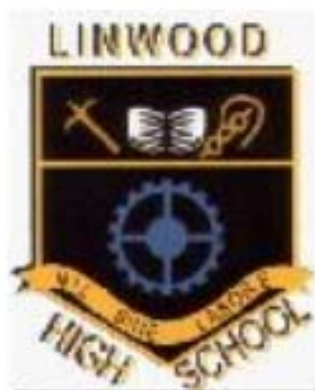
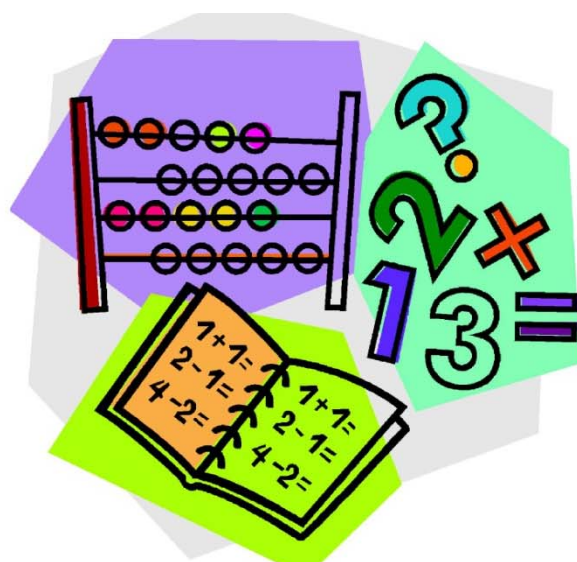


Linwood High School



Numeracy Across Learning



Numeracy Across Learning at Linwood High School

Numeracy is a proficiency which involves confidence and competence with numbers and measures. It is more than an ability to do basic arithmetic. It requires understanding of the number system, a repertoire of mathematical techniques and an inclination and ability to solve quantitative or spatial problems in a range of contexts. Numeracy also demands understanding of the ways in which data is gathered by counting and measuring and how it can be presented in graphs, diagrams, charts and tables.

It is the responsibility of all teaching staff in Linwood High to support and help deliver numeracy learning experiences and outcomes. As such, this guide, produced as a result of contributions from all subject departments, acts to ensure consistency of approach in Numeracy across the school.

The numeracy across learning experiences and outcomes are divided into 8 organisers and are detailed individually in this booklet.

The layout of the booklet is described below.

The experiences and outcomes are organised into level 2 (pink), level 3 (yellow) and level 4 (cyan).

Learning and teaching strategies used in the maths department are presented alongside examples.

Number and number processes

I have explored the range of whole numbers I can work with and having explored how decimal fractions are constructed, can explain the link between a digit, its place and its value. **MNU 2-03a**

Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others. **MNU 2-03a**

I have explored the contexts in which problems involving decimal fractions occur and can solve related problems using a variety of methods. **MNU 2-03b**

I can show my understanding of how the number line extends to include numbers less than zero and have investigated how these numbers occur and are used. **MNU 2-04a**

I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions. **MNU 3-03a**

I can continue to recall number facts quickly and use them accurately when making calculations. **MNU 3-03b**

I can use my understanding of numbers less than zero to solve simple problems in context. **MNU 3-04a**

Having recognised similarities between new problems and problems I have solved before, I can carry out the necessary calculations to solve problems set in unfamiliar contexts. **MNU 4-03a**

The number and number processes outcomes and experiences at levels 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
Maths	MNU 3-03a	S1	Addition, subtraction and multiplication of positive and negative numbers mentally and with a calculator
	MNU 3-03b	S1	Recall facts used in money and measurement
	MNU 3-04a	S1	Temperatures, dates and banking
	MNU 4-03a	S1	Example contexts provided
Biology	MNU 3-03a	S1	Percentages, averages, ratio
	MNU 4-03a	S2-S6	Protein solving
Chemistry	MNU 3-03b	S1-S6	Use of data book
	MNU 3-04a	S4-S6	Thermal expansion and relative density
Design and Technology	MNU 4-03a	S2-S3	Scale drawing
	MNU 3-03b	S1-S6	Recall number facts
History/Modern Studies	MNU 3-03a	S2-S6	Use of algebra to solve real world problems
	MNU 3-03b	S2-S6	Recall speed of sound and speed of light
Physics	MNU 3-03a	S1-S6	Discuss contexts to solve understanding

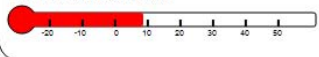
A list of which departments currently cover the experiences and outcomes are presented in a table.

Maths department support on number and number processes

Pupils should understand what order mathematical operations should be carried out. This is done using BODMAS

First B – brackets
O – orders (square and square roots)
D – division
M – multiplication
A – addition
Last S – subtraction

When discussing negative numbers, temperature is an excellent context to use as pupils are aware of negative temperatures. A thermometer can be drawn on the board to begin with before linking it to number lines and eventually to a wider range of contexts.



Additional resources on number and number processes

Worksheets, power points and video lectures on numerical processes.
<http://www.higlandclearning.org.uk/maths/7p-03a/node10>

Worksheets, power points and video lectures on negative numbers.
<http://www.higlandclearning.org.uk/maths/7p-03b/node10>

Worksheets, power points and video lectures on complex numerical processes.
<http://www.higlandclearning.org.uk/maths/7p-10a/node10>

Additional support for learning resources on number and number processes

When using number lines be aware that pupils may become confused if switching between horizontal and vertical lines. Lower ability pupils tend to find vertical number lines easier to understand.

Other departmental input on number and number processes

ASL and ICT support are provided to support personalisation and choice for the learners.

The 8 organisers which the Numeracy across Learning experiences and outcomes are divided into are:-

Estimation and rounding Page 4

Departments involved alongside Math's: Science, Biology, Chemistry, Physics Business Education, Computing, I.C.T., Geography, History, Modern Studies, HE, Music, Tech, P.E., S.f.L.

Number and number processes Page 6

Departments involved alongside Math's: English, Modern Languages, Science, Biology, Chemistry, Physics Business Education, I.C.T., Geography, History, Modern Studies, HE, Music, Tech, S.f.L.

Fractions, decimal fractions and percentages Page 9

Departments involved alongside Math's: Art, Science, Biology, Chemistry, Physics Business Education, Computing, I.C.T., Geography, History, Modern Studies, HE, Music, Tech, P.E., S.f.L.

