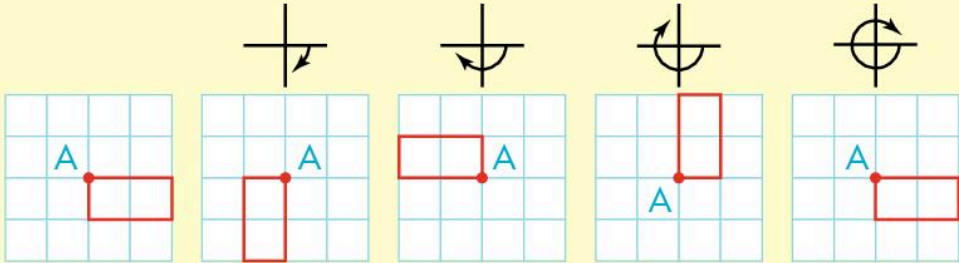
You can also move shapes less than 360°. These shapes have all rotated 90° clockwise or anti-clockwise. The rotation is described using degrees and direction below each shape.

| 90° | 90° | 90° | 90° |
| clockwise | anti-clockwise | clockwise | anti-clockwise |
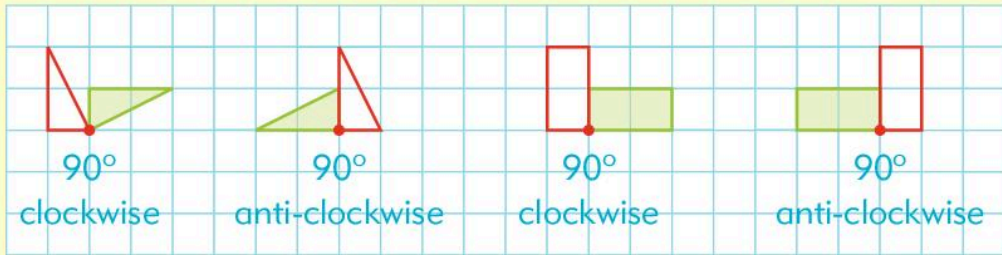
1 The green shapes were rotated about the red dot to form the blue shapes. Describe each rotation using degrees and direction.

a   b   c   d
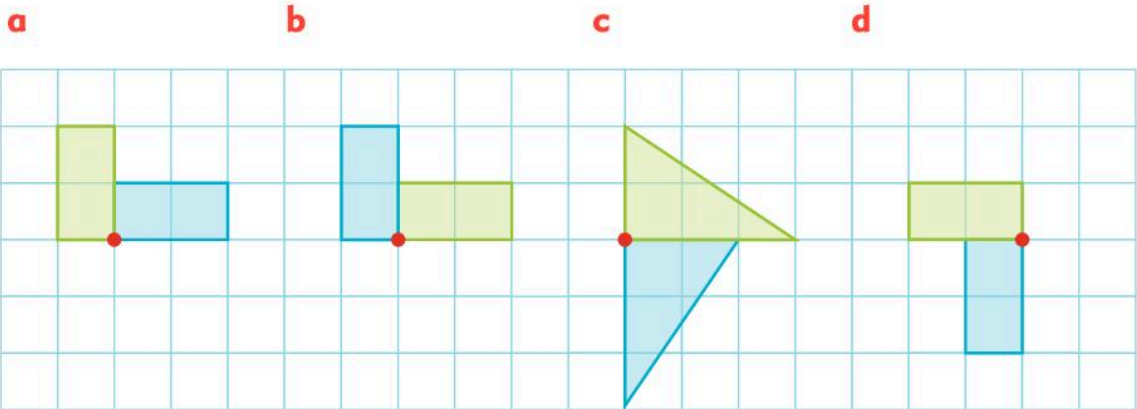
A **percentage** is a number out of 100.

92 out of 100 $= \frac{92}{100} = 92\%$

We use the % sign to write percentages.

Each of these squares has 100 blocks.

1 Write the percentage of each square that is shaded pink.

2 What percentage of each square is shaded purple?

a

b

c

d

e

f

g

h

i

j

k

l

you can use Workbook page 58
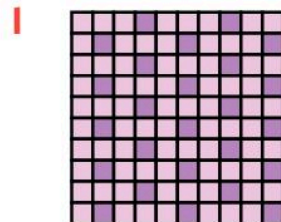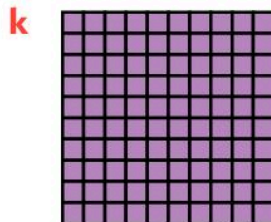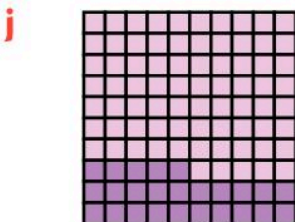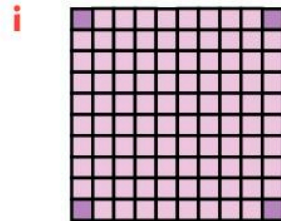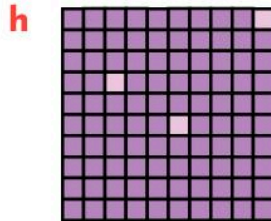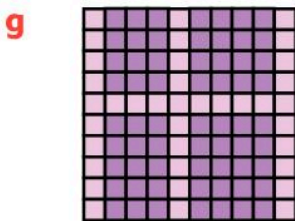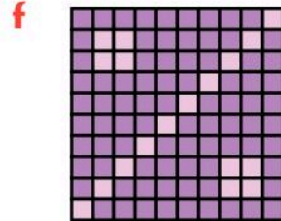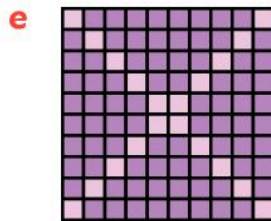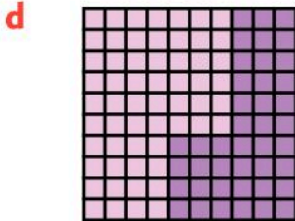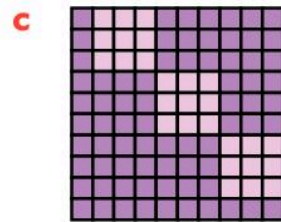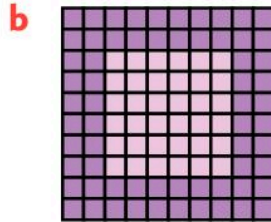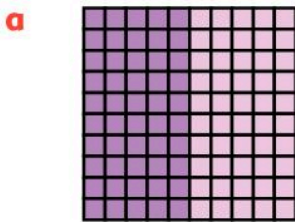
Percentages, fractions and decimals

Three girls are collecting pieces of a puzzle from a magazine. Sondra has $\frac{13}{20}$ pieces of the puzzle, Jenny has 0.6 pieces of the puzzle and Jess has 65% of the puzzle pieces.

How do you know who has most?

We can compare the numbers if they are all written in the same form.

Percentages can be converted to common fractions easily.

What fraction of the whole is 75%?

Write the percentage as a fraction of 100: $\frac{75}{100}$

Simplify the fraction: $\frac{75}{100} \div \frac{25}{25} = \frac{3}{4}$

Common fractions can be written as percentages.

Express $\frac{2}{5}$ as a percentage.

You can use equivalent fractions to do this: $\frac{2}{5} \times \frac{20}{20} = \frac{40}{100} = 40\%$

You can also multiply by $\frac{100}{1}$: $\frac{2}{5} \times \frac{100}{1} = \frac{200}{5} = 40\%$

Percentages can be converted easily to decimal fractions. Simply divide the decimal by 100. For example, $42\% = \frac{42}{100} = 0.42$.

Decimal fractions can be converted easily to percentages using the inverse operation. To convert a decimal to a percentage, multiply the decimal by 100.

What is 0.9 as a percentage? $\qquad$ $0.9 \times 100 = 90\%$

What is 0.09 as a percentage? $\qquad$ $0.09 \times 100 = 9\%$
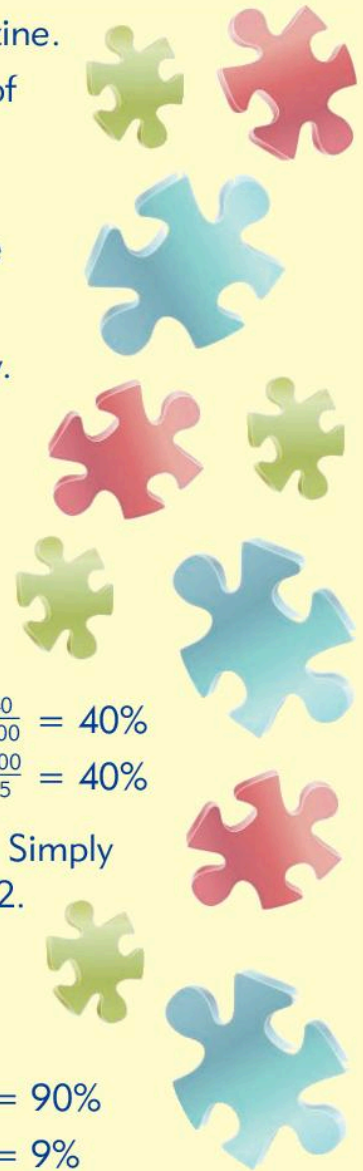
1 **Write each percentage as a fraction in its simplest form.**

a 10%   b 20%   c 40%   d 50%   e 75%

f 15%   g 22%   h 35%   i 92%   j 80%

k 25%   l 18%   m 6%   n 5%   o 65%

More conversions

1 **Express each fraction as a percentage.**

a $\frac{3}{10}$ b $\frac{9}{10}$ c $\frac{4}{10}$ d $\frac{25}{100}$ e $\frac{35}{100}$

f $\frac{1}{2}$ g $\frac{3}{4}$ h $\frac{16}{25}$ i $\frac{7}{20}$ j $\frac{45}{50}$

2 **Write these percentages as decimal fractions.**

a 27%   b 74%   c 9%   d 96%   e 17%

f 6%   g 12%   h 45%   i 4%   j 100%

3 **Write these decimal fractions as percentages.**

a 0.75   b 0.83   c 0.08   d 0.49   e 0.5

f 0.25   g 0.8   h 0.6   i 0.15   j 0.01

4 **Copy this table into your book and complete it.**

Fraction	Decimal	Percentage
$\frac{1}{4}$		
$\frac{1}{2}$		
$\frac{3}{4}$		
$\frac{1}{5}$		
$\frac{3}{5}$		
$\frac{4}{5}$		
$\frac{3}{8}$		
$\frac{7}{20}$		

5 **Rewrite each set of numbers in order from smallest to greatest.**

a $\frac{74}{100}$ 0.75   73%   b $\frac{50}{100}$ $\frac{1}{3}$ 0.4   c 9% $\frac{90}{100}$ $\frac{4}{5}$

d 25% $\frac{3}{4}$ 0.3   e $\frac{99}{100}$ 0.099   100%

6 **Write each amount as a fraction and then express it as a percentage.**

a 13 out of 20 biscuits in the box are broken.

b $\frac{19}{40}$ students in a class are girls.

c 105 children out of 200 voted in favour of more sport at school.

d 4 out of every 5 children watch TV at least once a week.

e The fielder caught 19 out of 20 catches.

f I got $\frac{23}{30}$ for my maths test.

Finding percentages of amounts

Sometimes you need to find a percentage of an amount.

For example, what is 10% of 80?

You can work this out in different ways.

$10\% \text{ of } 80 = \frac{10}{100} \times 80 = \frac{800}{100} = 8$

$10\% \text{ of } 80 = \frac{1}{10} \text{ of } 80 = \frac{80}{10} = 8$

You can also use the percentage key on a calculator to find percentages of amounts.

To find 10% of 80 you would enter | 1 | 0 | % | X | 8 | 0 | = |

1 Calculate.

a	10% of 50	**b** 20% of 60	**c** 30% of 120
d	15% of 90	**e** 25% of 200	**f** 25% of 1200
g	20% of 75	**h** 90% of 120	**i** 14% of 50

2 How much does each percentage represent?

a	20% of 50 girls	**b** 10% of 120 cows
c	25% of 80 children	**d** 25% of 48 bottles
e	25% of 40 cars	**f** 10% of 140 sweets

3 Work out. Show your working.

a	50% of $2.50	**b** 25% of 4 kg
c	75% of 1 l	**d** 10% of 90
e	5% of $1.60	**f** 45% of 900 g
g	75% of hours in a day	**h** 30% of 30 cm
i	90% of 100 m	**j** 15% of 120 ml

4 The students in a school collected $2004.80 for charity.
They shared the money among four charities in this way:

25% to Save the Children
40% to Working for Clean Water
20% to Earthquake Relief
15% to Disability Aid.

Work out how much money each charity received.

More percentages of amounts

1 Measure each coloured strip to find its total length in millimetres.

2 Calculate the percentage of each strip that is:

i yellow   **ii** blue   **iii** green

a

b

c

d

e
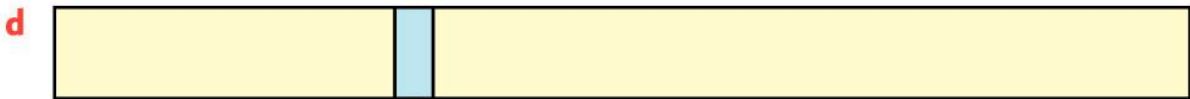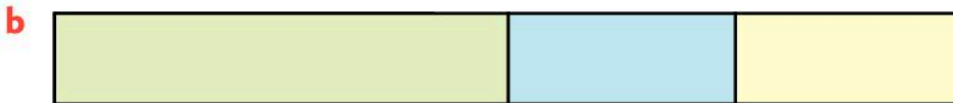
3 The table shows the percentage of boys and girls in different age groups in a school.

Age in years	Total: 300 girls	Total: 280 boys
10	25%	20%
11	30%	30%
12	18%	24%
13	27%	26%

a Work out how many boys and girls there are in each age group.

b How many girls are younger than 13?

c How many boys are older than 11?

When shops have sales they may show the reduction in price as a percentage. For example, '25% off' means that the price is reduced by 25%. You can also say this is a **discount** of 25%.

To find the new price, work out the amount of discount in money terms. Then subtract this to find the new price.

For example:

A shop offers 20% discount on sale goods. What will you pay in the sale for an item that was marked at $50?

20% of $50 $= \frac{20}{100} \times \$50 = \$10$

$50 − $10 = $40

You would pay $40 in the sale.

1 **Work out the sale price of each of these items.**

a
$59.00
10% off

b
$40.00
Less 25%

c
$225.00
SAVE 15%

d
$129.00
10% off

e
$30.50
20% off

f
$179.00
5% off

g
50% off
$99.99
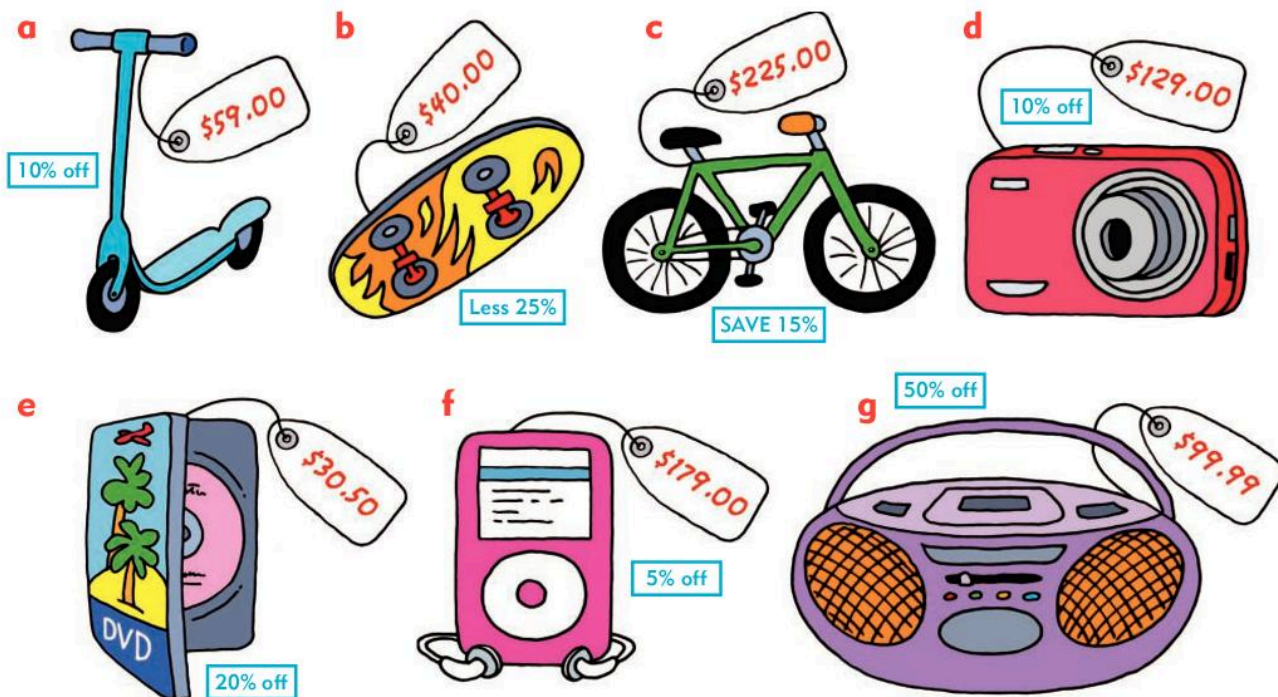
2 After two weeks, the shop in question 1 offers a further 5% discount on each item. Work out the price of each item with this extra discount.

