NUMERACY HANDBOOK

A guide for students, parents and staff

Introduction

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What is the purpose of the booklet?

This booklet has been produced to give guidance and help to staff, students and parents. It shows how certain common Numeracy topics are taught in mathematics and throughout schools in the cluster. It is hoped that using a consistent approach across all subjects will make it easier for students to progress.

How can it be used?

The booklet includes the Numeracy skills useful in subjects other than mathematics.

It is intended that staff from all cluster schools will support the development of Numeracy by reinforcing the methods contained in this booklet.

NOTE: $\frac{3}{4}$ means 3 parts out of a total of 4

also $\frac{3}{4}$ means $3 \div 4 = 0.75$

It should be noted that the context of the question, whether a calculator is permitted or not and the nature of the numbers involved has the potential to change the given level.

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. Big Maths / Mental Maths strategies taught.

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Other Related Documentation/Help Sheets/Posters

Related Documentation	**Topic**
Numeracy Experiences and Outcomes Summary	All
Multiplication Square - tablemat	Number and Number Processes
What's in a time – time periods poster	Time
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What's in a measurement – equivalences poster	Measurement
Fractions/Decimals/Percentages – poster (The Connection)	Fractions, Decimals and Percentages
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How to do Percentages side B - tablemat	Fractions, Decimals and Percentages
Rounding / decimal places - tablemat	Estimation and Rounding

Addition

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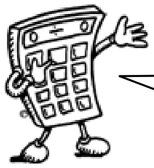
Mental strategies



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

Example 1 Calculate 54 + 27
Level 2

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

Addition

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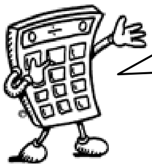
Written Method



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 2 Add 3032 and 589

Level 2

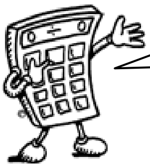
$$\begin{array}{r} 3032 \\ +\ 589 \\ \hline 1 \\ \hline {\scriptstyle 1\ \ } \end{array} \longrightarrow \begin{array}{r} 3032 \\ +\ 589 \\ \hline 21 \\ \hline {\scriptstyle 1\ 1\ \ } \end{array} \longrightarrow \begin{array}{r} 3032 \\ +\ 589 \\ \hline 621 \\ \hline {\scriptstyle 1\ 1\ \ } \end{array}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

2 + 9 = 11

3+8+1=12

0+5+1=6

3 + 0 = 3



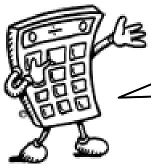
When adding decimals we make sure all the decimal points are lined up.

Example 3 Add 43.8 + 4 + 23.76

Level 2

$$\begin{array}{r} 43\ .\ 80 \\ 4\ .\ 00 \\ +\ \ 23\ .\ 76 \\ \hline 71\ .\ 56 \\ \hline {\scriptstyle 1\ \ 1\ \ \ \ \ \ \ } \end{array}$$

43.8 can be written as 43.80 and 4 as 4.00



Remember you can add as many numbers together in a single sum as you like.

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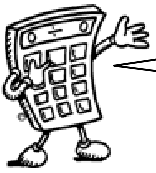
Subtraction

Mental Strategies



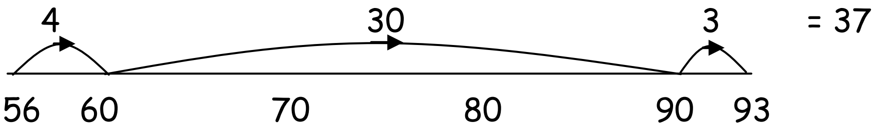
There are a number of useful mental strategies for subtraction.
Some examples are given below.

Example 1 Calculate 93 - 56

Level 2

Method 1 Count on

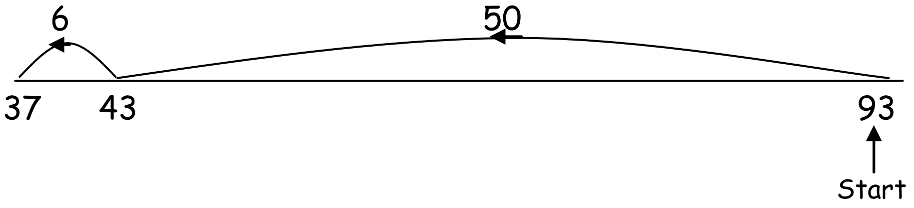
Count on from 56 until you reach 93. This can be done in several ways e.g.



Method 2 Break up the number being subtracted

e.g. subtract 50, then subtract 6

93 - 50 = 43
43 - 6 = 37



Subtraction

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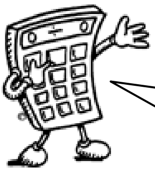
Written Method (We do NOT "borrow and pay back")



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

Example 2 4590 - 386

Level 2

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

Example 3 Subtract 692 from 14597

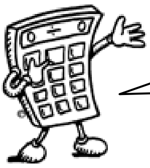
$$\begin{array}{r} 1\overset{3}{\cancel{4}}{}^{1}597 \\ -\ \ 692 \\ \hline 13905 \\ \hline \end{array}$$

Example 4 Find the difference between 327 and 5000

Level 2

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

We need to "BUMP" our borrow 1 back to the end.



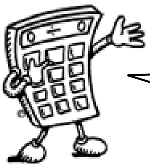
When subtracting decimals we make sure all the decimal points are lined up.

Example 5 Subtract 8.36 from 20.9

Level 2

$$\begin{array}{r} \overset{1}{\cancel{2}}{}^{1}0\ .\ \overset{8}{\cancel{9}}{}^{1}0 \\ -\ \ 8\ .\ 36 \\ \hline 1\ 2\ .\ 54 \\ \hline \end{array}$$

20.9 can be written as 20.90



Remember you can only have TWO numbers in a single subtraction calculation.

Multiplication

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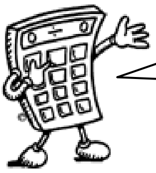
Mental Strategies

* Sum in isolation not merely station * Not reliant on multiplication square



It is expected that all of the multiplication tables from 1 to 10 are known. In most cases by end P5 all tables. 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

Example 1 Find 39 x 6

Method 1

Method 2

30 x 6
= 180

9 x 6
= 54

180 + 54
= 234

40 x 6
=240

40 is 1 too many
so take away 6x1

240 - 6
= 234

24 X 28

X	20	4
20		
8		

Multiplication

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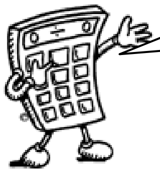
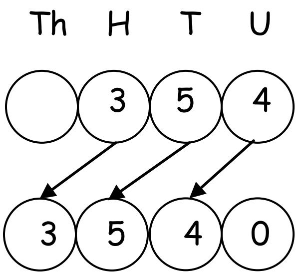
Multiplying by multiples of 10 and 100

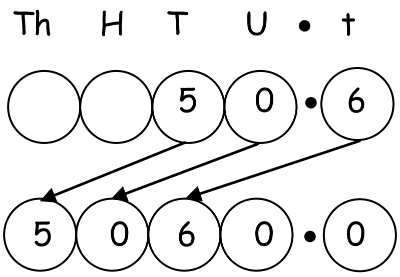


To multiply by **10** you move every digit ***one*** place to the left.
To multiply by **100** you move every digit ***two*** places to the left.

Example 2 (a) Multiply 354 by 10 (b) Multiply 50.6 by 100

Level 2





354 x 10 = 3540

50.6 x 100 = 5060

Level 3 (c) 35 x 30 (d) 436 x 600

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

35 x 3 = 105
105 x 10 = 1050
So 35 x 30 = 1050

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

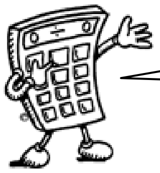
436 x 6 = 2616
2616 x 100 = 261600
So 436 x 600 = 261600

Example 3

Level 3

(a) 30 x 60
3 x 10 x 6 x 10
= 18 x 10 x 10
= 1800

(b) 20 x 700
2 x 10 x 7 x 100
= 14 x 10 x 100
= 14000



We may also use these rules for multiplying decimal numbers.

Example 4

Level 3

(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

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Written Method

Example 5 Multiply 246 by 8

Level 2

 2 4 6

x 8

1 9 6 8

3 4

Remember to ADD the carry.