Money Page 13

Departments involved alongside Math's: Modern Languages, Business Education, I.C.T., Geography, History, Modern Studies, HE, P.S.E., Tech, S.f.L.

Time Page 15

Departments involved alongside Math's: Modern Languages, Physics, Computing, Geography, History, Modern Studies, R.E., HE, Music, P.E., Tech, S.f.L.

Measurement Page 17

Departments involved alongside Math's: Art, Modern Languages, Science, Biology, Chemistry, Physics, Geography, HE, Music, Tech, P.E., S.f.L.

Data Handling and Analysis Page 19

Departments involved alongside Math's: English, Modern Languages, Science, Biology, Chemistry, Physics Business Education, I.C.T., Geography, History, Modern Studies, HE, Music, Tech, P.E., S.f.L.

Ideas and chance of uncertainty Page 23

Departments involved alongside Math's: Biology, Physics Geography, Music.

Within the 8 organisers details have been provided from subject departments as to when pupils are likely to cover particular topics. As classes in the math's department are set from S1-S3, pupils may encounter the experiences and outcomes at slightly different stages in their school career. The department will endeavour though, to ensure appropriate backup for other subjects as and when the need arises by providing examples of suitable teaching strategies in line with pupil experiences across the curriculum.

Appendix - Other Learning and Teaching Strategies in Mathematics Page 24

Estimation and Rounding

I can use my knowledge of rounding to routinely estimate the answer to a problem, then after calculating, decide if my answer is reasonable, sharing my solution with others. **MNU 2.01a**

I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem. **MNU 3.01a**

Having investigated the practical impact of inaccuracy and error, I can use my knowledge of tolerance when choosing the required degree of accuracy to make real life calculations. **MNU 4.01a**

The estimation and rounding outcomes and experiences at levels 2, 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
Math's	MNU 3-01a	S1-2	Rounding
	MNU 4-01a	S3	Rounding
Science	MNU 3-01a	S1-3	Rounding Percentages and averages
Biology	MNU 3-01a	S3	Rounding Percentages and averages
Business Education	MNU 3-01a	S2-6	Spreadsheets
Chemistry	MNU 3-01a	S3-6	Rounding final answers in calculations
	MNU 4-01a	S5-6	Errors in practical situations
Geography	MNU 3-01a	S1-6	Maps measuring river valley and rounding
	MNU 4-01a		Maps actual distance real life distance
History/Modern Studies	MNU 3-01a	S2-6	Analysing data on immigration, Rounding values for ease of remembering facts
Home Economics	MNU 3/4-01a	S1-2	Measuring ingredients in cookery lessons, Textile technology, Pizza Assignment
ICT	MNU 3-01a	S1 - 3	Spreadsheets
Physics	MNU 3-01a	S3-6	Rounding final answers in calculations
	MNU 4-01a	S5-6	Measurement uncertainties
Computing Science	MNU 4-01a	S3-6	Software Development (Programming)
Music	MNU 3-01a	S1-2	Instrumental Performance skills – estimating and counting patterns in music
Technical	MNU 3-01a	S1-2	Nesting Box, Key Tag, Mobile Phone Stand, pictorial Drawing
P.E.	MNU 3-01a	S1-2	Rounding up and down timed athletic events
S.f.L.	MNU 2/3-01a	S1-3	Rounding – focus on Life Skills

Mathematics Department Support on Estimation and Rounding

We expect pupils to

- at **Level 1** to round 3 digit whole numbers to the nearest 10
- at **Level 2** to round any number to the nearest whole number, 10 or 100
- at **Level 3** to round any number to 1 decimal place
- at **Level 4** to round to any number of decimal places or significant figures

Note: We always round up for 5 or above

WORKED EXAMPLES - Rounding:

Level 1

74 to the nearest 10 $\rightarrow 70$; 386 $\rightarrow 390$

Level 2

347.5 $\rightarrow 348$ (to nearest whole number); or $\rightarrow 350$ (to nearest ten); or $\rightarrow 300$ (to nearest hundred)

Level 3

7.51 (to 1 decimal place) $\rightarrow 7.5$; 8.997 (to 2 decimal places) $\rightarrow 9.00$

WORKED EXAMPLES - Estimating:

Level 2

You are calculating 107 times 56, and the calculator shows this:

952.00

Is that right?

"107 times 56 is a bit more more than 100 times 50, which is 5,000"

Ooops! You must have typed something wrong in fact you pressed 17×56 (you left out the zero), and **without estimating you could have made a really big mistake!**

Level 3

You want to buy five magazines that cost £1.95 each. When you go to buy them the cost is £12.25. Is that right?

"five at £1.95 each is about 5 times 2, or about £10" so £12.25 **seems too much!**

Number and Number Processes

I have extended the range of whole numbers I can work with and having explored how decimal fractions are constructed, can explain the link between a digit, its place and its value. **MNU 2-02a**

Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others. **MNU 2-03a**

I have explored the contexts in which problems involving decimal fractions occur and can solve related problems using a variety of methods. **MNU 2-03b**

I can show my understanding of how the number line extends to include numbers less than zero and have investigated how these numbers occur and are used. **MNU 2-04a**

I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions. **MNU 3-03a**

I can continue to recall number facts quickly and use them accurately when making calculations. **MNU 3-03b**

I can use my understanding of numbers less than zero to solve simple problems in context. **MNU 3-04a**

Having recognised similarities between new problems and problems I have solved before, I can carry out the necessary calculations to solve problems set in unfamiliar contexts. **MNU 4-03a**

