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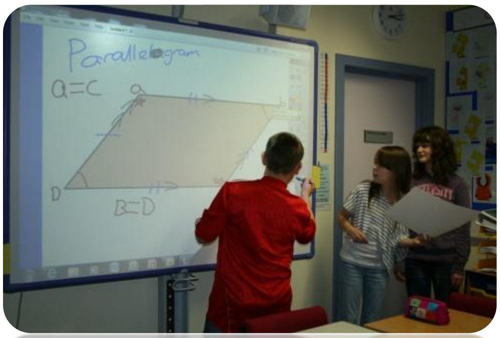
Whalsay School



Numeracy Booklet

A guide for parents and staff

Introduction

What is meant by numeracy?

Numeracy is a 'service' for various subjects, and for many things in everyday life: the numerical skills and reasoning capabilities that enable learners to make solid progress in their education. This booklet concentrates on the core numeracy needed to learn effectively in other subjects and for everyday life.

There is a strong focus on literacy and numeracy in the new curriculum, because all children and young people require these skills to learn effectively and to succeed in life. Confidence and competence in literacy and numeracy provide the foundations for lifelong learning.

What is the purpose of the booklet?

This booklet has been produced to give guidance to parents on how certain common numeracy topics are taught in mathematics and throughout the school. Staff from all departments have had input into the creation of the booklet, and it is hoped that with a consistent approach across all subjects pupils will progress successfully.

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.

The booklet includes numeracy skills that are useful in many other areas than mathematics. There is also a glossary at the back, which explains what several mathematical terms mean.

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.

What level of numeracy does this booklet cover?

This booklet broadly contains information about numeracy which is used in the school from nursery through to secondary level. There is a section at the start with some considerations for Early level – nursery and lower primary. The remainder of the booklet covers a variety of topics, up to around CfE Level 3.

If you have any questions, then please do not hesitate to contact the school.

Early Level

Some Considerations for Early Level for early mathematical development and some practical ideas to try out at home.

Children need to become confident and competent in learning and using key skills. These are:-

- Understanding and using number
- Developing a mathematical language –(words used in mathematics e.g. less, fewer, shorter. makes, equals, 2 pence, o'clock, empty) – See the Maths Glossary.
- Finding solutions to mathematical problems
- Pattern, order and relationships
- Logical thinking
- Exploring and comparing quantities, shapes and measures.

Children experience maths as part of their everyday environment. The type of maths young children now do is not writing sums but sorting socks. They need to touch and do in order to learn, so their early maths is based on practical activities that can be incorporated into their play.

Here are a few ideas to try:-

- Role play shopping – counting money, matching, recognising and writing numbers
- Setting the dinner table – counting, matching, ordering, position
- Water play – comparing volume, capacity, height and depth
- Climbing frame whole body experience of height, space, weight, angles and direction
- Outdoor walk– counting, recognising numbers, experimenting with big numbers, looking for shapes

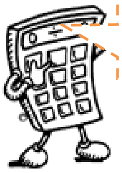
Counting is a skill that children often pick up very early. At first, your child might chant numbers in a random way without focusing on each object. Don't worry if your child doesn't seem to count carefully to begin with, this will come later as they learn to match numbers and objects.

Remember to:-

- Point to each object as you count it
- Take the cue from your child – if your child is not interested now, try again another day
- Talk about numbers in context such as "there are five buttons on your coat, but only four on mine, you've got more than me"

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 4 + 7 = 11 70 + 11 = 81

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

54 + 20 = 74 74 + 7 = 81

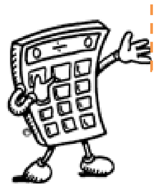
Method 3 Round up to nearest 10, then subtract

54 + 30 = 84 but 30 is 3 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.

