Roseburn Primary School

Numeracy and Mathematics Help Booklet

September 2017

We recognise that parental involvement has a large impact on children's learning. We strongly believe that you don't have to be a genius to support your child with their maths homework but we also understand that Numeracy and Mathematics is an area of the curriculum that many people lack confidence in. Our message is to be positive about maths and 'think growth mindset'. Maths is not a subject you either can or can't do. Like everything else in life, it is something you can learn to get better at. This is the attitude we want to pass on to our young learners.

We hope that you will find this to be a useful glossary when helping your child with their homework. Many thanks to Corstorphine Primary for piecing this booklet together and for sharing it with us.

Sites providing advice for parents:

https://education.gov.scot/parentzone/learning-at-home/supporting-numeracy - The Numeracy and Mathematics Glossary on this site contains some 'beyond number' topics not covered in our Maths Help Booklet.

https://www.nationalnumeracy.org.uk/your-childs-maths - The 'Advice for Families' section includes advice on promoting a positive attitude towards maths, as well as activities for children.

http://www.readwritecount.scot/count/ -The 'Ideas to Keep' feature includes a list of top ten counting books for younger learners.

https://highlandnumeracyblog.wordpress.com/parents-supporting-numeracy-at-home/ - Practical ideas for how to build learning opportunities into everyday routines.

https://www.oxfordowl.co.uk/welcome-back/for-home/maths-owl/expert-help--2 - The 'Maths in School' section includes short videos packed with hints and tips on various different maths topics.

Sites providing links to free quality online maths games and interactive tasks:

http://www.topmarks.co.uk/maths-games/3-5-years/counting - From here you can select an appropriate age range for your child and a category, depending on the area of maths you want to focus on.

https://nrich.maths.org/ - Use the student guide to select the appropriate stage for your child.

https://www.oxfordowl.co.uk/welcome-back/for-home/maths-owl/fun-activities - Select 'Times Tables' as a topic and scroll down to find an ocean inspired game to play.

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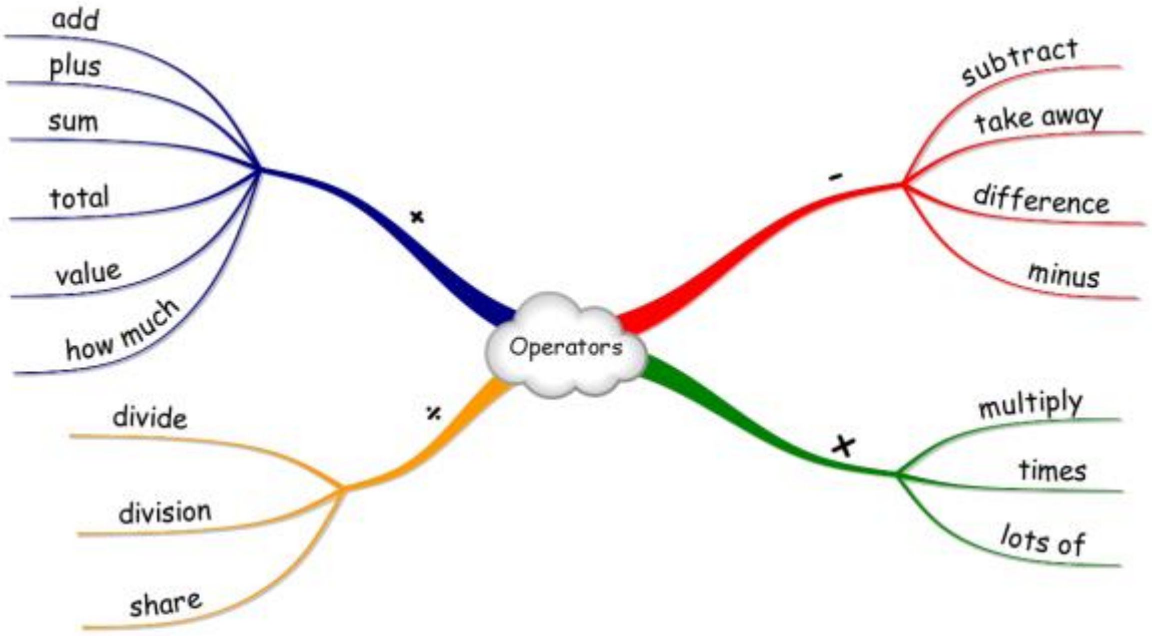

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2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
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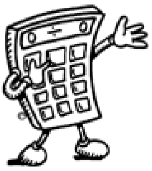
Units



Here are some useful unit conversions:

10 mm → 1 cm
100 cm → 1 m
1000 m → 1 km

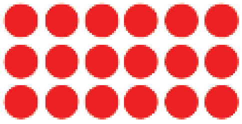
1000 mg → 1 g
1000 g → 1 kg
1000 kg → 1 tonne

1000 ml → 1 litre
1 ml → 1 cm^3

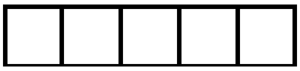
60 seconds → 1 minute
60 minutes → 1 hour
24 hours → 1 day
7 days → 1 week
14 days → 1 fortnight
12 months → 1 year
52 weeks → 1 year
365 days → 1 year
366 days → 1 leap year
Decade → 10 years
Century → 100 years
Millennium → 1000 years

1000 → 1 thousand
1000000 → 1 million
1000000000000 → 1 billion

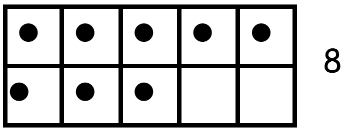
Early Number Glossary

Addend	See “Missing addend”
Additive task	Tasks involving what adults call addition. Children will interpret these tasks differently from each other and from the way adults will interpret them.
Arithmetic rack (Rekenrek)	Abacus-like instructional device consisting of 2 rows of beads. On each row the beads appear in two groups of five, shown by different colours. 
Array	An array is an orderly arrangement of items (often dots) in rows and columns It is used in the teaching of multiplication and division. 
BNWS	**B**ackward **N**umber **W**ord **S**equence. A regular sequence of number words backwards, typically but not necessarily by ones. e.g. the BNWS from ten to one, the BNWS from eighty-two to seventy-five, the BNWS in tens from eighty-three.
Canonical number	Standard number e.g. 5 tens and 7 units is the standard, **canonical**, form of 57 (4 tens and 17 units would be a non-canonical form of 57).
Combining	Putting numbers together to make a bigger number (usually combining to 5 or 10, or