Example 6 Multiply 4367 by 50

Level 3

 4 3 6 7

x 5 0

2 1 8 3 5 0

1 3 3

x 50 is the same as x 5 x 10
Put the 0 into the answer first ***(x 10)***
then multiply by 5

Example 7 Multiply 472 by 300

Level 3

 4 7 2

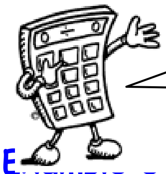
x 3 0 0

1 4 1 6 0 0

2

x 300 is the same as x 3 x 100
Put two 0's into the answer first ***(x 100)***
then multiply by 3

Long Multiplication



We can multiply by a 2 or 3 digit number by combining the above methods.

Example 8 Multiply 5246 by 52

Level 3

We can multiply by 52 if we split x52 into x2 and x50.

 5 2 4 6

x 5 2

1

1 0 4 9 2 x2

$+\ 2\ 6^{1}2^{2}3^{3}0\ 0$ x50

2 7 2 4 9 2 x52

To get the final answer add the two previous answers together. (50 + 2 = 52)

Or alternatively:

 5 2 4 6

x 2

1 3 3

2 1 8 3 5 0

x2

 5 2 4 6

x 5 0

1 2 3

2 6 2 3 0 0

x50

 1 0 4 9 2

+2 6 2 3 0 0

2 7 2 4 9 2

x52

Multiplication

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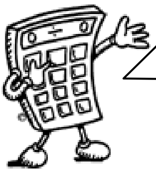

To multiply decimals we ignore the decimal point(s) until after we multiply. The point(s) are not necessarily lined up when setting the question out.
The decimal point gets placed in the answer after multiplication is complete.

Example 9 23.76 x 6

Level 2

Start by working out 2376 x 6

```
   2 3 . 76     ←  2 digits after point
 x        6     ←  0 digits after point
 1 4 2. 5 6        +/2
 ----------
     2 4   3
```

The decimal point goes in 2 places from the end of the answer.

Example 10 134.6 x 0.3

Start by working out 1346 x 3

Level 3

```
   1 3 4 . 6    ←  1 digits after point
 x       0 .3   ←  1 digits after point
  3 0 . 3 8        +/2
 ----------
      1    1
```

The decimal point goes in 2 places from the end of the answer.

Example 11 132.6 x 3.4

Start by working out 1326 x 34

Level 3

```
      1 3. 2  6       ←  2 digits after point
 x       1 13  2 4    ←  1 digits after point
        5 3 0 4   x4        +
 +  3 1 9 1 7 1 8 0   x30
     4 4. 0 8 4   x34       /3
```

The decimal point goes in 3 places from the end of the answer.

This would be a non-calculator method; these types of calculations would often be done by calculator.

Division

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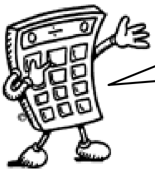
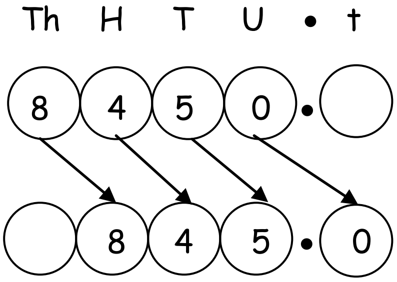
Dividing by multiples of 10 and 100

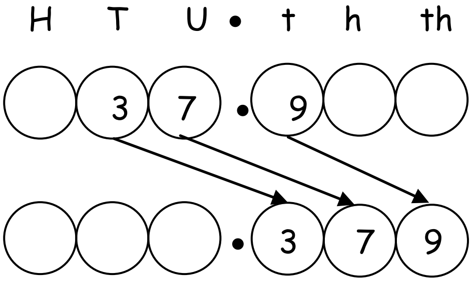


To divide by **10** you move every digit ***one*** place to the right.
To divide by **100** you move every digit ***two*** places to the right.

Example 1 (a) 8450 ÷ 10 (b) 37.9 ÷ 100

Level 2





8450 ÷ 10 = 845

37.9 ÷ 100 = 0.379

Level 3

(c) 440 ÷ 40

To divide by 40, divide by 4, then by 10.

440 ÷ 4 = 110
110 ÷ 10 = 11
So 440 ÷ 40 = 11

(d) 85.6 ÷ 200

To divide by 200, divide by 2, then by 100.

85.6 ÷ 2 = 42.8
42.8 ÷ 100 = 0.428
So 85.6 ÷ 200 = 0.428

Division

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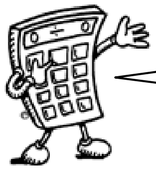

You should be able to divide by a single digit or by a multiple of 10 or 100 without a calculator.

Written Method

Example 2 There are 192 pupils in first year, shared equally between 8 classes. How many pupils are in each class?

Level 2

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

There are 24 pupils in each class

Example 3 Divide 4.74 by 3

Level 2

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

When dividing a decimal 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?

Level 2

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

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. 2.20 is the same as 2.2. Continue to add 0's as required

Each glass contains 0.275 litres

Example 5 Divide 575 by 4

Level 3

$$\begin{array}{rl} & \ \ 1\ \ 4\ 3.\ 7\ 5 \\ 4 & \overline{)\,5\,{}^{1}7\,{}^{1}5.\,{}^{3}0\,{}^{2}0} \end{array}$$

If there is no decimal point then put the point in place before you add the first zero. 575.0 is the same as 575.
Continue to add 0's as required.

Division

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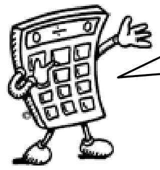

When dividing we want to divide by as small a number as possible without turning it into a decimal.
NEVER divide by a decimal.

Example 6 467400 ÷ 40

Level 3

$467400 \div 40$

$46740 \div 4$

We don't want to divide by 40. We can turn 40 into 4 by dividing it by 10.
If we do this, to balance the calculation, we must also divide 467400 by 10
The answer to both calculations will be the same if the calculation has been adjusted AND balanced.

$$\begin{array}{rl} & \ \ 1\ 1\ 6\ 8\ 5 \\ 4 & \overline{)\,4\ 6^{2}7^{3}4^{2}0} \end{array}$$

So 467400 ÷ 40 = 11685

Example 7 Divide 238.2 ÷ 300

Level 3

$238.2 \div 300$

$2.382 \div 3$

We don't want to divide by 300. We can turn 300 into 3 by dividing it by 100.
If we do this, to balance the calculation, we must also divide 238.2 by 100
The answer to both calculations will be the same if the calculation has been adjusted AND balanced.

$$\begin{array}{rl} & \ \ 0.\ 7\ \ 9\ \ 4 \\ 3 & \overline{)\,2.^{2}3^{2}8\ ^{1}2} \end{array}$$

So 238.2 ÷ 300 = 0.794

Example 8 Divide 357.9 by 0.6

Level 3

$357.9 \div 0.6$

$3579 \div 6$

We don't want to divide by a decimal. We can turn 0.6 into 6 by multiplying 0.6 by 10.
If we do this, to balance the calculation, we must also multiply 357.9 by 10
The answer to both calculations will be the same if the calculation has been adjusted AND balanced.

$$\begin{array}{rl} & \ \ 0\ 5\ \ 9\ \ 6.\ 5 \\ 6 & \overline{)\,3^{3}5^{5}7^{3}9.^{3}0} \end{array}$$

So 357.9 ÷ 0.6 = 596.5

Division

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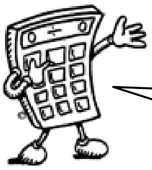
Long Division



We CAN divide by a 2 or 3 digit number without a calculator.

Example 9 3741 ÷ 32

Level 3

We don't want to divide by a decimal and we cannot make 32 simpler.

Method 1

$$\begin{array}{rccccc}
 & 0 & 1 & 1 & 6 & 9 \\ \cline{2-6}
32 & 3 & 7 & 4 & 0 & 8 \\
 & -3 & 2\downarrow & & \downarrow & \downarrow \\ \cline{2-3}
 & & 5 & 4 & & \\
 & & -3 & 2 & \downarrow & \\ \cline{2-4}
 & & 2 & 2 & 0 & \\
 & & -1 & 9 & 2 & \downarrow \\ \cline{2-5}
 & & & 2 & 8 & 8 \\
 & & & -2 & 8 & 8 \\ \cline{4-6}
 & & & & & 0
\end{array}$$

This is the method most used when setting out working.

Possibly an easier way may be to treat the long division as a normal divide calculation and list the tables at the side.