Subtraction



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

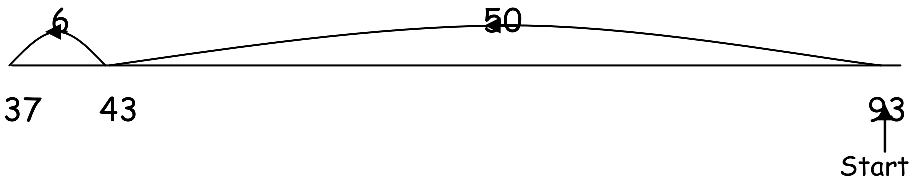
Mental Strategies

Example Calculate 93 - 56

Method 1 Break up the number being subtracted

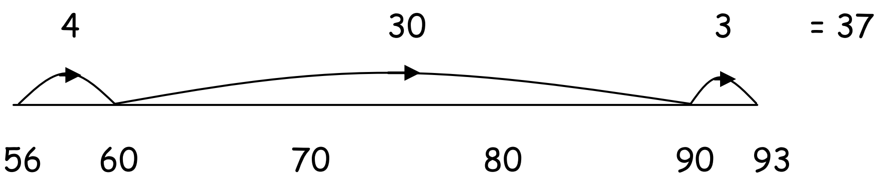
e.g. subtract 50, then subtract 6

93 - 50 = 43
43 - 6 = 37



Method 2 Count on

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



Written Method

Example 1 4590 – 386

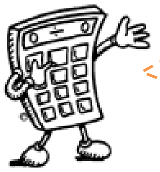
$$\begin{array}{r} 4\,5\,\overset{8}{\cancel{9}}\,{}^{1}0 \\ -\ 3\,8\,6 \\ \hline 4\,2\,0\,4 \\ \hline \end{array}$$

Example 2 Subtract 692 from 14597

$$\begin{array}{r} 1\,\overset{3}{\cancel{4}}\,{}^{1}5\,9\,7 \\ -\ \ 6\,9\,2 \\ \hline 1\,3\,9\,0\,5 \\ \hline \end{array}$$

In our method, we refer to "exchanging" and we never use the "borrow and pay back" method.

Multiplication 1



It is very important that you practise all of the multiplication tables from 1 to 10. We aim to have pupils confident up to the 12 times table by the end of S1.   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 the cost of 6 Playstation games which cost £39 each.

Method 1

30 x 6
= 180

9 x 6
= 54

180 + 54
= £234

Method 2

40 x 6
=240

40 is 1 too many
so take away 6x1

240 - 6
= £234

Common misconception

Pupils should also be aware that multiplying *does not always make the numbers greater!*

E.g. 0.5 x 0.5 = 0.25.

Multiplication 2

Some useful strategies for learning tables...

1. Fingers for 9x:
   Place hands out in front of you
   9x1 – put 1st digit down, left with a space then 9 together = 09 or just 9
   so 9 x 1 = 9

   9x2 – put 2nd digit down, left with 1 digit, a space then 8 together = 18
   so 9 x 2 = 18

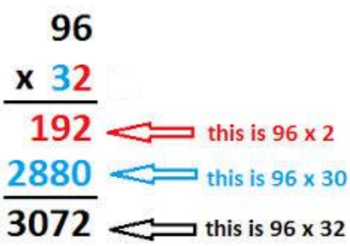
   9 x 5 = 45 9 x 7 = 63 9 x 10 = 90

2. Pupils are encouraged to see the connections between tables.
   a. 4 x 5 = 5 x 4 (commutative property)
   b. 4 times table is twice the 2 times table
      i. A useful mental maths strategy for multiplying larger numbers by four is to double then double again.
      ii. Example. Find 4 x 45.
         Think: 2 x 45 = 90. 2 x 90 = 180. So 4 x 45 = 180.
   c. The 10 times table is twice the 5 times table.
      i. A useful mental maths strategy for multiplying larger numbers by five, is to first times by 10 then find half of the answer.
      ii. Example. Find 5 x 120.
         Think: 10 x 120 = 1200, so 5 x 120 = 600.

3. Pupils also encouraged to appreciate how ***tables can help with other calculations***.
   a. Eg. If you know that 3 x 4 = 12, what else can you work out?

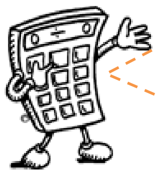
4. Long multiplication:



Please try to encourage the use of these techniques for multiplication, rather than repeated addition.

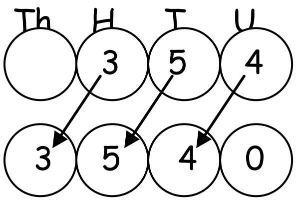
Multiplication 3

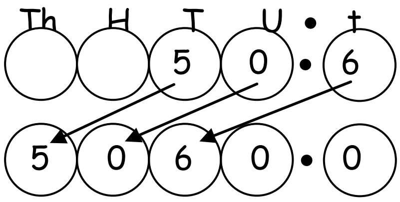
Multiplying by multiples of 10 and 100



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





354 x 10 = 3540

50.6 x 100 = 5060

(c) 35 x 30

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

35 x 3 = 105
105 x 10 = 1050

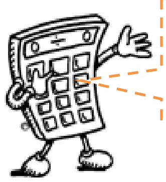
so 35 x 30 = 1050

(d) 436 x 600

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

436 x 6 = 2616
2616 x 100 = 261600

so 436 x 600 = 261600



We may also use these rules for multiplying decimal numbers.

