

# CULTS ACADEMY



## Numeracy Booklet Parent/Pupil Version

A guide for S1 and S2 pupils, parents  
and staff

**Cults Academy  
Faculty of Mathematics & Numeracy  
would like to thank  
James Gillespie's High School  
for allowing the use of their material  
in this booklet.**

# Introduction

## **What is the purpose of the booklet?**

This booklet has been produced to give guidance to pupils and parents on how certain common Numeracy topics are taught in mathematics and throughout the school. Staff from all departments have been consulted during its production and will be issued with a copy of the booklet. It is hoped that using a consistent approach across all subjects will make it easier for pupils to progress.

## **How can it be used?**

If you are helping your child with their homework, you can refer to the booklet to see what methods are being taught in school. Look up the relevant page for a step by step guide. Pupils have been issued with their own copy and can use the booklet in school to help them solve number and information handling questions in any subject.

The booklet includes the Numeracy skills useful in subjects other than mathematics. For help with mathematics topics, pupils should refer to their mathematics textbook or ask their teacher for help. If you would like to know what your child is studying in mathematics, please ask to see the Mathematics Pupil Handbook which was issued to your child at the start of the session.

## **Why do some topics include more than one method?**

In some cases (e.g. percentages), the method used will be dependent on the level of difficulty of the question, and whether or not a calculator is permitted.

For mental calculations, pupils should be encouraged to develop a variety of strategies so that they can select the most appropriate method in any given situation.

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# Addition

## Mental strategies



There are a number of useful mental strategies for addition. Some examples are given below.

**Example** Calculate  $54 + 27$

**Method 1** Add tens, then add units, then add together

$$50 + 20 = 70 \qquad 4 + 7 = 11 \qquad 70 + 11 = 81$$

**Method 2** Split up number to be added into tens and units and add separately.

$$54 + 20 = 74 \qquad 74 + 7 = 81$$

**Method 3** Round up to nearest 10, then subtract

$$54 + 30 = 84 \quad \text{but } 30 \text{ is } 3 \text{ too much so subtract } 3;$$
$$84 - 3 = 81$$

## Written Method

When adding numbers, ensure that the numbers are lined up according to place value. Start at right hand side, write down units, carry tens.

**Example** Add 3032 and 589

$\begin{array}{r} 3032 \\ +589 \\ \hline 1 \\ \hline \end{array}$	→	$\begin{array}{r} 3032 \\ +589 \\ \hline 21 \\ \hline \end{array}$	→	$\begin{array}{r} 3032 \\ +589 \\ \hline 621 \\ \hline \end{array}$	→	$\begin{array}{r} 3032 \\ +589 \\ \hline 3621 \\ \hline \end{array}$

# Subtraction



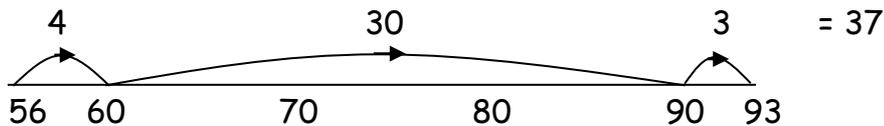
We use decomposition as a written method for subtraction (see below). Alternative methods may be used for mental calculations.

## Mental Strategies

**Example** Calculate  $93 - 56$

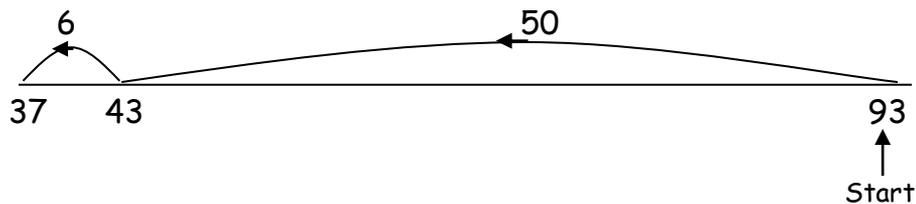
**Method 1** Count on

Count on from 56 until you reach 93. This can be done in several ways e.g.



**Method 2** Break up the number being subtracted

e.g. subtract 50, then subtract 6  $93 - 50 = 43$   
 $43 - 6 = 37$



## Written Method

**Example 1**  $4590 - 386$

$$\begin{array}{r} 81 \\ 4590 \\ - 386 \\ \hline 4204 \end{array}$$

**Example 2** Subtract 692 from 14597

We do not  
"borrow and  
pay back".

$$\begin{array}{r} 31 \\ 14597 \\ - 692 \\ \hline 13905 \end{array}$$

# Multiplication 1



It is essential that you know all of the multiplication tables from 1 to 10. These are shown in the tables square below.

x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

## Mental Strategies

**Example** Find  $39 \times 6$

### Method 1

$$\begin{array}{l} 30 \times 6 \\ = 180 \end{array}$$

$$\begin{array}{l} 9 \times 6 \\ = 54 \end{array}$$

$$\begin{array}{l} 180 + 54 \\ = 234 \end{array}$$

### Method 2

$$\begin{array}{l} 40 \times 6 \\ = 240 \end{array}$$

40 is 1 too many  
so take away  $6 \times 1$

$$\begin{array}{l} 240 - 6 \\ = 234 \end{array}$$

## Multiplication 2

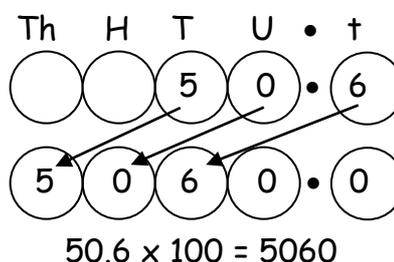
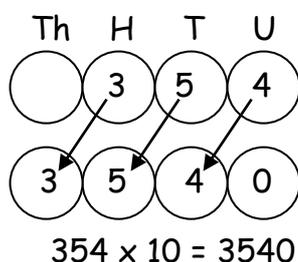
### Multiplying by multiples of 10 and 100



To multiply by **10** you move every digit *one* place to the left.