Method 2

$$\begin{array}{r|l}
 & 0\;\;1\;\;1\;\;\;6\;\;9 \\ \hline
32 & 3\,{}^{3}7\,{}^{5}4\,{}^{22}0\,{}^{28}8
\end{array}$$

32	32	32
	64	64
	96	96
	128	128
	160	160
	192	192
		224
		256
		288

We only list the 32 times table as far as we need to go. We can add to it if we need to. The list length will only ever be a maximum of 9 numbers.

Example 10 357.4 ÷ 4.6

Level 3

357.4 ÷ 4.6

35.74 ÷ 46

We never want to divide by a decimal. Change the calculation and balance it.

$$\begin{array}{r|l}
 & \;\;0.\;\;7\;\;\;7\;\;\;6\,.\,.\,. \\ \hline
46 & 3\,{}^{3}5.\,{}^{35}7\,{}^{32}4\,{}^{22}0
\end{array}$$

46
92
138
184
230
276
322
368

357.4 ÷ 4.6 = 0.78

These tools are taught within Secondary where appropriate.

When we have a never ending decimal as our answer we have to decide when to stop dividing and round appropriately (see rounding).

These tools are taught within Secondary where appropriate.

Order of Calculation (BODMAS)

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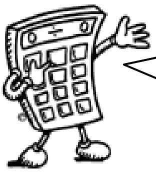
Consider this: What is the answer to 2 + 5 x 8 ?

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 higher the level the higher the priority

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

BODMAS represents:

ODMAS is Level 2 but if we include brackets (BODMAS) this moves us to level 3.

(B)rackets	Top level
(O)f **(D)ivide** **(M)ultiply**	Middle level
(A)dd **(S)ubract**	Bottom level

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

Example 1
Level 2

$15 - 12 \div 6$ BODMAS says divide first,
$= 15 - 2$ then subtract
$= 13$

Example 2
Level 4

$(9 + 5) \times 6$ Brackets first
$= 14 \times 6$ then multiply.
$= 84$

Example 3
Level 4

$18 + 6 \div (5 - 2)$ Brackets first
$= 18 + 6 \div 3$ then divide
$= 18 + 2$ now add
$= 20$

Example 4
Level 3

$16 + 5^2$ multiply first (5 x 5)
$= 16 + 25$ then add
$= 41$

Example 5
Level 4

$(4 + 2)^2$ brackets first
$= 6^2$ then multiply (6 x 6)
$= 36$

Evaluating Formulae

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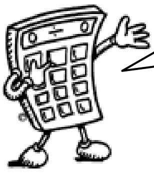


To find the value of a variable in a formula, we must substitute all of the given values into the formula, then use BODMAS rules to work out the answer.

Step 1: write formula
Step 2: substitute numbers for letters
Step 3: start to evaluate (BODMAS)
Step 4: write answer

Example 1 Use the formula $P = 2L + 2B$ to evaluate P when $L = 12$ and $B = 7$.
Level 3

$P = 2L + 2B$
$P = 2 \times 12 + 2 \times 7$
$P = 24 + 14$
$P = 38$

BODMAS rules come into play.
Multiply before add.

Example 2 Use the formula $I = \frac{V}{R}$ to evaluate I when $V = 240$ and $R = 40$
Level 3

$I = \frac{V}{R}$
$I = \frac{240}{40}$
$I = 6$

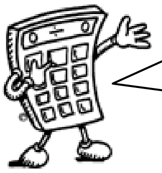
Example 3 Use the formula $F = 32 + 1.8C$ to evaluate F when $C = 20$
Level 3

$F = 32 + 1.8C$
$F = 32 + 1.8 \times 20$
$F = 32 + 36$
$F = 68$

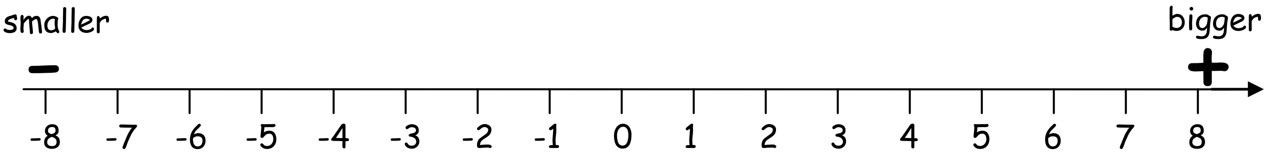
BODMAS rules come into play.
Multiply before add.

Negative Numbers (Integers)

contents page



We can extend our number line to include numbers below zero.
The numbers below zero are called NEGATIVE numbers.
(We NEVER use the word MINUS as this is used for subtraction).



The further LEFT we go the SMALLER we get

The further RIGHT we go the BIGGER we get

Example 1 Compare the following pairs of numbers.

Level 3

a) 3 and -4

$3 > -4$

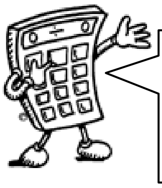
b) -6 and 4

$-6 < 4$

c) -8 and -3

$-8 < -3$

$<$ means less than
$>$ means greater than



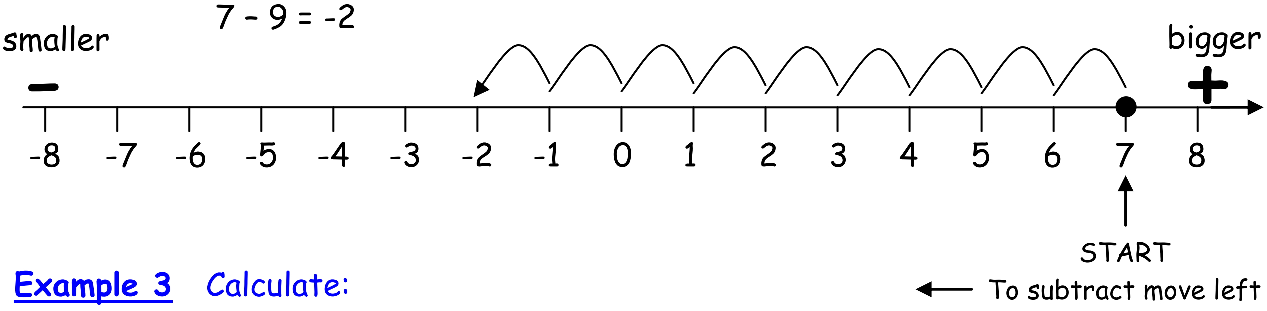
When we ADD a positive number we move RIGHT on our number line.

When we SUBTRACT a positive number we move LEFT on our number line.

Example 2 Calculate:

Level 3

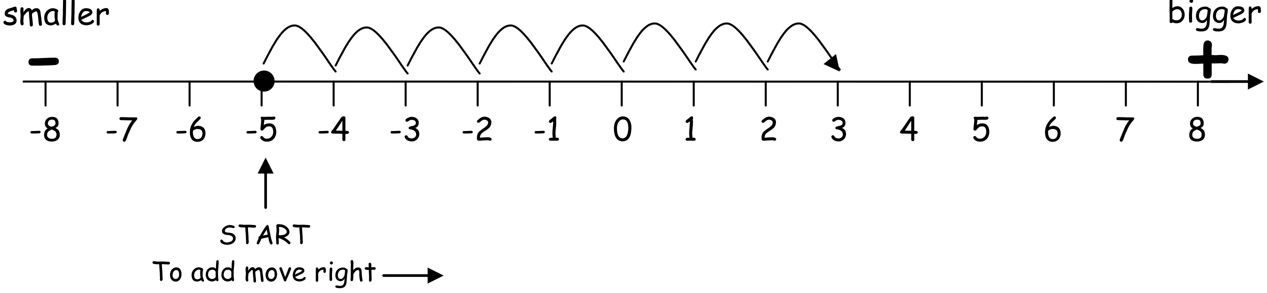
$7 - 9 = -2$



Example 3 Calculate:

Level 3

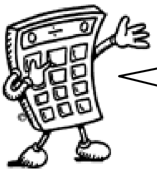
$-5 + 8 = 3$



Estimation : Rounding

contents page

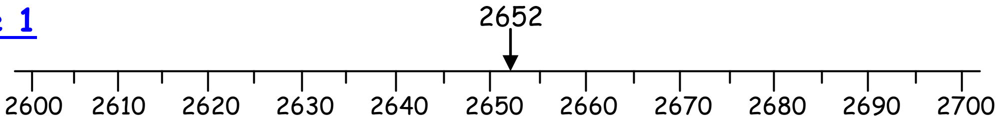
Numbers can be rounded to give an approximation.



The number to the right of the place value to which we want to round tells us how to round.