Example 2 (a) 2.36 x 20

2.36 x 2 = 4.72
4.72 x 10 = 47.2

so 2.36 x 20 = 47.2

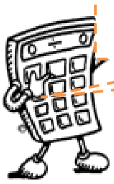
(b) 38.4 x 50

38.4 x 5 = 192.0
192.0x 10 = 1920

so 38.4 x 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?

$$\begin{array}{rl} & \,2\,4 \\ 8 & \overline{)1\,9\,{}^{3}2} \end{array}$$

There are 24 pupils in each class

Example 2 Divide 4.74 by 3

$$\begin{array}{rl} & 1\,.\,5\,8 \\ 3 & \overline{)4\,.\,{}^{1}7\,{}^{2}4} \end{array}$$

When dividing a decimal fraction by a whole number, keep the decimal point 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?

$$\begin{array}{rl} & 0\,.\,2\,7\,5 \\ 8 & \overline{)2\,.\,{}^{2}2\,{}^{6}0\,{}^{4}0} \end{array}$$

Each glass contains 0.275 litres

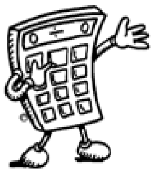
If you have a remainder at the end of a calculation, keep placing zeros on the end of the calculation until no remainder is left. If it is a recurring decimal, keep placing zeros until the desired level of accuracy is calculated.

Order of Calculation (BODMAS)

Consider this: What is the answer to 2 + 5 x 8 ?

Is it 7 x 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**

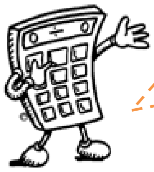
The **BODMAS** rule tells us which operations should be done first. **BODMAS** represents:

(B)rackets
(O)f (O)rder
(D)ivide
(M)ultiply
(A)dd
(S)ubract

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

Example 1	15 – 12 ÷ 6	BODMAS tells us to divide first
	= 15 – 2	
	= 13	
Example 2	(9 + 5) x 6	BODMAS tells us to work out the brackets first
	= 14 x 6	
	= 84	
Example 3	18 + 6 ÷ (5-2)	Brackets first
	= 18 + 6 ÷ 3	Then divide
	= 18 + 2	Now add
	= 20	

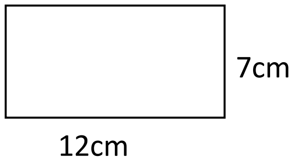
Substitution into Expressions/Formulae



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* = 2*L* + 2*B* to find the perimeter of this rectangle.



$$
\begin{aligned}
P &= 2l + 2l \\
&= 2 \times 12 + 2 \times 7 \\
&= 24 + 14 \\
&= \underline{38\ cm}
\end{aligned}
$$

1. State the formula
2. Substitute numbers for letters
3. Carry out calculations *(remember BODMAS)*
4. State answer with units. Underline.

Example 2

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

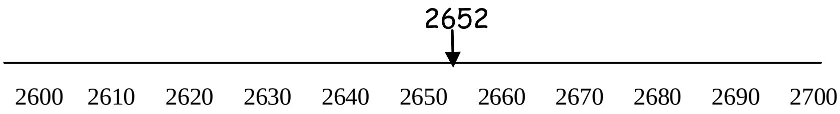
$$I = \frac{V}{R}$$

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

$$\underline{= 6}$$

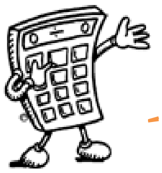
Estimation and Rounding

Numbers can be rounded to create a less exact, but more convenient, number.



26**5**2 rounded to the nearest 10 is 2650.
2**6**52 rounded to the nearest 100 is 2700.

When rounding numbers which are exactly in the middle, the convention is to **round up**.
78**6**5 rounded to the nearest 10 is 78**7**0.
Caution! See note below.



The same principles apply 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 - 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 next digit (in the hundreds column) is a 7, so round up.

4**6** 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 next digit (the third number after the decimal point) is a 3, so round down.

1.5**7**359
= 1.57 to 2 decimal places

Caution! Sometimes we need to think carefully about the context of the question before rounding.

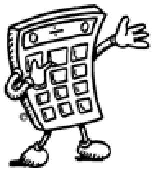
Example 3 If Jane has £470, how many computer games can she purchase at £30 each?

Solution: 470 ÷ 30 = 15.6666... So she can buy 15 computer games.

Here the answer is rounded down, as you can't buy 0.666... of a computer game!

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. *It is wise to estimate before calculating to give you an idea of what the answer should be.*



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

Estimate = 500 + 200 + 200 + 300 = 1200

Calculate:

$$\begin{array}{r} 486 \\ 205 \\ 197 \\ +321 \\ \hline 1209 \\ \hline \end{array}$$

Answer = 1209 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?

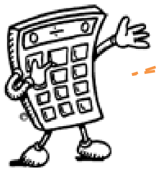
Estimate = 50 x 40 = 2000g

Calculate: 42 x 48 = 2016g

Always ask yourself: "HOW REASONABLE IS MY ANSWER?"