To multiply by **100** you move every digit *two* places to the left.

**Example 1** (a) Multiply 354 by 10      (b) Multiply 50.6 by 100



(c)  $35 \times 30$

To multiply by 30,  
multiply by 3,  
then by 10.

$$35 \times 3 = 105$$

$$105 \times 10 = 1050$$

so  $35 \times 30 = 1050$

(d)  $436 \times 600$

To multiply by  
600, multiply by 6,  
then by 100.

$$436 \times 6 = 2616$$

$$2616 \times 100 = 261600$$

so  $436 \times 600 = 261600$



We may also use these rules for multiplying decimal numbers.

**Example 2** (a)  $2.36 \times 20$       (b)  $38.4 \times 50$

$$2.36 \times 2 = 4.72$$

$$4.72 \times 10 = 47.2$$

so  $2.36 \times 20 = 47.2$

$$38.4 \times 5 = 192.0$$

$$192.0 \times 10 = 1920$$

so  $38.4 \times 50 = 1920$

# Division



You should be able to divide by a single digit or by a multiple of 10 or 100 without a calculator.

## Written Method

**Example 1** There are 192 pupils in first year, shared equally between 8 classes. How many pupils are in each class?

$$\begin{array}{r} 24 \\ 8 \overline{) 192} \end{array}$$

There are 24 pupils in each class

**Example 2** Divide 4.74 by 3

$$\begin{array}{r} 1.58 \\ 3 \overline{) 4.74} \end{array}$$

When dividing a decimal number by a whole number, the decimal points must stay in line.

**Example 3** A jug contains 2.2 litres of juice. If it is poured evenly into 8 glasses, how much juice is in each glass?

$$\begin{array}{r} 0.275 \\ 8 \overline{) 2.260} \end{array}$$

Each glass contains  
0.275 litres

If you have a remainder at the end of a calculation, add a zero onto the end of the decimal and continue with the calculation.

## Order of Calculation (BODMAS)

Consider this: What is the answer to  $2 + 5 \times 8$  ?

Is it  $7 \times 8 = 56$  or  $2 + 40 = 42$  ?

The correct answer is 42.



Calculations which have more than one operation need to be done in a particular order. The order can be remembered by using the mnemonic **BODMAS**

The **BODMAS** rule tells us which operations should be done first.

**BODMAS** represents:

**(B)**rackets

**(O)**f

**(D)**ivide

**(M)**ultiply

**(A)**dd

**(S)**ubtract

Scientific calculators use this rule, some basic calculators may not, so take care in their use.

**Example 1**      $15 - 12 \div 6$      BODMAS tells us to divide first  
                  =  $15 - 2$   
                  = 13

**Example 2**      $(9 + 5) \times 6$      BODMAS tells us to work out the  
                  =  $14 \times 6$      brackets first  
                  = 84

**Example 3**      $18 + 6 \div (5-2)$      Brackets first  
                  =  $18 + 6 \div 3$      Then divide  
                  =  $18 + 2$      Now add  
                  = 20

## Evaluating Formulae



To find the value of a variable in a formula, we must substitute all of the given values into the formula, then use BODMAS rules to work out the answer.

### Example 1

Use the formula  $P = 2L + 2B$  to evaluate  $P$  when  $L = 12$  and  $B = 7$ .

$$P = 2L + 2B$$

$$P = 2 \times 12 + 2 \times 7$$

$$P = 24 + 14$$

$$P = 38$$

Step 1: write formula

Step 2: substitute numbers for letters

Step 3: start to evaluate (BODMAS)

Step 4: write answer

### Example 2

Use the formula  $I = \frac{V}{R}$  to evaluate  $I$  when  $V = 240$  and  $R = 40$

$$I = \frac{V}{R}$$

$$I = \frac{240}{40}$$

$$I = 6$$

### Example 3

Use the formula  $F = 32 + 1.8C$  to evaluate  $F$  when  $C = 20$

$$F = 32 + 1.8C$$

$$F = 32 + 1.8 \times 20$$

$$F = 32 + 36$$

$$F = 68$$

## Estimation : Rounding

Numbers can be rounded to give an approximation.

2652

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

2600 2610 2620 2630 2640 2650 2660 2670 2680 2690 2700

2652 rounded to the nearest 10 is 2650.

2652 rounded to the nearest 100 is 2700.

When rounding numbers which are exactly in the middle, convention is to **round up**.

7865 rounded to the nearest 10 is 7870.



The same principle applies to rounding decimal numbers.

In general, to round a number, we must first identify the place value to which we want to round. We must then look at the next digit to the right (the "check digit") - if it is 5 or more round up.

**Example 1** Round 46 753 to the nearest thousand.

6 is the digit in the thousands column - the check digit (in the hundreds column) is a 7, so round up.