The number and number processes outcomes and experiences at levels 1,2, 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
Math's	MNU 3-03a	S1	Add, subt and mult of positive and negative no.'s
	MNU 3-03b	S1	Recall facts used in money and measurement
	MNU 3-04a	S1	Temperatures, dates and banking
	MNU 4.03a	S1	Problems in contexts familiar/unfamiliar
English	MNU 1-02a	S1-6	Ordinal numbers in linguistic usage
Mod Languages	MNU 1-02a	S1-6	Ordinal numbers in linguistic usage
	MNU 2/3-04a	S1-6	Temperatures, dates and banking
Science	MNU 3-03a	S1-2	Percentages , averages, ratio
	MNU 4-03a	S1-2	Obscure contexts to prove understanding
Biology	MNU 3-03a	S3-6	Percentages , averages, ratio
	MNU 4-03a	S3-6	Problem solving
	MNU 3-03b	S3-6	Use of data book.
Chemistry	MNU 3-04a	S3-6	Valency -> formulae
	MNU 4-03a	S4-6	Calculations out of context
Technical	MNU 3-03a	S1-2	Trinket box, Shoe Horn, Bridges, Ball Game Box, Toothbrush Holder
Geography	MNU 3-04a	S3	Interpretation of climate graphs
History	MNU 3-03b	S1-6	Recall number facts
Modern Studies	MNU 2/3-03a	S1-6	Interpreting data differences , money data
Home Economics	MNU 3/4-03a	S1-2	Textile Project, Pizza Assignment, Game Design
	MNU 3-03b	S1-2	Quantities for recipes, Eat Well guidance
Physics	MNU 3-03a	S3-6	Use of algebra to solve real world problems
	MNU 3-03b	S3-6	Recall speed of sound and speed of light
	MNU 4-03a	S3-6	Obscure contexts to prove understanding
Business & ICT	MNU 3-03a	S1-6	Spreadsheets
Music	MNU 3-03a	S1	Rhythm , Performing ,Listening, Media– symbols, beats, rhythm patterns with numerical answers
Music	MNU 3-03b	S1	Ringtones Composition - graphic score grid map + decipher symbols
S.f.L.	MNU 2/3-03a	S1-3	Reinforcing all of above

Mathematics Department Support on Number and Number Processes

Subtraction

From **Level 1** onwards we do....

- subtraction using decomposition (as a written method)
- check by addition
- promote alternative mental methods where appropriate

WORKED EXAMPLES

- Decomposition:

$$\begin{array}{r} 6 \\ 27^{11} \\ \underline{38} \\ 233 \end{array}$$

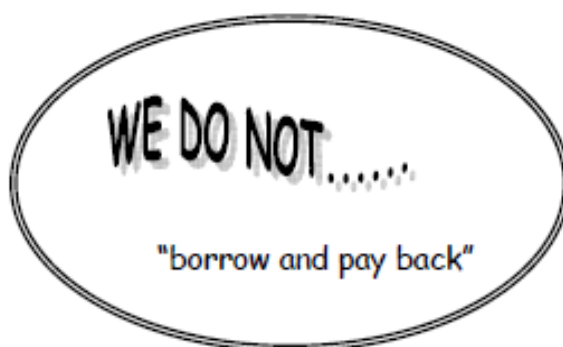
$$\begin{array}{r} 39 \\ 40^{10} \\ \underline{74} \\ 326 \end{array}$$

- Counting on:

To solve $41 - 27$, count on from 27 until you reach 41

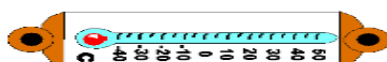
- Breaking up the number being subtracted:

e.g. To solve $41 - 27$, subtract 20 then subtract 7



Negative Numbers

When discussing negative numbers pupils understand the concept better if set in the context of temperature



Mathematics Department Support on Number and Number Processes

Order of operations

BODMAS is the mnemonic which we teach in maths to enable pupils to know exactly the right sequence for carrying out mathematical operations.

Scientific calculators use this rule to know which answer to calculate when given a string of numbers to add, subtract, multiply, divide etc.

For example

What do you think the answer to $2 + 3 \times 5$ is?

Is it $(2 + 3) \times 5 = 5 \times 5 = 25$? or $2 + (3 \times 5) = 2 + 15 = 17$?

We use BODMAS to give the correct answer.:

(B)rackets (O)rder (D)ivision (M)ultiplication (A)ddition (S)ubtraction

According to BODMAS, multiplication should always be done before addition, therefore 17 is the correct answer according to BODMAS and should also be the answer which your calculator will give if you type in $2 + 3 \times 5$ <enter>.

Order means a number raised to a power such as 2^2 or $(-3)^3$.

Worked example

Calculate $4 + 70 \div 10 \times (1 + 2)^2 - 1$ according to the BODMAS rules.