	combining with 5 or 10), e.g. “What goes with 3 to make 5?”
Commutative	An operation for any two numbers where the order does not change the result, e.g. 7 + 4 = 4 + 7. Multiplication/addition are commutative; division and subtraction are not.
Compensation	Adjusting both parts of a sum and knowing the answer will still be the same e.g. changing 7 + 9 to 8 + 8 or 10 + 6 (usually to make the sum easier to do).
Counting-back-from (Counting-off-from; counting-down-from)	A strategy to solve removed Items (subtraction/take away) tasks, e.g. 11 remove 3, count back 3 from 11 (.. ten, nine, **eight**).
Counting-down-to (Counting-back-to)	Regarded as the most advanced of the count-by-one strategies. Typically used to solve missing subtrahend tasks, eg 11- __ =8, so ' ... ten, nine, eight = three'. Also used to solve subtractions, such as 18 - 16, efficiently (count down from 18 to 16 to get the answer 2).
Counting-on	A term for **counting-up-from** and **counting-up-to** strategies – see below.
Counting-up-from	An advanced counting-by-ones strategy used to solve additive tasks involving two hidden collections, for example seven and five, is solved by counting up five from seven (7..8,9,10,11,**12**).
Counting-up-to	An advanced counting-by-ones strategy used to solve missing addend tasks, for example child is asked “Seven and how many make twelve?” Problem is solved by counting from seven up to twelve, and keeping track of five counts.

Decrementing	Counting back by a repeated regular amount e.g. by 1s, by 5s, by 10s from a given start point.
Difference	See **Minuend.**
Digit	The ten basic symbols in the modern numeration system, 0,1,2……9.
Emergent	An emergent child is at the start of their learning journey within number. They may have some counting skills and know some number words, but these skills will not be secure.
Empty number line (ENL)	A setting consisting of a simple arc or line which is used by children and teachers to record and explain mental strategies for adding and subtracting.
Facile	Used in the sense of having good facility i.e. confidence, fluency and accuracy – a child who has mastered a strategy is said to be "facile" in it.
Figurative	Figurative counting involves counting all items, even when the items are screened. For example, when presented with two screened collections, the child will count from 'one' instead of counting on. The child does not need to see the items.
Five Frame	A setting consisting of a 1 x 5 rectangular array which is used to support children's thinking about combinations to 5 (eg. 4 + 1). 
Five-wise pattern	A spatial pattern for a number in the range 1 to 10 made on a ten frame (2 rows and 5 columns). The five-wise patterns are made by filling the

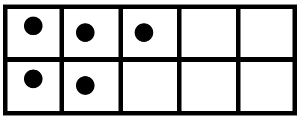
top row first, and then filling the bottom row. For example a five-wise pattern for 8 has a top row of 5 and a bottom row of 3, a five-wise pattern for 4 has a top row of 4 dots only.

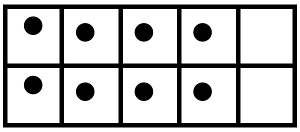


FNWS	**F**orward **N**umber **W**ord **S**equence. A regular sequence of number words forward, typically but not necessarily in ones, for example the FNWS from one to twenty, the FNWS from eighty-one to ninety-three, the FNWS in tens from twenty-four.
Incrementing	Counting forward by a repeated regular amount eg by 1s, by 5s, by 10s from a given start point.
Jump Strategy	A category of mental strategies for 2-digit addition and subtraction. Strategies in this category involve starting from one number and incrementing or decrementing that number by tens and/or ones. For example, 34 + 25 can be solved by starting at 34, jumping up 20 to get to 54 and then jumping a further 5 to get to 59. This is seen as a more sophisticated strategy than a split strategy.
Micro-adjusting	Making small moment-by-moment adjustments in interactive teaching which are informed by one's observation of student responses, e.g. removing or adding screens to make a task simpler/more challenging.
Minuend, subtrahend and difference	In subtraction the subtrahend is the number subtracted and the minuend is the number from which it is taken, for example, in 12 – 3 = 9, 12 is the **minuend**, 3 is the **subtrahend** and 9 is the **difference**..

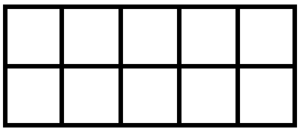
Missing addend	A task posed in the form of addition with one addend missing. For example "12 and how many make 15?" (12 + __ = 15) or "What add 6 gives 18?" (__ + 6 = 18).
Missing subtrahend	A task posed in the form of subtraction with the number being removed missing. For example "I had 8 counters, I removed some and I now have 5. How many did I remove?"
Non-canonical	The number 64 can be expressed in the form of 50 + 14. This form is known as a non-canonical i.e. non-standard form of 64. This is important to help children carry out subtraction with regrouping, e.g. 64 – 56.
Non-count-by-ones	A class of strategies which involve aspects other than counting-by-ones. *Part* of the strategy may involve counting-by-ones but the solution must also involve a more advanced procedure, e.g. 6 + 8 is solved by saying 'double 6 is 12, and 2 more makes 14'.
Number	A number is the idea or concept associated with a specific amount. We distinguish between the number 24 – i.e. the concept; the spoken/heard number word "twenty-four"; the numeral '24' and the read or written number word 'twenty-four'. These distinctions are important in understanding children's early numerical stages.
Number word	In most cases in early number, the term 'number word' refers to the spoken and heard names for numbers e.g. "seven", "twenty three".
Numerals	Numerals are written symbols for numbers, for example, '5', '27'.

Numeral identification	Stating the name of a displayed numeral e.g. "What is this?".When assessing numeral identification, numerals are not displayed in numerical sequence.
Numeral recognition	Selecting a nominated numeral from a randomly arranged group of numerals, e.g. "Can you find fourteen?"
Numeral sequence	A regularly ordered sequence of numerals typically a forward sequence by ones (could go up in other increments, such as tens), e.g. 37, 38, 39, 40, 41.
Numeral track	An instructional device consisting of a sequence of numerals and for each numeral, a hinged lid which can be used to display or screen the numeral.
Off-Decade Numerals	Numerals which are not in the 10-times table, e.g. 7, 17, 27, 37.
Ordering Numerals	Putting numerals in the correct order (usually from smallest to biggest). Numerals can be selected from any suitable range e.g. 2, 37, 41, 90.
Pair-wise pattern	A spatial pattern for a number in the range 1 to 10 made on a ten frame (2 rows and 5 columns). The pair-wise patterns are made by progressively filling the columns. For example, a pair-wise pattern for 8 has four pairs, a pair-wise pattern for 5 has two pairs and one single dot.