Example 1

Level 2



265② rounded to the nearest **10** is 2650.

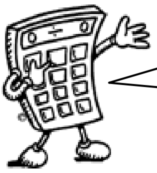
2 is to the right of the 10's column.
Round down.

26⑤2 rounded to the nearest **100** is 2700.

5 is to the right of the 100's column.
Round up.

2⑥52 rounded to the nearest **1000** is 3000

6 is to the right of the 1000's column.
Round up.



When rounding numbers that lie exactly in the middle it is convention to ALWAYS round UP.

Example 2 345 to the nearest 10

Level 2

34⑤ = 350 to the nearest 10

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 the "check digit" is less than 5 (0, 1, 2, 3, 4) round down.
If the "check digit" is 5 or more (5, 6, 7, 8, 9) round up.

Estimation: Rounding

contents page

The same principle applies when rounding decimal numbers.

Example 1 Round 1.5739 to 1 decimal places (1.d.p.)

Level 3

The 1st number after the decimal point (5) is the position of our place value. The rounded number lies between 1.5 and 1.6

The 2nd number after the decimal point is a 7. (this is the "check digit"). 7 means round up.

1.5⑦39 = 1.6 (1.d.p.)

Example 2 Round 6.4721 to 2 decimal places (2.d.p.)

Level 3

The 2nd number after the decimal point (7) is the position of our place value. The rounded number lies between 6.47 and 6.48

The 3rd number after the decimal point is a 2. (this is the "check digit"). 2 means round down.

6.47②1 = 6.47 (2 d.p.)

Example 3 Round 19.49631 to 2 decimal places (2.d.p.)

Level 3

19.49⑥31 = 19.50 (2.d.p.)

The number lies between 19.49 and 19.50.
6 to the right means we round up.
We must include the 0 at the end as we require 2 numbers after the point.

Some students need a bit more visual help.
You could also use a mini number line.

0, 1, 2, 3, 4	lower
5, 6, 7, 8, 9	upper

Example 1 1. 5|⑦3 9 = 1.6 (1.d.p.)

Level 3

1.5
1.6 ← 7 upper

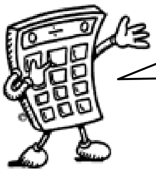
Example 2 6. 4 7|②1 = 6.47 (2 d.p.)

Level 3

6.47 ← 2 lower
6.48

Estimation : Calculation

contents page



Using rounded numbers in calculations to check an answer allows us to judge whether our answer is sensible or not.

Example 1
Level 2

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
(reasonable when compared to estimate).

Example 2
Level 3

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

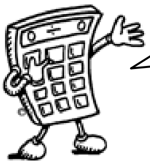
Calculate:

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

Answer = 2016g
(reasonable when compared to estimate).

Time

contents page

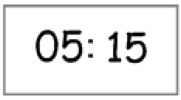


It is essential to know the number of months, weeks and days in a year, and the number of days in each month.

Time may be expressed in 12 or 24 hour notation.

12-hour clock

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



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

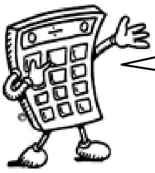
When writing times in 12 hour clock, we need to add a.m. or p.m. after the time.

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

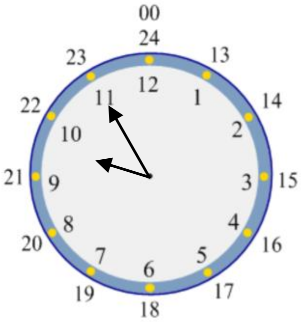
p.m. is used for times between 12 noon and midnight (afternoon / evening).

5.15 am or 5.15pm?

24-hour clock



In the 24 hour clock, the hour is written as a 2 digit number between 00 and 24. Midnight is expressed as 00 00, or 24 00. After 12 noon, the hours are numbered 13, 14, 15 … etc.



Examples

Level 2

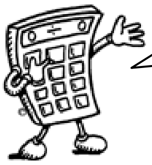
12 hr		24 hr
9.55 am	⟷	09 55 hours
3.35 pm	⟷	15 35 hours
12.20 am	⟷	00 20 hours
2.16 am	⟷	02 16 hours
8.45 pm	⟷	20 45 hours

24hr no am or pm

L Watson 2012

Time

contents page



It is important to be able to change between units of time.
Hours to minutes and minutes to hours.

Students should recognise everyday equivalences.

Level 3

MINUTES ⟷ HOURS			
15 mins	$\frac{15}{60}$ hr	$\frac{1}{4}$ hr	0.25 hr
30 mins	$\frac{30}{60}$ hr	$\frac{1}{2}$ hr	0.5 hr
45 mins	$\frac{45}{60}$ hr	$\frac{3}{4}$ hr	0.75 hr

Example 1 Change minutes into hours

Divide by 60

Level 4

20 mins = $\frac{20}{60}$ = 0.333333. . . hrs = 0.33 hrs (2.d.p.)

12 mins = $\frac{12}{60}$ = 0.2 hrs

55 mins = $\frac{55}{60}$ = 0.916666 . . . hrs = 0.92 hrs (2.d.p)

2hrs 18 mins = 2.3hrs

18 mins = $\frac{18}{60}$ = 0.3 hrs

Example 2 Change hours into minutes

Multiply by 60

Level 4

0.6 hrs = 0.6 x 60 = 36 mins
0.35 hrs = 0.35 x 60 = 21 mins

2.8 hrs = 2hrs 48 mins
= 168 mins

0.8 hrs = 0.8 x 60 = 48 mins

2 hrs = 2 x 60 = 120 mins
0.8 hrs = 0.8 x 60 = 48 mins
168 mins

or
2.8 hrs = 2.8 x 60 = 168 mins

Time 1

Time may be expressed in 12 or 24 hour notation.

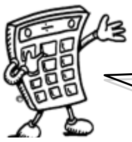
12 – hour clock Time can be displayed on a clock face, or digital clock.

05: 15

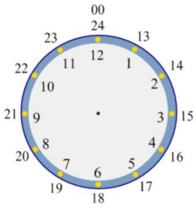
These clocks both show fifteen minutes past five, or quarter past five.

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

24-hour clock



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



Examples

12 hr	24 hr
9.55 am	09 55 hours
3.35 pm	15 35 hours
12.20 am	00 20 hours
2.16 am	02 16 hours
8.45 pm	20 45 hours

Reading timetables
When reading timetables you often have to convert to and from 24 hours clock.

To convert from 24-hour time to 12-hour time:

A. If the hour is 13 or more, subtract 12 from the hours and call it p.m. Otherwise it is a.m.
B. If the hour is 12, leave it unchanged, but call it p.m.
C. If the hour is 0, make it 12 and call it a.m.
D. Otherwise, leave the hour unchanged and call it a.m.

To convert from 12-hour time to 24-hour time:

A. If the p.m. hour is from 1 through 11, add 12.
B. If the p.m. hour is 12, leave it as is.
C. If the a.m. hour is 12, make it 0.
D. Otherwise, leave the hour unchanged.

Then drop the a.m. or p.m., of course.

*****************Check rules with the examples above*****************

Time 2

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

Time Calculations

Example 1 How long is it from 0755 to 0948?

Method – Working

0755 ➔ 0800 ➔ 0900 ➔ 0948
(5mins) ▯ (1hr) ▯ (48mins)

*****WE DON'T TEACH TIME AS SUBTRACTION*****

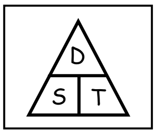
Example 2 Change 27 minutes into hours equivalent

27mins = 27 ÷ 60
= 0.45 hours

Time 3

contents page

Distance, Speed and Time.

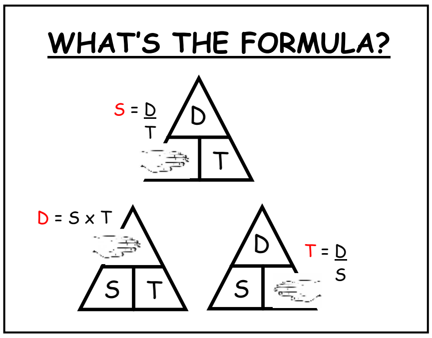


For any given journey, the distance travelled depends on the speed and the time taken. If we consider speed to be constant, then the following formulae apply:

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

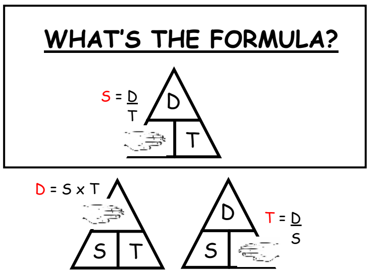
$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

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



Example 3 Calculate the speed of a train which travelled 450 km in 5 hours

Level 3



D = 450 km T = 5 hrs

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

$S = \boxed{}$

S = 90 km/h

The distance was in km and the time taken was in hours. The speed therefore should be given as km/h

Example 4 How long did it take for a car to travel 209 miles at an average speed of 55 mph?