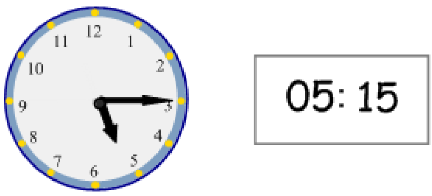
Time 1

Time may be expressed in 12 or 24 hour notation.



12-hour clock

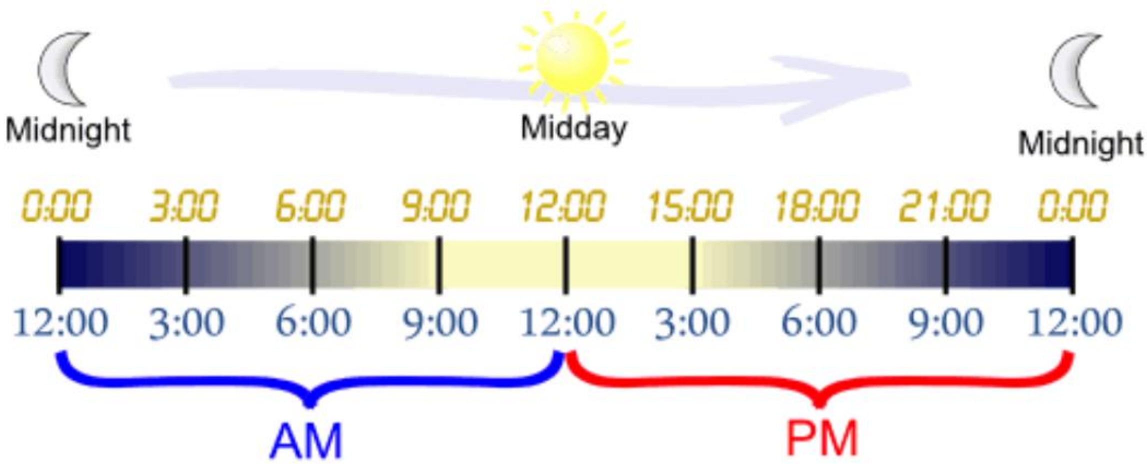
Time can be displayed on an analogue clock face, or digital clock.



These clocks both show quarter past five.

When writing times in 12 hour notation, we need to add a.m. or p.m. after the time.
am is used for times between midnight and 12 noon (morning)
pm is used for times between 12 noon and midnight (afternoon / evening).

24-hour clock

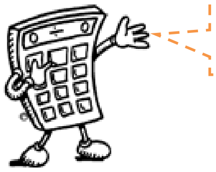


Examples

9.55 am → 09 55
3.35 pm → 15 35
12.20 am → 00 20

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.

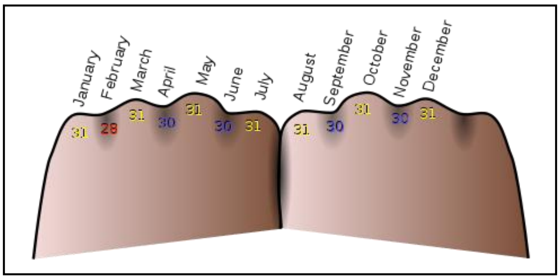
Time Facts

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."

There is also an easy way to remember the days in a month using your knuckles.



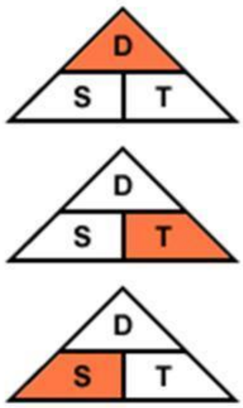
Put your hands together leaving out your thumb knuckle as shown above. Begin counting through the months from your furthest left knuckle, counting in turn the knuckles and the grooves in between.

Rule: Every month which lands on a knuckle has 31 days.
Every month which lands on a groove has 30 days
(except February 28 days or 29 in leap year)

Time 3

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:



$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Example One Calculate the speed of a train which travelled

450 km in 5 hours

$s = \dfrac{d}{t}$

$s = \dfrac{450}{5}$

s = 90 km/h

Example Two Calculate the distance travelled at a speed of 15km/h for 3 and a half hours.

d = st

d= 15 x 3.5

d = 52.5km

Example Three Calculate the time it takes for Kathryn to walk to school, a distance of 5km, at a speed of 4 km/h.

$t = \dfrac{d}{s}$

$t = \dfrac{5}{4} = 1.25\text{h}$

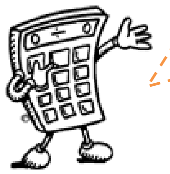
= 1 hour 15 minutes

Important Note

In these formulae time must be written as a decimal fraction of an hour.
To convert a number of minutes into a decimal fraction divide by 60.
To convert a decimal fraction of an hour into minutes multiply by 60.