Working with money

Remember: Money amounts are written as decimal quantities.

One dollar and fifty cents is written as $1.50.

We can write amounts in cents as decimals too.
One dollar = 100 cents
20 cents is a fraction of a dollar. $\frac{20}{100}$ cents = $0.20

You can estimate, add, subtract, multiply and divide money amounts using the same methods you learned when you worked with decimal fractions.

1 **Round each of these money amounts to the closest dollar.**
a $34.26   b $7.54   c $34.57
d $0.50   e $199.99   f $2999.55

2 **How much will you pay for these groceries?**
a 2 packets of sugar at $2.99 per packet
b 2 sacks of rice at $8.99 per packet
c 3 cartons of milk at $1.25 each
d 6 tins of fish at $3.45 per tin
e 4 kilograms of vegetables at $1.89 per kilogram

3 a What is the total cost of all the groceries in question 2?
b How much change would you get from $100?

4 **Sam buys 300 m of fabric at $40 per metre.**
a What is the total cost?
b The shopkeeper adds 14% tax to the cost. How much will Sam pay altogether?

5 **Leela paid $156 for 400 identical plastic containers. How much was each container?**

6 **A waiter earns $5.45 per hour. If he works an eight-hour shift, how much will he earn?**

7 **Sanita buys 40 m of fabric at a sale for $2.50 per metre. She sells all the fabric to her friends for $4.25 per metre. How much money does she make? Think carefully about this!**

Checking calculator addition

When you add a long list of numbers on a calculator it is easy to make mistakes.

You can check your work by adding again in a different order like this:

Add up this bill:

Add from top to bottom.	Check by adding again from bottom to top.
43.50	12.99
19.20	13.99
29.30	29.30
13.99	19.20
12.99	43.50
118.98	118.98

The answers are the same, so your total is likely to be correct.

1 Add each list of figures from top to bottom on your calculator. Write the answers in your exercise book.

a	b	c	d
12.99	123.45	20.05	36.99
+ 12.99	+ 123.45	+ 30.45	+ 19.99
+ 12.99	+ 345.50	+ 50.99	+ 45.99
+ 5.99	+ 34.99	+ 40.45	+ 23.99
+ 5.99	+ 23.45	+ 45.05	+ 21.99
+ 5.99		+ 23.05	+ 45.99

e	f	g	h
7.99	12.99	100.00	125.40
+ 9.99	+ 12.45	+ 34.00	+ 136.80
+ 5.99	+ 12.45	+ 39.99	+ 190.70
+ 12.99	+ 12.88	+ 29.99	+ 250.80
+ 4.99	+ 12.67	+ 99.99	+ 450.50
+ 8.99	+ 12.45		

2 Check your addition by adding again from bottom to top. If you have made a mistake, add again.

you can use Workbook page 62

1 Here are the orders for four tables at the Fancy Fast Food Restaurant.

a Use the prices on page 103 and calculate the cost of each order.

b The restaurant adds 10% of the cost of each order to the bill as a service charge. Work out 10% of each bill and find the total cost per person.

Table 1
1 Fish and chips
1 Salad
1 Ice cream
1 Cola

Table 2
2 Sandwiches and fries
1 Fried chicken
2 Chocolate milkshakes
1 Cola
1 Fruit salad

Table 3
2 Noodles and vegetables
1 Sandwich and fries
1 Fried chicken
1 Fries
1 Salad
3 Ice creams
2 Chocolate milkshakes
1 Apple juice

Table 4
4 Noodles and vegetables
1 Sandwich and fries
1 Salad
4 Fruit salads
3 Apple juice
1 Mango juice

2 Work with a partner. You have $10.00 between you to spend at the restaurant.

a Decide what you will order.

b Check that the total bill for both of you is $10.00 or less. Remember to include the service charge.

3 At the end of the year, the restaurant owner decides to put the prices up by 5%. The service charge will remain at 10%.

a Work out the new price of each item.

b Record the new prices on the menu in your Workbook.

c Work out the cost of the meal you and your partner ordered using the new prices.

d Can you still pay for it with $10.00?

4 Talk about the prices shown on the menu.

a Do you know what fast foods like these cost in your country?

b Are these prices realistic or not?

c Why do you think different meals cost different amounts?

you can use Workbook page 63

Fancy Fast Food

To Eat

Fish and Chips	1.99
Sandwich and Fries	2.40
Fried Chicken	1.99
Noodles and Vegetables	1.29
Just Fries	0.50
Salad	1.00

Something Sweet

Ice Cream	1.99
Fruit Salad	1.50

Drinks

Fresh Juice (Apple, Orange, Mango)	1.29
Cola	1.39
Milkshake (Chocolate/Lime)	2.75

A 10% service charge will be added to all orders

Paying by mass

When you post a letter or parcel to another country the amount you pay for postage depends on the mass of the item you are posting. The table shows the cost of sending different items by airmail and by sea mail (ordinary mail).

Mass of item	Airmail	Ordinary mail
Up to 250 g	$5.75	$4.00
Over 250 g to 500 g	$10.50	$7.00
Over 500 g to 750 g	$15.25	$10.00
Over 750 g to 1 kg	$20.00	$13.00
Over 1 kg to 1.25 kg	$24.75	$16.00
Over 1.25 kg to 1.5 kg	$29.50	$19.00
Over 1.5 kg to 1.75 kg	$34.25	$22.00
Over 1.75 kg to 2 kg	$39.00	$25.00
Every 500 g or part thereof above 2 kg	$6.50	$3.00

1 Work out the cost of sending each parcel by ordinary mail.

a
500 g

b
100 g

c
1.3 kg

d
750 g

e
0.45 kg

f
3000 g

g
2100 g

h
2 x 1.5 kg
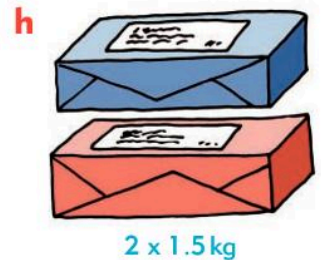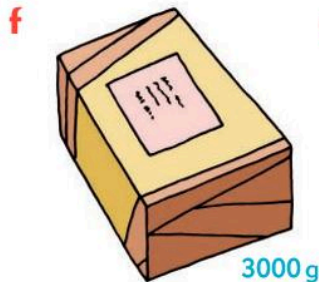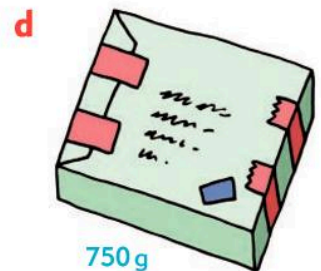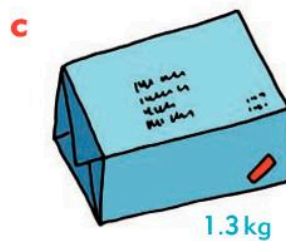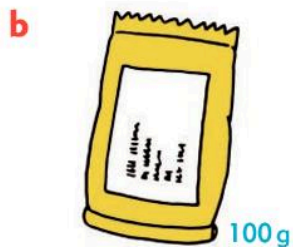
2 Calculate how much more you would pay if you sent each parcel by airmail.

How much does it weigh?

When you travel by aeroplane, the airline weighs your luggage to make sure it is not too heavy. The mass of the luggage is shown on a digital scale in kilograms. Grams are rounded off to the nearest tenth of a kilogram. For example, luggage that weighs 19 kg and 450 g would show as 19.5 kg.

1 What would the scale show for each of these sets of luggage?

a 9.45 kg
11.73 kg
3.68 kg

b 12.61 kg
8.02 kg

c 21 kg 750 g

d 8 kg 900 g
4.09 kg
4.15 kg

e 5000 g
17.21 kg

f 21 kg 475 g

g 13.75 kg
8020 kg
11 kg 830 g

h 6.47 kg
18 kg 900 g

i 14 kg 850 g
12 kg 610 g

j 21 kg 400 g

k 16 kg 395 g
11.48 kg

l 14950 g
7300 g

2 Each passenger is allowed to check in 23 kg of luggage.

a Which sets of luggage are within this limit?

b Which sets of luggage are too heavy?

c Which three sets of luggage are lightest? Write them in order from lightest to heaviest.

Describing probability

You have already described the chance of different things happening using words like impossible (no chance), unlikely, even chance (50%), likely and certain.

For example:

- If you leave chocolate in the sun it is **likely** to melt.
- There is **no chance** of seeing a living dinosaur today. This is **impossible**.
- We can be **certain** that the sun will rise tomorrow.
- If you toss a coin you have an **even chance** of getting heads or tails.

We can show these words on a probability scale like this:

impossible (no chance)	unlikely	even chance (50%)	likely	certain

When we describe the chance of something happening we are using **probability**. We can say that probability is a measure of how likely or unlikely a certain result is.

1 **Use words from the scale to describe the probability of each of these things happening:**

a   You will go to bed early tonight.

b   It will rain tomorrow.

c   You will be younger tomorrow.

d   You will travel by train next week.

e   If you toss a coin, it will land on heads.

f   It will get dark tonight.

g   If you throw a die you will get a number lower than 7.

h   In 100 years' time people will be able to fly.

i   Your next lesson will be English.

j   You will find ice at the North Pole.

2 **Tell your partner one thing in your life that is:**

a   impossible   b   certain   c   likely   d   unlikely.

What is the chance?

Use the scale on page 106 to help you answer these questions.

1 On this spinner, what is your chance of spinning:
- **a** yellow
- **b** green
- **c** orange?
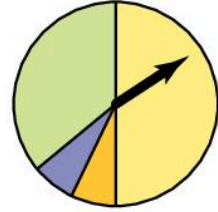
2 On this spinner, what is your chance of spinning:
- **a** orange
- **b** purple
- **c** red?
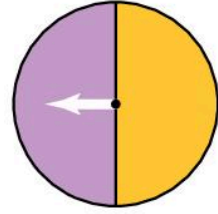
3 From this bag of marbles, what is your chance of pulling out:
- **a** blue
- **b** red
- **c** green?
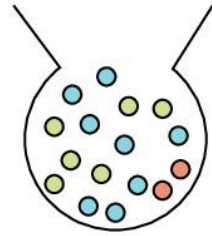
4 From this bag of marbles, what is your chance of pulling out:
- **a** yellow
- **b** red
- **c** blue or yellow?
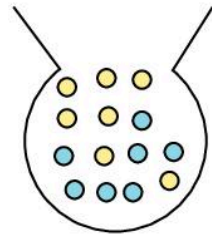
5 Work with a partner.
- **a** Draw a spinner that has an equal chance of red or blue.
- **b** Draw a spinner that has no chance of landing on green, and more than an even chance of landing on yellow.

More probability

1 Use a word to describe the probability that the spinner will stop on red.

a   b   c   d
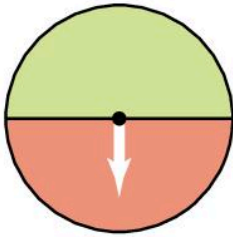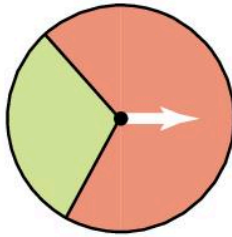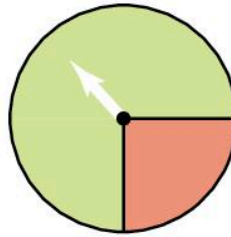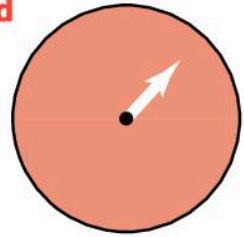
e Which spinner has the lowest likelihood of landing on red?

2 Use a word to describe the probability that the spinner will stop on yellow.

a   b   c   d
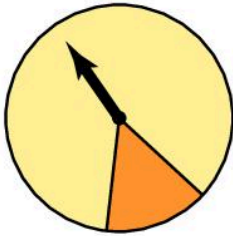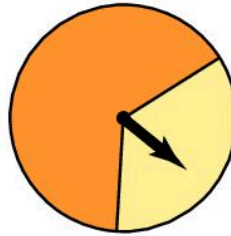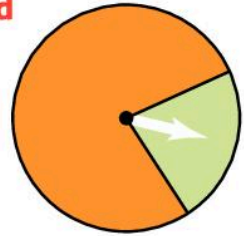
e Which spinner has the best chance of landing on yellow? Why?

3 If you threw this die, what is the likelihood that you would get:

a a prime number
b a square number
c a factor of 6
d a multiple of 2
e an odd number
f a number <7?
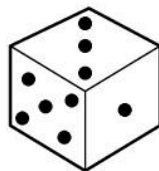
Revising co-ordinates

Do you remember how to give the position of points on a grid like this one?

The position of any point can be given using two numbers. On this grid, A is at position (3, 2).

The first number is the x-co-ordinate. It tells you how many units to move along the x-axis.

The second number is the y-co-ordinate. It tells you how many units to move up against the y-axis.

The x-co-ordinate is always written first. You can remember this if you remember that x comes before y in the alphabet.

The point where the two axes meet is called the **origin**. It has the co-ordinates (0, 0).
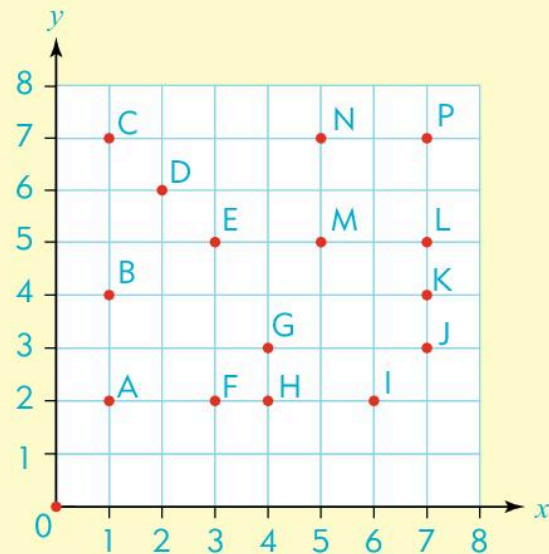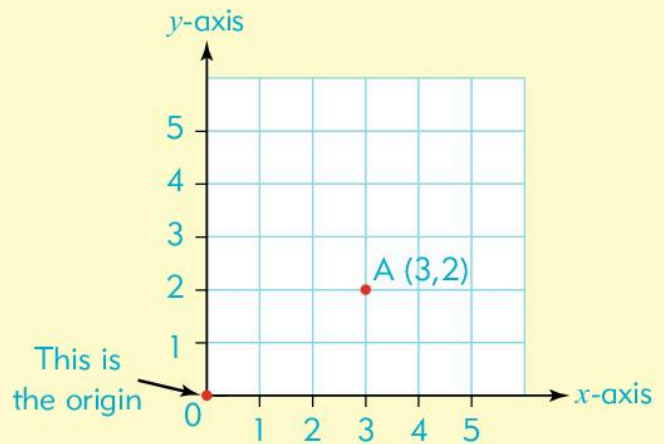
1 Write down the capital letter in the grid used to name each point.

a	(5, 7)	b	(7, 7)	c	(1, 2)	d	(0, 0)
e	(3, 2)	f	(1, 4)	g	(7, 3)	h	(4, 2)
i	(4, 3)	j	(3, 5)	k	(7, 5)	l	(7, 4)
m	(6, 2)	n	(5, 5)	o	(2, 6)	p	(1, 7)

You have already extended number lines below 0 to show negative numbers. Just as you extended the number lines, you can extend the *x*-axis to the left and *y*-axis downwards on a grid to include negative numbers. You can see how this is done on the grid below.