Partitioning	An arithmetical strategy involving splitting a small number into two parts without counting, typically with both parts in the range 1 to 5, e.g. splitting 6 into 5 + 1, 4 + 2 etc.
Perceptual	Involving direct sensory input – usually seeing but may also refer to hearing or feeling. Thus perceptual counting involves counting items seen, heard or felt.
Quinary	This refers to the use of five as a base in some sense, and typically in conjunction with, rather than instead of, ten as a base. The arithmetic rack may be regarded as a quinary-based instructive device.
Removed item	A term for a standard subtraction problem (e.g. 19 - 6= or 23 - 4=).
Screening	A technique used in the presentation of instructional tasks which involves placing a small screen over all or part of a setting.
Sequencing Numerals	Putting numerals in the correct sequence (usually from smallest to biggest). Numerals usually go up in ones, but can increment by any constant e.g. tens.
Setting	A physical situation used by a teacher in posing numerical tasks, for example collections of counters, numeral track, hundreds chart, ten frame.
Split strategy	A category of mental strategies for 2-digit addition and subtraction. Strategies in this category involve mentally breaking the numbers

	into tens and ones and working separately with the tens and ones, e.g. 32 + 54 is solved by doing 30 + 50 = 80, and 2 + 4 = 6 which gives the answer of 86 (80 + 6).
Subitising	The immediate, correct recognition of the amount in small collection of items (i.e. without the need to count).
Subtractive task	A generic label for tasks involving what adults would regard as subtraction. Children will interpret these tasks differently from each other and from the way adults will interpret them.
Subtrahend	See **Minuend** above.
Temporal sequence	A sequence of events that occur sequentially in time, for example, sequences of sounds or movements.
Ten frame	A setting consisting of a 2 x 5 rectangular array which is used to support children's thinking about combinations to 10 (eg. 7 + 3) and combinations involving 5 (e.g. 7 is 5 + 2). 

Mathematical Dictionary (Key words):

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.
Axis	A line along the base or edge of a graph. Plural – Axes
Calculate	Find the answer to a problem. It doesn't mean that you must use a calculator!
Compound Interest	Interest paid on the full balance of the account.
Data	A collection of information (may include facts, numbers or measurements).
Denominator	The bottom number in a fraction
Digit	A number
Discount	The amount an item is reduced by.
Equivalent fractions	Fractions which have the same value. Example and 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 $10 > 6$
Gross Pay	Pay before deductions.
Histogram	A bar chart for continuous numerical values.
Increase	A value that has gone up.
Least	The lowest number in a group (minimum).
Less than (<)	Is smaller or lower than. Example: 15 is less than 21. $15 < 21$.

Mathematical Dictionary (Key words):

Maximum	The largest or highest number in a group.
Mean	The average of a set of numbers
Median	A type of average - the middle number of an ordered set of data (ordered from lowest to highest)
Minimum	The smallest or lowest number in a group.
Mode	Another type of average – the most frequent number or category
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 (the answers to the times tables)
Negative Number	A number less than zero. Shown by a negative sign. Example -5 is a negative number.
Net Pay	Pay after deductions.
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
Per annum	Each year (annually).
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 prime number is a number that has exactly 2 factors (can only be divided by itself and 1). Note: 1 is **not** a prime number as it only has 1 factor.
Remainder	The amount left over when dividing a number.
Simple Interest	Interest paid only on an initial amount of money.
V.A.T.	Value Added Tax.

Problem Solving

Solving any maths problem is as easy as 1,2,3…(Read. Think. Talk)

1. The Problem

READ the information given at least twice to understand the problem. **Think** about what you already know and **talk** about what the problem is about with a learning partner.

TIPs:

a. highlight any mathematical words (check vocab mat)
b. identify any important numbers or words.
c. draw a picture or a diagram or use equipment to represent the problem if this is helpful.

2. Working it out

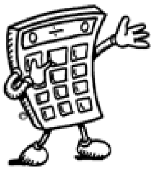
- Think about the steps you need to take to solve the problem. You may want to write a number sentence using letters and numbers.
- Decide the order and type of maths thinking you need to do.
- Do the maths – check the answer(s) you get – look back at the question – does you answer make sense!!

3. Presenting your answer

- Check your answer against the problem - use your model or diagram if you have one to double check you are on the right lines
- Use the correct unit of measure to record your answer.

Addition

Mental strategies



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

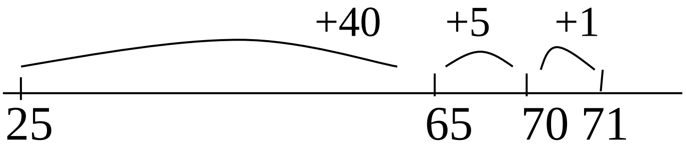
Mental Methods

Example: Work out 25 + 46

Method 1: Split the number.
Add the tens, then add the units, then add them together

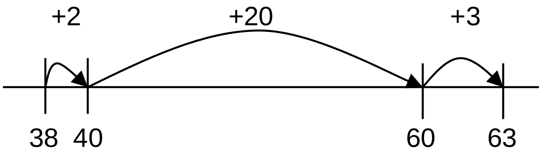
20 + 40 = 60, 5 + 6 = 11, 60 + 11 = 71

Method 2: Jump on from one number (showing working on the empty number line).

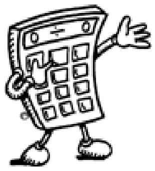


Example: Begin from one number, jump to the nearest decade, jump tens, then jump remaining ones.

e.g. 38 + 25 = 63



Mental strategies



There are a number of useful mental strategies for addition. Some more 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 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.

Example Add 3032 and 589

$$\begin{array}{r} 3032 \\ +5\underset{1}{8}9 \\ \hline 1 \\ \hline \end{array} \rightarrow \begin{array}{r} 3032 \\ +\underset{1}{5}\underset{1}{8}9 \\ \hline 21 \\ \hline \end{array} \rightarrow \begin{array}{r} 3032 \\ +\underset{1}{5}\underset{1}{8}9 \\ \hline 621 \\ \hline \end{array} \rightarrow \begin{array}{r} 3032 \\ +\underset{1}{5}\underset{1}{8}9 \\ \hline 3621 \\ \hline \end{array}$$

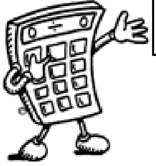
2 + 9 =

3+8+1=1

0+5+1=

3 + 0 =

Subtraction



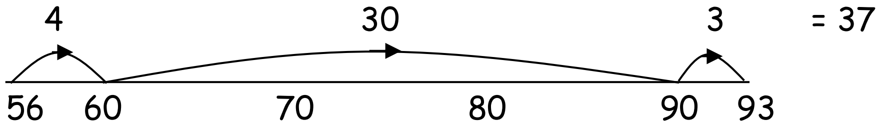
We use decomposition as a written method for subtraction (see below). Alternative methods may be used for mental calculations.