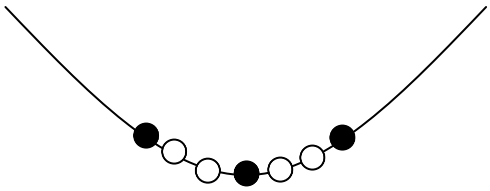
Fractions 1

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.

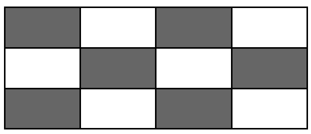


What fraction of the beads are black?

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?



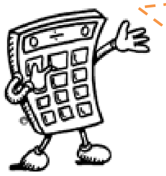
6 out of 12 squares are shaded. So $\frac{6}{12}$ of the flag is shaded.

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

$\frac{6}{12}$ and $\frac{1}{2}$ are **equivalent fractions.** This means they have the same value.

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)
$$\frac{20}{25} \underset{\div 5}{\overset{\div 5}{=}} \frac{4}{5}$$

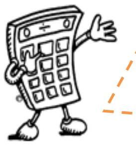
(b)
$$\frac{16}{24} \underset{\div 8}{\overset{\div 8}{=}} \frac{2}{3}$$

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

Example 2 Simplify $\frac{72}{84}$

$$\frac{72}{84} = \frac{36}{42} = \frac{18}{21} = \frac{6}{7} \textit{ (simplest form)}$$

Calculating Fractions of a Quantity



To find a fraction of a quantity, divide by the denominator, then multiply the answer by the numerator.
To find $\frac{1}{2}$ divide by 2, to find $\frac{1}{3}$ divide by 3, to find $\frac{3}{7}$ divide by 7, then multiply by 3 etc.

Example 1

Find $\frac{1}{5}$ of £150

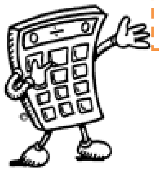
$\frac{1}{5}$ of £150 = 150 ÷ 5
= £30

Example 2

Find $\frac{3}{4}$ of 48

$\frac{3}{4}$ of 48 = 48 ÷ 4 x 3
= 12 x 3
= 36

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

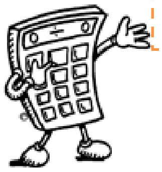
Common Percentages

Some percentages are used very frequently. It is essential to know and recall 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
$33^{1}/_{3}$%	$\frac{1}{3}$	0.333…
50%	$\frac{1}{2}$	0.5
$66^{2}/_{3}$%	$\frac{2}{3}$	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% of £640 $= \frac{1}{4}$ of £640 = £640 ÷ 4 = £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% of 200g = $\frac{1}{100}$ of 200g = 200g ÷ 100 = 2g

so 9% of 200g = 9 x 2g = 18g

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% of £35 = $\frac{1}{10}$ of £35 = £35 ÷ 10 = £3.50

so 70% of £35 = 7 x £3.50 = £24.50

Percentages 3

Non-Calculator Methods (continued)

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

Example Find 23% of £15000

10% of £15000 = £1500 so 20% = £1500 x 2 = £3000
1% of £15000 = £150so 3% = £150 x 3 = £450

23% of £15000 = £3000 + £450 = £3450

Finding VAT (without a calculator)

Value Added Tax (VAT) = 20% (from 4th January 2010)
To find VAT, divide by 5.

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

20% of £650 = $\frac{1}{5}$ of 650
= 650 ÷ 5
= 130

Total price = 650 + 130
= £780

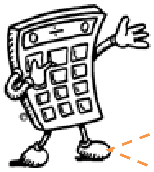
Percentages 4

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 so 23% of £15000 = 0.23 x £15000 = £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?

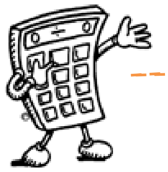
19% = 0.19 so Increase = 0.19 x £236000
= £44840

Value at end of year = original value + increase
= £236000 + £44840
= £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. Convert to a percentage by dividing the top by the bottom and multiplying by 100.

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

$$\frac{18}{30} = 18 \div 30 \times 100 = 60\%$$

60% of A3 are girls

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

Score = $\frac{36}{44}$

$36 \div 44 \times 100 = 0.81818\ldots \times 100$

$= 81.818..\% = 81.82\%$ (to two decimal places)

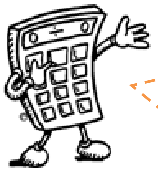
Example 3 In class P1, 14 pupils had brown hair, 6 pupils had blonde hair, 3 had black hair and 2 had red hair. What percentage of the pupils were blonde?

Total number of pupils = 14 + 6 + 3 + 2 = 25
6 out of 25 were blonde, so,

$$\frac{6}{25} \times 100 = 24\%$$

24% were blonde.