Brackets gives $4 + 70 \div 10 \times (3)^2 - 1$

Order gives $4 + 70 \div 10 \times 9 - 1$

Division gives $4 + 7 \times 9 - 1$

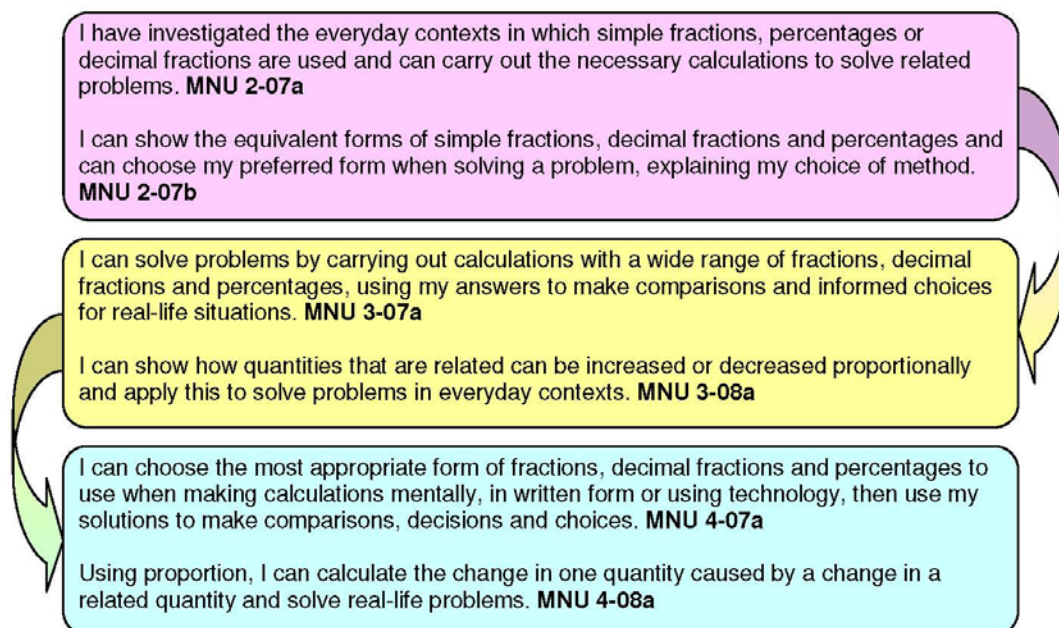
Multiplication gives $4 + 63 - 1$

Addition gives $67 - 1$

Subtraction gives 66

Answer 66

Fractions, Decimal Fractions and Percentages



The fractions, decimal fractions and percentages outcomes and experiences at levels 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
	MNU 3-07a	S1	Decimals, fractions and percentages
Math's	MNU 3-08a	S1-3	Rates and ratios
	MNU 4-07a	S1	Linking decimals, fractions and percentages
	MNU 4-08a	S1-2	Proportion and inverse proportion
Art	MNU 3-08a	S1-6	Scaling and proportion, repetition of patterns
Science	MNU 3/4-08a	S1-2	Everyday Chemical contexts & Graphing results
Biology	MNU 3-07a	S3-6	Genetics
	MNU 4-08a	S3-6	Graphing results
Business Ed.	MNU 3-07a	S2-6	Calculations in spreadsheets.
	MNU 3-08a	S2-6	Calculations in spreadsheets
	MNU 3-07a	S3-6	Chemical calculations - atomic mass, % composition, % yield, radioactivity
Chemistry	MNU 3-08a	S3-6	Ratio for chemical formulae, general formulae
	MNU 4-07a	S3-6	Chemical calculations – moles, titrations
	MNU 4-08a	S3-6	Manipulative chemical calculations
Geography	MNU 4-08a	S2-6	Development indicators and proportion E.g. (% of population illiterate)
Modern Studies	MNU 3-07a	S2-6	%, fractions of amounts in data
Home Economics	MNU 3/4-07a	S1-2	Textile manufacture, Consumer Investigations, Pizza Assignment, Eat Well guidance
	MNU 3/4-08a	S4-6	Quantities for recipes, Eat Well guidance
PE	MNU 3-07a	S1-6	Heart rate training zones
	MNU 3-08a	S1-6	Heart rate training zones
Physics	MNU 3-07a	S3-6	Voltage dividers and efficiency of systems
Computing Science	MNU 3-07a	S1-6	Spreadsheets & Programming
Music	MNU 3-07a	S1	Space Unit Composition use of timeline to 2 d.p. Listening - use addition and subtraction skills involving fractions of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$.
Music	MNU 3-07a	S2	Ejay – Composition, Sibelius Technology – BPM & tempo marking, use addition and subtraction skills involving fractions of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$. using ICT
Music	MNU 3-08a	S1	Ringtones - repeated melodic patterns with same number of notes of differing durations
S.f.L.	MNU 2/3-07a	S1-3	Displays + Reinforcing across curriculum

Mathematics Department Support on Fractions, Decimals and Percentages

Fractions

At **Level 1** we expect pupils to do very simple fractions of 1 or 2 digit numbers e.g.

$$\frac{1}{2} \text{ of } 46 \quad (46 \div 2), \quad \frac{1}{4} \text{ of } 32 \quad (32 \div 4)$$

At **Level 2** we expect pupils to do fractions of up to 4 digit numbers e.g

$$\frac{3}{5} \text{ of } £475 \quad (£475 \div 5 \times 3),$$

At **Level 3** we:-

- use equivalence of widely used fractions and decimals e.g. $\frac{3}{10} = 0.3$
- find widely used fractions mentally
- find fractions of a quantity with a calculator

At **Level 4** we:-

use equivalence of all fractions, decimals and percentages
add, subtract, multiply and divide fractions with and without a calculator

WORKED EXAMPLES

Add and Subtract	Multiply	Divide
Make the denominators equal	Multiply top and multiply bottom	Invert the second fraction and multiply
$\begin{array}{r} \frac{1}{2} + \frac{1}{3} \\ = \frac{3}{6} + \frac{2}{6} \\ = \frac{5}{6} \end{array}$	$\begin{array}{r} \frac{2}{3} \times \frac{3}{4} \\ = \frac{6}{12} \\ = \frac{1}{2} \end{array}$	$\begin{array}{r} \frac{3}{4} \div \frac{2}{5} \\ = \frac{3}{4} \times \frac{5}{2} \\ = \frac{15}{8} = 1\frac{7}{8} \end{array}$

Mathematics Department Support on Fractions, Decimals and Percentages

Percentages

- At Level 2 we expect pupils to find 50%, 25%, 10% and 1% without a calculator and use addition and multiples to find other amounts
- At Level 3 find % ages on calculator using decimal equivalents
 - e.g. 23% of £300 = $0.23 \times 300 = £69$and recognise that "of" means multiply
- At Level 3/4 we expect pupils to
Express a fraction as a percentage via the decimal equivalent

WORKED EXAMPLES

- Find 36% of £250
10% is £25
30% is £75 ($\times 3$)
5% is £12.50 ($10\% \div 2$)
1% is £ 2.50 ($10\% \div 10$)
36% is **£90** ($30\% + 5\% + 1\%$)
- Express two fifths as a percentage

$$\frac{2}{5} = \frac{4}{10} = \frac{40}{100} = 40\%$$

- You buy a car for £5000 and sell it for £3500 what is the percentage loss?

$$\text{Loss} = £5000 - £3500 = £1500$$

$$\frac{1500}{5000} = \frac{15}{50} = \frac{30}{100} = 30\%$$

- Increase £350 by 18%

$$18\% \text{ of } 350 = 0.18 \times 350 = £63.00 \quad (\text{..... to find the increase})$$

$$(\text{then add on for the new total}) £350 + £63.00 = £413.00$$

WE DO NOT

..... use the % button on the calculator because of inconsistencies between models

Proportion

At level 4/4 we expect pupils to

- identify direct and inverse proportion
- record appropriate "headings" with the unknown on the right
- use the unitary method (i.e. find the value of 'one' first then multiply by the required value)
- if rounding is required we do not round until the last stage

WORKED EXAMPLES:

A. Direct Unitary Method

If 5 bananas cost 80 pence, then what do 3 bananas cost?

bananas	cost (pence)
5 →	80
1 → (less)	$80 \div 5 = 16$
3 → (more)	$16 \times 3 = 48$

B. Inverse Unitary Method

The journey time at 60 km/h = 30 minutes, so what is the journey time at 50km/h?