To find the co-ordinates of a point (or to plot a point) on the extended graph, you work in the same way as you did before.

First find the *x*-co-ordinate, remembering it could be a negative number.

Then find the *y*-co-ordinate, remembering it could be a negative number.

For example, to find point G on the star.

Find the *x*-co-ordinate. It is 3.
Find the *y*-co-ordinate. It is −3.
G is at point (3, −3).

1 Work with a partner. Find and write down the co-ordinates of each letter from A to Q. (Note: there is no letter O as O is used for the origin.)
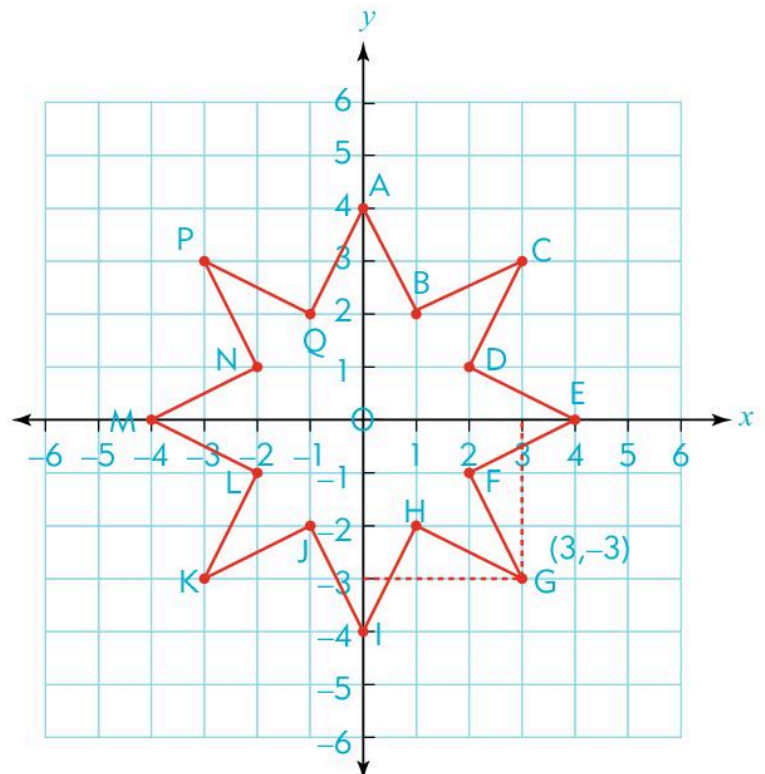
you can use Workbook page 65

Co-ordinates and quadrants

When you extend the x- and y-axes you get a grid that is divided into four parts.

These parts are called **quadrants**. The quadrants are labelled from the top right in an anti-clockwise direction.
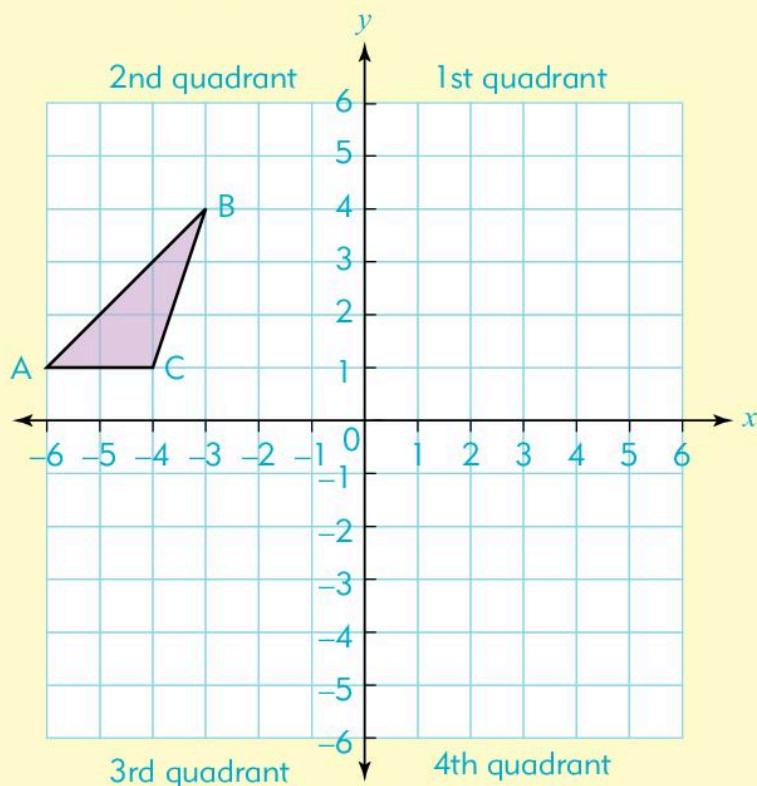
Triangle ABC is in the second quadrant.
The x-co-ordinate of vertex A is -6.
The y-co-ordinate of vertex A is 1.
The co-ordinates of A are $(-6, 1)$.

1 What are the co-ordinates of vertex B and vertex C?

2 Look at the x-co-ordinates of each vertex. Are they positive or negative?

3 Look at the y-co-ordinates of each vertex. Are they positive or negative?

4 What rule can you make about the x- and y-co-ordinates of any point in the second quadrant?

Reflections

You should remember from last year that a reflection is a mirror image of a shape. The line about which the shape is reflected is called the mirror line.

Look at these two shapes. The green shape is a reflection of the red shape. The blue line is the mirror line.
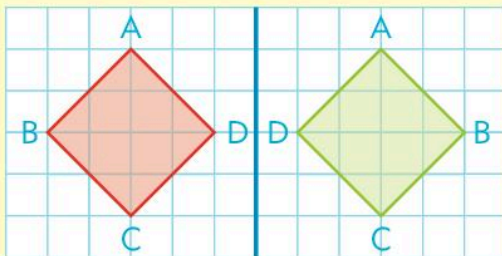
Matching points on a shape and its reflection are always the same distance from the mirror line. Check this with a ruler if you cannot see it.

1 **Find the pairs of shapes that are reflections of each other.**
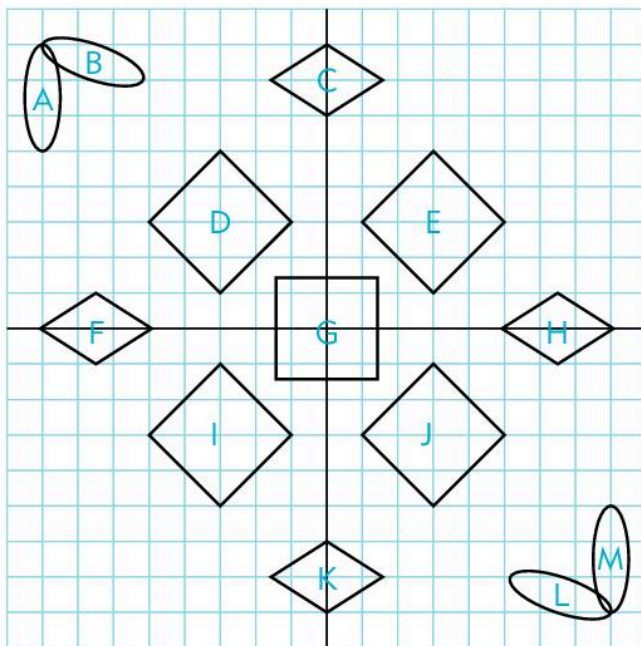
Translations

You have already learned that you can reflect a shape about a mirror line. But we can also slide shapes to move them about the grid. A slide movement is called a translation.

You will work with these two different types of translations:

- horizontally (a number of blocks across from left to right or right to left)
- vertically (a number of blocks up or down).

Look at the diagram. The red triangle has been translated in different ways. The yellow triangles show its position after each translation.

A to C: 7 blocks left

A to B: 7 blocks down
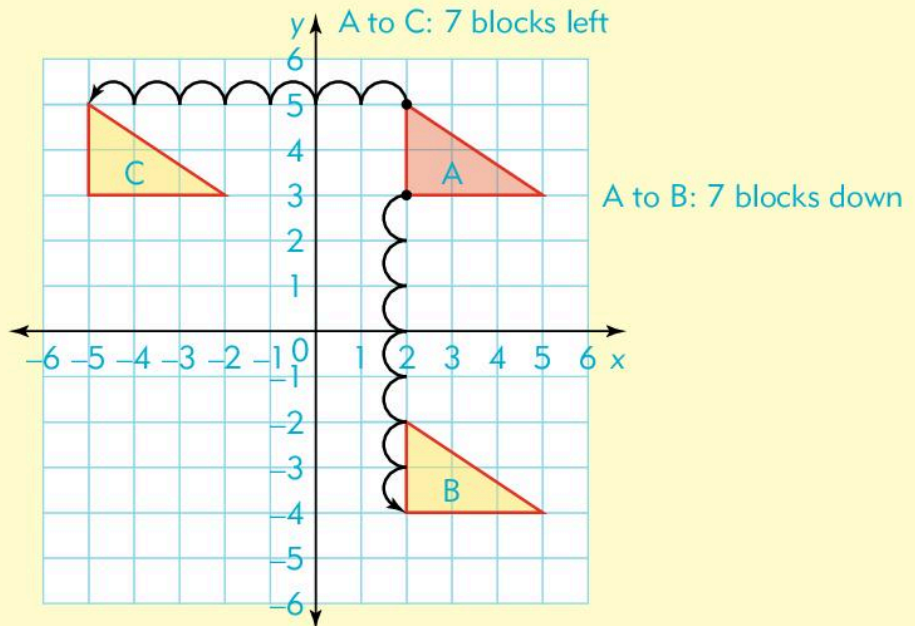
1. The blue shapes show the position of the red shapes after a translation. Write the letters of the shapes that match each translation:

   a   a translation two blocks left
   b   a translation three blocks up
   c   a translation four blocks down
   d   a translation five blocks right.

2. Look at shape D. What would the new co-ordinates of each of its vertices be if it was translated:

   a   2 blocks right
   b   3 blocks down?
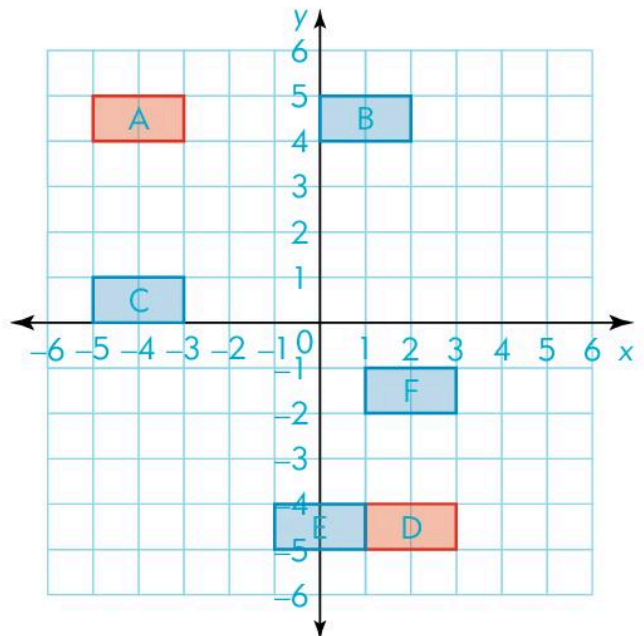
Find the matching shapes
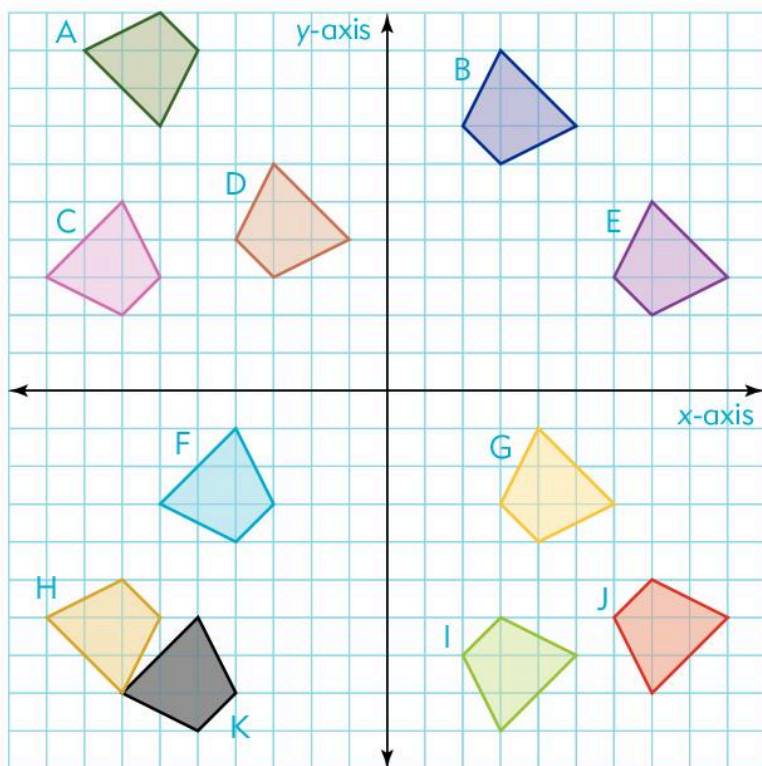
1 Use the shapes on the grid to help you work out whether the following statements are true or false.

a A is a reflection of D.

b C is a reflection of E.

c B is a translation of E.

d F is a translation of G.

e C is a reflection of I.

f H is a rotation of K.

g C is a rotation of F.

2 Write down three true statements of your own about the shapes. Use these key words in your statements:

a rotation

b translation

c reflection.

Revising mental strategies for division

Remember:

- division is the opposite, or inverse of multiplication, so you can use multiplication facts to find the answers to divisions

- you can use multiplication and division facts to divide decimals by whole numbers as long as you put the decimal point in the correct place

- when you divide by 10 the digits move one place to the right and when you divide by 100 the digits move two places to the right.

Try to do all these calculations using mental methods.

1 **Copy and complete.**

a $9 \times 5 = \square$ $45 \div 9 = \square$ $45 \div 5 = \square$ $4.5 \div 0.8 = \square$ $45 \div 10 = \square$

b $\square \times 9 = 72$ $72 \div 9 = \square$ $72 \div \square = 9$ $7.2 \div 9 = \square$ $72 \div 10 = \square$

c $7 \times 6 = \square$ $\square \div 7 = 6$ $42 \div \square = 7$ $4.2 \div 7 = \square$ $42 \div 10 = \square$

d $\square \times 8 = 64$ $64 \div \square = 8$ $64 \div 8 = \square$ $6.4 \div 8 = \square$ $64 \div 10 = \square$

e $6 \times 9 = \square$ $\square \div 6 = 9$ $54 \div 9 = \square$ $5.4 \div 6 = \square$ $54 \div 10 = \square$

2 **Copy and fill in < , > or = in place of $\square$.**

a $27 \div 3 \square 40 \div 4$ b $60 \div 10 \square 56 \div 8$ c $42 \div 7 \square 25 \div 5$

d $36 \div 6 \square 72 \div 8$ e $63 \div 9 \square 65 \div 5$ f $32 \div 4 \square 36 \div 9$

g $48 \div 6 \square 60 \div 10$ h $72 \div 8 \square 84 \div 9$ i $63 \div 9 \square 28 \div 4$

3 **Fill in ÷ 10 or ÷ 100 in the spaces.**

a $345\,000 \square 34\,500 \square 345 \square 3.45$

b $908\,000 \square 9080 \square 908 \square 9.08$

c $765\,300 \square 76\,530 \square 7653 \square 765.3$

d $530\,000 \square 5300 \square 53 \square 0.53$

4 **Divide:**

a $5.4 \div 9$ b $1.8 \div 3$ c $7.2 \div 9$ d $4.8 \div 8$

e $4.8 \div 8$ f $6.4 \div 8$ g $3.5 \div 5$ h $3.5 \div 7$

5 **Share the following amounts of money equally between two children:**

a $34.80   b $24.12   c $18.36   d $100.50

e $35.90   f $23.48   g $19.86   h $99.90

you can use Workbook page 67

I want to share these 9 bars of chocolate equally between four friends. How much will each friend get?

Each friend can get two full bars. There is one bar remaining.

But, I can divide the last bar among the friends. They will each get $\frac{1}{4}$ of the remaining bar.

So, each friend will get $2\frac{1}{4}$ bars of chocolate.

If the remainder can be shared, you should write your answer as a mixed number. The remainder forms the fraction part of the mixed number.

You can also write remainders that can be shared as decimal fractions. Your calculator will give remainders as decimals.

Share $19 equally among five students. How much will each student get?

$19 \div 5 = 3.8$

Each student will get $3.80.