Level 4

D = 209 miles S = 55 mph

mph - miles per hour so time comes out in hours.

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

$T = \frac{209}{55}$

T = 3.8 hrs

T = 3hrs 48 mins

0.8 hrs = 0.8 x 60

= 48 mins

contents page

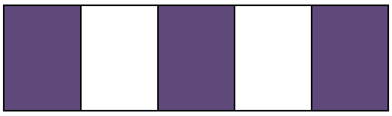
Fractions

What is a Fraction?

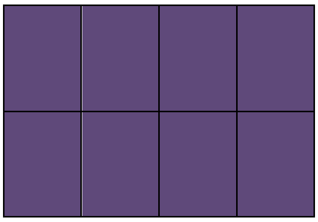
$$\frac{3}{5}$$

The top of a fraction is called the NUMERATOR

The bottom of a fraction is called the DENOMINATOR



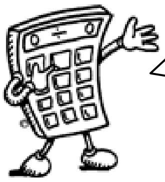
3 parts shaded out of a total of 5 equal pieces $\frac{3}{5}$



$$1 = \frac{8}{8}$$

If the numerator and the denominator are the same number we have 1 whole.

Equivalent Fractions



Equivalent fractions are fractions that represent the SAME AMOUNT. To find an equivalent fraction we multiply or divide both the numerator and the denominator of a fraction by the SAME number.

Example 1 Find equivalent fractions

Level 2

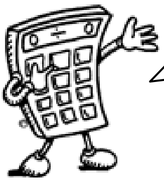
(a)

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

(b)

$$\frac{2}{3} \overset{\times 8}{\underset{\times 8}{=}} \frac{16}{24}$$

Simplifying Fractions



When we DIVIDE to find an equivalent fraction, it is called SIMPLIFYING. We can simplify (divide) repeatedly until the fraction is in its SIMPLEST FORM.

Example 2 Write $\frac{56}{72}$ in its simplest form

Level 3

Times tables knowledge

$$\frac{56}{72} \overset{\div 2}{\underset{\div 2}{=}} \frac{28}{36} \overset{\div 2}{\underset{\div 2}{=}} \frac{14}{18} \overset{\div 2}{\underset{\div 2}{=}} \frac{7}{9}$$

simplest form

or

$$\frac{56}{72} \overset{\div 2}{\underset{\div 2}{=}} \frac{28}{36} \overset{\div 4}{\underset{\div 4}{=}} \frac{7}{9}$$

simplest form

or

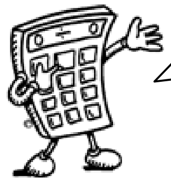
$$\frac{56}{72} \overset{\div 8}{\underset{\div 8}{=}} \frac{7}{9}$$

simplest form

Fractions

contents page

Improper Fractions



A top heavy fraction is called an IMPROPER fraction and is greater than 1. A MIXED NUMBER has a whole number part and a fraction part.

Example 3 Change the improper fraction $\frac{32}{6}$ to a mixed number.
Level 3

32 ÷ 6 = 5 remainder 2

$\frac{32}{6} = 5\frac{2}{6} = 5\frac{1}{3}$

$\frac{6}{6}$ = 1 so how many 6's can we get from 32

Always write fractions in their simplest form.

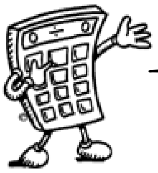
Example 4 Change the mixed number $3\frac{5}{7}$ to an improper fraction
Level 3

$3\frac{5}{7} = \frac{26}{7}$

$3\frac{5}{7} = \underbrace{\frac{7}{7} + \frac{7}{7} + \frac{7}{7}} + \frac{5}{7} = \frac{26}{7}$

$3 \times 7 + 5 = 26$

A Fractions of a Quantity



To find the fraction of a quantity:
divide by the denominator(bottom).
multiply by the numerator(top).

Example 5 Find $\frac{1}{5}$ of £150
Level 2

$\frac{1}{5}$ of £150

$= \frac{150}{5}$

= £30

Line means ÷

If the numerator is 1 then we only:
÷ by the bottom.

Example 6 Find $\frac{3}{4}$ of 48
Level 2

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

$= \frac{48}{4} \times 3$

$= 12 \times 3$

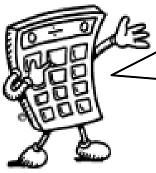
$= 36$

x by the top.

÷ by the bottom.

Percentages: Non- Calculator

contents page



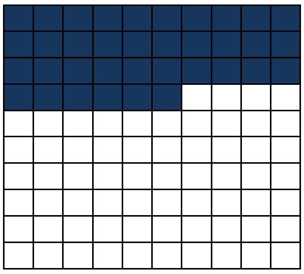
Percent means out of 100. The symbol for percent is: %

A percentage can be converted to an equivalent fraction or decimal.

Level 2

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

$36\% = \frac{36}{100} = \frac{9}{25} = 0.36$



Common Percentages

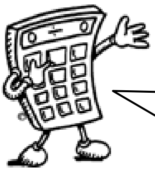
Level 2

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

Percentage	Fraction		Decimal
		Simplest Form	
1%	$\frac{1}{100}$	$\frac{1}{100}$	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
$33^{1}/_{3}\%$	$\frac{33 1/3}{100}$	$\frac{1}{3}$	0.333… 0.33 on calculator
50%	$\frac{50}{100}$	$\frac{1}{2}$	0.5
$66^{2}/_{3}\%$	$\frac{66^{2}/_{3}}{100}$	$\frac{2}{3}$	0.666…
75%	$\frac{75}{100}$	$\frac{3}{4}$	0.75
100%	$\frac{100}{100}$	1	1

Percentages: Non- Calculator

contents page



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 (use table on previous page)

Example 1 Find 25% of £48

Level 2

If we use a more complicated number then the level would go up to 3.

25% of £48

$= \frac{1}{4}$ of 48

$= \frac{48}{4}$

= £12

Method 2 Using 1% (1% - 9%)

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

Example 2 Find 9% of 200g

Level 3

1% of 200g

$= \frac{1}{100}$ of 200

$= \frac{200}{100}$

= 2g

so 9% of 200g = 9 x 2g

= 18g

Method 3 Using 10% (10% and multiples of 10%)

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

Example 3 Find 70% of £35

Level 3

10% of £35

$= \frac{1}{10}$ of 35

$= \frac{35}{10}$

= £3.50

so 70% of £35 = 7 x £3.50

= £24.50

Percentages: Non- Calculator

contents page

Non- Calculator Methods

Combining Methods

The previous 2 methods can be combined so allowing us calculate any percentage.

Example 4 Find 23% of £15000

Level 3

10% of £15000 = £1500

10% = 1/10 divide by 10

20% of £15000 = 2 x £1500

= £3000

20% = 2 x 10% multiply by 2

1% of £15000 = £150

1 % = 1/100 divide by 100

3% of £15000 = 3 x 150

= £450

3% = 3 x 1% multiply by 3

23% of £15000 = £3000 + £450

= £3450

23% = 20% + 3%

Example 5 Calculate the sale price of a computer which costs £650 and has a 15% discount

Level 3

10% of £650 = £65

5% of £650 = £32.50

5% = 1/2 of 10% divide by 2

so 15% of £650 = £65 + £32.50 = £97.50

15% = 10% + 5%

Total price = £650 - £97.50 = £552.50

Percentages: Calculator

contents page

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

Level 3

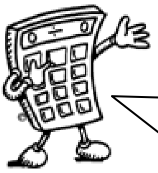
'of means ×'

23% of £15000

$= \frac{23}{100} \times 15\,000$

= 0.23 x £15000

= £3450



We **NEVER** 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?