Speed (km/h)	Time (mins)
60 →	30
1 → (more)	$30 \times 60 = 1800$ minutes
50 → (less)	$1800 \div 50 = 36$ minutes

Money

I can manage money, compare costs from different retailers, and determine what I can afford to buy. **MNU 2-09a**

I understand the costs, benefits and risks of using bank cards to purchase goods or obtain cash and realise that budgeting is important. **MNU 2-09b**

I can use the terms profit and loss in buying and selling activities and can make simple calculations for this. **MNU 2-09c**

When considering how to spend my money, I can source, compare and contrast different contracts and services, discuss their advantages and disadvantages, and explain which offer best value to me. **MNU 3-09a**

I can budget effectively, making use of technology and other methods, to manage money and plan for future expenses. **MNU 3-09b**

I can discuss and illustrate the facts I need to consider when determining what I can afford, in order to manage credit and debt and lead a responsible lifestyle. **MNU 4-09a**

I can source information on earnings and deductions and use it when making calculations to determine net income. **MNU 4-09b**

I can research, compare and contrast a range of personal finance products and, after making calculations, explain my preferred choices. **MNU 4-09c**

The money outcomes and experiences at levels 2, 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
	MNU 3-09a	S1-3	Shopping and banking
	MNU 3-09b	S1-3	RBS Moneysense
Math's	MNU 4-09a	S1	Loans, higher purchase and wages
	MNU 4-09b	S2	Wages and income
	MNU 4-09c	S2	Insurance, higher purchase and foreign exchange
Mod languages	MNU 2/3/4-09a	S1-6	Shopping and banking, value for money, foreign exch
Business education	MNU 3-09a	S2-6	Spreadsheet analysis
	MNU 3-09b	S4-6	Spreadsheet analysis
	MNU 4-09a	S2-6	Spreadsheet formulae
Geography	MNU 3-09b	S1	Making money (paper bag game)(India-Shanty)
	MNU 4-09a	S2	Coastal defense costing
	MNU 4-09a	S3-4	Trade, trade deficits and trade surpluses
Modern Studies	MNU 3-09a	S3-6	Appreciation of government spending, budgets
Home Economics	MNU 3-09a	S1-3	Are You a Wise Consumer, Product evaluation Project
ICT	MNU 3-09b	S1 -3	Spreadsheets
P.S.E	MNU 3-.09 a	S1-6	Financial education/Money Management
	MNU 3-09 b	S1-6	Financial education/Money Management
ICT Faculty	MNU 3-09 a	S5-6	Financial Education (Personal Finance)
	MNU 3-09 b	S5-6	Financial Education (Personal Finance)
Technical	MNU 3-09a	S1-2	Nesting box, Key Tag, Pictorial Drawing
	MNU 3-09b	S1-2	Nesting box
S.f.L.	MNU 2/3-09a/b	S3-4	Asdan Modules – practical applications
	MNU 3-09a/b	S2	Planning foreign trip project

Mathematics Department Support on Money

Many of the other examples given in this booklet use money as a context, as such, won't be repeated.

The following websites from major banks and financial institutions give further examples of good practice – too many to illustrate on this page.

<http://www.nationwideeducation.co.uk/www/index.php#>

<http://www.barclaysmoneyskills.com/>

<http://www.addinguptolifetime.org.uk>

<http://rbsmoneysense.co.uk/schools/schools>

<http://www.pfeg.org/>



Time

I can use and interpret electronic and paper-based timetables and schedules to plan events and activities, and make time calculations as part of my planning. **MNU 2-10a**

I can carry out practical tasks and investigations involving timed events and can explain which unit of time would be most appropriate to use. **MNU 2-10b**

Using simple time periods, I can give a good estimate of how long a journey should take, based on my knowledge of the link between time, speed and distance. **MNU 2-10c**

Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance. **MNU 3-10a**

I can research, compare and contrast aspects of time and time management as they impact on me. **MNU 4-10a**

I can use the link between time, speed and distance to carry out related calculations. **MNU 4-10b**

The time outcomes and experiences at levels 2, 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
Math's	MNU 3-10a	S1-3	Time spans from hundredths of a second to years
	MNU 4-10a	S1-2	Small time intervals
Mod Languages	MNU 3-10a	S1-3	Timetables and planning a journey
Geography	MNU 4-10b	S3	Calculating river speed
Home economics	MNU 4-10a	S1-6	Time management for recipes
Physics	MNU 3-10a	S3-6	Speed, distance and time calculations
	MNU 4-10b	S3-6	Speed, distance and time calculations
R.E.	MNU 2-10a	S1-3	Biblical Time spans - A.D./B.C. Age of the universe
Computing	MNU 4-10b	S3-6	Programming Tasks
Music	MNU 3-10a	S1-2	Space Unit & Expression/Moods Composition – timelines, Scottish Topic - calculate the duration of pieces by multiplying bars
History	MNU 2-10a	S1-4	Historical Time Spans , Time proximity of sources
Modern Studies	MNU 2-10a	S1-4	Time Spans for recent events
Technical	MNU 3-10a	S2	Mobile Phone Stand, Pictorial Drawing
	MNU 4-10a	S1	Nesting Box, Key Tag
P.E.	MNU 2.10b	S1-2	Timed athletic events
S.f.L.	MNU 2/3-10a	S1-3	Reinforcing all of above

Mathematics Department Support on Time

We expect pupils at Level 2/3 to

- Convert between 12 and 24 hour clock (2327 = 11:27pm).
- Calculate the duration in hours and minutes by counting up to the next hour then on to the required time.
- Convert between hours and minutes (multiply by 60 for hours into minutes)

Worked Example

Level 2/3

How long is it from 0755 to 0948

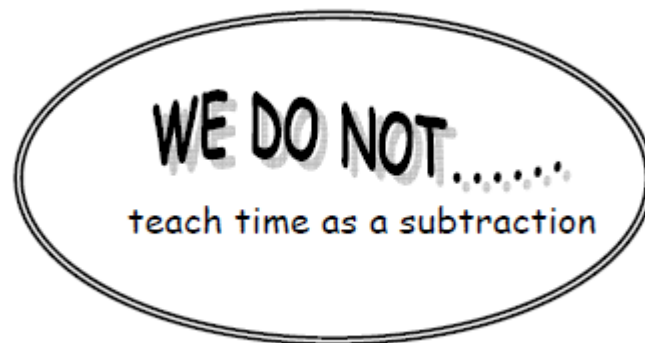
$$\begin{array}{ccccccc} 0755 & \rightarrow & 0800 & \rightarrow & 0900 & \rightarrow & 0948 \\ & & 5\text{mins} & + & 1\text{hour} & + & 48\text{ mins} \end{array}$$

Total time 1 hr 53 minutes

Level 4

Convert 27minutes in to hours equivalent

$$27 \text{ min} = 27 \div 60 = 0.45 \text{ hours}$$



Measurement

I can use my knowledge of the sizes of familiar objects or places to assist me when making an estimate of measure. **MNU 2-11a**

I can use the common units of measure, convert between related units of the metric system and carry out calculations when solving problems. **MNU 2-11b**