Remember to write 0 as a place holder because money amounts are written with two decimal places.
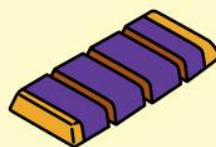
1 Divide. Write the answer as a mixed number.

a $63 \div 3$ b $87 \div 4$ c $97 \div 6$

2 Divide. Write the answer as a decimal fraction.

a $53 \div 5$ b $81 \div 4$ c $63 \div 10$

3 Share the following bars of chocolate equally among the number of children given. Write how much each child will get.

Chox
144 bars
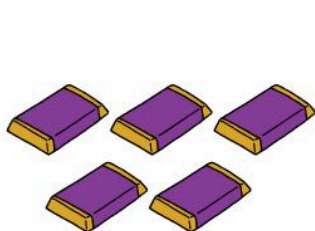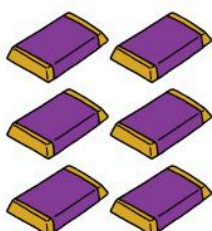
4 children   4 children   3 children   10 children
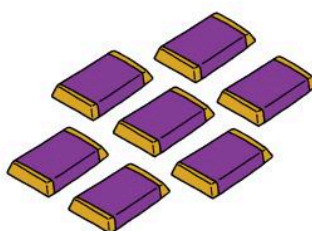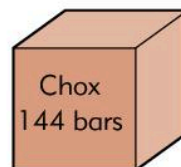
Division by repeated subtraction

To answer the question 'How many threes are in twelve?' we can use a number line and jump back from 12 in steps of 3. This is equivalent to repeatedly subtracting 3.
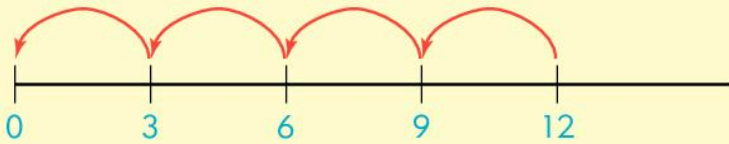
$12 \div 3 = 4$

We can use repeated subtraction to divide. Look at this example showing $196 \div 6$:

196

-60	6×10
$\overline{136}$	
-60	6×10
$\overline{-76}$	
-60	6×10
$\overline{16}$	
-12	$6 \times \underline{2}$
4	32

Answer 32 r 4

Remember the 'chunks' can be any size so if you knew $6 \times 30 = 180$ you could subtract 180 as a single 'chunk'

196

-180	6×30
$\overline{16}$	
-12	$6 \times \underline{2}$
4	32

Answer 32 r 4

1 Work out the answers to the calculations. All answers are whole numbers.

a $245 \div 5$ b $612 \div 3$ c $340 \div 4$

d $288 \div 6$ e $413 \div 7$ f $102 \div 6$

g $729 \div 3$ h $376 \div 8$ i $513 \div 9$

2 Work out the answers to the calculations. Some answers will have a remainder.

a $413 \div 8$ b $812 \div 8$ c $367 \div 7$

d $421 \div 9$ e $823 \div 5$ f $698 \div 7$

3 What number goes in the box to make these calculations correct?

a $\square \times 3 = 105$ b $366 \div 6 = \square$ c $52 \times \square = 364$

47 students are going on a school outing. They will travel by mini-bus taxi. Each taxi can safely carry 10 students. How many taxis will you need to transport the students?

You can work this out by division: $47 \div 10 = 4.7$

This is 4 full taxis of 10 students (40) with 7 students remaining. In other words you will need 5 taxis.

You cannot have $\frac{7}{10}$ or 0.7 of a taxi, so you need to round up the remainder.

Sometimes you have to round down. You need to think carefully about the particular problem to decide what to do with the remainder.

1 **Divide. Round the answer up to the next whole number.**

  a $40 \div 6$ **b** $76 \div 9$ **c** $87 \div 3$

  d $604 \div 6$ **e** $563 \div 3$ **f** $482 \div 8$

2 **Anita is organising a dance. She needs to order tables for people to sit at. Each table can seat 8 people. How many tables should she order if 312 people are coming to the dance?**

3 **Cedric sells sets of six teacups. He has 263 cups. How many sets of six can he make?**

4 **458 chickens need to be taken to market in boxes. Each box can hold 8 chickens. How many boxes will be needed for all the chickens?**

5 **Cecilia has 938 grams of sugar. How many 10-gram sachets can she fill with this?**

6 **Tickets to a show cost $6. How many tickets can you buy with $400?**

7 **Mrs Smith is organising a school trip. She has collected $1000. Hiring the bus costs $275 and the accommodation costs $340. She has to decide whether to take the students to the museum or to the art gallery with the remainder of the money. Tickets to the museum cost $9. Tickets to the art gallery cost $8.**

  a How many museum tickets can she buy?

  b How many art gallery tickets can she buy?

you can use Workbook page 68

Rounding to estimate answers

It is very easy to make mistakes with place value when you multiply and divide larger numbers.

Estimating the answer before you calculate can help you to see if you have worked correctly.

To estimate you round off each number and work out a rough answer.

Read these examples carefully to make sure you understand how to round off to estimate an answer.

What is 38×12?　　　　　　　　Estimate: $40 \times 10 = 400$

$38 \times 12 = (38 \times 10) + (38 \times 2)$
$\qquad\qquad = 380 + 76$
$\qquad\qquad = 456$

What is $585 \div 9$?　　　　　　　　Estimate: $600 \div 10 = 60$

$$
\begin{array}{r}
585 \\
- \ 540 \\
\hline
45 \\
- \ \ 45 \\
\hline
0
\end{array}
$$

9×60

9×5
$\overline{65}$

$585 \div 9 = 65$

1 **Estimate by rounding. Use a calculator to find the exact answer.**

a 92×11	**b** 72×29	**c** 54×15	**d** 81×32
e 42×125	**f** 38×192	**g** 81×668	**h** 22×896

2 **Round off each number to the nearest ten or hundred and divide to find an estimated value.**

a $1583 \div 12$	**b** $3615 \div 39$	**c** $4434 \div 16$	**d** $1836 \div 32$
e $9469 \div 18$	**f** $8634 \div 36$	**g** $2314 \div 14$	**h** $3386 \div 35$

3 A box can hold 25 kg. How many boxes will you need to transport 2946 kg?

4 A bus can seat 38 people. How many buses will you need for 722 people?

5 Mr Sanjay travels 388 km a week to work and back. How many kilometres is this per year? (Use 52 weeks for one year.)

Multiplying larger numbers

You already know how to multiply using a variety of methods. Here are four different methods to multiply 1437×5

Grid method						Doubling and halving:

$\times$	1000	400	30	7	
5	5000	2000	150	35	$= 7185$

Doubling and halving:
$1437 \times 10 = 14370$
(doubling)
$14370 \div 2 = 7185$
(halving)

Partitioning:
$1437 \times 5 = (1000 \times 5) + (400 \times 5) + (30 \times 5) + (7 \times 5)$
$= 5000 + 2000 + 150 + 35$
$= 7185$

Vertical compact method:
$$\begin{array}{r} 1\,4\,3\,7 \\ 5 \times \\ \hline 7\,1\,8\,5 \\ {\scriptstyle 2\ \ 1\ \ 3} \end{array}$$

1 Use the method you find easiest to do these multiplications. Remember to estimate first.

a 1234×8 b 3208×5 c 1366×6

d 4099×9 e 5129×4 f 8100×8

g 3145×6 h 6243×5 i 9001×8

2 Do these multiplications. Remember to estimate before you multiply.

a 4134×8 b 4618×5 c 9366×6

d 5219×9 e 8129×4 f 3100×8

g 3465×6 h 7243×5 i 4421×8

3 Estimate by rounding the thousands to the nearest 1000. Then do these multiplications using the column method with trading. Use a calculator to check your answers.

a 1456×4 b 1567×5 c 1987×3

d 2456×6 e 2590×4 f 2097×8

g 3167×9 h 3098×6 i 3556×7

j 4876×3 k 4188×6 l 4076×9

m 5543×2 n 5679×8 o 5004×8

p 6086×4 q 6998×6 r 6199×9

s 8098×3 t 8123×7 u 9087×6

Multiplication by two-digit numbers

We can extend the grid method to multiply by two-digit numbers. Here are two examples.

$75 \times 23 =$

×	70	5
20	1400	100
3	210	15

→ 1500
→ 225

1725

75	
× 23	
225	225 is 3 times 75; you work it out by multiplying each digit in the top row by 3.
1500	1500 is 20 times 75; you work it out by writing a 0 (×10) in the units column and then multiplying each digit in the top row by 2 (2 × 10 = 20).
1725	1725 is the sum of 225 and 1500.

1 Do these multiplications. Look at the numbers and use the method you find easiest.

a 428×13 b 187×19 c 345×12

d 456×19 e 564×23 f 567×29

g 675×24 h 543×36 i 342×55

2 Estimate the answer. Then do each multiplication.

a 234×23 b 453×65 c 198×68

d 432×85 e 908×43 f 654×38

g 342×54 h 966×77 i 466×49

j 654×51 k 329×97 l 419×59

m 987×31 n 298×99 o 865×87

Before you solve each problem, think about what operation or operations you need to do and decide which method you will use to find the answer.

1 A school donates $375 each month to charity. How much would they donate in a year?

2 Saleem bought 36 rugs for $145 each. He sold them for $259 each.
a How much did the rugs cost him altogether?
b How much money would he get if he sold them all?
c Calculate the difference between the total cost of the rugs and the money he made if he sold them all.

3 Sound travels through the air at a speed of approximately 330 m per second. How far would the sound travel in 45 seconds?

4 A small tube of glue has a mass of 18 g. A school buys 545 tubes of glue for the students.
a What is the total mass of the glue?
b If each tube of glue costs 75c, how much would it cost to buy 545 tubes?

5 Paul used 938 ml of vinegar to fill seven identical bottles. How much did he pour into each bottle?

6 It took Jess 6 hours to read 426 pages of her book. How many pages is this per hour?

7 Mr Smit paid $68.76 for nine tickets to the movies. What did each ticket cost?

8 Tiffany has invited 252 people to her wedding. Each table can seat 8 people. How many tables will she need?

9 347 school children are going on a bus trip. Each bus can carry 40 children. How many buses will the school need to transport all the children?

Ratio

The diagram shows you how to mix squash with water to make drink.

The ratio of squash to water is 1 to 3.

The order in a ratio is very important. Think about making a drink from squash.

The instructions say 1 part orange squash to 3 parts water. This is a ratio of 1 to 3.

This means that if you pour 1 cup of orange squash you have to add 3 cups of water. This will give you the correct mix and a nice drink of squash. It would taste horrible if you mixed it the wrong way round and used 3 cups of squash and only added 1 cup of water!

Ratios don't have units. A ratio of 1 to 2 could mean 1 cup to 2 cups, 1 bag to 2 bags, 1 metre to 2 metres and so on.

Squash

1   to 3

Write a ratio to compare each of these quantities.

1

2

3

4

5

6

7

123 Working with ratios
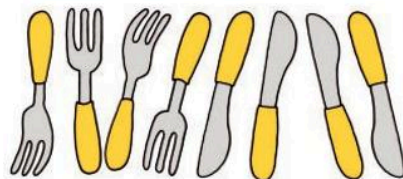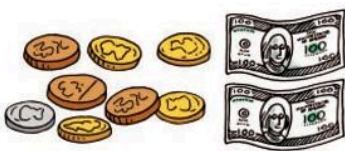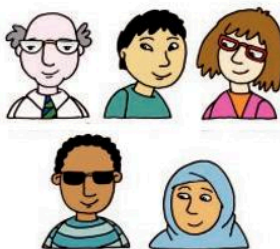
A magnifying glass makes things seem bigger than they really are.

This beetle is actually 1.5 cm long but under a magnifying glass it looks 7.5 cm long.

The ratio of the magnified length to the actual length is 5 to 1.

1 Copy and complete the table to show the actual length and the magnified length of some creatures. The magnifying glass makes objects look 5× bigger.

	Actual length	Magnified length
Ladybird	1.2 cm	
Caterpillar		7 cm
Spider	3 cm	
Ant		1.5 cm
Snail		5.5 cm
Beetle	5 cm	

2 A magnifying glass makes objects look 10× bigger. What is the actual size of a fly with a magnified length of 6 cm?

3 A bag of four oranges cost 87 cents. How much would twelve oranges cost?

4 Here is a recipe for pasta sauce.

Alex makes the pasta sauce using 900 grams of tomatoes. How many grams of onions does he use?

Pasta sauce
300 grams tomatoes
90 grams onions
2 spoons olive oil

5 A rectangle has a perimeter of 24 centimetres. The rectangle is twice as long as it is wide. How long is the rectangle?

6 Angelina makes a fruit salad using bananas, mangoes and peaches. For every one banana she uses 2 mangoes and 5 peaches. She uses 24 fruits altogether. How many peaches does she use?

Proportion

The relationship between the amount of petrol and what you pay is shown in this table:

Litres	1	2	3	4	5	6	7	8	9	10
Price ($)	2	4	6	8	10	12	14	16	18	20

If you buy more petrol, you pay more.

If you buy less petrol, you pay less.

We can say that the price you pay for petrol is **in proportion** to the amount of petrol you buy.

When quantities are in proportion like this, their ratio stays the same as the quantities increase or decrease. The ratio of the number of litres to the price of petrol in the example above is always 1 to 2.

1 **Copy and complete these price lists.**

a

kg	$
1	0.80
2	1.60
3	2.40
4	
5	

b

kg	$
1	
2	
3	12.00
4	
5	

c

kg	$
2	
4	
6	
8	
10	29.40

2 **It costs 50c per hour to park in the city. Work out how much it would cost to park for:**

a 3 hours   b 5 hours   c $4\frac{1}{2}$ hours

3 **Jassy charges $4.25 per hour for babysitting. How much will she get paid if she babysits for:**

a 3 hours   b 6 hours   c $1\frac{1}{2}$ hours?

Ratio and proportion problems

Work with a partner. Talk about how you will solve each of these problems before you start.

1 What proportion of each pattern is shaded? Give your answer as fractions.

a

b

c
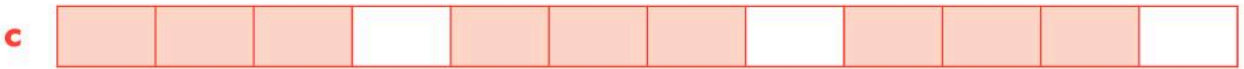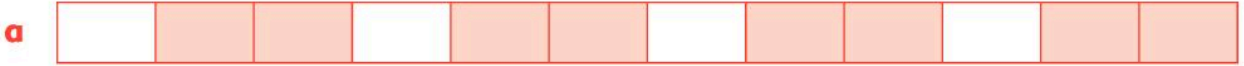
2 A box contains 20 cubes. 13 cubes are red and the rest are green. What proportion of the cubes is green. Give your answer as a fraction.

3 It costs $4.50 to spend 15 minutes on a boat on the lake. How much will it cost to spend 1 hour on the boat?

4 Mrs Singh has bought some fertiliser for her vegetable plants. The instructions tell her to dilute the fertiliser in the proportion 50 ml per litre of water.

a Write this as a ratio in its simplest form.

b How much water will she need if she plans to use 25 ml of fertiliser?

c If she has $2\frac{1}{2}$ litres of water, how much fertiliser should she add to it?

5 One third of the students in a class wear glasses. The other 18 students do not wear glasses. How many students are in the class?

6 A train travels at a speed of 140 km per hour. How many kilometres does it travel in:

a 1 hour   b 2 hours   c 3 hours   d 20 minutes?

7 5 miles is approximately equal to 8 km.

Copy and complete this table to compare miles to kilometres.

Miles	1	2	3	4	5	6	7
Kilometres					8		

you can use Workbook page 70

Investigating multiplication

You will need to work with a partner to complete these activities.

1 A teacher asked her class to find 410.5×4. This is how two students found their answers:

410.5×4 $410 + 410 + 410 + 410 = 1640$

                   $0.5 + 0.5 + 0.5 + 0.5 = 2$

Answer: 1642

$410.5 \times 4 = 410.5 \times 2 \times 2$

Double 410.5 is 821
Double 821 is 1642

Answer: 1642

a Discuss what mathematical properties the students used to find their answers.

b Which method do you think is easier? Why?

c Can you think of any other ways of doing this calculation?

2 Look at these two examples.

$3 \times 4 \times 25$ $5 \times 63 \times 20$

$\rightarrow 3 \times 100$ $\rightarrow 63 \times 100$

$\rightarrow 300$ $\rightarrow 6300$

a What do these examples show about the order in which you multiply?

b Why do you think this student worked in this way?