Level 3

Increase = 19% of £236 000

$= \frac{19}{100} \times 236\,000$

= 0.19 x £236 000

= £44 840

Value at end of year = original value + increase

= £236 000 + £44 840

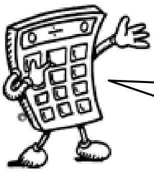
= £280 840

The new value of the house is £280 840

contents page

Percentages: One Quantity as a % of Another

Finding the percentage



To find one quantity as a percentage of another:
Make a FRACTION then multiply the fraction by 100

$$\frac{a}{b} \times 100 \Rightarrow \%$$

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

18 **out of** 30 are girls

$$\frac{18}{30} \times 100$$
$= 0.6 \times 100$
$= 60\%$ of 3A3 are girls

Example 2 James scored 36 **out of** 44 his biology test. What is his percentage mark?
Level 3

Score $= \frac{36}{44} \times 100$
$= 0.81818\ldots \times 100$
$= 81.818..\%$
$= 82\%$ (see rounding)

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

Total number of pupils = 14 + 6 + 3 + 2 = 25
6 **out of** 25 were blonde.

$$\frac{6}{25} \times 100$$
$= 0.24 \times 100$
$= 24\%$ were blonde

Ratio

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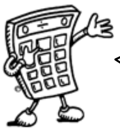


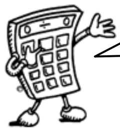
A ratio allows us to compare amounts.
When writing a ratio we usually use " : ", 1 : 3
When reading a ratio we use the word "to", 1 to 3
The order of the numbers in a ratio matters,
1 : 3 is NOT the same as 3 : 1

Example 1
Level 3

○●○●○●○

The ratio of beads is

● : ○	○ : ●
3 : 4	4 : 3
3 to 4	4 to 3



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.

Example 2
Level 3

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

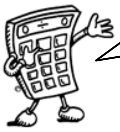
The ratio of water to cordial is 4 : 1
The ratio of cordial to water is 1 : 4

Example 3
Level 3

In a bag of balloons, there are 5 pink, 7 blue and 8 yellow balloons.

The ratio of pink : blue : yellow is 5 : 7 : 8

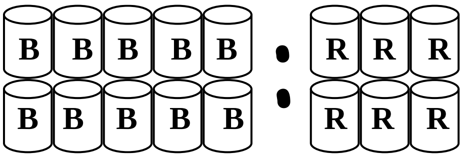
Simplifying Ratios



Ratios which describe the same proportion are known as equivalent ratios.
Ratios can be simplified in much the same way as fractions.

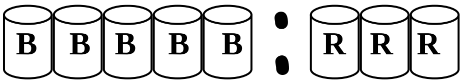
Example 4
Level 3

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



Blue : Red

$$\begin{tikzcd}
10 \arrow[d, bend right, "\div 2"'] & : & 6 \arrow[d, bend left, "\div 2"] \\
5 & : & 3
\end{tikzcd}$$



Ratio

contents page

Simplifying Ratios

Example 5 Simplify each ratio:
Level 3

Divide all by 3.

(a) 4 : 6 (b) 24 : 36 (c) 6 :3 : 12

$$\begin{tikzcd} 4 \arrow[d, bend right, "\div 2"'] & : & 6 \arrow[d, bend left, "\div 2"] \\ 2 & : & 3 \end{tikzcd}$$

$$\begin{tikzcd} 24 \arrow[d, bend right, "\div 12"'] & : & 36 \arrow[d, bend left, "\div 12"] \\ 2 & : & 3 \end{tikzcd}$$

6 : 3 : 12

2 : 1 : 4

Example 6 A ruler costs £1.20 and a pencil costs 40p. What is the ratio of the cost of a pencil to the cost of a ruler?
Level 3

When we compare two quantities in a ratio the numbers used must both be in the same units.

pencil : ruler

$$\begin{tikzcd} 40 \arrow[d, bend right, "\div 4"'] & : & 120 \arrow[d, bend left, "\div 4"] \\ 1 & : & 3 \end{tikzcd}$$

Example 7 On a map 1cm represents 500m. Write this as a ratio.
Level 3

1cm : 500m
1cm : 50 000cm

The units here are not the same. Change m into cm (x 100)

Ratio 1 : 50 000

The units are now the same so drop the units to complete the ratio.

Using ratios

Example 8 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?
Level 3

$$\begin{tikzcd} \underline{\text{Fruit}} & : & \underline{\text{Nuts}} \\ 3 \arrow[d, bend right, "\times\ 5"'] & : & 2 \arrow[d, bend left, "?"] \\ 15 & : & ? \end{tikzcd}$$

Whatever you do to one side you do the same to the other side. (x 5)

$$\begin{tikzcd} \underline{\text{Fruit}} & : & \underline{\text{Nuts}} \\ 3 \arrow[d, bend right, "\times\ 5"'] & : & 2 \arrow[d, bend left, "\times\ 5"] \\ 15 & : & 10 \end{tikzcd}$$

The chocolate bar contains 10g of nuts.

Ratio

contents page

Sharing in a given ratio

Example
Level 3

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

Total number of parts = 3 + 2
= 5

Using the ratio 3 : 2 add up the numbers to find the total number of parts.

Step 2

1 part = 90 ÷ 5
= £18

Divide the total by the total number of parts (step 1) to find the value of 1 part.

3 : 2
3 x 18 : 2 x 18
£54 : £36

Multiply each side of the ratio by the value found in Step 2.

Step 4

£54 + £36 = £90 √

CHECK: add the answers to get back to the total.

Lauren received £54 and Sean received £36

Proportion

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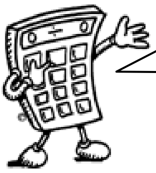


Two quantities are said to be in direct proportion if when one doubles the other doubles etc.
We can use proportion to solve problems.

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

Example 1
Level 3

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

We can change 30 into 90 if we multiply by 3. So, multiply 1500 by 3 also.

	Days	Cars	
	30	1500	
x3			x3
	90	**4500**	

The factory would produce 4500 cars in 90 days.

Example 2
Level 3

The Davidson's are off to France.
The exchange rate is 1.4 euros for a £1. How many euros do they get for £500?

	£	Euros	
	1	1.4	
x 500			x 500
	500	**700**	

They get 700 euros for £500

Example 3
Level 3

5 apples cost £2.25. How much do 8 apples cost?

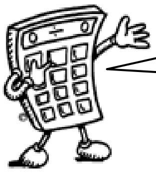
We can't change 5 directly into 8 but if we reduce 5 to 1 we can then find the cost of any amount of apples.

	Apples	Cost	
	5	2.25	
÷5			÷ 5
	1	**0.45**	
x 8			x 8
	8	**3.60**	

8 apples cost £3.60

Information Handling : Tables

contents page



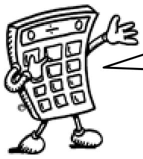
It is sometimes useful to display information in graphs, charts or tables.

Example 1
Level 2

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 collect and present data.
Often, but not always, the data is grouped into intervals.

Example 2
Level 2

Homework marks for Class 4B

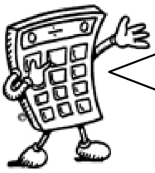
27 30 23 24 22 35 24 33 38 43 18 29 28 28 27
33 36 30 43 50 30 25 26 37 35 20 22 24 31 48

Mark	Tally	Frequency
16 - 20	||	2
21 - 25	𝍸 ||	7
26 - 30	𝍸 ||||	9
31 - 35	||||	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

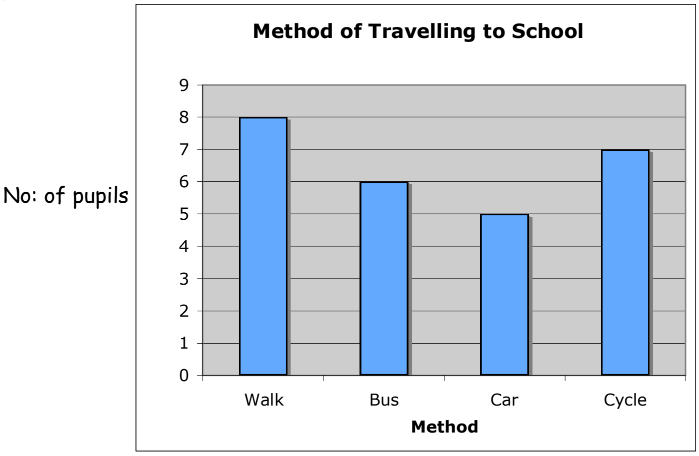
contents page



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 How do pupils travel to school?