Mental Strategies

Example Calculate 93 - 56

Method 1 Count on

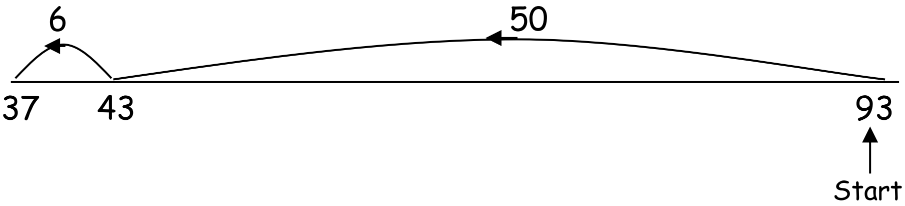
Count on from 56 until you reach 93. This can be done in several ways e.g.



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

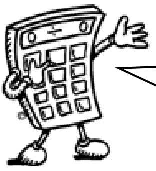
$$\begin{array}{r} 45\overset{8}{\cancel{9}}\overset{1}{0} \\ -\ 386 \\ \hline 4204 \\ \hline \end{array}$$

Remember to "exchange" when you don't have enough.

Example 2 Subtract 692 from 14597

$$\begin{array}{r} 1\overset{3}{\cancel{4}}\overset{1}{5}97 \\ -\ \ 692 \\ \hline 13905 \\ \hline \end{array}$$

Multiplication 1



It is essential that you know all of the multiplication tables from 1 to 12. These are shown in the tables square below.

x	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

Mental Strategies

Example Find 39 x 6

Method 1

30 x 6
= 180

9 x 6
= 54

180 + 54
= 234

Method 2

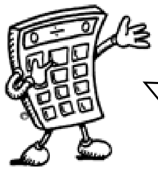
40 x 6
=240

40 is 1 too many
so take away

240 - 6
= 234

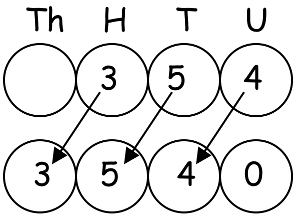
Multiplication 2

Multiplying by multiples of 10 and 100

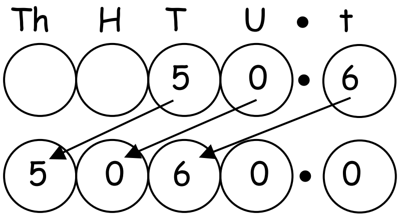


To multiply by **10** you move every digit ***one*** place to the left.
To multiply by **100** you move every digit ***two*** places to the left.
We do **<u>NOT</u>** just add a zero to the end of the number

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

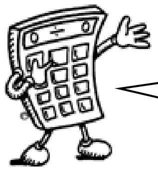
so 35 x 30 = 1050

(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

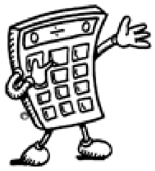
Multiplication of 2 decimals

To multiply two decimals change both the decimals to whole numbers by multiply by 10 or 100. Carry out the multiplication as above. Change the answer back by dividing by 10 or 100 as necessary.

Example: Work out 3•4 x 0•26

Change to 34 x 26	3•4 x 10 = 34, 0•26 x100 = 26
Work out 34 x 26 as above	34 x 26 = 884
Change back to 3•4 x 0•26	944 ÷10 ÷ 100 = 0•884

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?

$$\begin{array}{r|l} & 2\,4 \\ \cline{2-2} 8 & 1\,9^{3}2 \end{array}$$

There are 24 pupils in each class

Example 2 Divide 24 by 5

$$\begin{array}{r|l} & 4 \text{ r } 4 \\ \cline{2-2} 5 & 2^{2}4 \end{array}$$

Warning:

4 r 4 is <u>NOT</u> the same as 4.4

Example 3 Divide 4.74 by 3

$$\begin{array}{r|l} & \Downarrow \\ & 1\,.\,5\,8 \\ \cline{2-2} 3 & 4\,.\,{}^{1}7^{2}4 \\ & \Uparrow \end{array}$$

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

Example 4 A jug contains 2.2 litres of juice. If it is poured evenly into 8 glasses, how much juice is in each glass?

$$\begin{array}{r|l} & 0\,.\,2\,7\,5 \\ \cline{2-2} 8 & 2\,.{}^{2}2^{6}0^{4}0 \end{array}$$

Each glass contains
0.275 litres

Where appropriate:
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.

Negative Numbers

Negative numbers or *integers* are used in many real life situations.

The temperature is -4 ^{o}C (negative 4 degrees Celsius)

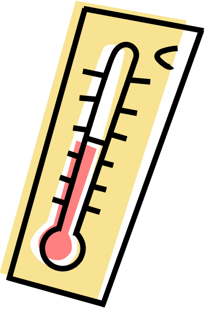
Addition/Subtraction	**Examples**
When adding on a positive number go upwards	3 + 5 = 8
When adding on a negative number go downwards	3 + (-5) = -2
When subtracting a positive number do downwards	4 – 7 = -3
When subtracting a negative number do upwards	4 – (-7) = 11

Multiplication/Division

(+ve positive number, -ve negative number)

Multiplying a +ve by a +ve the answer will be +ve	3 x 5 = 15
Multiplying a –ve by a +ve the answer will be –ve	(-3) x 5 = -15
Multiplying a +ve by a –ve the answer will be –ve	3 x (-5) = -15
Multiplying a –ve by a –ve the answer will be +ve	(-3) x (-5) = 15

Dividing a +ve by a +ve the answer will be +ve	24 ÷ 6 = 4
Dividing a –ve by a +ve the answer will be –ve	(-24) ÷ 6 = -4
Dividing a +ve by a –ve the answer will be –ve	24 ÷ (-6) = -4
Dividing a –ve by a –ve the answer will be +ve	(-24) ÷ (-6) = 4

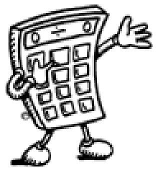


Order of Calculation (BODMAS)

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
(D)ivide
(M)ultiply
(A)dd
(S)ubract

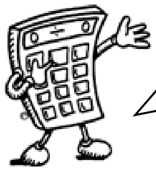
Scientific calculators use this rule, some basic calculators may not, so take care in their use.