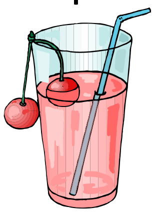
Ratio 1



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 (we say "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.

Blue : Red = 10 : 6
= 5 : 3

To simplify a ratio, divide each number in the ratio by the highest 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 through by 2

(b) 24:36
= 2:3

Divide through by 12

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

Divide through by 3

Example 3

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

Sand : Cement = 20 : 4
= 5 : 1

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	
x5			x5
	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 amount by this number to find the value of one part

$90 \div 5 = £18$

Step 3 Multiply to find the value of each part

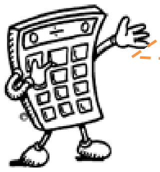
$3 \times £18 = £54$
$2 \times £18 = £36$

Step 4 Check that the total is correct

$£54 + £36 = £90$

Lauren received £54 and Sean received £36

Proportion



Two quantities are said to be in direct proportion if when one doubles the other doubles.
We can use proportion to solve problems.

It is often useful to make a table when solving problems involving proportion.

Example 1
A car factory produces 1500 cars in 30 days. How many cars would they produce in 90 days?

Days	Cars
30	1500
90	**4500**

x3 x3

The factory would produce 4500 cars in 90 days.

Example 2
5 adult tickets for the cinema cost £27.50. How much would 8 tickets cost?

Tickets	Cost
5	£27.50
1	£5.50
8	£44.00

Find the cost of 1 ticket

Working:

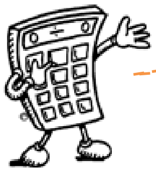
$$5 \overline{)\,£27.50\,} = £5.50$$

$$£5.50 \times 8 = £44.00$$

The cost of 8 tickets is £44

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	**24**	27	27	25	21	16	14
Edinburgh	6	6	8	11	14	17	18	18	16	13	8	6

The average maximum 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

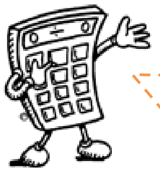
27 30 23 24 22 35 24 33 38 43 18 29 28 28 27
33 36 30 43 50 30 25 26 37 35 20 22 24 31 48

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.

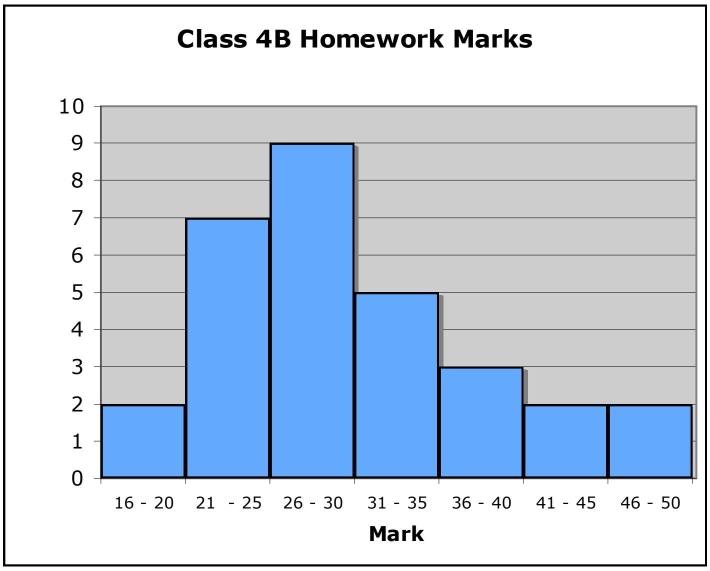
Tally marks are grouped in 5's to make them easier to read and count.

Information Handling : Bar Graphs

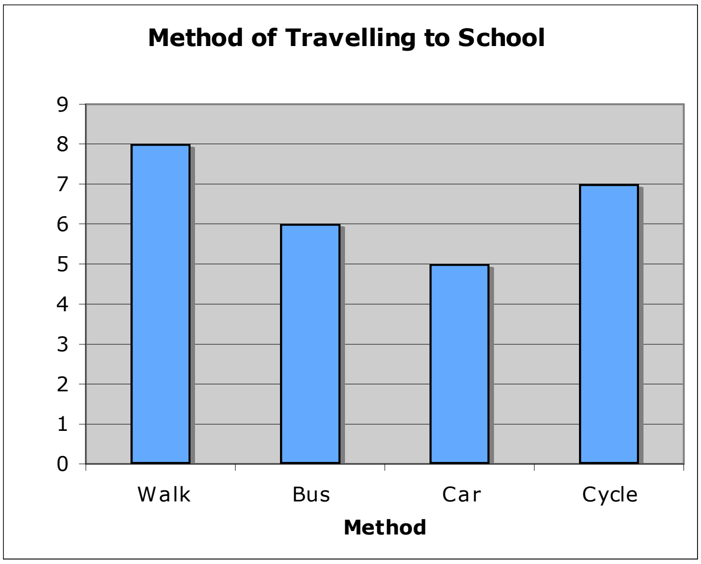


Bar graphs are often used to display data. The horizontal axis should show the categories or class intervals, and the vertical axis the frequency. All graphs should have a title, and each axis must be labelled.