46 753  
= 47 000 to the nearest thousand

**Example 2** Round 1.57359 to 2 decimal places

The second number after the decimal point is a 7 - the check digit (the third number after the decimal point) is a 3, so round down.

1.57359  
= 1.57 to 2 decimal places

## Estimation : Calculation



We can use rounded numbers to give us an approximate answer to a calculation. This allows us to check that our answer is sensible.

### Example 1

Tickets for a concert were sold over 4 days. The number of tickets sold each day was recorded in the table below. How many tickets were sold in total?

Monday	Tuesday	Wednesday	Thursday
486	205	197	321

$$\text{Estimate} = 500 + 200 + 200 + 300 = 1200$$

Calculate:

$$\begin{array}{r} 486 \\ 205 \\ 197 \\ +321 \\ \hline 1209 \end{array} \quad \text{Answer} = 1209 \text{ tickets}$$

### Example 2

A bar of chocolate weighs 42g. There are 48 bars of chocolate in a box. What is the total weight of chocolate in the box?

$$\text{Estimate} = 50 \times 40 = 2000\text{g}$$

Calculate:

$$\begin{array}{r} 42 \\ \times 48 \\ \hline 336 \\ 1680 \\ \hline 2016 \end{array} \quad \text{Answer} = 2016\text{g}$$

# Time 1

Time may be expressed in 12 or 24 hour notation.



## 12-hour clock

Time can be displayed on a clock face, or digital clock.



05:15

These clocks both show fifteen minutes past five, or quarter past five.

When writing times in 12 hour clock, we need to add a.m. or p.m. after the time.

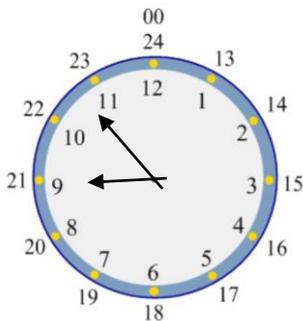
a.m. is used for times between midnight and 12 noon (morning)

p.m. is used for times between 12 noon and midnight (afternoon / evening).

## 24-hour clock



In 24 hour clock, the hours are written as numbers between 00 and 24. Midnight is expressed as 00 00, or 24 00. After 12 noon, the hours are numbered 13, 14, 15 ... etc.



### Examples

9.55 am → 09 55 hours

3.35 pm → 15 35 hours

12.20 am → 00 20 hours

02 16 hours → 2.16 am

20 45 hours → 8.45 pm

## Time 2



It is essential to know the number of months, weeks and days in a year, and the number of days in each month.

### Time Facts

In 1 year, there are:      365 days (366 in a leap year)  
   52 weeks  
   12 months

The number of days in each month can be remembered using the rhyme:

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

### Distance, Speed and Time.

For any given journey, the distance travelled depends on the speed and the time taken. If speed is constant, then the following formulae apply:

$$\text{Distance} = \text{Speed} \times \text{Time} \quad \text{or} \quad D = S T$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad \text{or} \quad S = \frac{D}{T}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} \quad \text{or} \quad T = \frac{D}{S}$$

**Example**      Calculate the speed of a train which travelled 450 km in 5 hours

$$S = \frac{D}{T}$$

$$S = \frac{450}{5}$$

$$S = 90 \text{ km/h}$$

# Fractions 1

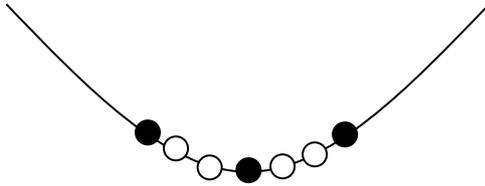


Addition, subtraction, multiplication and division of fractions are studied in mathematics. However, the examples below may be helpful in all subjects.

## Understanding Fractions

### Example

A necklace is made from black and white beads.



What fraction of the beads are black?

There are 3 black beads out of a total of 7, so  $\frac{3}{7}$  of the beads are black.

## Equivalent Fractions

### Example

What fraction of the flag is shaded?



6 out of 12 squares are shaded. So  $\frac{6}{12}$  of the flag is shaded.

It could also be said that  $\frac{1}{2}$  the flag is shaded.

$\frac{6}{12}$  and  $\frac{1}{2}$  are **equivalent fractions**.

## Fractions 2

### Simplifying Fractions



The top of a fraction is called the **numerator**, the bottom is called the **denominator**.

To simplify a fraction, divide the **numerator** and **denominator** of the fraction by the same number.

#### Example 1

(a)  $\frac{20}{25} = \frac{4}{5}$

Diagram showing the simplification of  $\frac{20}{25}$  to  $\frac{4}{5}$ . A curved line connects 20 to 4 with  $\div 5$  above it. Another curved line connects 25 to 5 with  $\div 5$  below it. An equals sign is in the center.

(b)  $\frac{16}{24} = \frac{2}{3}$

Diagram showing the simplification of  $\frac{16}{24}$  to  $\frac{2}{3}$ . A curved line connects 16 to 2 with  $\div 8$  above it. Another curved line connects 24 to 3 with  $\div 8$  below it. An equals sign is in the center.

This can be done repeatedly until the numerator and denominator are the smallest possible numbers - the fraction is then said to be in its **simplest form**.

**Example 2** Simplify  $\frac{72}{84}$        $\frac{72}{84} = \frac{36}{42} = \frac{18}{21} = \frac{6}{7}$  (simplest form)

### Calculating Fractions of a Quantity



To find the fraction of a quantity, divide by the denominator.