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

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 $B = 7$.

$P = 2L + 2B$	Step 1: write formula
$P = 2 \times 12 + 2 \times 7$	Step 2: substitute numbers for letters
$P = 24 + 14$	Step 3: start to evaluate (BODMAS)
$P = 38$	Step 4: write answer

Example 2

Use the formula $I =$ to evaluate I when $V = 240$ and $R = 40$

$I =$

$I =$

$I = 6$

Example 3

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

$F = 32 + 1.8C$

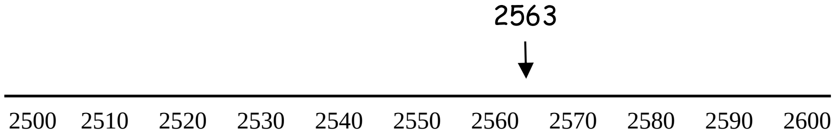
$F = 32 + 1.8 \times 20$

$F = 32 + 36$

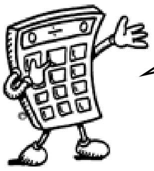
$F = 68$

Rounding

Numbers can be rounded to give an approximation.



25**6**3 rounded to the nearest 10 is 2560.
2**5**63 rounded to the nearest 100 is 2600.
2563 rounded to the nearest 1000 is 3000.



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

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 1.54359 to 1 decimal place

The first number after the decimal point is a 5 - the check digit (the second number after the decimal point) is a 4, so leave the 5 as it is.

1.5 4 ~~359~~
= 1.5 (to 1 decimal place)

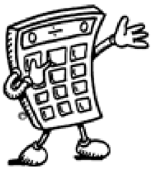
Example 2 Round 4.78632 to 2 decimal places

The second number after the decimal point is an 8 – the check digit (the third number after the decimal point) is a 6, so we round the 8 up to a 9

4.78 6 ~~32~~
= 4.79

Estimation : Calculation

Rounding helps estimate answers to our calculations.



Example 1
The number of computers sold over 4 days was recorded in the table below. How many computers 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 computers

Example 2
A muesli bar weighs 42g. There are 48 muesli bars in a box. What is the total weight of bars in the box?

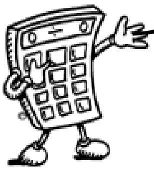
Estimate = 50 x 40 = 2000g

Calculate:

$$\begin{array}{r} 42 \\ \times 48 \\ \hline 336 \\ 1680 \\ \hline 2016 \\ \hline \end{array}$$

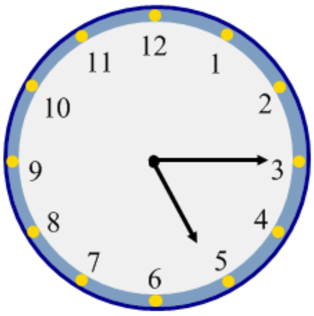
Answer = 2016g

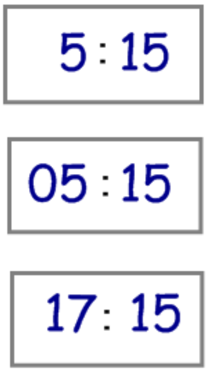
Time



Time may be expressed in 12 hour clock or 24 hour clock.

Time can be displayed in many different ways.



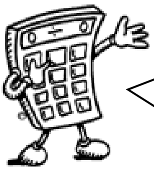


All these clocks show fifteen minutes past five, or quarter past five.

12 hour clock

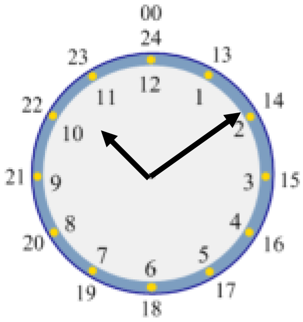
When writing times in 12 hour clock, we **need** to add a.m. or p.m. after the time.
a.m. is used for times between midnight and 12 noon (morning)
p.m. is used for times between 12 noon and midnight (afternoon / evening).

Time



In 24 hour clock:
The hours are written as numbers between 00 and 24
After 12 noon, the hours are numbered 13,14,15..etc
Midnight is expressed as 0000
We do **not** use am or pm with 24 hour clock

24 hour clock



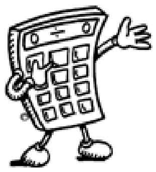
Examples

12 hour	24 hour
2:16 am →	0216
8:55 am →	0855
3:35 pm →	1535
8:45 pm →	2045
12:20 am →	0020

Time Facts

60 seconds → 1 minute
60 minutes → 1 hour
24 hours → 1 day

Time Facts



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

Time Facts

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

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

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

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:

Distance = Speed x Time or $D = S\,T$

Speed = or $S =$

Time = or $T =$

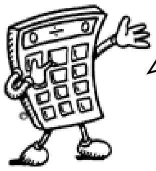
Example

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

$S =$
$S =$
$S = 90$ km/h

[In science speed is referred to as velocity]

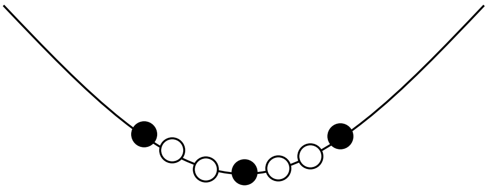
Fractions



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.

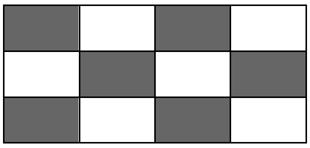


What fraction of the beads are black?

There are 3 black beads out of a total of 7, so of the beads are black.

Equivalent Fractions

Example
What fraction of the flag is shaded?

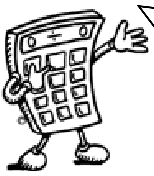


6 out of 12 squares are shaded. So $\frac{6}{12}$ of the flag is shaded.

It could also be said that the flag is shaded.
 and are **equivalent fractions**.