Level 2

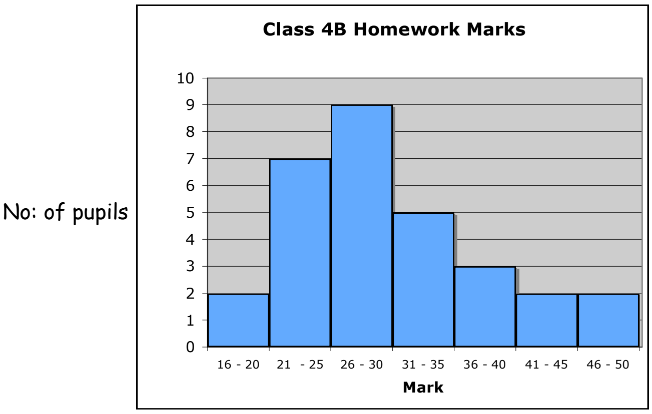


Histogram

When the horizontal axis shows categories, rather than grouped intervals, it is common practice to leave gaps, of equal size, between the bars. All bars should be of equal width. Numbers on the vertical axes should go up evenly.

Example 2 The graph below shows the homework marks for Class 4B.

Level 2



Bar graph

All bars should be of equal width.
Numbers on the vertical axes should go up evenly.

Information Handling : Line Graphs

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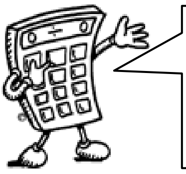
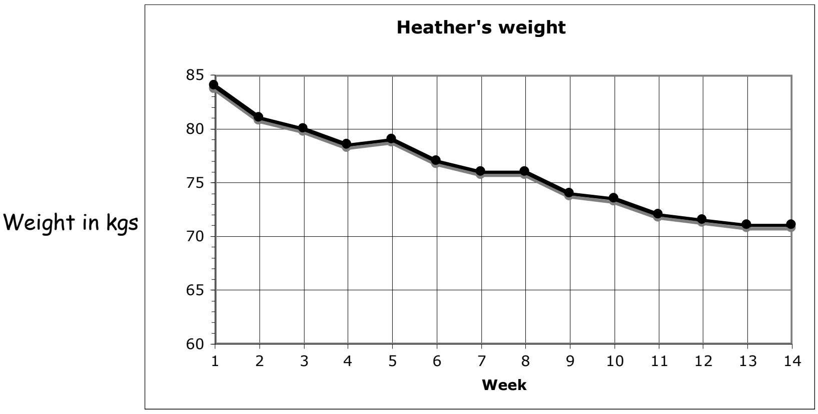


Line graphs consist of a series of points which are plotted, then joined by a line. All graphs should have a title, and each axis must be labelled. The trend of a graph is a general description of it.

Example 1
Level 2

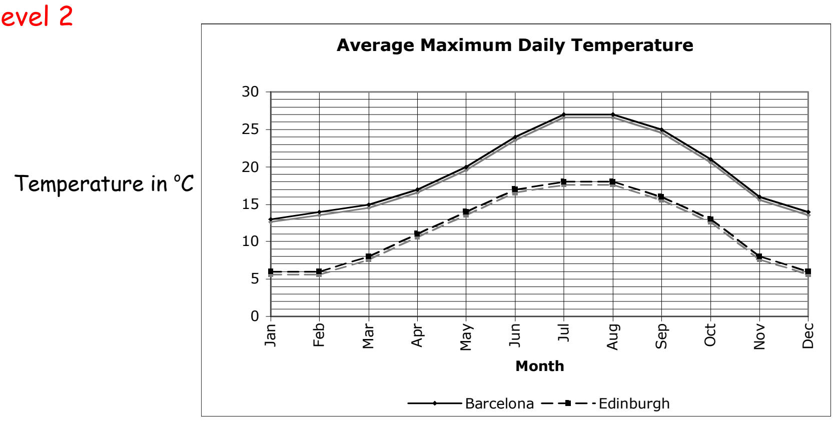
The graph below shows Heather's weight over 14 weeks as she follows an exercise programme.



The graph shows a decreasing trend.
Her weight has decreasing over the course of the 14 weeks.
Numbers on both axes should be spaced evenly.

Example 2
Level 2

Graph of temperatures in Edinburgh and Barcelona.



Numbers and/or categories on the axes should be spaced evenly.

Information Handling : Scatter Graphs

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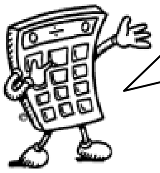


A scatter diagram is used to display the relationship between two variables.
A pattern may appear on the graph. This is called a **correlation**.

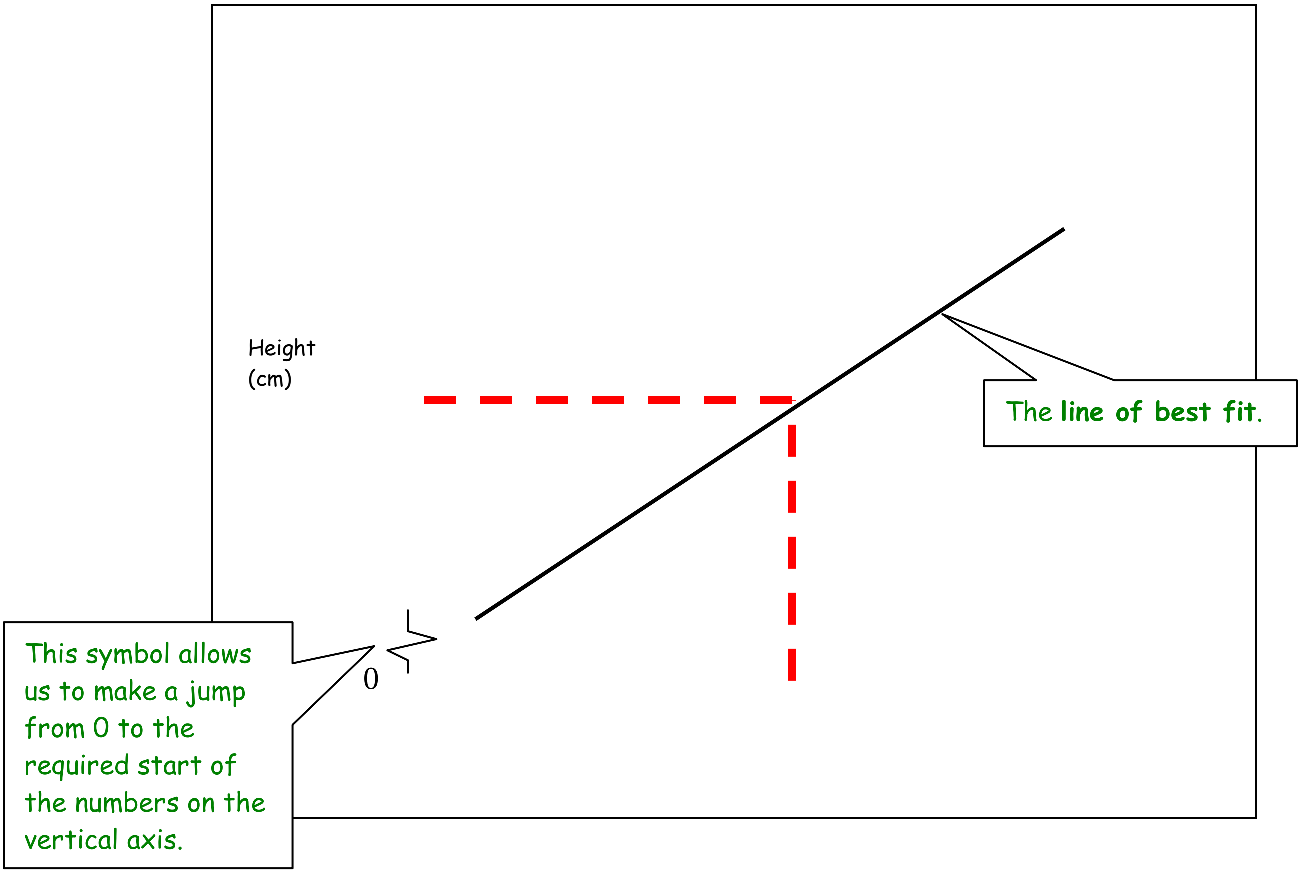
Example 1

Level 4 and beyond

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 positive (slopes up from left to right) trend.
As the arm span increases, the height also increases.
This graph shows a **positive correlation** between arm span and height.



The **line of best fit**.

This symbol allows us to make a jump from 0 to the required start of the numbers on the vertical axis.