To find  $\frac{1}{2}$  divide by 2, to find  $\frac{1}{3}$  divide by 3, to find  $\frac{1}{7}$  divide by 7 etc.

**Example 1** Find  $\frac{1}{5}$  of £150

$$\frac{1}{5} \text{ of } \pounds 150 = \pounds 150 \div 5 = \pounds 30$$

**Example 2** Find  $\frac{3}{4}$  of 48

$$\frac{1}{4} \text{ of } 48 = 48 \div 4 = 12$$

$$\text{so } \frac{3}{4} \text{ of } 48 = 3 \times 12 = 36$$

To find  $\frac{3}{4}$  of a quantity, start by finding  $\frac{1}{4}$

# Percentages 1



Percent means out of 100.  
A percentage can be converted to an equivalent fraction or decimal.

36% means  $\frac{36}{100}$

36% is therefore equivalent to  $\frac{9}{25}$  and 0.36

## Common Percentages

Some percentages are used very frequently. It is useful to know these as fractions and decimals.

Percentage	Fraction	Decimal
1%	$\frac{1}{100}$	0.01
10%	$\frac{1}{10}$	0.1
20%	$\frac{1}{5}$	0.2
25%	$\frac{1}{4}$	0.25
$33\frac{1}{3}\%$	$\frac{1}{3}$	0.333...
50%	$\frac{1}{2}$	0.5
$66\frac{2}{3}\%$	$\frac{2}{3}$	0.666...
75%	$\frac{3}{4}$	0.75

## Percentages 2



There are many ways to calculate percentages of a quantity. Some of the common ways are shown below.

### Non- Calculator Methods

#### Method 1 Using Equivalent Fractions

**Example** Find 25% of £640

$$25\% \text{ of } \pounds 640 = \frac{1}{4} \text{ of } \pounds 640 = \pounds 640 \div 4 = \pounds 160$$

#### Method 2 Using 1%

In this method, first find 1% of the quantity (by dividing by 100), then multiply to give the required value.

**Example** Find 9% of 200g

$$1\% \text{ of } 200\text{g} = \frac{1}{100} \text{ of } 200\text{g} = 200\text{g} \div 100 = 2\text{g}$$

$$\text{so } 9\% \text{ of } 200\text{g} = 9 \times 2\text{g} = 18\text{g}$$

#### Method 3 Using 10%

This method is similar to the one above. First find 10% (by dividing by 10), then multiply to give the required value.

**Example** Find 70% of £35

$$10\% \text{ of } \pounds 35 = \frac{1}{10} \text{ of } \pounds 35 = \pounds 35 \div 10 = \pounds 3.50$$

$$\text{so } 70\% \text{ of } \pounds 35 = 7 \times \pounds 3.50 = \pounds 24.50$$

## Percentages 3

### Non- Calculator Methods (continued)

The previous 2 methods can be combined so as to calculate any percentage.

**Example** Find 23% of £15000

$$10\% \text{ of } \pounds 15000 = \pounds 1500 \quad \text{so } 20\% = \pounds 1500 \times 2 = \pounds 3000$$

$$1\% \text{ of } \pounds 15000 = \pounds 150 \quad \text{so } 3\% = \pounds 150 \times 3 = \pounds 450$$

$$23\% \text{ of } \pounds 15000 = \pounds 3000 + \pounds 450 = \pounds 3450$$

### Finding VAT (without a calculator)

Value Added Tax (VAT) = 15%

To find VAT, firstly find 10%

**Example** Calculate the total price of a computer which costs £650 excluding VAT

$$10\% \text{ of } \pounds 650 = \pounds 65 \quad (\text{divide by } 10)$$

$$5\% \text{ of } \pounds 650 = \pounds 32.50 \quad (\text{divide previous answer by } 2)$$

$$\text{so } 15\% \text{ of } \pounds 650 = \pounds 65 + \pounds 32.50 = \pounds 97.50$$

$$\text{Total price} = \pounds 650 + \pounds 97.50 = \pounds 747.50$$

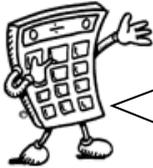
## Percentages 4

### Calculator Method

To find the percentage of a quantity using a calculator, change the percentage to a decimal, then multiply.

**Example 1** Find 23% of £15000

$$23\% = 0.23 \text{ so } 23\% \text{ of } \pounds 15000 = 0.23 \times \pounds 15000 = \pounds 3450$$



We do not use the % button on calculators. The methods taught in the mathematics department are all based on converting percentages to decimals.

**Example 2** House prices increased by 19% over a one year period. What is the new value of a house which was valued at £236000 at the start of the year?

$$19\% = 0.19 \quad \text{so} \quad \text{Increase} = 0.19 \times \pounds 236000 \\ = \pounds 44840$$

$$\text{Value at end of year} = \text{original value} + \text{increase} \\ = \pounds 236000 + \pounds 44840 \\ = \pounds 280840$$

The new value of the house is £280840

## Percentages 5

### Finding the percentage



To find a percentage of a total, first make a fraction, then convert to a decimal by dividing the top by the bottom. This can then be expressed as a percentage.