Fractions

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.

$$\frac{\textbf{numerator}}{\textbf{denominator}}$$

Example 1

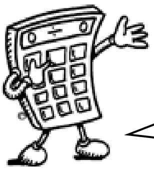
(a) $\xrightarrow{\div 5}$ = $\xrightarrow[\div 5]{}$

(b) $\xrightarrow{\div 8}$ = $\xrightarrow[\div 8]{}$

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 $\xrightarrow[\div 2]{\div 2}$ = $\xrightarrow[\div 2]{\div 2}$ = $\xrightarrow[\div 3]{\div 3}$ = (simplest form)

Calculating Fractions of a Quantity



To find the fraction of a quantity:
Divide by the denominator, multiply by the numerator.
[÷ by bottom, × by top]

Example 1 F

of £150 = 150 ÷ 5 x 1

= £30

Example 2 Find of 48

of 48 = 48 ÷ 4 x 3

= 36

Improper Fractions and Mixed Numbers

An improper fraction is one where the number on the top is larger than the number on the bottom. We can express improper fractions as a mixed number (a whole number and a fraction) by simplifying.

23 ÷ 4 = 5 remainder 3

$$\frac{23}{4} = 5\frac{3}{4}$$

Addition and Subtraction

Fractions can only be added or subtracted if they have the same denominator.

Examples:

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

$$= \frac{3}{6} + \frac{2}{6}$$

$$= \frac{5}{6}$$

$$\frac{5}{4} - \frac{1}{3}$$

$$= \frac{15}{12} - \frac{4}{12}$$

$$= \frac{11}{12}$$

Multiplication

To multiply fractions multiply the numerators, then multiply the denominators.

Examples:

$$\frac{4}{7} \times \frac{2}{3}$$

$$= \frac{4 \times 2}{7 \times 3}$$

$$= \frac{8}{21}$$

$$\frac{3}{7} \times \frac{2}{3}$$

$$= \frac{6}{21}$$

$$= \frac{2}{7}$$

Division

To divide fractions flip the second fraction and change the sum to multiply.

Please note *a/b* means $\frac{a}{b}$.

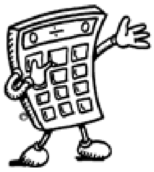
Example:

$$\frac{5}{7} \div \frac{2}{3}$$

$$= \frac{5}{7} \times \frac{3}{2}$$

$$= \frac{15}{14} = 1\frac{1}{14}$$

Percentage Facts



Percent means out of 100.
A percentage can be converted to an equivalent fraction or decimal.
The symbol for percent is **%**

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

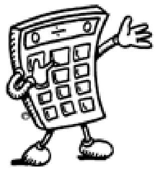
36% is therefore equivalent to $\frac{9}{25}$ and 0.36

Common Percentages

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

Percentage	Fraction (in simplest form)	Decimal
1%	$\frac{1}{100}$	0.01
10%	$\frac{10}{100} = \frac{1}{10}$	0.1
20%	$\frac{20}{100} = \frac{1}{5}$	0.2
25%	$\frac{25}{100} = \frac{1}{4}$	0.25
50%	$\frac{50}{100} = \frac{1}{2}$	0.5
75%	$\frac{75}{100} = \frac{3}{4}$	0.75
100%	$\frac{100}{100}$	1.0

Finding a Percentage of a Quantity
Non-Calculator



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 x 1

= £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 200 $= \frac{1}{100}$ of 200

= 200 ÷ 100 x 1

= 2

so 9% of 200g = 9 x 2 = 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 x 1

= 3.50

so 70% of £35 = 7 x 3.50 = £24.50

Finding a Percentage of a Quantity

Non- Calculator Methods (continued)

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

Example Find 23% of £15000

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

23% of £15000 = £3000 + £450
= £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% of £650 = 65 (divide by 10)
5% of £650 = 32.50 (divide previous answer by 2)

so 15% of £650 = 65 + 32.50
= £97.50

Total price = 650 + 97.50
= £747.50

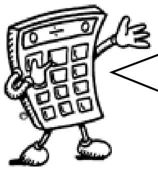
Finding a Percentage of a Quantity
Calculator Method

Calculator Method

To find the percentage of a quantity using a calculator, change the percentage to a fraction.

Example 1 Find 23% of £15000

23% of 15000 = $\frac{23}{100}$ x 15000 or = 0.23 x 15000
= 15000 ÷ 100 x 23 = £3450
= £3450



We **<u>NEVER</u>** use the % button on calculators. The methods taught in the mathematics department are all based on converting percentages to fractions.

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% = $\frac{19}{100}$ so

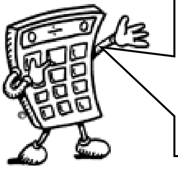
Increase = $\frac{19}{100}$ x 236000 or = 0.19 x 236000
= 236000 ÷ 100 x 19 = 44840
= 44840

Value at end of year = original value + increase
= 236000 + 44840
= 280840

The new value of the house is £280840

Finding a Percentage

Finding the percentage



To find a percentage of a total:

1. make a fraction,
2. change to a decimal by dividing the top by the bottom.
3. multiply by 100 to make a %

Example 1 There are 30 pupils in a class. 18 are girls.
What percentage of the class are girls?

$\frac{18}{30}$ = 18 ÷ 30

= 0.6

= 0.6 x 100

= 60%

60% of the class are girls

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

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

= 36 ÷ 44

= 0.81818…

= 0.81818 x 100

= 81.818..%

= 82% (to nearest whole number)

Example 3 In a class, 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,

$\frac{6}{25}$ = 6 ÷ 25

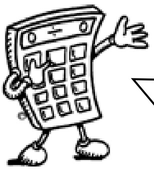
= 0.24

= 0.24 x 100

= 24%

24% of pupils 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

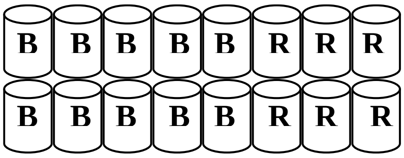
Simplifying Ratios

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, each containing 5 tins of blue and 3 tins of red.



Blue : Red = 10 : 6
Blue : Red = 5 : 3

To simplify a ratio, divide each figure 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 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

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	
×5			×5
	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

$90 \div 5 = 18$

Step 3 Multiply each figure by the value of each part

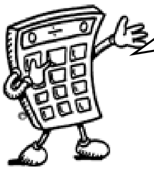
$3 \times 18 = 54$
$2 \times 18 = 36$

Step 4 Check that the total is correct

$54 + 36 = 90$ ✓

Lauren received £54 and Sean received £36

Proportion



When two quantities change in the same ratio, the quantities are said to be **directly proportional**.

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	
×3			×3
	90	**4500**	

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?