I can explain how different methods can be used to find the perimeter and area of a simple 2D shape or volume of a simple 3D object. **MNU 2-11c**

I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the task and using a formula to calculate area or volume when required. **MNU 3-11a**

I can apply my knowledge and understanding of measure to everyday problems and tasks and appreciate the practical importance of accuracy when making calculations. **MNU 4-11a**

The measurement outcomes and experiences at levels 2, 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
Math's	MNU 3-11a	S1	Perimeters, areas and volumes of 2-D and 3D shapes
	MNU 4-11a	S1	Length, area and scale drawings
Mod Languages	MNU 2-11a	S1-6	Shopping for food quantities
Science	MNU 3/4-11a	S1-2	Experimental work
Biology	MNU 4-11a	S3-6	Experimental work
Chemistry	MNU 3-11a	S3-6	Rates of reaction mass, volume, time
	MNU 4-11a	S3-6	Experimental measurement
Technical	MNU 3-11a	S1-2	Trinket Box , Nesting Box, Key Tag, Shoe Horn, Bridges, Orthographic Drawing, Sketch and Draw, Ball Game Box, Mobile Phone Stand, Toothbrush Holder, Pictorial Drawing
	MNU 3-11b	S2	Ball Game Box, Toothbrush Holder,
Geography	MNU 3-11a	S1	Measuring and calculating scale on a map.
Home Economics	MNU 3/4-11a	S1-6	Measuring for recipes, Eat Well Guidance
Physics	MNU 3-11a	S2-6	Areas and volumes of shapes
	MNU 4-11a	S1-6	Experimental measurement and uncertainties
P.E.	MNU 2-11a	S1-6	Measuring heights and distances for field events
Music	MNU 3-11a	S1-2	Instrumental Performance Skills, Music Ace – ICT listening, Sound Engineering, Scottish topic - identify and count the time and space for performing, tempo markings, identify errors in timing, speed of rest.
Art	MNU 3/4-11a	S1-6	Be able to measure and convert readily cm to mm and vice versa for drawings and design
S.f.L.	MNU 2-11a/b/c	S1-3	ASDAN – Measuring Food Ingredients, Calculating Costs Life Skills

Mathematics Department Support on Measurement

We expect pupils to

- At **Level 1** to estimate length, weight, volume in cm^3 , kg, litres
 - length of pencil = 10cm
- At **Level 2** to convert between units of measurement
 - e.g. bag of sugar = 1kg = 1000g
- At **Level 3** to choose most appropriate units and accuracy.
 - e.g. diameter of 1p = 15mm
 - area of a blackboard = 4m^2

Some Reminders

Length

1 cm = 10 mm, 1 m = 100 cm, 1m = 1000mm, 1km = 1000m

Volume

1 litre = 1000 cm^3 1 litre = 1000ml 1 m^3 = 1000 litres

Mass (sometimes wrongly referred to in maths as weight)

1kg = 1000g 1 tonne = 1000kg

Handling Data and Analysis

Having discussed the variety of ways and range of media used to present data, I can interpret and draw conclusions from the information displayed, recognising that the presentation may be misleading. **MNU 2-20a**

I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way. **MNU 2-20b**

I can work collaboratively, making appropriate use of technology, to source information presented in a range of ways, interpret what it conveys and discuss whether I believe the information to be robust, vague or misleading. **MNU 3-20a**

I can evaluate and interpret raw and graphical data using a variety of methods, comment on relationships I observe within the data and communicate my findings to others. **MNU 4-20a**

The Handling Data and Analysis outcomes and experiences at levels 2, 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
Math's	MNU 3-20a	S1	Analysis of databases, diagrams, graphs and statistical information.
	MNU 4-20a	S1-2	Analysis of statistics
Science	MNU 3/4-20a	S2-6	Analysis of graphs and drawing conclusions
Biology	MNU 4-20a	S3-6	Analysis of graphs and drawing conclusions
Business	MNU 3-20a	S2-6	Analysis of spreadsheets and graphs
education	MNU 4-20a	S4-6	Analysis of spreadsheets and graphs
Chemistry	MNU 3/4-20a	S3-6	Evaluating graphs and drawing conclusions
English	MNU 3-20a	S2-6	Discursive essay research
	MNU 4-20a	S2-6	Discursive essay research
Geography	MNU 3-20a	S2-3	Weather and Countries, Traffic Flow, GDP and life expectancy. Processing Stats and figures. Processing techniques
	MNU 4-20a	S2-6	Weather and countries, Climate, Traffic Flow Drawing graphs Charts etc, processing information, appropriate ways of illustrating and displaying data
History	MNU 3 / 4-20a	S1-6	Evaluating historical sources – potato famine, WW1, WW2
Modern Studs	MNU 3 / 4-20a	S4-6	Analysing source information from graphs tables and spreadsheets– poverty, wealth, government expenditure, voting patterns
ICT / Comp /Info Sys	MNU 4-20a	S1-6	D'base / Spreadsheet charting
Home Economics	MNU 3/4-20a	S1-3	Are You a Wise Consumer, Food for Life Project
P.E.	MNU 4-20a	S4-6	Analysis and comparison of gathered results
Physics	MNU 3-20a	S1-6	Analysis of data in wide variety of contexts
	MNU 4-20a	S1-6	Analysis of graphs and drawing conclusions
Music	MNU 3-20a	S1-2	Rhythm Unit , Music Ace, Expression/Moods, Performing, Sound Engineering - draw patterns and sequences of musical notation, interpret information on screen, analysis and judgement of the text, notation and symbols
S.f.L.	MNU 2-20a/b	S1-3	ASDAN – Conducting a Survey

Mathematics Department Support on Handling Data and Analysis

Line Graphs

At level 2 we expect pupils to

- use a sharp pencil and ruler
- choose an appropriate scale for axes to fit the paper
- label the axes
- give the graph a title
- number the lines not the spaces
- plot the points neatly (using a + sign)
- fit a suitable line