**Example 1** There are 30 pupils in Class 3A3. 18 are girls.  
What percentage of Class 3A3 are girls?

$$\frac{18}{30} = 18 \div 30 = 0.6 = 60\%$$

60% of 3A3 are girls

**Example 2** James scored 36 out of 44 his biology test. What is his percentage mark?

$$\begin{aligned} \text{Score} &= \frac{36}{44} = 36 \div 44 = 0.81818\dots \\ &= 81.818\dots\% = 82\% \text{ (rounded)} \end{aligned}$$

**Example 3** In class 1X1, 14 pupils had brown hair, 6 pupils had blonde hair, 3 had black hair and 2 had red hair. What percentage of the pupils were blonde?

$$\text{Total number of pupils} = 14 + 6 + 3 + 2 = 25$$

6 out of 25 were blonde, so,

$$\frac{6}{25} = 6 \div 25 = 0.24 = 24\%$$

24% were blonde.

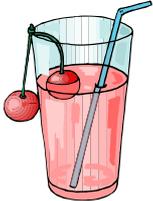
# Ratio 1



When quantities are to be mixed together, the ratio, or proportion of each quantity is often given. The ratio can be used to calculate the amount of each quantity, or to share a total into parts.

## Writing Ratios

### Example 1



To make a fruit drink, 4 parts water is mixed with 1 part of cordial.

The ratio of water to cordial is 4:1  
(said "4 to 1")

The ratio of cordial to water is 1:4.

**Order is important when writing ratios.**

### Example 2



In a bag of balloons, there are 5 red, 7 blue and 8 green balloons.

The ratio of red : blue : green is 5 : 7 : 8

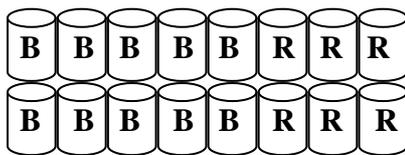
## Simplifying Ratios

Ratios can be simplified in much the same way as fractions.

### Example 1

Purple paint can be made by mixing 10 tins of blue paint with 6 tins of red. The ratio of blue to red can be written as 10 : 6

It can also be written as 5 : 3, as it is possible to split up the tins into 2 groups, each containing 5 tins of blue and 3 tins of red.



$$\begin{aligned} \text{Blue : Red} &= 10 : 6 \\ &= 5 : 3 \end{aligned}$$

To simplify a ratio, divide each figure in the ratio by a common factor.

## Ratio 2

### Simplifying Ratios (continued)

#### Example 2

Simplify each ratio:

(a) 4:6

(b) 24:36

(c) 6:3:12

(a) 4:6  
= 2:3

Divide each  
figure by 2

(b) 24:36  
= 2:3

Divide each  
figure by 12

(c) 6:3:12  
= 2:1:4

Divide each  
figure by 3

#### Example 3

Concrete is made by mixing 20 kg of sand with 4 kg cement. Write the ratio of sand : cement in its simplest form

$$\begin{aligned}\text{Sand : Cement} &= 20 : 4 \\ &= 5 : 1\end{aligned}$$

### Using ratios

The ratio of fruit to nuts in a chocolate bar is 3 : 2. If a bar contains 15g of fruit, what weight of nuts will it contain?

Fruit	Nuts
3	2
15	10

So the chocolate bar will contain 10g of nuts.

## Ratio 3

### Sharing in a given ratio

#### Example

Lauren and Sean earn money by washing cars. By the end of the day they have made £90. As Lauren did more of the work, they decide to share the profits in the ratio 3:2. How much money did each receive?

Step 1      Add up the numbers to find the total number of parts

$$3 + 2 = 5$$

Step 2      Divide the total by this number to find the value of each part

$$90 \div 5 = \text{£}18$$

Step 3      Multiply each figure by the value of each part

$$3 \times \text{£}18 = \text{£}54$$

$$2 \times \text{£}18 = \text{£}36$$

Step 4      Check that the total is correct

$$\text{£}54 + \text{£}36 = \text{£}90 \quad \checkmark$$

Lauren received £54 and Sean received £36



## Information Handling : Tables



It is sometimes useful to display information in graphs, charts or tables.

**Example 1** The table below shows the average maximum temperatures (in degrees Celsius) in Barcelona and Edinburgh.

	J	F	M	A	M	J	J	A	S	O	N	D
Barcelona	13	14	15	17	20	<b>24</b>	27	27	25	21	16	14
Edinburgh	6	6	8	11	14	17	18	18	16	13	8	6

The average temperature in June in Barcelona is 24°C

**Frequency Tables** are used to present information. Often data is grouped in intervals.

**Example 2** Homework marks for Class 4B

27 30 23 24 22 35 24 33 38 43 18 29 28 28 27  
 33 36 30 43 50 30 25 26 37 35 20 22 24 31 48

Mark	Tally	Frequency
16 - 20		2
21 - 25		7
26 - 30		9
31 - 35		5
36 - 40		3
41 - 45		2
46 - 50		2

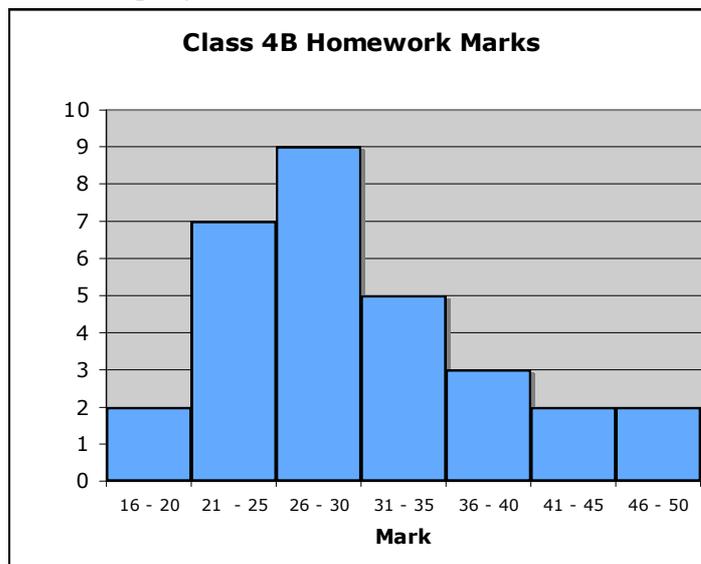
Each mark is recorded in the table by a tally mark. Tally marks are grouped in 5's to make them easier to read and count.