The line of best fit 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

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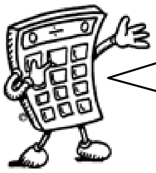
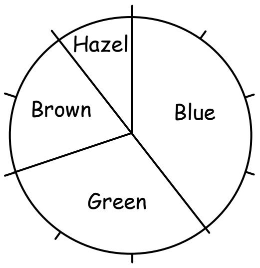


A pie chart can be used to display information. Each sector (slice) of the chart represents a different category. The size of each category can be worked out as a fraction of the total using the number of divisions or by measuring angles.

Example 1
Level 2

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

Eye colour of 30 S1 pupils



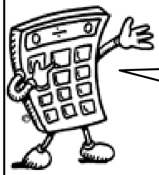
How many pupils had brown eyes?

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

$= \frac{30}{10} \times 2$

= 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.

Level 3

The angle in the brown sector is 72°.

so the fraction of pupils with brown eyes is $\frac{72}{360}$

$\frac{72}{360}$ of 30.

$= \frac{72}{360} \times 30$

= 6 pupils

If you find a number of pupils for each eye colour using the same method as above the total should be 30 pupils.

Information Handling : Pie Charts

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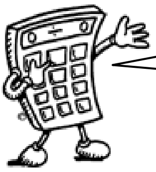
Drawing Pie Charts



On a pie chart, the size of the angle for each sector is calculated as a fraction of 360°.

Example 2
Level 3

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

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

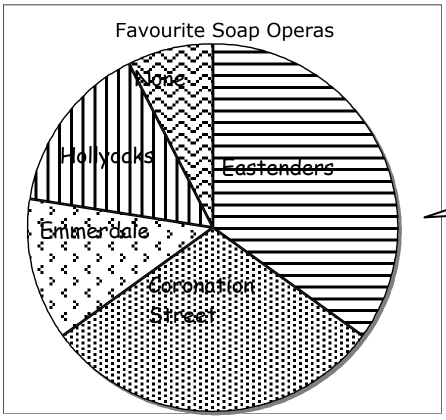
Emmerdale $= \frac{10}{80} \times 360^\circ = 45^\circ$

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

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

360°

Check that the total is 360° by adding up all the answers



Use a protractor to measure the angles you worked out remembering to label each sector or draw a key at the side.

Information Handling : Averages

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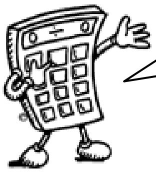

To provide information about a set of data, the average value may be given. There are 3 ways of finding the average value – the MEAN, the MEDIAN and the MODE.

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 we have middle pair of 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 1
Level 2

Class 1R2 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, 8, 10

MEAN

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

$$= \frac{102}{14}$$

$$= 7.28571\ ...$$

$$= 7.3\ \text{(1.d.p.)}$$

Level 3

MEDIAN - middle

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

$$\text{Median} = \frac{7+8}{2}$$

$$= \frac{15}{2} \quad = 7.5$$

This is a middle pair.
A single value would BE the median.
No calculation necessary.

MODE – most popular

8 is the most frequent mark, so Mode = 8

Range

Range = 10 – 4 = 6

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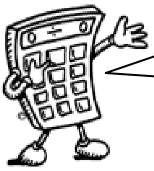
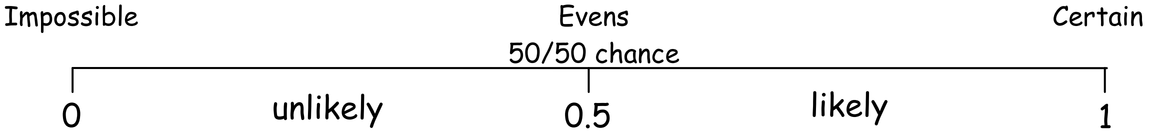
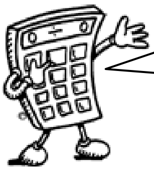
Probability



Probability is a measure of how likely or unlikely an event is of happening. It is measured on a scale of 0 (impossible) to 1 (certain).



Level 2



P(event) = $\frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$

Example 1 What is the probability of rolling a 4?

Level 3

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

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

(2, 4, 6)

Level 3

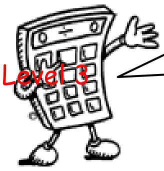
$P(\text{even number}) = \frac{3}{6} = \frac{1}{2}$

Example 3 What is the probability of rolling number greater than 2?

(3, 4, 5, 6)

Level 3

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



Level 3

Probabilities can be expressed as a FRACTION or a DECIMAL and even if we want as a percentage.

Example 4 What is the probability of a tail when you toss a coin?

Level 3

$P(\text{tail}) = \frac{1}{2} = 0.5$

When making choices we need to consider:

the element of risk,
the probability of the event happening and
the consequences of the event happening.

Probability

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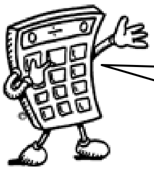

Expectation = P(event) × Number of trials

Example 5 If I were to roll a die 300 times. How many 5's should I expect to get?

Level 4

$P(5) = \frac{1}{6}$

$$\begin{aligned}\text{Expected number of 5's} &= \frac{1}{6} \times 300 \\ &= \frac{300}{6} \\ &= 50\end{aligned}$$

I should expect to roll a 5 fifty times.

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Mathematical Dictionary (Key words):

Term	Definition
Add; Addition (+)	To combine 2 or more numbers to get one number (called the sum or the total) Example: 12+76 = 88
a.m.	(ante meridiem) Any time in the morning (between midnight and 12 noon).
Approximate	An estimated answer, often obtained by rounding to nearest 10, 100 or decimal place.
Axis	
Calculate	Find the answer to a problem. It doesn't mean that you must use a calculator!
Data	A collection of information (may include facts, numbers or measurements).
Denominator	The bottom number in a fraction (the number of parts into which the whole is split).
Difference (-)	The answer to a subtraction calculation (amount between 2 numbers). Example: The difference between 50 and 36 is 14 50 – 36 = 14
Digit	A single number. The digits are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Discount	Amount of money you save on an item.
Division (÷)	Sharing a number into equal parts. 24 ÷ 6 = 4
Double	Multiply by 2.
Equals (=)	Makes or has the same amount as.
Equivalent fractions	Fractions which have the same value. Example $\frac{6}{12}$ and $\frac{1}{2}$ are equivalent fractions
Estimate	To make an approximate or rough answer, often by rounding.
Evaluate	To work out the answer.
Even	A number that is divisible by 2. Even numbers end with 0, 2, 4, 6 or 8.
Factor	A number which divides exactly into another number, leaving no remainder. Example: The factors of 15 are 1, 3, 5, 15.
Frequency	How often something happens. In a set of data, the number of times a number or category occurs.
Greater than (>)	Is bigger or more than. Example: 10 is greater than 6. 10 > 6
Gross Pay	The amount of money you earn before any deductions are taken.
Histogram	A bar chart for continuous numerical values.

Increase	An amount added on.
Least	The lowest number in a group (minimum).
Less than (<)	Is smaller or lower than. Example: 15 is less than 21. 15 < 21.
Maximum	The largest or highest number in a group.
Mean	The arithmetic average of a set of numbers (see p32)
Median	Another type of average - the middle number of an ordered set of data (see p32)
Minimum	The smallest or lowest number in a group.
Minus (-)	To subtract.
Mode	Another type of average – the most frequent number or category (see p32)
Most	The largest or highest number in a group (maximum).
Multiple	A number which can be divided by a particular number, leaving no remainder. Example Some of the multiples of 4 are 8, 16, 48, 72
Multiply (x)	To combine an amount a particular number of times. Example 6 x 4 = 24
Negative Number	A number less than zero. Shown by a minus sign. Example -5 is a negative number.
Numerator	The top number in a fraction.
Odd Number	A number which is not divisible by 2. Odd numbers end in 1 ,3 ,5 ,7 or 9.
Operations	The four basic operations are addition, subtraction, multiplication and division.
Order of operations	The order in which operations should be done. BODMAS (see p9)
Per annum	Per year.
Place value	The value of a digit dependent on its place in the number. Example: in the number 1573.4, the 5 has a place value of 100.
p.m.	(post meridiem) Any time in the afternoon or evening (between 12 noon and midnight).
Prime Number	A number that has exactly 2 factors (can only be divided by itself and 1). Note that 1 is not a prime number as it only has 1 factor.
Product	The answer when two numbers are multiplied together. Example: The product of 5 and 4 is 20.
Quotient	The answer to a divide calculation. Usually we also have a remainder
Remainder	The amount left over when dividing a number.
Share	To divide into equal groups.
Sum	The answer to an add calculation (Total of a group of numbers).
Total	The sum of a group of numbers (found by adding).