Find the cost of 1 ticket →

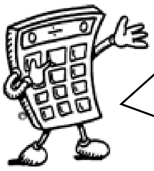
Tickets	Cost
5	27.50
1	5.50
8	44.00

Working:

$$\begin{array}{r} 5.50 \\ 5\overline{)27.50} \end{array} \qquad \begin{array}{r} 5.50 \\ \underline{{}_4\times 8} \\ \underline{44.00} \end{array}$$

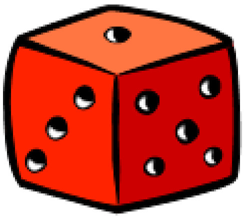
The cost of 8 tickets is £44

Probability



Probability is how likely or unlikely an event is of happening.
If an event is certain to happen, it has a probability of 1.
If an event is impossible or unlikely it has a probability of 0.
Probability of an event E happening:

$$P(E) = \frac{\text{number of ways an event can occur}}{\text{total number of different outcomes}}$$



A dice is rolled:

Example 1 What is the probability of rolling a 1?

$$P(1) = \frac{1}{6}$$

Example 2 What is the probability of rolling an even number?

3 even numbers

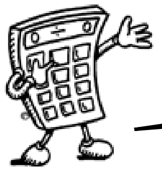
$$P(\text{even}) = \frac{3}{6} = \frac{1}{2}$$

Example 3 What is the probability of rolling a number greater than 4?

2 numbers greater than 4 (5 and 6)

$$P(>4) = \frac{2}{6} = \frac{1}{3}$$

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 temperature in June in Barcelona is 24°C

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

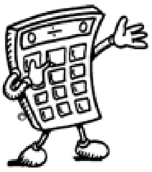
Example 2 Homework marks for Class 4B

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	𝍸 ||	7
26 - 30	𝍸 ||||	9
31 - 35	𝍸	5
36 - 40	|||	3
41 - 45	||	2
46 - 50	||	2

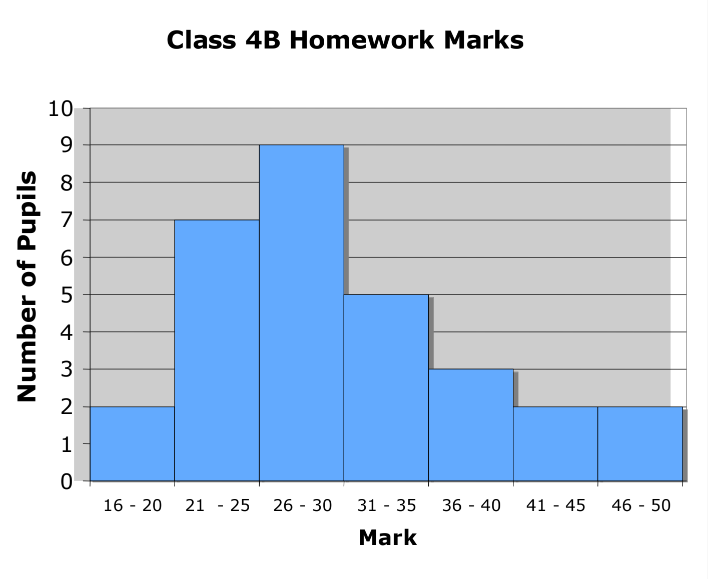
Each mark is recorded in the table by a tally mark.
Tally marks are grouped in 5's to make them easier to read and count.

Information Handling : Bar Graphs



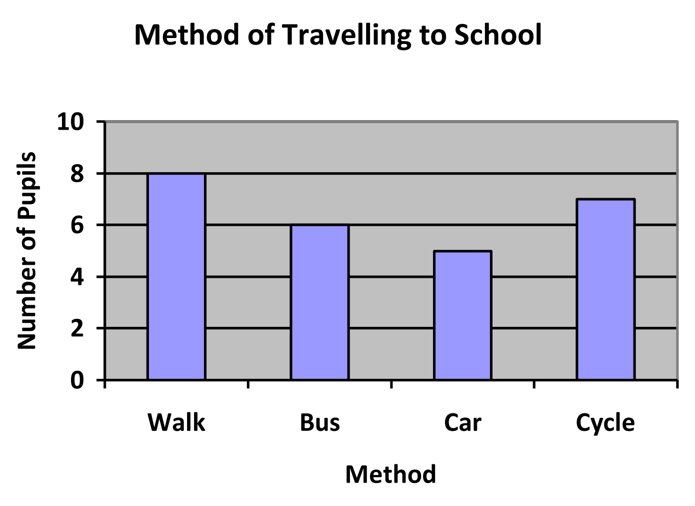
Bar graphs are often used to display data. The horizontal axis should show the categories or class intervals, and the vertical axis the frequency. All graphs should have a title, and each axis must be labelled.

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



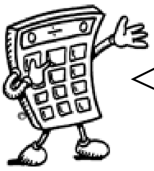
This is an example of a histogram ie no spaces between bars

Example 2 How do pupils travel to school?



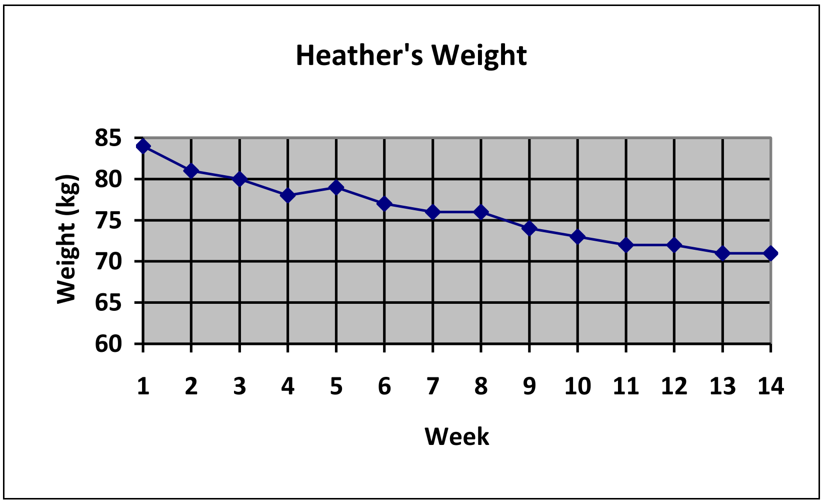
This is an example of a bar chart ie spaces between bars