## Information Handling : Bar Graphs

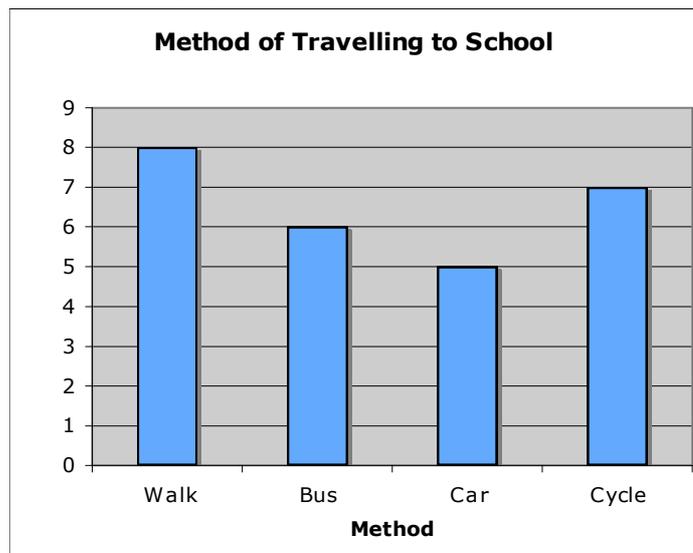


Bar graphs are often used to display data. The horizontal axis should show the categories or class intervals, and the vertical axis the frequency. All graphs should have a title, and each axis must be labelled.

**Example 1** The graph below shows the homework marks for Class 4B.



**Example 2** How do pupils travel to school?



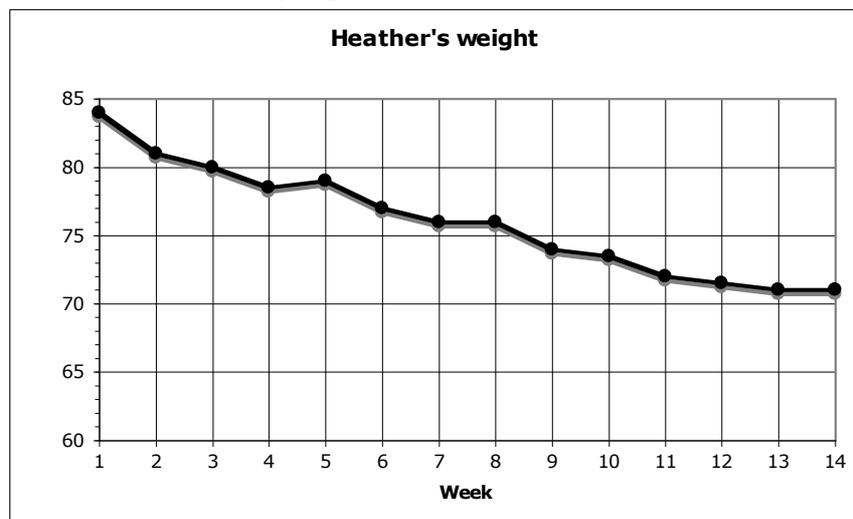
When the horizontal axis shows categories, rather than grouped intervals, it is common practice to leave gaps between the bars.

## Information Handling : Line Graphs



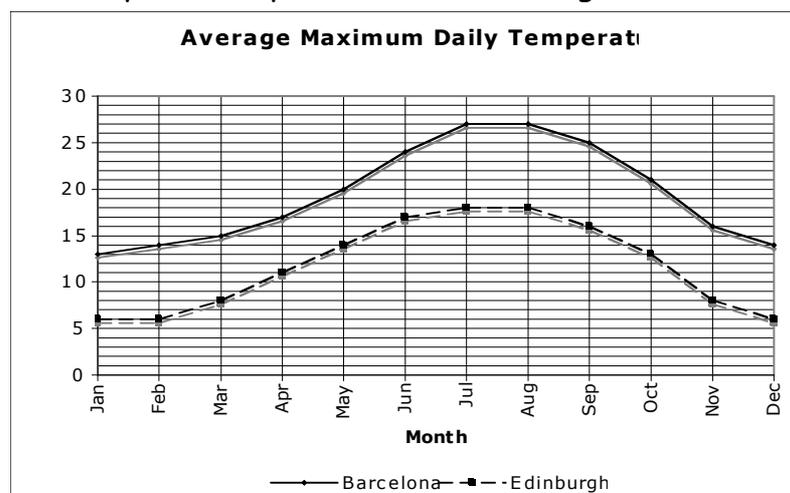
Line graphs consist of a series of points which are plotted, then joined by a line. All graphs should have a title, and each axis must be labelled. The trend of a graph is a general description of it.