3 This is how another student found 43×23.

43×23

43×20 $= 430 \times 2$ $= 860$

43×3 $= 40 \times 3 + 3 \times 3$ $= 120 + 9$

                                   $= 980 + 9 = 989$

a What strategies did this student use to find the answer?

b How would you work out this answer? Show your partner.

you can use Workbook page 71

You already know quite a few properties of multiplication. Read through the table to remind yourself of some of the properties and what they mean.

Property of multiplication	Example
Multiplying by 0 always gives 0	$22 \times 0 = 0$ $12\,435 \times 0 = 0$ $0.5 \times 0 = 0$
Multiplication by 1 does not change the number you are multiplying	$22 \times 1 = 22$ $12\,345 \times 1 = 1$ $0.5 \times 1 = 0.5$
You can change the order of numbers in multiplication and you will still get the same answer	$2 \times 4 = 4 \times 2 = 8$ $2 \times 5 \times 4 = 4 \times 2 \times 5 = 40$
You can write a number as a product of its factors and then multiply by each factor (in any order) to get the same answer as you would if you multiplied by the number itself	$12 \times 250 = 3000$ $(3 \times 4) \times 250 = 3 \times 1000 = 3000$

1 **Draw number lines to show that:**

a $4 \times 1 = 4$ b $3 \times 2 = 2 \times 3$ c $2 \times 2 \times 3 = 4 \times 3$

2 **Read each statement. Say whether it is true or false.**

a $324 \times 9 = 9 \times 324$ b $346 \times 1 = 1$

c $987 \times 0 = 0$ d $8 \times 0.5 = 0.5 \times 8$

e $400 \times 0.25 = 0.25 \times 200 \times 2$ f $45 \times 90 = 90 \times 5 \times 9$

g $(12 \times 4) \times 2 = 12 \times (4 \times 2)$ h $(10 \times 10) \times 5 = 10 \times (10 + 5)$

i $12 \times 4 \times 2 = 12 \times 6$ j $10 \times 3 \times 25 = 25 \times 10 \times 3$

3 **Do the same properties apply to division? Discuss this in your group and draw up a table showing the properties of division you know with examples.**

Using the properties of multiplication

1 Copy and complete these number sentences.

a $9 \times \square = 0$ **b** $1 \times \square = 432$ **c** $532 \times \square = 532$

d $\square \times 0 = 0$ **e** $90 \times 24 = \square \times 90$ **f** $65 \times 25 = \square \times 65$

g $0.5 \times \square = 0.5 \times 0.5$ **h** $18 \times 6 = 6 \times 6 \times \square$ **i** $2 \times 4 \times 39 = 39 \times \square$

2 Rewrite each multiplication using only two numbers.

a $25 \times 4 \times 3 \times 9 = \square \times \square$ **b** $14 \times 8 \times 2 \times 10 = \square \times \square$

c $35 \times 3 \times 19 \times 5 = \square \times \square$ **d** $10 \times 100 \times 3 \times 28 = \square \times \square$

e $0.3 \times 1.8 \times 10 \times 2 = \square \times \square$ **f** $3 \times 9 \times 312 \times 7 = \square \times \square$

3 Use a calculator to work out both sides of the number sentences you made in question 2 to check that your answers were correct.

4 Fill in the missing number in each number sentence.

a $5 \times 96 \times 6 = 96 \times \square$ **b** $16 \times 97 \times 2 = 32 \times \square$

c $23 \times 0.12 \times 5 = 23 \times \square$ **d** $0.5 \times 114 \times 100 = 114 \times \square$

5 Use the multiplication properties you know to solve these problems as quickly as possible.

a $45 \times 9 \times 12 \times 0$ **b** $4.5 \times 12 \times 2$

c $0.25 \times 300 \times 4$ **d** $5 \times 96 \times 2 \times 10$

e $4 \times 129 \times 5 \times 5$ **f** $25 \times 9 \times 2 \times 7 \times 2$

g $123 \times 0.5 \times 97 \times 0$ **h** $25 \times 85 \times 4 \times 2$

6 Read what four students have to say about multiplication. Decide whether each student is correct. If not, explain why not.

To multiply a number by thirty you could first multiply by 3 and then by 10.

If you have to multiply three or more numbers, you must work from left to right.

To multiply by twelve you could first double the number and then times by six.

When you have to times two numbers you can do the calculation in any order.

Remember:

$9 \times (12 + 3) = (9 \times 12) + (9 \times 3)$

$27 \times (20 + 3) = (27 \times 20) + (27 \times 3)$

This is called the distributive property of multiplication. It means that you can write numbers that you have to multiply into sums or differences and then multiply each term separately to make the calculation easier. Read through the examples to remind yourself of how this works.

Calculate 7×99

$$\begin{aligned} 7 \times 99 \ &= 7 \times (100 - 1) \\ &= (7 \times 100) - (7 \times 1) \\ &= 700 - 7 \\ &= 693 \end{aligned}$$

Calculate 6×432

$$\begin{aligned} 6 \times 432 \ &= 6 \times (400 + 30 + 2) \\ &= 6 \times 400 + 6 \times 30 + 6 \times 2 \\ &= 2400 + 180 + 12 \\ &= 2592 \end{aligned}$$

Calculate 7×101

$$\begin{aligned} 7 \times 101 \ &= 7 \times (100 + 1) \\ &= (7 \times 100) + (7 \times 1) \\ &= 700 + 7 \\ &= 707 \end{aligned}$$

Calculate $92 \times 19 + 8 \times 19$

$$\begin{aligned} (92 + 8) &\times 19 \\ &= 100 \times 19 \\ &= 1900 \end{aligned}$$

1 Calculate.

a 6×99 b 12×99 c 25×98
d 12×86 e 18×124 f 74×101
g 47×102 h 187×4 i 15×210
j 17×11 k 29×5 l 412×5

2 Calculate.

a $30 \times 11 + 70 \times 11$ b $4 \times 20 + 7 \times 20$
c $14 \times 69 - 14 \times 67$ d $19 \times 28 - 19 \times 8$
e $53 \times 98 - 53 \times 91$ f $230 \times 8 - 190 \times 8$

Making sense of bar graphs

1 This bar graph shows the results of tossing a die.

Scores from throwing a die

a How many times did this person throw a 5?

b How many times did this person throw a 1?

c What score was thrown the most?

d What score was thrown the least?

e How many times did this person throw the die altogether?

f Why do you think there is no score of 0?

2 This graph shows the heights of trees in a garden.

a How many trees are less than 1.5 m tall?

b What is the height of the tallest trees in the garden?

c Can you tell how many trees are exactly 1.5 m tall? Explain why or why not.

d Why do you think the vertical scale starts at 8 on this graph?

Height of trees

you can use Workbook page 72
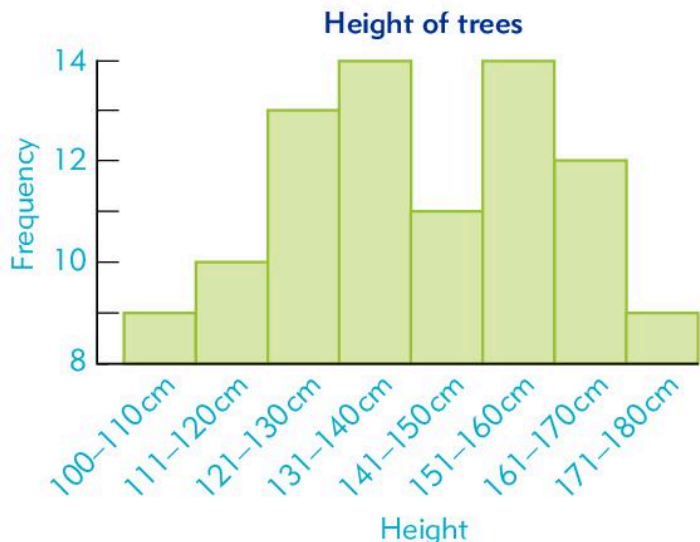
Making sense of line graphs

1 This line graph shows the monthly temperature patterns for two different towns (A and B) for a year.

a What is the title of the graph?

b What units of time are shown on the horizontal axis?

c What scale is used on the vertical axis?

d Which is the hottest month of the year in each town?

e Which are the summer months in this country?

f Which are the winter months in this country?

g Which town is warmer in winter?

h Which town is cooler in summer?

Temperature figures for Town A and Town B
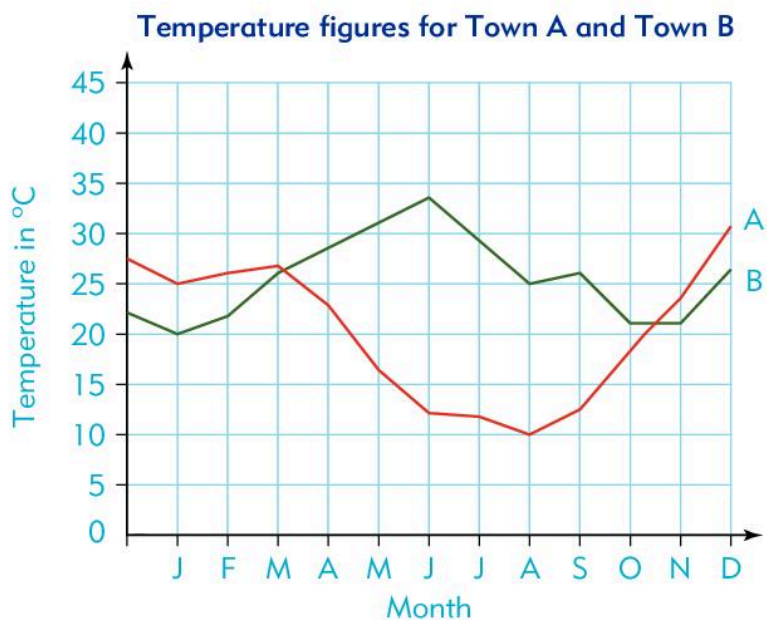
2 This graph shows the highest and lowest temperatures measured in Town C for one week.

a What was the hottest temperature recorded this week?

b What was the coldest temperature recorded this week?

c What was the highest temperature on Friday?

d What was the lowest temperature on Friday?

e What was the difference between the highest and lowest temperatures recorded on Friday?

Daily temperature range
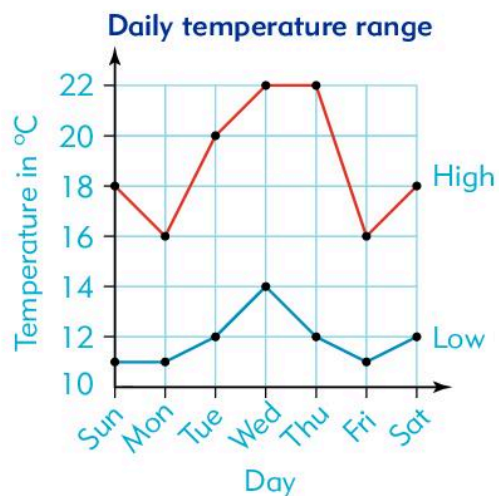
you can use Workbook page 73

Working with data

The **mode** is the value that appears most often in a set of data.

Look at these test results from 10 students:

5　　7　　8　　9　　8　　7　　5　　6　　7　　7

If you organise the data in a frequency table you can easily see the mode. It is the value with the highest frequency.

4 of the students got a score of 7. The mode is 7.

The **range** is the difference between the highest value and the lowest value in a set of data.

The highest score in this set is 9. The lowest score is 5.

Range = highest score – lowest score = 9 – 5 = 4

Score	Frequency
5	2
6	1
7	4
8	2
9	1

1 Here is some information about seven students.
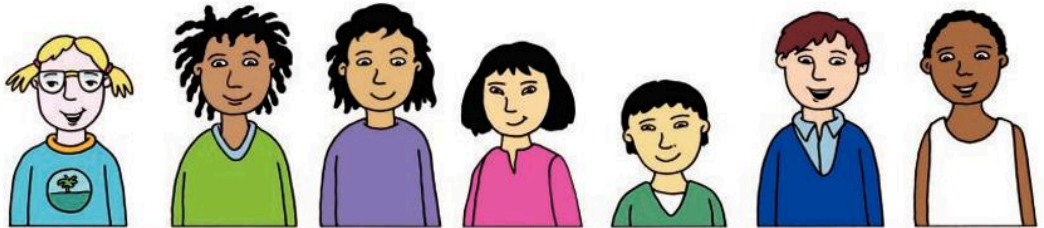
Height (cm)	141	132	122	130	133	125	133
Mass (kg)	48	46	45	46	43	41	46
Age (years)	12	11	11	11	12	10	11
Shoe size	$4\frac{1}{2}$	4	4	$3\frac{1}{2}$	$3\frac{1}{2}$	2	4

a What is the modal height?

b What is the modal shoe size?

c What is the range of masses?

d What is the range of ages?

e What is the range of heights?

f What is the modal mass?

2 Find the mode of the shoe sizes in your class.

The median

The **median** is a type of average. It is the middle value in a set of data. To find the median you have to write the data in size order and then find the middle value.

Here are the shoe sizes of the students from the previous page. What is the median shoe size?

Shoe size	$4\frac{1}{2}$	4	4	$3\frac{1}{2}$	$3\frac{1}{2}$	2	4

First put the shoe sizes in order from smallest to largest like this:

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

The middle value is 4, so the median shoe size is 4.

1 **Use the table of data on the previous page.**

a Find the median height of the students.

b Find the median mass of the students.

c Find the median age of the students.

2 **Six students each throw a die five times. Their results are shown here.**

a For each student, write their scores in order from smallest to largest. Find the median score for each student.

b Add up each student's scores to get a total score. Find the range of total scores.

Alice

Katie

Sam

Jonas

Beauty

Petros

3 **Here are five sets of measurements. Find the median of each set.**

a 20 cm   80 cm   80 cm   60 cm   60 cm

b 30°C   25°C   22°C   28°C   10°C

c 19 m   13 m   90 m   8 m   11 m

d 12 l   14 l   10 l   8 l   10 l

e 41 kg   42 kg   40 kg   39 kg   41 kg

The mean

The **mean** is an arithmetic average. To find the mean of a set of data you have to add up all the values and then divide the total by the number of values.

Here are the masses of the students from page 133.

Mass (kg)	48	46	45	46	43	41	46

Mean = sum of all the values ÷ number of values
= (48 + 46 + 45 + 46 + 43 + 41 + 46) ÷ 7
= 315 ÷ 7
= 45

The mean mass is 45 kg.

1 **Use the table from page 133.**

a Find the mean height of the students in centimetres.

b Find the mean age of the students in years.

2 **Find the mean of each of these sets of data.**

a 5, 7, 6, 8, 7, 5

b 12, 12, 13, 11, 12, 13

c 15, 16, 24, 31, 24

d 147, 145, 144, 141, 141

e 141, 137, 135, 125, 125, 120

f 9.1, 9.5, 9.9, 8.5, 8.6, 9.6

g 34.5, 35, 34.8, 38.2, 39.5

3 **Here is a set of data. It has already been placed in size order. How could you find the median score?**

2, 2, 3, 4, 5, 5, 8, 9

4 **Joe collects some data about the number of brothers and sisters his friends have. He finds that:**

- **The modal number of brothers and sisters is 2.**
- **The median number of brothers and sisters is 2.**
- **The mean number of brothers and sisters is 2.5.**

Joe is confused. He can't understand how the mean can be a fraction. Can you explain how this is possible?

How can you work out how many counters you need to make the next two shapes in this pattern?

Shape 1   Shape 2   Shape 3

You could get counters and build the next two shapes following the pattern or you could draw them.

You could look at the pattern to see how it works.

Shape 1 = 4 counters   Shape 2 = 8 counters   Shape 3 = 12 counters

By doing this you can see that there is a number pattern in the shapes. This pattern is made of multiples of 4. So the next shape will have 16 counters and the one after that will have 20, and so on.

1 For each pattern, draw the next two shapes.

2 Count the number of rods or counters used to make each shape in the pattern and write these in a row.

A   B

C   D

E   F
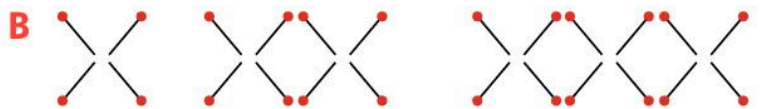
3 Work with a partner. Tell each other in words how you can find the number of rods or counters in each pattern.

Finding the rules patterns

It was easy to work out how many rods or counters you needed to make the next two shapes for each pattern on the previous page. This was because you could build them or count on to find the number.