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

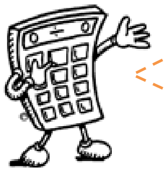


Example 2 How do pupils travel to school?



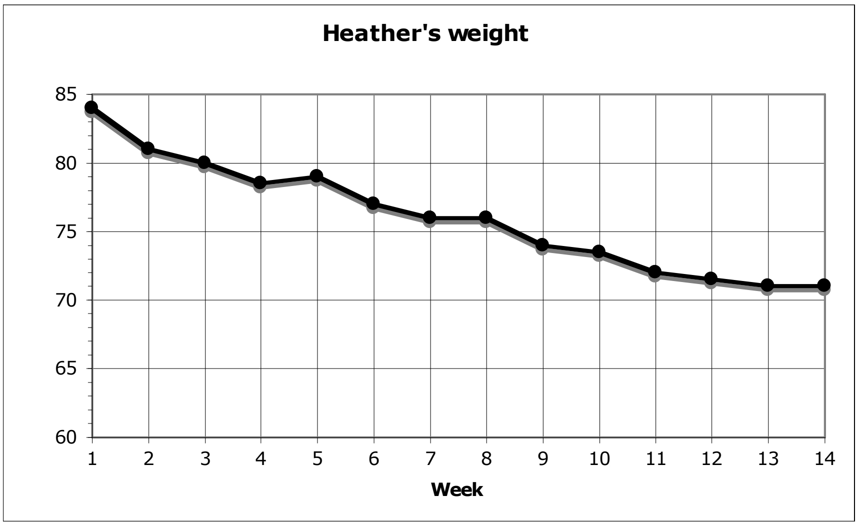
When the horizontal axis shows categories, rather than grouped intervals, it is common practice to leave gaps between the bars.

Information Handling : Line Graphs



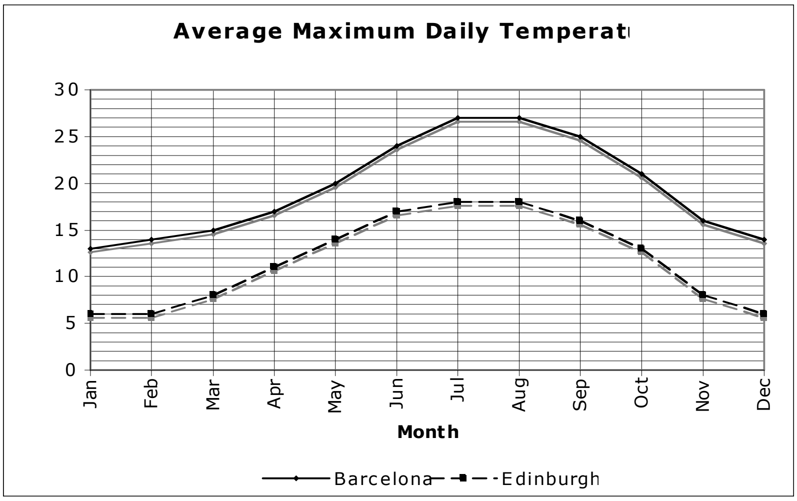
Line graphs consist of a series of points which are plotted, then joined by a line. All graphs should have a title, and each axis must be labelled. The trend of a graph is a general description of it.

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

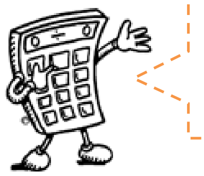


The trend of the graph is that her weight is decreasing.

Example 2 Graph of temperatures in Edinburgh and Barcelona.