**Example 1** The graph below shows Heather's weight over 14 weeks as she follows an exercise programme.



The trend of the graph is that her weight is decreasing.

**Example 2** Graph of temperatures in Edinburgh and Barcelona.



## Information Handling : Scatter Graphs

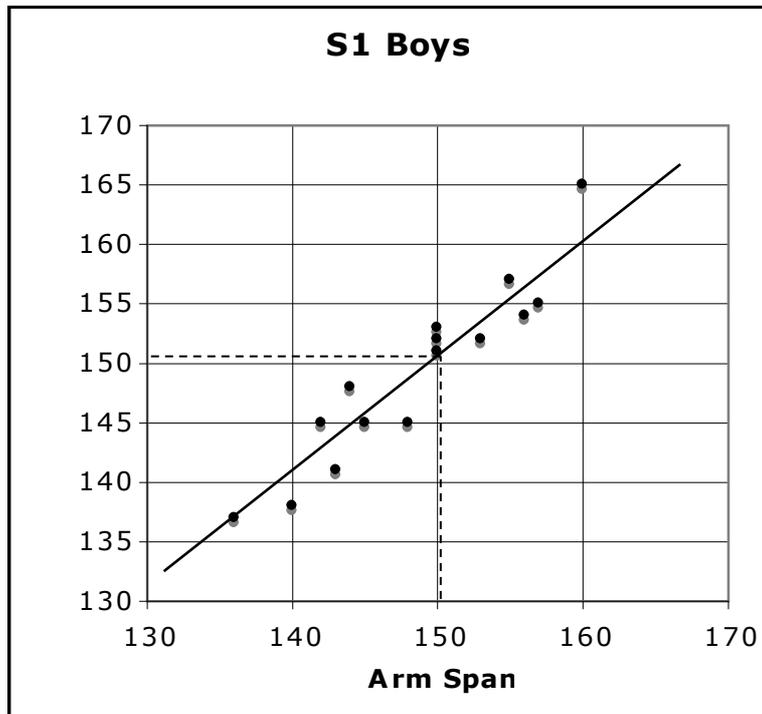


A scatter diagram is used to display the relationship between two variables.  
A pattern may appear on the graph. This is called a **correlation**.

### Example

The table below shows the height and arm span of a group of first year boys. This is then plotted as a series of points on the graph below.

Arm Span (cm)	150	157	155	142	153	143	140	145	144	150	148	160	150	156	136
Height (cm)	153	155	157	145	152	141	138	145	148	151	145	165	152	154	137



The graph shows a general trend, that as the arm span increases, so does the height. This graph shows a positive correlation.

The line drawn is called the line of best fit. This line can be used to provide estimates. For example, a boy of arm span 150cm would be expected to have a height of around 151cm.

Note that in some subjects, it is a requirement that the axes start from zero.

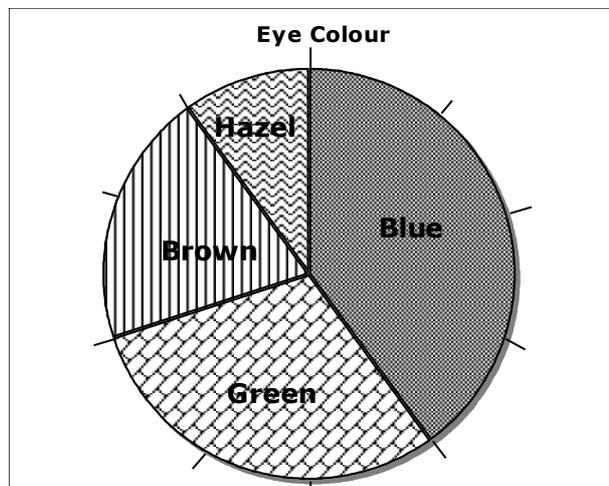
## Information Handling : Pie Charts



A pie chart can be used to display information. Each sector (slice) of the chart represents a different category. The size of each category can be worked out as a fraction of the total using the number of divisions or by measuring angles.

### Example

30 pupils were asked the colour of their eyes. The results are shown in the pie chart below.



How many pupils had brown eyes?

The pie chart is divided up into ten parts, so pupils with brown eyes represent  $\frac{2}{10}$  of the total.

$\frac{2}{10}$  of 30 = 6 so 6 pupils had brown eyes.

If no divisions are marked, we can work out the fraction by measuring the angle of each sector.

The angle in the brown sector is  $72^\circ$ .  
so the number of pupils with brown eyes  
 $= \frac{72}{360} \times 30 = 6$  pupils.

If finding all of the values, you can check your answers - the total should be 30 pupils.

## Information Handling : Pie Charts 2

### Drawing Pie Charts



On a pie chart, the size of the angle for each sector is calculated as a fraction of  $360^\circ$ .

**Example:** In a survey about television programmes, a group of people were asked what was their favourite soap. Their answers are given in the table below. Draw a pie chart to illustrate the information.