It is not so easy to see how many rods or counters you need to make the 10th shape in a pattern, or the 100th shape, without building the pattern. But you can work this out easily if you find the **rule** for the pattern.

Look at this pattern of shapes made from rods. How many rods will you need to build the 20th shape in this pattern?

Make a table.

Number of rods = number of shapes × 4

So, if we want to make 20 shapes, we would need 80 rods.

Number of rods = 20 × 4 = 80

Number of shapes	Number of rods used	Pattern
1	4	1 × 4
2	8	2 × 4
3	12	3 × 4
4	16	4 × 4

1 **For each pattern:**

a Complete the table of numbers (you can use the one on page 74 of your Workbook).

b Write the rule for making the pattern.

c Work out how many rods you would need to build the 15th shape and the 100th shape in each pattern.

A

B

C

D

2 **Make a pattern of your own using rods or counters.**

a Write the rule that you used.

b Use the rule to work out how many rods or counters you would need to build the 15th shape in the pattern.

c Draw the pattern to the 15th shape and check that you were correct.

This number machine changes or **processes** the numbers that are put into it. It uses a rule (×3) to change the numbers.

The number that goes into the machine is called the **input**.

The number that comes out is called the **output**.

Any number can be used as an input.

The output depends on the input, but it will always be the input ×3.

input	process	output
8	×3	24
10		30
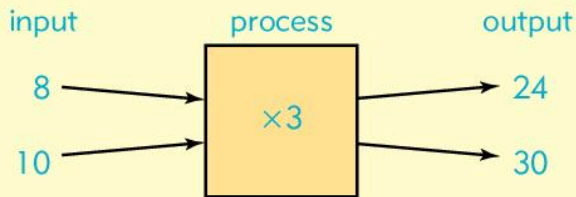
1 Draw these number machines in your exercise book. Work out the missing values.

a
14
96
104
208
+7

b
2.5
1.8
0.7
0.43
×10

c
712
127
93
104
−23

d
9
27
107
3421
÷10

e
×10
1.2
6.4
12.6
19.4

f
÷100
1.2
90
10
4.5
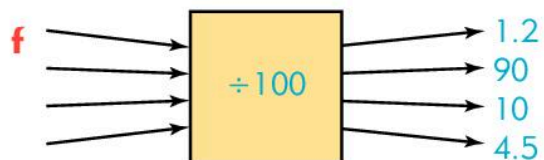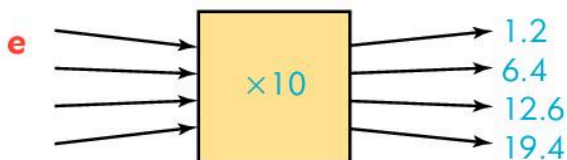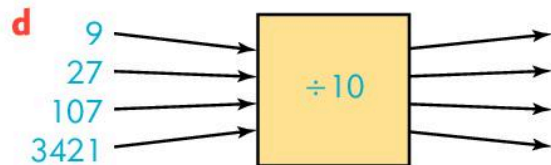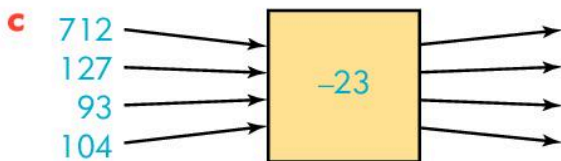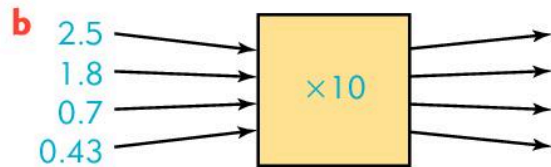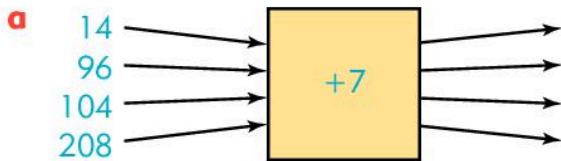
More number machines

This number machine is missing the input numbers.

You can work these out by looking at the outputs and doing the inverse operation.

Remember if $\square \times 3 = 24$

then $24 \div 3 = \square$

input   output

$\times 3$ 24

30

$8 \xleftarrow{\div 3} 24$

$10 \xleftarrow{\div 3} 30$
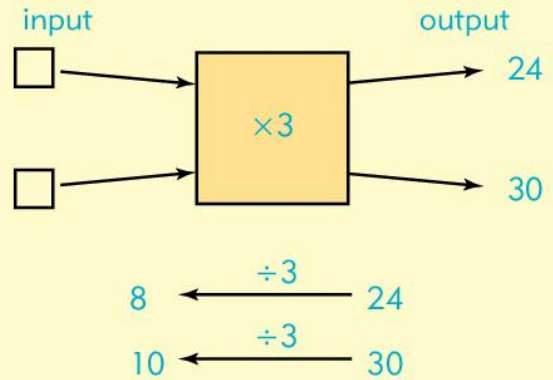
1 Work out the missing input numbers on each of these number machines. Show your working.

i
a → $\times 8$ → 64
b → 80
c → 480
d → 120

ii
a → $\div 2$ → 93
b → 45
c → 16
d → 18

iii
a → $+3$ → 19
b → 29
c → 73
d → 80

iv
a → -6 → 27
b → 14
c → 96
d → 100

v
a → $\times 4$ → 40
b → 60
c → 96
d → 4000

vi
a → $\div 10$ → 0.2
b → 4.6
c → 12.4
d → 126.2
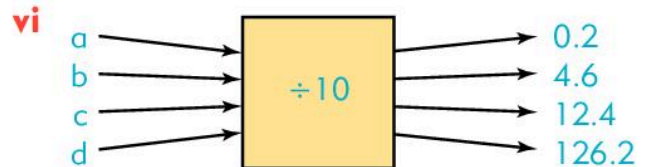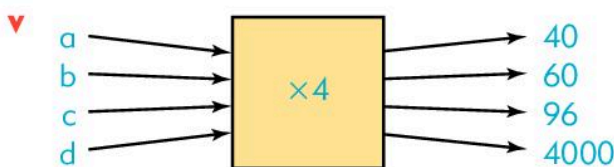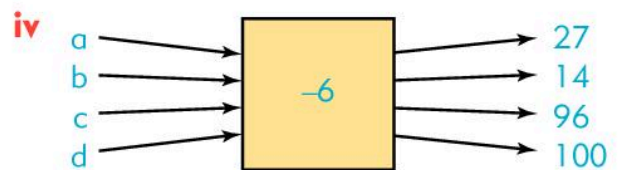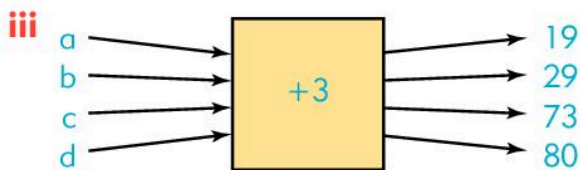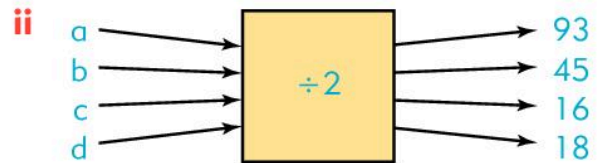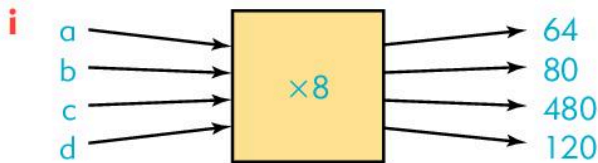
2 Can you find the missing inputs for these machines?

i
a → $\times 2$ → $+4$ → 18
b → 28
c → 40
d → 60

ii
a → $+1$ → $\div 2$ → 13
b → 27
c → 98
d → 101

1 **Work with a partner.**

3	12	8	7	9	1
13	34	29	40	45	
42	37	19	48	26	
21	33	44	50	39	
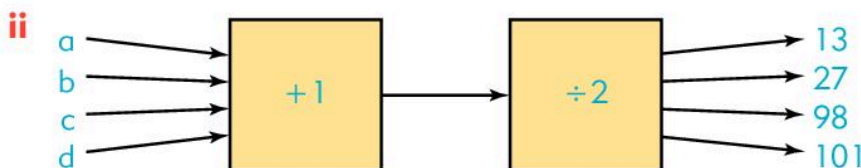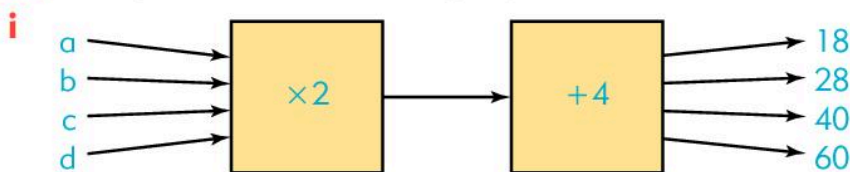
a Which of the numbers in the box are even?

b How did you know this?

c Copy and complete these sentences.

If you add two even numbers your answer will be …

If you add two odd numbers your answer will be …

If you add three odd numbers your answer will be …

If you multiply only even numbers, your answer will be …

If you multiply two odd numbers your answer will be …

2 **Six students are playing a game. They take turns to throw five stones onto a target. If the total is an odd number, then the student gets a point. Work out, without adding, which students would get a point in this round.**

a

5   3
17   9
7   2
4   6

Amy

b

5   3
17   9
7   2
4   6

Nick

c

5   3
17   9
7   2
4   6

Imran

d

5   3
17   9
7   2
4   6

Aisha

e

5   3
17   9
7   2
4   6

Jabu

f

5   3
17   9
7   2
4   6

Nomi
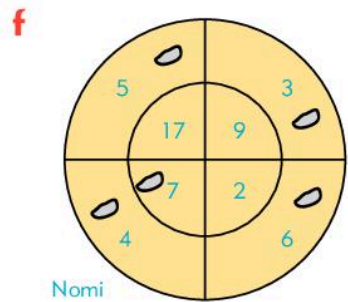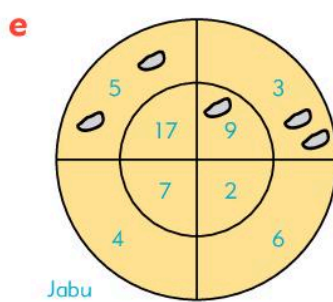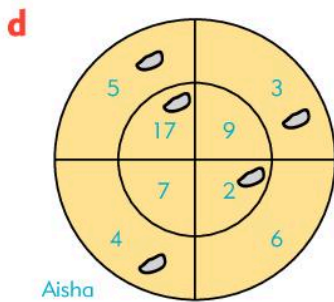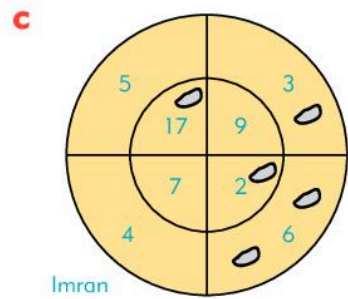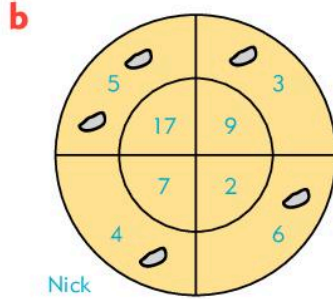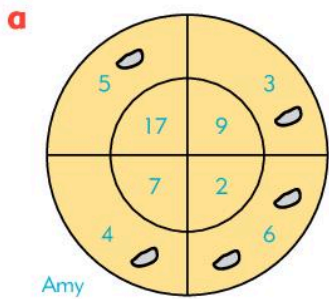
3 **Write down the next three numbers in each pattern.**

a 1, 3, 5, 7, …

b 125, 124, 123, 122, …

c 200, 202, 204, 206, …

d 3, 7, 11, 15, …

e 35, 45, 55, 65, …

f 900, 850, 800, …

g 10, 20, 40, 80, …

h 800, 400, 200, …

you can use Workbook page 76

Patterns of odd and even numbers

You have already seen some of the patterns that you get when you add, subtract and multiply odd and even numbers.

+	Odd	Even
Odd	Even	Odd
Even	Odd	Even

−	Odd	Even
Odd	Even	Odd
Even	Odd	Even

×	Odd	Even
Odd	Odd	Even
Even	Even	Even

Use these rules and patterns to find the missing letters in these flow diagrams.

1 O $\xrightarrow{+}$ O $\xrightarrow{-}$ ☐ $\xrightarrow{+}$ ☐

2 E $\xrightarrow{+}$ E $\xrightarrow{\times}$ O → ☐

3 E $\xrightarrow{\times}$ O $\xrightarrow{+}$ ☐ → ☐

4 E $\xrightarrow{+}$ ☐ $\xrightarrow{-}$ ☐ $\xrightarrow{\times}$ O

5 O $\xrightarrow{\times}$ ☐ $\xrightarrow{-}$ ☐ $\xrightarrow{-}$ E

6 E $\xrightarrow{+}$ ☐ $\xrightarrow{\times}$ ☐ $\xrightarrow{-}$ O

7 Talk with a partner. Try to explain why an odd number plus an odd number always gives you an even number.

Number sequences

A sequence is an ordered set of numbers that makes a pattern because it follows a rule.

Look at these number sequences:

1, 3, 5, 7, 9 … This is a sequence of odd numbers. Each new number is found by adding 2 to the number before it. This is the same as counting on in twos.

81, 27, 9, 3 … In this sequence, each new number is found by dividing the number before it by 3.

$\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$ … In this sequence, each new number is found by adding $\frac{1}{4}$ to the previous number. This is the same as counting on in quarters.

When a sequence is in ascending order you have to add or multiply to make the next number.

When a sequence is in descending order you have to subtract or divide to make the next number.

1 Find the next three numbers in each of these sequences.

a 35, 37, 39, __, __, __

b 10, 8, 6, 4, __, __, __

c $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$, __, __, __

d 12.25, 12, 11.75, __, __, __

e 2.5, 3.5, 4.5, __, __, __

f 3, 3.3, 3.6, __, __, __

g 2, 4, 8, 16, __, __, __

h 100, 50, 25, __, __, __

2 The rule for each sequence is given. Use the rule to find the missing numbers.

a halve the number __, __, 12, 6, 3, __

b multiply the number by 10 0.45, __, __, __

c add 1.2 to the number __, 2.4, 3.6, __, __

d double the number and subtract 1 $1\frac{1}{2}$, __, 3, __, __, __

e divide by 5 __, 250, 50, 10, __

3 Talk to your partner about these two sequences. Try to explain how they were made.

1, 4, 9, 16 …

100, 400, 900, 1600 …

Calculating periods of time

You can use different methods to calculate how much time has passed from one time to another. Read through the examples carefully to see how to do this.

A train left Station A at 14:15. It arrived at Station B at 15:20. How long did the journey take?

14.15   15.20
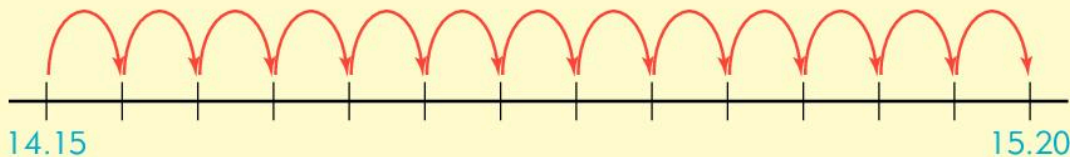
It took 1 hour and 5 minutes.

A clock shows 7.40 a.m. How long is it until 9.15 p.m.?

7.40 a.m. until 8.00 a.m.	20 minutes
8.00 until 12.00 noon	4 hours
12.00 noon until 9.00 p.m.	9 hours
9.00 p.m. until 9.15 p.m	15 minutes

4 hrs + 9 hrs = 13 hrs
20 mins + 15 mins = 35 mins
It is 13 hrs and 35 minutes until 9.15 p.m.

The school day is $6\frac{1}{2}$ hours long. It is 1 hr 35 minutes until home time. How long have we been at school?

6 hrs 30 − 1 hr 35
6 hrs and 30 minutes = 5 hrs 90 minutes   Change 1 hr to 60 minutes.

5 hrs 90 − 1 hr 35
5 hrs − 1 hr = 4 hrs
90 mins − 35 mins = 55 mins
We have been at school for 4 hours and 55 minutes.

1 **How much time passes from:**
   a 11:20 to 13:25   **b** 15:15 to 17:35
   c half past one until quarter to four   **d** 8.30 a.m. until 1.45 p.m.