Information Handling : Line Graphs



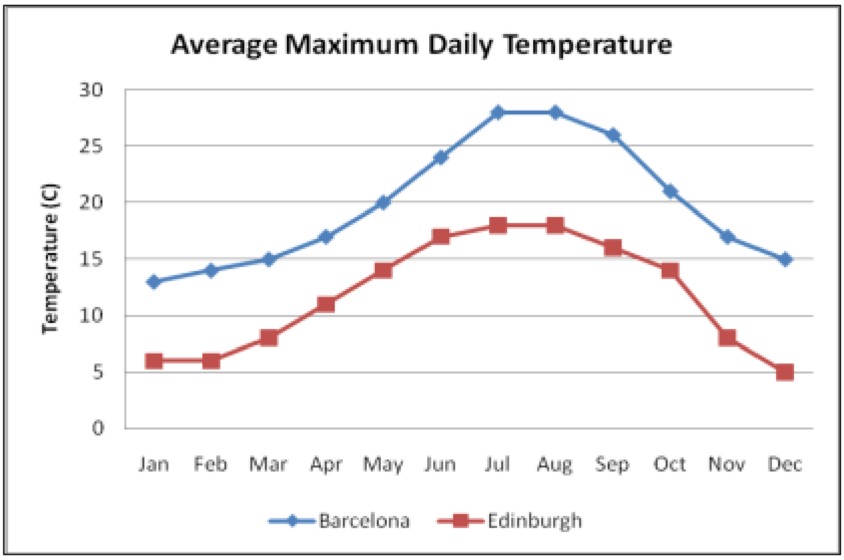
Line graphs consist of a series of points which are plotted, then joined by a line. All graphs should have a title, and each axis must be labelled. The trend of a graph is a general description of it.

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

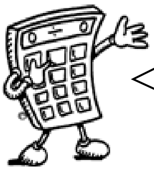


The trend of the graph is that her weight is decreasing.

Example 2 Graph of temperatures in Edinburgh and Barcelona.



Information Handling : Scatter Graphs

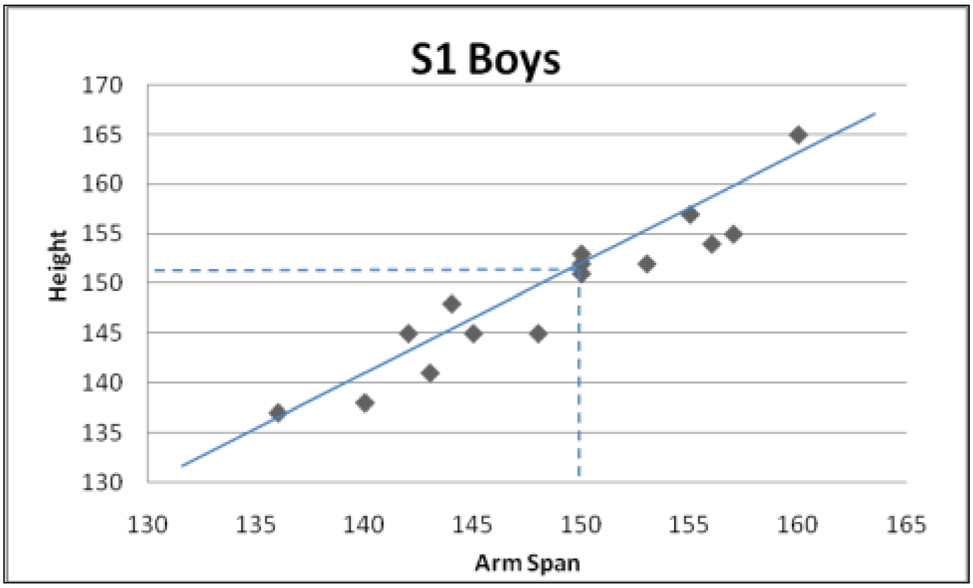


A scatter diagram is used to display the relationship between two variables.
A pattern may appear on the graph.
This is called a **correlation**.

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.

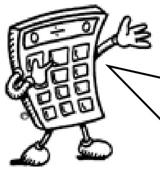
Arm Span (cm)	150	157	155	142	153	143	140	145	144	150	148	160	150	156	136
Height (cm)	153	155	157	145	152	141	138	145	148	151	145	165	152	154	137

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



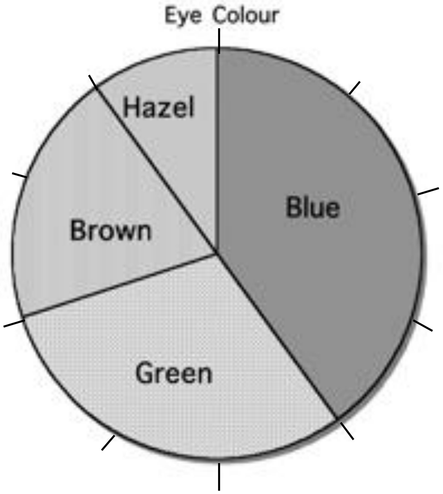
The line drawn is called the line of best fit. This line can be used to provide estimates. For example, a boy of arm span 150cm would be expected to have a height of around 151cm.

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.

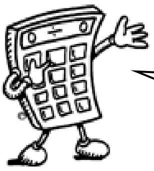
If no divisions are marked, we can work out the fraction by measuring the angle of each sector.

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

If you find a value for each sector, this should add up to 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 $= \frac{28}{80} \rightarrow \frac{28}{80} \times 360^\circ = 126^\circ$

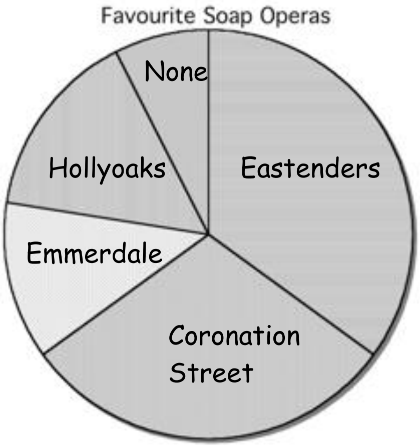
Coronation Street $= \frac{24}{80} \rightarrow \frac{24}{80} \times 360^\circ = 108^\circ$

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

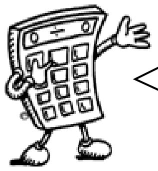
Hollyoaks $= \frac{12}{80} \rightarrow \frac{12}{80} \times 360^\circ = 54^\circ$

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

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 methods 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 from smallest to largest (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 A class 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

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

$= \dfrac{102}{14} = 7.285...$

Mean = 7.3 to 1 decimal place

Ordered values: 4, 5, 5, 6, 7, 7, $\boxed{7,\ 7,}$ 8, 8, 9, 9, 10, 10

Median = 7

7 is the most frequent mark, so **Mode** = 7

Range = 10 – 4 = 6