Kilwinning Academy

Numeracy

A Common Approach

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A Common Approach

The Numeracy policy was formed to establish a common methodology and language across the school and address any difficulties or inconsistencies between departments in order to improve attainment and to facilitate effective learning and teaching.

By developing a common language and methodology for teaching numeracy and providing guidance on the correct use of mathematical language it aims to support teachers of numeracy.

It is hoped that use of the information in this booklet may lead to a more consistent approach to the use and teaching of Numeracy topics across the whole school and consequently, an improvement in progress and attainment for all learners.

Place Value

The concept of place value should be applied in working with the four basic number processes: addition, subtraction, multiplication and division.

At **Second Level** we expect learners to explore decimal fractions and the function of the decimal point

Use concrete materials such as pizza (one whole) cut into 10 equal parts (each having a value of one tenth).

Recorded as:	units	.	tenths	
	1	.	0	one whole
	0	.	1	one tenth

The value headings can be used initially to illustrate the value of a digit. Learners should understand that whole numbers are positioned to the left of the decimal point and decimal fractions are positioned to the right of the decimal point.

Learners should use the concept of place value in application of the four basic number processes including the role of the decimal point and how it acts in application.

Learners should explore the effect of moving digits one place to the left, when multiplying by 10, and how the value is altered. This should then be extended to include multiplying by 100 and 1000 and a rule determined.

Learners should then explore the effect of moving digits one place to the right, when dividing by 10, and how the value is altered. This should then be extended to include dividing by 100 and 1000 and a rule determined.

As a memory aid, the number of zeros indicates the number of places to be moved. e.g.

multiply/divide by 10 – the ten has **one** zero so move digits **one** place.

multiply/divide by 100 – the hundred has **two** zeros so move digits **two** places.

Through time and investigation learners may develop their own rules consistent with Place Value.

Basic Calculation – Vocabulary

Addition (+)

- sum of
- more than
- add
- total
- and
- plus

Multiplication (x)

- multiply
- times
- product
- lots of
- sets of
- multiplied by

Equals (=)

- is equal to
- same as
- makes
- will be

Subtraction (-)

- less than
- take away
- minus

Division (÷)

- divide
- share
- split

- subtract
- difference between

- splitting into equal groups of
- divided by
- quotient

We Do Not…

Use the word '**sum**'

as a general descriptor for the

above '**calculations'** as

this suggests

addition

Basic Number Operations - Addition

At **Second Level** we expect learners to

- solve problems involving whole numbers and decimal fractions using a range of methods while sharing their approaches and solutions with others
- understand number line extends to include numbers less than zero and investigate how they occur and are used
- continue to develop money management through cost comparison and determine what they can afford to buy

This should include

- adding mentally for 2 digit whole numbers and beyond in some cases involving multiples of 10 and 100
- adding, without a calculator, for 4 digits with at most 2 decimal places)
- adding, with a calculator, for 4 digits with at most 2 decimal places
- adding in practical applications of number, money and measurement
- adding in applications of money up to £20
- giving payment and change using decimals up to £20
- adding mentally for 2 digit numbers including decimal
- adding, with a calculator, for any number of digits with at most 3 decimal places
- adding decimals to 3 places in applications of measurement
- adding positive and negative numbers in applications such as rise in temperature

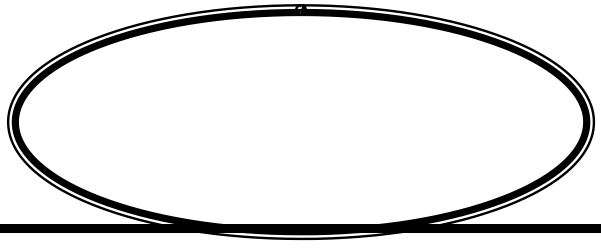
At **Third Level** we expect learners to

- continue to recall number facts and use them accurately in calculations.
- use a variety of methods to solve number problems in familiar context and communicate clearly processes and solutions
- continue to use numbers less than zero to solve simple problems in context

This should include

- adding mentally for 2 digit numbers including integers.
- adding, without a calculator, for 4 digits including integers and decimals.
- adding with a calculator for whole numbers, decimals and integers with any number of digits of digits with at most 3 decimal places.
- adding in practical applications of number, money and measurement.