2 **A bus journey from A to B takes 3 hrs and 17 minutes. If the buses depart from A at the following times, work out when they will arrive at B.**
   a 08.20 a.m.   **b** 12.12 p.m.   **c** 19:55

More calculations involving time

1 Work out the time interval in hours and minutes that passes between these times on the same day.

a 15:30 to 18:45 **b** 05:20 to 09:00

c 1.15 p.m to 4.40 p.m. **d** 2.40 a.m. to 9.45 p.m.

2 How long is it from:

a 19:00 on Monday till 14:00 on Tuesday?

b 3.30 p.m. on Wednesday until 5.45 a.m. on Thursday?

3 Work out what time it would be in each case. Give the times as a.m. and p.m times using the 12-hour clock system and as 24-hour times.

a $1\frac{1}{2}$ hours after 3.30 p.m.

b $2\frac{1}{4}$ hours before 14:25

c 2 hrs and 40 minutes after 18.20 p.m.

d $1\frac{3}{4}$ hours before 23:20

4 Mrs Dawoot has a roast that needs to cook for 3 hrs and 20 minutes. She puts it into the oven at 10.45 a.m. At what time will it be cooked?

5 A train leaves Station A at 05:53. It arrives at Station B at 11:12. How long did the journey take?

6 Rewrite each of these times in minutes.

a 2 hrs and 29 minutes **b** 3 hrs and 45 minutes

c $9\frac{1}{4}$ hours **d** 6 hrs and 5 minutes

7 Rewrite each of these times in hours and minutes.

a 90 minutes **b** 85 minutes

c 292 minutes **d** 375 minutes

8 Convert each of these times to seconds.

a 4 minutes **b** $6\frac{1}{2}$ minutes

c 4 minutes and 29 seconds **d** 3 minutes and 4 seconds

Timetables

Here is part of a train timetable. The train leaves (departs) from Station A and makes three stops before it gets to Station E. Times are given using the 24-hour system.

Departs Station A	Arrives Station B	Arrives Station C	Arrives Station D	Arrives Station E
14:38	14:47	14:52	14:58	15:01
15:20	15:29	15:34	15:40	15:43
15:48	15:57	16:02	16:08	16:11
16:10	16:19	16:24	16:30	16:33
16:35	16:44	16:49	16:55	16:58
17:08	17:17	17:22	17:28	17:31

1 At what time does the 16:10 train from Station A arrive at:

a Station B **b** Station E

2 How long does the train take to travel from:

a Station A to Station C **b** Station B to Station E

3 The 16:35 train leaves Station A 12 minutes late. At what time would it arrive at Station D?

4 Imran wants to catch the 15:20 train from Station A. It takes him 25 minutes to walk to the station. What is the latest time he can leave home to catch this train?

5 This timetable shows the departure and arrival times of four daily flights from Barbados to St Lucia.

Flight	Dep Bar	Arr St L
BD 098	07:25	08:20
BD 099	09:05	10:00
BD 100	16:00	16:55
BD 101	20:05	21:00

a Gloria arrives at the airport at quarter past two in the afternoon. How long does she have to wait for flight BD 100?

b Silvia catches flight BD 099. The departure is delayed by 28 minutes. At what time will she arrive in St Lucia?

c Fabio catches flight BD 098. It arrives on time in St Lucia but it takes him 34 minutes to collect his luggage and clear customs. He then takes 10 minutes to organise a taxi to his hotel. The taxi ride takes $\frac{3}{4}$ of an hour. At what time does he arrive at the hotel?
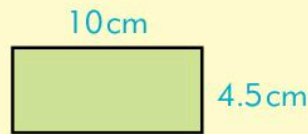
Revising area

Remember: The area of a shape is how much space it takes up. Area is always measured in square units such as mm^2, cm^2, m^2 and km^2.

To work out the area of a rectangle, multiply the length by the breadth. Look at this example to make sure you remember how to do this.
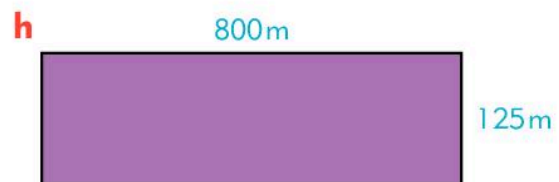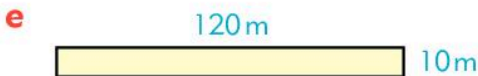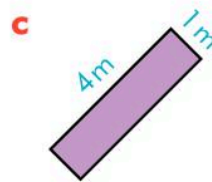
Area = $L \times B$
Area = $10\,cm \times 4.5\,cm$
Area = $45\,cm^2$

10 cm

4.5 cm

1 Calculate the area of each of these shapes. Show your working out.

a 6 cm, 2 cm

b 8 cm, 5.5 cm

c 4 m, 1 m

d 12.5 m, 6.4 m

e 120 m, 10 m

f 72 mm, 14 mm

g 110 mm, 55 mm

h 800 m, 125 m
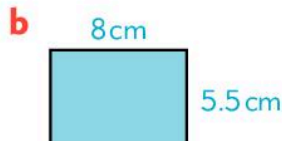
2 The area and the length of one side of each rectangle is given. Work out the length of the other side.

a 13.5 cm — Area: 135 cm²

b 12.6 mm — Area: 1260 mm²

c 30 m — Area: 750 m²

d 20 cm — Area: 400 cm²
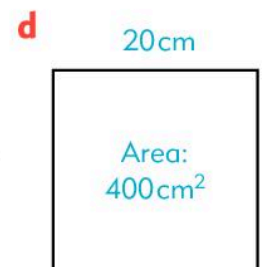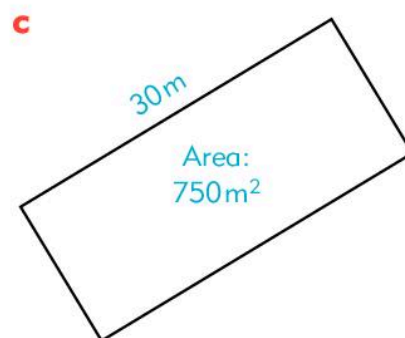
Area of combined shapes

Some shapes are made from more than one rectangle. To find the area of shapes like this it is useful to divide them into rectangles.

Once you have divided the shape into rectangles you can find the area of each rectangle. Then you add the areas together to find the area of the whole shape.

4 cm

1 cm

$4 \text{ cm} \times 1 \text{ cm}$
$= 4 \text{ cm}^2$

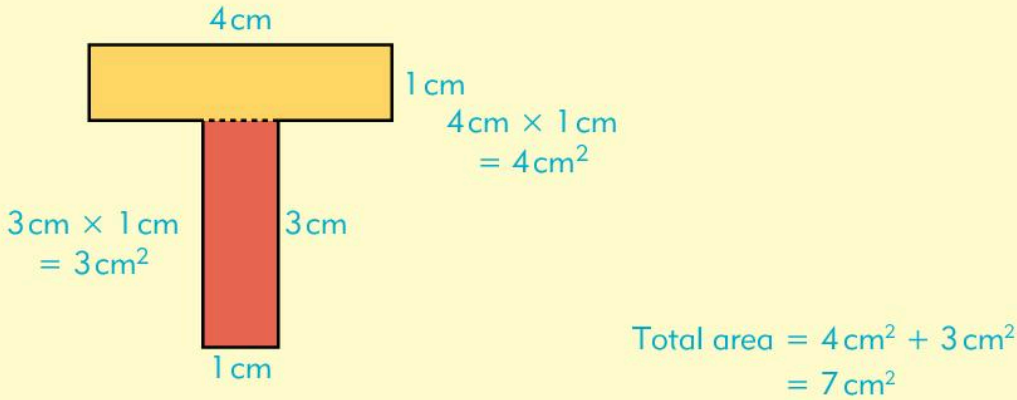$3 \text{ cm} \times 1 \text{ cm}$
$= 3 \text{ cm}^2$

3 cm

1 cm

Total area $= 4 \text{ cm}^2 + 3 \text{ cm}^2$
$= 7 \text{ cm}^2$

Redraw each shape accurately in your book. Divide it into rectangles and then work out its area.

1 **a**

3 cm

1 cm

1 cm

4 cm

1 cm

1 cm

b

4 cm

1 cm

1 cm

4 cm

2 cm

c

2 cm

2 cm

2 cm

1 cm

3 cm

4 cm

1 cm

3 cm
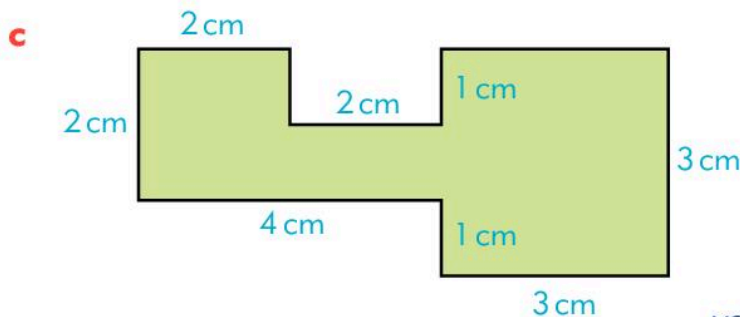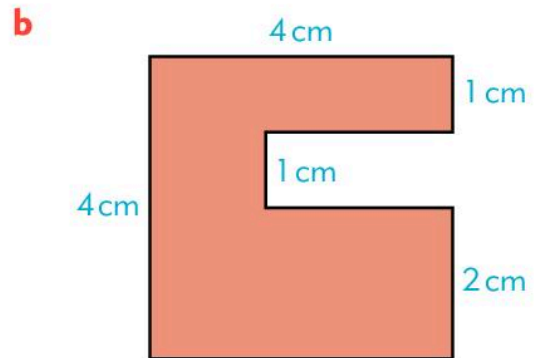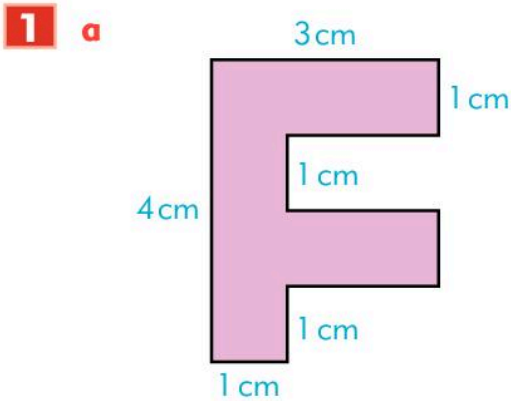
you can use Workbook page 77

Estimating area using a grid

You already know that area is measured in square units. We can use this fact to estimate the area of a shape that is drawn on a grid by counting the number of squares it covers.

If the shape is irregular, it may not cover an exact number of squares. Follow these steps to estimate the area of an irregular shape:

- Count all whole squares.
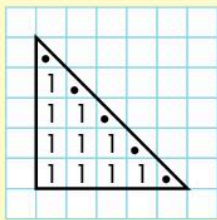- Combine half squares to make whole squares.
- Count any parts that are bigger than half a square.
- Ignore any parts that are less than half a square.
- Add to find the total number of squares.
- Give your answer in square units.

10 wholes $= 10$ cm^2
5 halves $= 2\frac{1}{2}$ cm^2
$= 12\frac{1}{2}$ cm^2
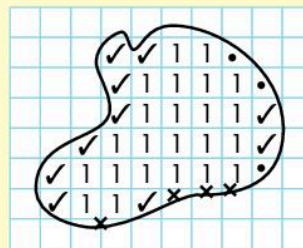
23 wholes $= 23$ cm^2
10 > half $= 10$ cm^2
3 halves $= 1.5$ cm^2
$= 34.5$ cm^2

× ignore

One square on this grid represents 1 cm^2. Estimate the area of each shape.

a
b
c
d
e
f

More estimating area

1 **This is a map of part of Asia.**

a Use the grid to estimate the area of each country. Give your answer in squares. For example, the area of Thailand is approximately one square.
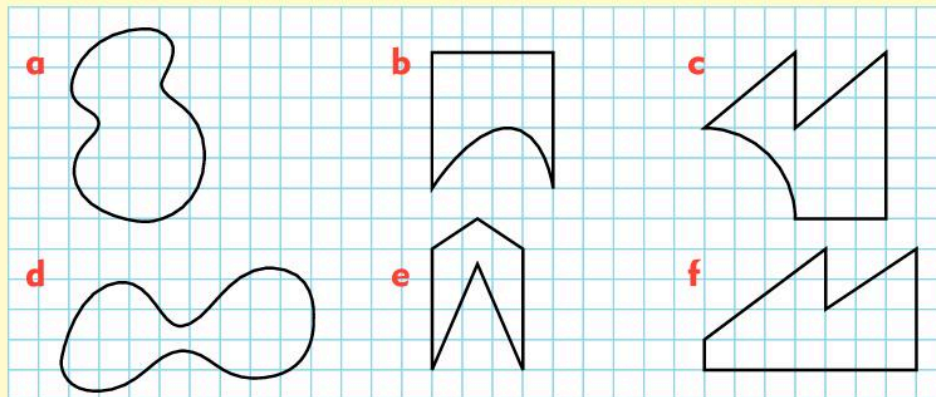
b Use your estimates to write the names of the countries in order from the one with the greatest area to the smallest area.

2 **Complete these sentences.**

a The area of India is approximately _____ times greater than the area of Thailand.

b Afghanistan and _____ cover a similar area.

c Vietnam has an area _____ times smaller than that of Indonesia.

3 **Estimate (in squares):**

a the total area of land shown on the map

b the total area of ocean shown on the map.

4 **Afghanistan has an actual area of just over 650 000 square kilometres. Use this figure to estimate the area covered by one square on the map.**

Area problems

1 Work with a partner. Read through each problem and talk about how you will solve it before you start.

2 Solve each problem. Show all your working out.

a This square tile measures 30 cm by 30 cm. The blue stripe round the edges is 5 cm wide. Work out the area of the yellow square.
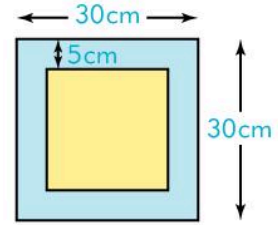
b This is the plan of a rectangular kitchen floor. The owner wants to tile the floor with square tiles. Each tile is 50 cm by 50 cm.
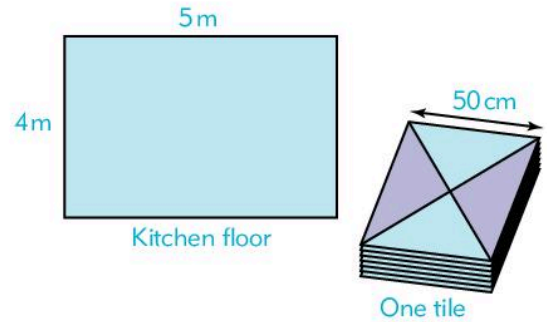
Work out the area of the kitchen floor.

How many tiles will the owner need to cover the floor?

c This is the plan of Mrs Singh's garden. The brown areas are flower beds. The green area is her lawn.
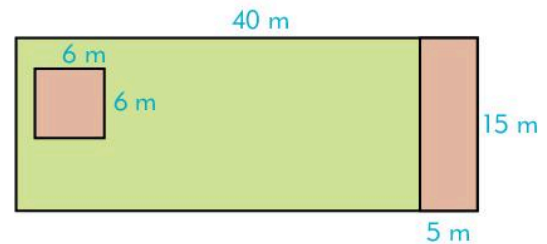
Work out the area of the garden.

Work out the area covered by lawn.

d Goolam has four pictures that he wants to stick in his book. The diagram shows the size of the pictures and the size of the page.

Will he be able to fit all the pictures onto the page?

Draw a diagram to show how he could arrange his pictures.
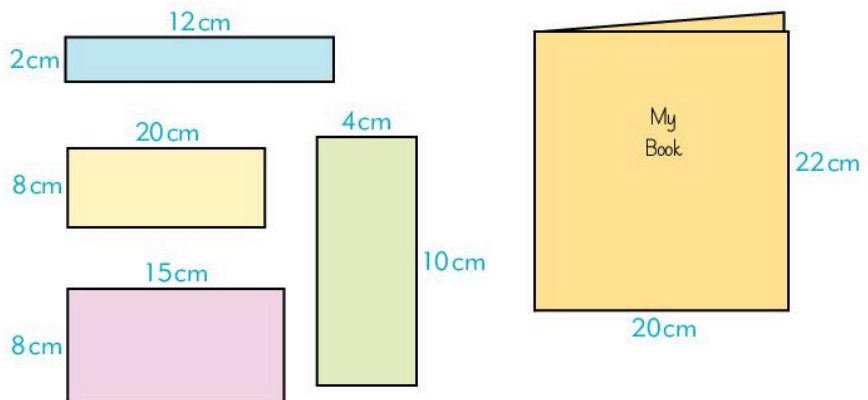
Revise division with remainders

Use the methods that you find easiest to do the calculations on this page.