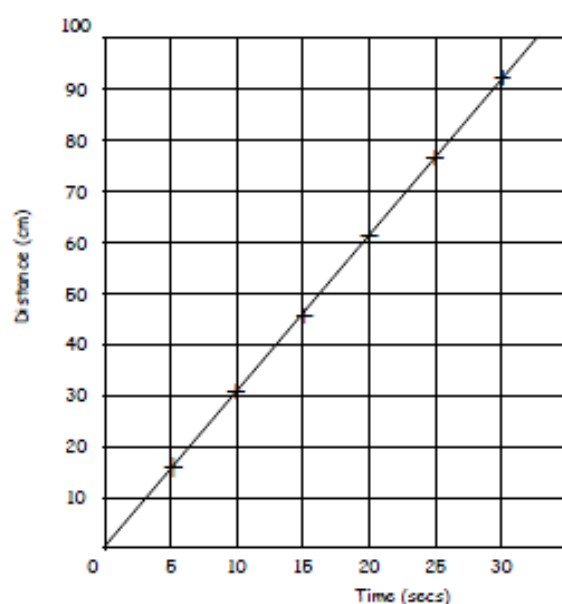
At level 3/4 we expect pupils to

- if necessary make use of a jagged line to show that the lower part of a scale has been omitted
- use spreadsheet software to produce line graphs

WORKED EXAMPLES: The distance a fluid travels over time has been recorded in the table below:

Time (s)	0	5	10	15	20	25	30
Distance (cm)	0	15	30	45	60	75	90

Distance travelled by a fluid over time



Mathematics Department Support on Handling Data and Analysis

Bar Graphs

We expect pupils to

- use a sharp pencil and ruler
- choose an appropriate scale for axes to fit the paper
- label the axes
- give the graph a title
- label the frequency (usually vertical axis) on the lines not the spaces
- label the bars in the centre of the bar (each bar has an equal width)
- make sure there are consistent spaces or no spaces between bars

At **level 1/2** we expect pupils to construct bar graphs with frequencies in graduated multiple units using $\frac{1}{2}$ cm or cm squared paper.

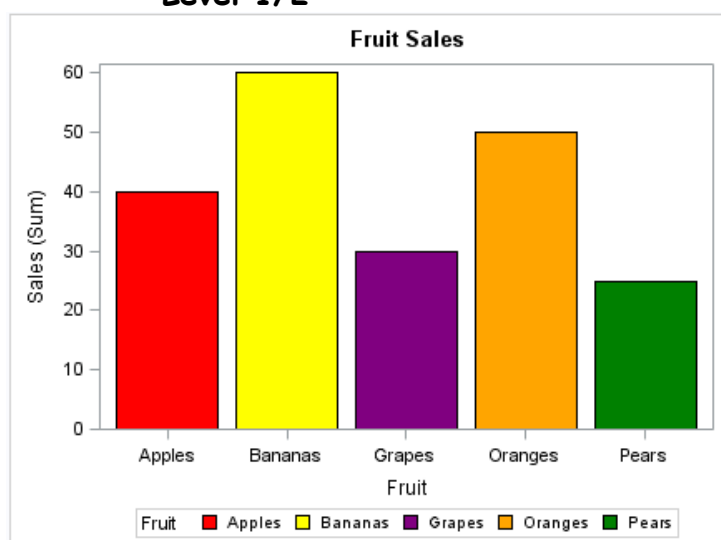
At **level 2/3** we expect pupils to

- construct (compound) bar graphs with frequencies in fraction or decimal scaling using $\frac{1}{2}$ squared paper or 1/2 mm graph paper.
- use spreadsheet software to produce bar graphs

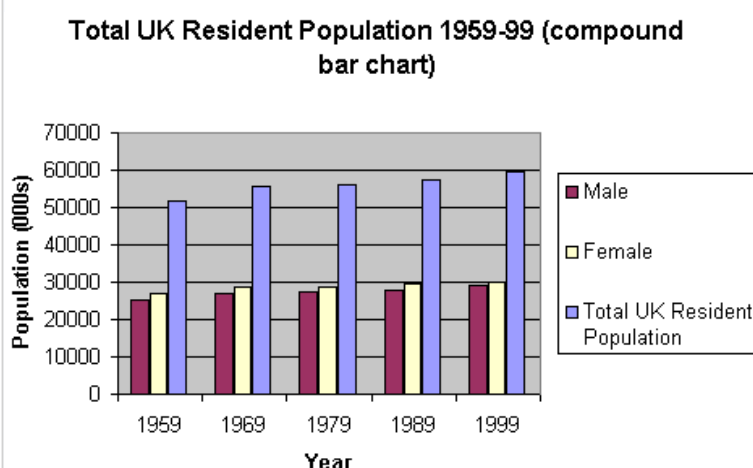
We do not confuse bar graph with histogram, which is area dependant.

Worked Examples

Level 1/2



Level 2/3



Mathematics Department Support on Handling Data and Analysis

Pie Charts

We expect pupils to

- use a sharp pencil and ruler
- label all the slices or insert a key as required
- give the pie chart a title

At **level 2** we expect pupils to construct pie charts using simple fractions or decimals

At **level 3** we expect pupils to construct pie charts with data expressed in percentages

At **level 2/3** we expect pupils to use spreadsheet software to produce pie charts

At **level 4** we expect pupils to construct pie charts using raw data

Worked Examples

Level 3

30% of pupils travel to school by bus, 10% by car, 55% walk and 5% cycle.

Draw a pie chart of the data.

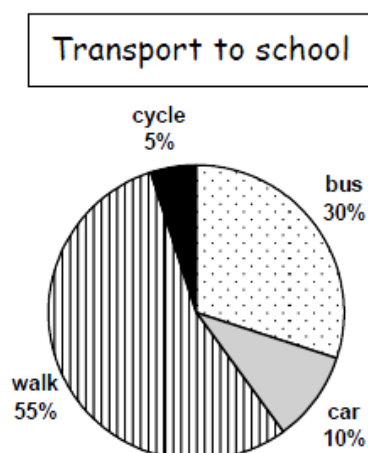
$$10\% \text{ of } 360^\circ = 36^\circ$$

$$\text{Bus } 30\% = 3 \times 10\% = 108^\circ$$

$$\text{Car } 10\% = 1 \times 10\% = 36^\circ$$

$$\text{Walk } 55\% = 5.5 \times 10\% = 198^\circ$$

$$\text{Cycle } 5\% = 0.5 \times 36\% = 18^\circ$$



Level 4

20 pupils were asked "What is your favourite subject?"

Replies were Maths 5, English 6, Science 7, Art 2

Draw a pie chart of the data.