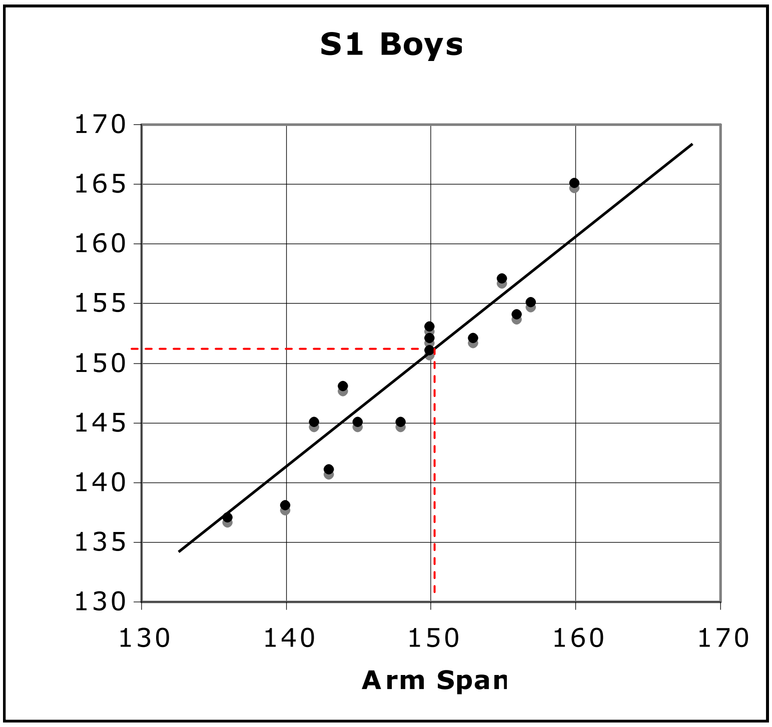
Information Handling : Scatter Graphs



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

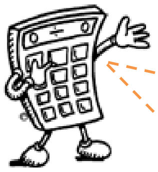
Arm Span (cm)	150	157	155	142	153	143	140	145	144	150	148	160	150	156	136
Height (cm)	153	155	157	145	152	141	138	145	148	151	145	165	152	154	137



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

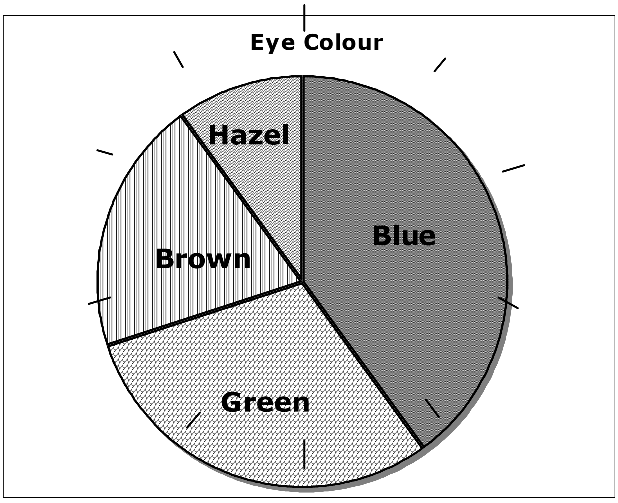
The line drawn is called the line of best fit. This line can be used to provide estimates. For example, a boy of arm span 150cm would be expected to have a height of around 151cm (as indicated by the red dotted line).

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.

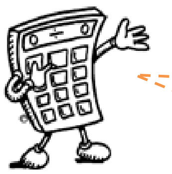
The angle in the brown sector is 72°.

So the number of pupils with brown eyes = $\frac{72}{360}$ x 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°.

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

Eastenders $= \frac{28}{80} \rightarrow \frac{28}{80} \times 360° = 126°$

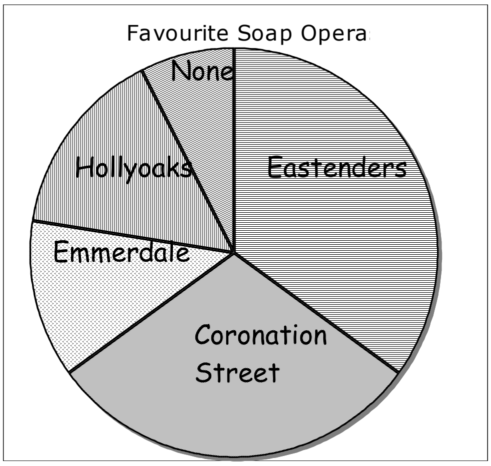
Coronation Street $= \frac{24}{80} \rightarrow \frac{24}{80} \times 360° = 108°$

Emmerdale $= \frac{10}{80} \rightarrow \frac{10}{80} \times 360° = 45°$

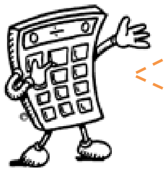
Hollyoaks $= \frac{12}{80} \rightarrow \frac{12}{80} \times 360° = 54°$

None $= \frac{6}{80} \rightarrow \frac{6}{80} \times 360° = 27°$

Check that the total = 360°



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.

Pupils learn how to decide when average is most appropriate for a data set.

Range

The range of a set of data is a **measure of spread**.
This gives us an idea of how the data is distributed.

Range = Highest value – Lowest Value = H – L.

Example Class 4B 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

$$\text{Mean} = \frac{7+9+7+5+6+7+10+9+8+4+8+5+7+10}{14}$$

$$= \frac{102}{14} = 7.285\ldots \qquad \text{Mean} = 7.3 \text{ to 1 decimal place}$$

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