1 Find half of each amount.

a 75 b 57 c 109 d 129
e 349 f 433 g 945 h 981

2 Divide. Write the remainder as a fraction.

a $25 \div 2$ b $46 \div 3$ c $31 \div 7$ d $45 \div 6$
e $40 \div 9$ f $60 \div 8$ g $39 \div 6$ h $25 \div 4$
i $95 \div 7$ j $91 \div 9$ k $66 \div 4$ l $75 \div 4$

3 Divide. Write the remainder as a decimal.

a $234 \div 10$ b $432 \div 10$ c $981 \div 10$
d $129 \div 100$ e $312 \div 100$ f $298 \div 100$

4 Find the missing values.

a $\square \div 4 = 6 \text{ r } 3$ b $\square \div 8 = 11 \text{ r } 2$ c $\square \div 7 = 13 \text{ r } 6$
d $\square \div 3 = 19 \text{ r } 1$ e $\square \div 4 = 13 \text{ r } 3$ f $\square \div 6 = 10 \text{ r } 4$

5 Find the missing values.

a $59 \div \square = 8 \text{ r } 3$ b $85 \div \square = 9 \text{ r } 4$ c $92 \div \square = 9 \text{ r } 2$
d $48 \div \square = 9 \text{ r } 3$ e $78 \div \square = 19 \text{ r } 2$ f $39 \div \square = 6 \text{ r } 3$

6 Without working out the answer, say which of the following divisions will have a remainder.

a $345 \div 10$ b $400 \div 10$ c $1200 \div 100$
d $467 \div 100$ e $909 \div 10$ f $3400 \div 10$

7 Calculate.

a $167 \div 4$ b $157 \div 5$ c $400 \div 7$
d $309 \div 6$ e $704 \div 5$ f $200 \div 7$

8 List five numbers between 50 and 120 that are:

a divisible by 2 with a remainder of 1
b divisible by 5 with a remainder of 3
c divisible by 10 with a remainder of 0.4
d divisible by 4 with a remainder of $\frac{1}{4}$.

1 2 3 Long division

You already know how to divide whole numbers by a single-digit number. Read through the examples on page 30 again to remind you of some of the methods you can use.

You can use these methods to divide by larger numbers. Read through these examples carefully to see how you can divide 513 by 19.

Estimate first using rounding: $500 \div 20 = 25$

Using long division

Step 1

H t u

```
         2
19 | 5 1 3
     3 8    (2 × 19)
     1 3
```

Step 2

H t u

```
        2 7
19 | 5 1 3
     3 8
     1 3↓
     1 3 3
     1 3 3  (7 × 19)
   Answer: 27
```

Repeated subtraction

```
19 | 513
   − 190  19 × 10
     323
   − 190  19 × 10
     133
   −  95  19 × 5
      38
   −  38  19 × 2
   Answer: 27
```

Moving towards long division

```
19 | 513
   − 380  19 × 20
     133
   −  95  19 × 5
      38
   −  38  19 × 2
   Answer: 27
```

1 Estimate the answers to these divisions by rounding. Then use pen and paper methods to find the correct answer.

- **a** 975 ÷ 15
- **b** 546 ÷ 13
- **c** 819 ÷ 21
- **d** 600 ÷ 24
- **e** 496 ÷ 31
- **f** 408 ÷ 34

2 The mass of 23 bags of cement is 552 kilograms. Find the mass of one bag.

3 945 trees are planted in 45 rows. Each row has the same number of trees. Work out how many trees there are in each row.

More division

1 Copy and complete this table. Do any working that you need to do to find the answers.

Divide	Round numbers to nearest 10 and/or 100	Estimated answer	Calculated answer	Difference between estimated and calculated answer
266 ÷ 19				
792 ÷ 22				
510 ÷ 15				
522 ÷ 18				
868 ÷ 28				
960 ÷ 32				

2 A shopkeeper orders 35 identical items from a factory. He is charged $665 in total. Calculate the cost of one item.

3 A school principal divides 960 desks equally among 30 classrooms. How many desks are in each classroom?

4 A number divided by 12 gives an answer of 420. What is the number?

5 What number divided by 23 will give a result of 736?

6 How many groups of 17 are there in 544?

7 How many groups of 57 can you make out of 969 counters?

8 Pencils are sold in boxes of 24. How many boxes will you need if you want:

a 360 pencils

b 552 pencils

c 744 pencils?

Dividing decimals

You can use the written methods you have learnt for division to solve division problems involving money and other decimal amounts as long as you remember to write the decimal point in the correct place.

Read through these methods to see how this works.

$5.10 \div 34$	Tickets for 12 students to visit a museum cost \$7.80. How much did each ticket cost?

$5.10 \div 34$

Estimate: I know $51 \div 3 = 17$
But the answer must be smaller than 1 so it will be around 0.17.

```
      0.15
34 │ 5.10
    3.4↓   34 × 10 = 340
    1.70   170 is half of 340, so
    1.70   34 × 5 must be 170
```

Answer is 0.15

Tickets for 12 students to visit a museum cost \$7.80. How much did each ticket cost?

$12 \times 6 = 72$, so $12 \times 0.6 = 7.2$
The tickets cost about \$0.60.

```
       0.65
12 │ 7.80
    7.2↓   12 × 0.6
    0.60   12 × 0.5
    0.60
```

The tickets cost \$0.65 each.
This is the same as 65 c.

Use the method you find easiest to do each calculation.
Check all your answers using a calculator.

1 Divide:
a $8.20 \div 20$ b $15.00 \div 12$ c $45.50 \div 15$
d $19.56 \div 12$ e $24.70 \div 19$ f $51.75 \div 15$

2 A group of 12 students raised \$32.40 for charity. Find the mean amount raised per student.

3 14 friends want to share \$702.00 equally. How much will they each get?

4 A box of 36 pencils costs \$5.40. What is the cost of one pencil?

5 A 9.90 m long piece of wire is cut into 22 equal pieces. What is the length of each piece?

you can use Workbook page 79

Division problems

For each problem, estimate the answer and then use a calculator to find the answer.

1 What is:

a 16.15 divided by 5

b 8.82 divided by 18

c $\frac{3}{10}$ of 58

d $\frac{9}{10}$ of 94

2 Find the missing numbers.

a $12.35 \div 5 = \square$

b $43.12 \div \square = 5.39$

c $18.4 \div \square = 2.3$

3 Work out what number each child is talking about.

If you divide my number by 24 you get 1.75.

If you multiply my number by 9 you will get 4.1.

If you multiply my number by 12 you will get 33.

My number is 15 less than 131.36 divided by 8.

4 Make up a number riddle like the ones above of your own. Give it to a partner to solve.

5 Mika has 24.99 metres of string. How long will each piece be if he cuts it into the following number of equal pieces?

a 3

b 30

c 21

d 17

6 $264 is shared equally among 40 people. How much does each one receive?

7 Salman has to share $143.28 equally among 15 people. He divides 143.28 by 15 using his calculator. The answer is 9.552.

a How much should each person get?

b How did you decide this?

8 Amanda has to work out $7.25 \div 0.5$. This is what she does:

$7.25 \div 0.5$ is the same as $72.5 \div 5$ which is the same as $145 \div 10$, so the answer is 14.5.

a Is her answer correct? Check using a calculator.

b Talk with your partner about each step in Amanda's working. Explain what she did to solve the problem.

Mixed calculations

1 You are given the number fact 19 × 41 = 779. Use this fact to work out:

a 779 ÷ 41 = ☐   b 19 × ☐ = 77.9

c 20 × 41 = ☐   d 38 × 82 = ☐

2 Here are five numbers:

| 16.2 | 254 | 49 | 32.5 | 12.45 |

a Find the sum of the largest and smallest numbers.

b What is the difference between the smallest number and 49?

c Which of these numbers is divisible by 7?

d What is the product of the smallest number and 100?

e What is the greatest number divided by 100?

3 Amaal has $8.00 to spend on stamps. It costs $0.45 for a stamp.

a How many stamps can she buy with $8.00?

b How much money will she have left?

c How much more money will she need to buy another 3 stamps?

4 Joshi wants to buy the following items:

a Work out the cost for each type of fruit.

b What will it cost to buy all the fruit?

4 kg of bananas at $1.25 per kilogram

2 kg of apples at $2.50 per kilogram

$2\frac{1}{2}$ kilograms of berries at $3.50 per kilogram

c How much change will Joshi get if he pays with a $20.00 bill?

5 Andrew divided 13.74 by 4 and got an answer of 34.35.

a Without dividing, how can you tell his answer is wrong?

b What do you think he did wrong?

c What is the correct answer? Show how you worked it out.

6 A rectangle has a perimeter of 12.88 cm. If one side is 4.2 cm long, find the length of the other sides.

Mixed problems

1 What is half of 142.8?

2 Complete this number pattern:
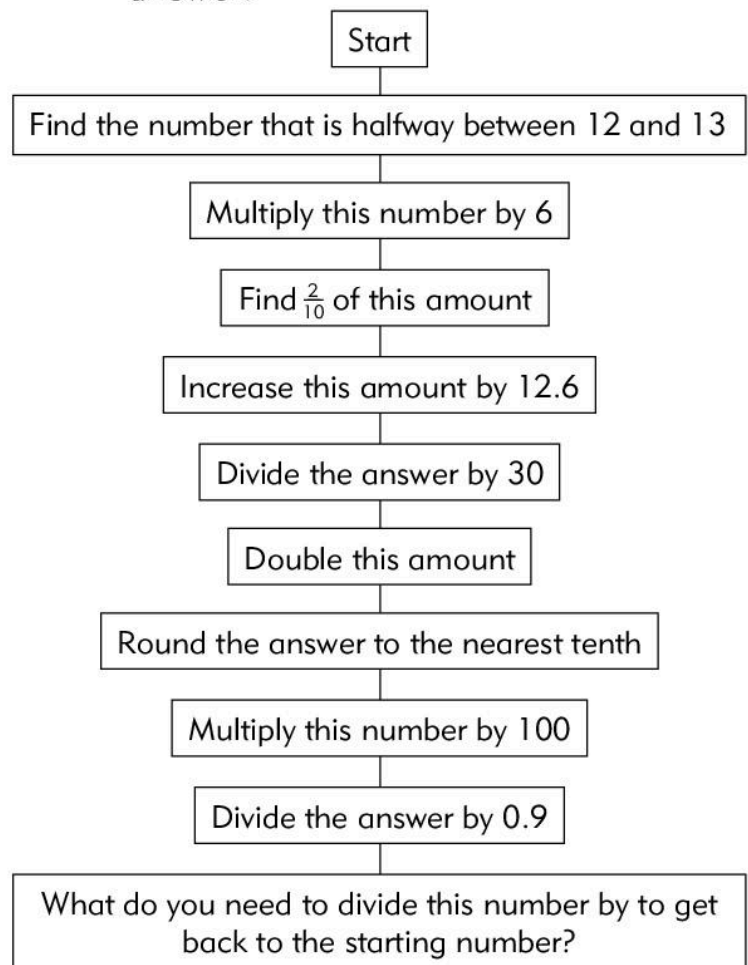
1.45 → double 2.9 → double ☐ → double ☐

3 Naresh borrowed $48.30 from his sister to buy some books. He offers to pay her back in six weeks by paying an equal amount each week.

a How much is this amount?

b His sister says this is a silly amount. She tells him to pay her $8.00 per week for five weeks and the balance in week 6. What will he have to pay in week 6?

4 Nandi has 55.9 metres of fabric. She cuts it into 13 equal pieces. How long will each piece be?

5 A square table has one side that is 5.25 m long. What is the perimeter of the table?

6 Follow the steps to find the answer:

Start

Find the number that is halfway between 12 and 13

Multiply this number by 6

Find $\frac{2}{10}$ of this amount

Increase this amount by 12.6

Divide the answer by 30

Double this amount

Round the answer to the nearest tenth

Multiply this number by 100

Divide the answer by 0.9

What do you need to divide this number by to get back to the starting number?

Glossary

A

Area – the amount of space taken up by a flat shape, measured in square units such as mm², cm² and km²

B

Bar graph – a graph where bars are used to show numbers or measurements

C

Capacity – the amount of liquid a container can hold, measured in millilitres (ml), litres (l) and kilolitres (kl)

Centimetre (cm) – a unit of length (your thumb is about 1cm wide)

Circle – a round, flat shape

Clockwise – the direction in which the hands move forwards in a circle around the face of an analogue clock; the opposite direction is called anti-clockwise

Cone – a solid shape with a pointed end and flat circular face

Co-ordinates – a pair of numbers used to give the position of a point on a grid

Cube – a solid shape with six faces; all the faces are square

Cuboid – a solid shape with six faces; all the faces are rectangles

Cylinder – a solid shape with two circular end faces; a tin is a cylinder

D

Data – information that is collected about a topic

Degrees – the unit we use for measuring angles and temperature

Divide – share equally into groups

E

Estimate – a guess, what you think an answer will be

F

Factor – a number which can divide into another number without remainder; 1, 2, 3 and 6 are all factors of 6

Fraction – a part of a whole

Frequency – how often something occurs

G

Geo-board – board with a grid of nails or pegs for making polygons

Gram (g) – a unit of mass used for light objects

Glossary

H

Hexagon – a flat shape with six sides

Horizontal – a line that goes from one side to the other, parallel to the horizon

K

Kilogram (kg) – a unit of mass used for heavy objects

L

Line graph – a graph where points are joined by a line

Litre (l) – a unit of capacity, how much a container holds

M

Mean – an average: the sum of all data in a set divided by the number of bits of data

Median – the middle value in an ordered set of data

Metre (m) – a unit of length used for larger measurements

Millimetre (mm) – a unit of length used for small measurements

Minute – a measure of time, there are 60 minutes in one hour

Mixed number – a number containing a whole number and a fraction

N

Negative numbers – numbers less than zero, they are shown with a – sign

Net – a flat shape that folds to enclose a 3-D solid

P

Pentagon – a flat shape with five sides

Percentage – a number or amount in each hundred: we use the % sign to show this is a fraction of 100

Perimeter – the distance around a shape

Polygon – a flat shape with straight sides

Prime number – a number with only two factors: the number 1 and itself

Prism – a solid shape that is the same all the way through

Probability – the likelihood that something will happen

Protractor – an instrument we use to measure angles

Pyramid – a solid shape with a flat base and faces that meet at a point

Q

Quadrilateral – a flat shape with four sides

Glossary

R

Range – the difference between the highest and lowest values in a set of data

Ratio – a comparison of two amounts, for example 1:3

Rectangle – a four-sided, flat shape with four right-angled corners and opposite sides equal

Reflection – a mirror image or flip

Remainder – the number left over after division

Right angle – a quarter turn, like the corner of this page

Round off – change a number to a lower place value to make it easier to work with, for example, we can round a number to the nearest ten, 100 or 1000

S

Second – a unit of time: there are 60 seconds in 1 minute

Sphere – a solid, round shape; a ball is a sphere

Square – a four-sided, flat shape with all sides equal

Symmetrical – able to be divided into two identical parts

T

Tally – a small slanted mark (/) used to count one object; every fifth mark is drawn across the previous four tallies ////

Triangle – a flat shape with three sides

V

Vertical – a line that goes straight up and down, perpendicular to the horizon

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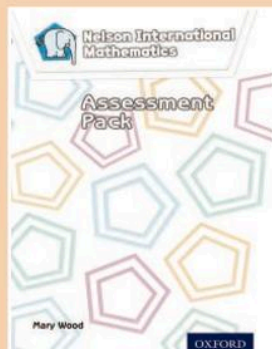**Provides full syllabus coverage for the Stage 6 Cambridge Primary Maths curriculum framework**

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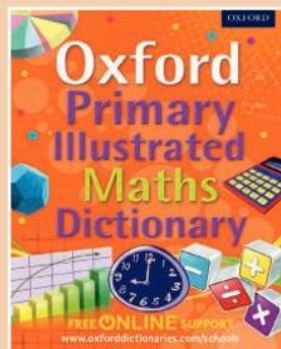
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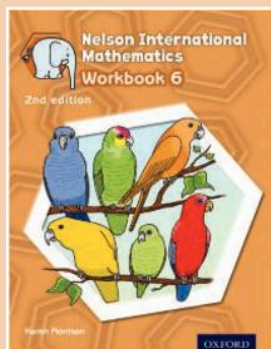
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