Soap	Number of people
Eastenders	28
Coronation Street	24
Emmerdale	10
Hollyoaks	12
None	6

Total number of people = 80

$$\text{Eastenders} = \frac{28}{80} \rightarrow \frac{28}{80} \times 360^\circ = 126^\circ$$

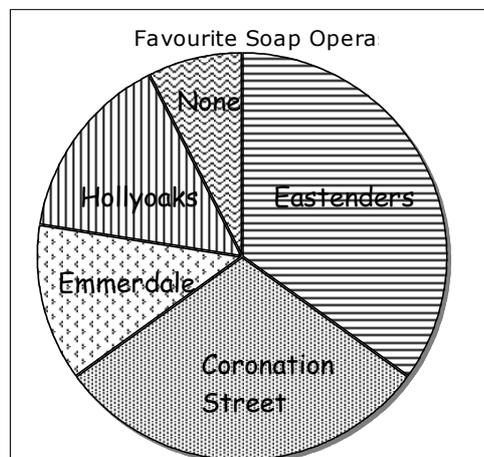
$$\text{Coronation Street} = \frac{24}{80} \rightarrow \frac{24}{80} \times 360^\circ = 108^\circ$$

$$\text{Emmerdale} = \frac{10}{80} \rightarrow \frac{10}{80} \times 360^\circ = 45^\circ$$

$$\text{Hollyoaks} = \frac{12}{80} \rightarrow \frac{12}{80} \times 360^\circ = 54^\circ$$

$$\text{None} = \frac{6}{80} \rightarrow \frac{6}{80} \times 360^\circ = 27^\circ$$

Check that the total =  $360^\circ$



## Information Handling : Averages



To provide information about a set of data, the average value may be given. There are 3 ways of finding the average value - the mean, the median and the mode.

### Mean

The mean is found by adding all the data together and dividing by the number of values.

### Median

The median is the middle value when all the data is written in numerical order (if there are two middle values, the median is half-way between these values).

### Mode

The mode is the value that occurs most often.

### Range

The range of a set of data is a measure of spread.

Range = Highest value - Lowest value

**Example** Class 1A4 scored the following marks for their homework assignment. Find the mean, median, mode and range of the results.

7, 9, 7, 5, 6, 7, 10, 9, 8, 4, 8, 5, 7, 10

$$\begin{aligned}\text{Mean} &= \frac{7+9+7+5+6+7+10+9+8+4+8+5+7+10}{14} \\ &= \frac{102}{14} = 7.285\dots \quad \text{Mean} = 7.3 \text{ to 1 decimal place}\end{aligned}$$

Ordered values: 4, 5, 5, 6, 7, 7, 7, 7, 8, 8, 9, 9, 10, 10  
Median = 7

7 is the most frequent mark, so Mode = 7

Range = 10 - 4 = 6

### Mathematical Dictionary (Key words):

Add; Addition (+)	To combine 2 or more numbers to get one number (called the sum or the total) Example: $12+76 = 88$
a.m.	(ante meridiem) Any time in the morning (between midnight and 12 noon).
Approximate	An estimated answer, often obtained by rounding to nearest 10, 100 or decimal place.
Calculate	Find the answer to a problem. It doesn't mean that you must use a calculator!
Data	A collection of information (may include facts, numbers or measurements).
Denominator	The bottom number in a fraction (the number of parts into which the whole is split).
Difference (-)	The amount between two numbers (subtraction). Example: The difference between 50 and 36 is 14 $50 - 36 = 14$
Division ( $\div$ )	Sharing a number into equal parts. $24 \div 6 = 4$
Double	Multiply by 2.
Equals (=)	Makes or has the same amount as.
Equivalent fractions	Fractions which have the same value. Example $\frac{6}{12}$ and $\frac{1}{2}$ are equivalent fractions
Estimate	To make an approximate or rough answer, often by rounding.
Evaluate	To work out the answer.
Even	A number that is divisible by 2. Even numbers end with 0, 2, 4, 6 or 8.
Factor	A number which divides exactly into another number, leaving no remainder. Example: The factors of 15 are 1, 3, 5, 15.
Frequency	How often something happens. In a set of data, the number of times a number or category occurs.
Greater than ( $>$ )	Is bigger or more than. Example: 10 is greater than 6. $10 > 6$
Least	The lowest number in a group (minimum).
Less than ( $<$ )	Is smaller or lower than. Example: 15 is less than 21. $15 < 21$ .

Maximum	The largest or highest number in a group.
Mean	The arithmetic average of a set of numbers (see p32)
Median	Another type of average - the middle number of an ordered set of data (see p32)
Minimum	The smallest or lowest number in a group.
Minus (-)	To subtract.
Mode	Another type of average - the most frequent number or category (see p32)
Most	The largest or highest number in a group (maximum).
Multiple	A number which can be divided by a particular number, leaving no remainder. Example Some of the multiples of 4 are 8, 16, 48, 72
Multiply (x)	To combine an amount a particular number of times. Example $6 \times 4 = 24$
Negative Number	A number less than zero. Shown by a minus sign. Example -5 is a negative number.
Numerator	The top number in a fraction.
Odd Number	A number which is not divisible by 2. Odd numbers end in 1, 3, 5, 7 or 9.
Operations	The four basic operations are addition, subtraction, multiplication and division.
Order of operations	The order in which operations should be done. BODMAS (see p9)
Place value	The value of a digit dependent on its place in the number. Example: in the number 1573.4, the 5 has a place value of 100.
p.m.	(post meridiem) Any time in the afternoon or evening (between 12 noon and midnight).
Prime Number	A number that has exactly 2 factors (can only be divided by itself and 1). Note that 1 is not a prime number as it only has 1 factor.
Product	The answer when two numbers are multiplied together. Example: The product of 5 and 4 is 20.
Remainder	The amount left over when dividing a number.
Share	To divide into equal groups.
Sum	The total of a group of numbers (found by adding).
Total	The sum of a group of numbers (found by adding).