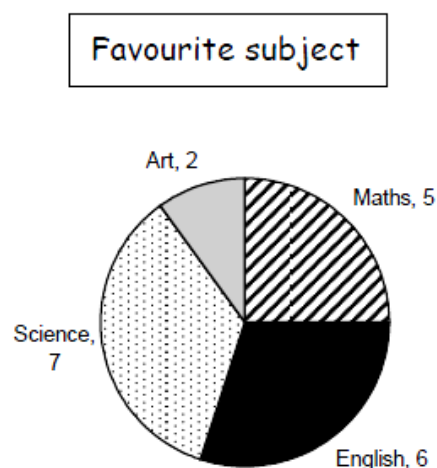
$$360 \div 20 (\text{the total}) = 18^\circ$$

$$\text{Maths } 5 \quad 5 \times 18 = 90^\circ$$

$$\text{English } 6 \quad 6 \times 18 = 108^\circ$$

$$\text{Science } 7 \quad 7 \times 18 = 126^\circ$$

$$\text{Art } 2 \quad 2 \times 18 = 36^\circ$$



Ideas of Chance and Uncertainty

I can conduct simple experiments involving chance and communicate my predictions and findings using the vocabulary of probability. **MNU 2-22a**

I can find the probability of a simple event happening and explain why the consequences of the event, as well as its probability, should be considered when making choices. **MNU 3-22a**

By applying my understanding of probability, I can determine how many times I expect an event to occur, and use this information to make predictions, risk assessment, informed choices and decisions. **MNU 4-22a**

The ideas of chance and uncertainty outcomes and experiences at levels 3 and 4 are currently being delivered by the following departments.

Department	Outcome	Stage	Context
Math's	MNU 3-22a	S1-2	Probability
	MNU 4-22a	S1-2	Probability
Biology	MNU 4-22a	S3-6	Genetics
Geography	MNU 3-22a	S2-3	Earthquakes
	MNU 4-22a	S3	Weather patterns
Physics	MNU 4-22a	S3 -6	Radioactivity and decay probability
Music	MNU 3-22a	S1-2	Graphic Score, Space Unit, Instrument Recordings - in compositions there will always be some uncertainty as to how our group members will play their part - adapt

Chance and Uncertainty

At level 1/2 we expect pupils to understand:-

- concepts such as likely, probable, unlikely, certain, never; possible, impossible and using the vocabulary in everyday life.
- equal chance, fifty-fifty
- one in two, two in three

At level 2/3 we expect pupils to understand:-

- percentage chance
- how the implications of chance are used in daily routines, decision making and the media
- the probability scale 0 - 1 in simple experiments
- the probability of an event not happening is 1 minus the probability of it occurring

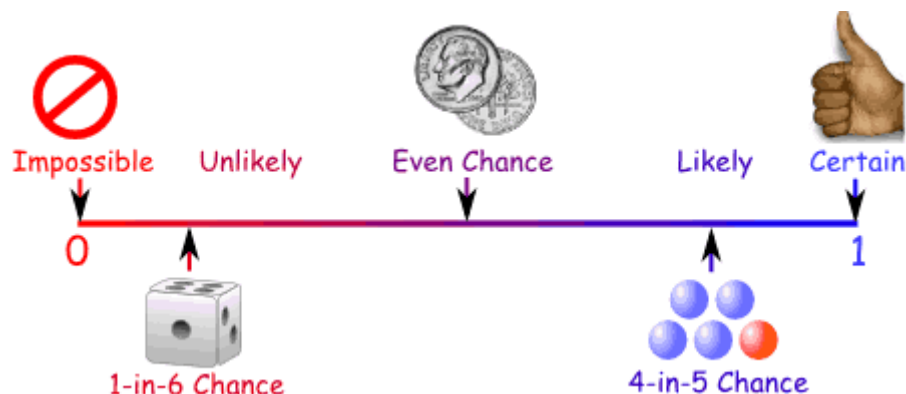
At level 4 we expect pupils to understand:-

- the link between the frequency of an event occurring and the probability of it occurring
- the investigation of real-life situations which involve making decisions based on the likelihood of events occurring and beginning to understand the concept of a 'random' outcome

Worked Examples

Level 2/3

You can show probability on a Probability Line



The probability is always between 0 and 1

Appendix - Other Learning and Teaching Strategies in Mathematics

Guidance on the following topics from Mathematics (rather than Numeracy) may also be of use to some subject departments.

Equations

At **Level 3(CfE)** we expect pupils to solve simple equations by

- "Balancing"
- performing the same operation to each side of the equation
- doing "Undo" operations e.g.
undo + with -, undo - with +
undo \times with \div , undo \div with \times
- encouraging statements like:
"add something to both sides"
"multiply both sides by something"
- We prefer
the letter x to be written differently from a multiplication sign
one equals sign per line
equals signs beneath each other
we discourage bad form such as $3 \times 4 = 12 \div 2 = 6 \times 3 = 18$

WORKED EXAMPLES:

Level 3

$$\begin{array}{rcl} 2x + 3 & = & 9 \\ -3 & -3 & \text{take away 3 from both sides} \\ \hline 2x & = & 6 \\ \div 2 & \div 2 & \text{divide by 2 both sides} \\ \hline x & = & 3 \end{array}$$



Using Formulae

We expect pupils to use and construct simple formulae at level 3/4 CfE by

- writing down the formula first
- Rewriting the formulae replacing letters with appropriate numbers (substitution)
- solving the equation
- interpreting the answer and putting appropriate units back into context

Worked Examples

The length of string S mm for the weight g is given by the formula:

$$S = 16 + 3W$$

(a) Find S when $W = 3g$

$$S = 16 + 3W$$

write the formula

$$S = 16 + 3 \times 3$$

replace letters by numbers

$$S = 16 + 9$$

choose the correct order of operations

$$S = 25$$

Length of string is 25 mm (interpret result in context)

(b) Find W when $S = 20.5$ mm

$$S = 16 + 3W$$

write the formula

$$20.5 = 16 + 3W$$

replace letters by numbers

$$4.5 = 3W$$

solve the equation by balancing

$$1.5 = W$$

The weight is 1.5g (interpret result in context)

WE DO NOT.....

- Rearrange the formula before substitution (*too difficult*)
 - State the answer only. Working must be shown

Scientific Notation Or Standard Form

In mathematics we introduce Scientific Notation at level 4 CfE.

We teach that a number in scientific notation consists of a number between one and ten multiplied by 10 to some power.

For example

$$24,500,000 = 2.45 \times 10^7$$

$$0.000988 = 9.88 \times 10^{-4}$$

Discreet sciences may approach this topic differently and timings may not match

At level 2/3 CfE we introduce the terms:-

- kilo meaning 1000
- milli meaning one thousandth

At level 4 CfE pupils should be able to use powers and square roots