Basic Number Operations - Subtraction



We Do Not…

Borrow and pay back

At **Second Level** we expect learners to

- solve problems involving whole numbers and decimal fractions using a range of methods while sharing their approaches and solutions with others.
- understand number line extends to include numbers less than zero and investigate how they occur and are used.
- continue to develop money management through cost comparison and determine what they can afford to buy.

This should include

- subtracting mentally for 2 digit whole numbers and beyond in some cases involving multiples of 10 and 100 and decimals.
- subtracting, without a calculator, for 4 digits with at most 2 decimal places (progressive examples).
- subtracting, with a calculator, for 4 digits with 2 decimal places progressing to 3 places.
- subtracting in applications of number, money and measurement.
- subtract positive and negative numbers in applications such as rise in temperature.
- say “negative 4” for -4. Explain that for temperatures and other uses “minus 4” is mathematically wrong though it is widely used.

Basic Number Operations - Multiplication

At **Second Level** we expect learners

- to explore the context in which problems involving decimal fractions occur and solve related problems using a variety of methods
- to have explored the need for rules for the order of operations in problems which involve successive number calculations

The order for teaching multiplication of decimals is

1. multiplication of units and tenths, no carrying
   e.g. 1 · 3

   x 2

   2.6

2. multiplication of units and tenths, with carrying

   e.g. 2· 4

   x 3

   1

   7.2

3. multiplication of tens, units and tenths with carrying

   e.g. 1 2· 5

   x 4

   1 2

   5 0 . 0

4. multiplication of hundreds, tens, units and tenths with carrying

   e.g. $124 \cdot 5$

$$\begin{array}{r} 2\ 4.5 \\ \times\ 6 \\ \hline 1\ 4\ 4.\ 0 \\ \hline 7\ 4\ 7.\ 0 \\ \hline \end{array}$$

Learners should explore

- multiplying by 10 and looking for a rule for it
- the pattern which occurs when calculations are done.

E.g. 12 x 10 = 120 162 x 10 = 1 620 210 x 10 = 2 100

A learner's response of "you add a zero when you multiply by 10" would be an acceptable rule **at this stage**.

Learners further explore the pattern which occurs for decimal multiple by 10.

$$\begin{array}{r} 2.3 \\ \times\ 10 \\ \hline 23.0 \\ \hline \end{array} \qquad \begin{array}{r} 4.6 \\ \times\ 10 \\ \hline 46.0 \\ \hline \end{array}$$

← ←

Discuss the patterns of the answers, then establish a rule for multiplying by 10, **you must emphasise the digit shift.**

- To multiply by 10, we move each digit one column to the left.
- Tenths digit moves into units column, units digit moves into the tens column and we place a zero into the tenths column.
- Emphasise that add a zero rule will **only** work if a **whole number** is multiplied by 10.

Through time and investigation learners may develop their own rules such as moving the point a certain number of places. This may aid all learners and in particular those who require visual aids. Although **mathematically incorrect** it may support learning.

At **Second level** we expect learners to

- multiply 4 digit numbers with at the most 2 decimal places by a single digit
  e.g. 24 · 51 x 6.
- complete many of the examples with money and length.
  e.g. £ 2 · 36 x 4 5 · 25m x 7
- use a calculator for calculations to second decimal place.
- enter amounts of money into the calculator correctly, e.g.

For money	For length
27p = £ 0 · 27	2m 34 cm = 2 · 34 m
9p = £ 0 · 09	56 cm = 0 · 56 m

At **Third Level** we expect learners to

- continue to recall number facts quickly and accurately within calculations.
- use a variety of methods to solve number problems in a familiar context, clearly communicating the process and solutions.
- multiply 4 digit numbers with both 1 and 2 decimal places.

This was introduced at **Second Level**, therefore this is revision before moving on to numbers with 3 decimal places.

The order for teaching multiplication of decimals is

- multiply numbers with one decimal place, using order described in **Second Level.**
- multiplication of numbers with 2 decimal places, using order and method described in **Second Level**.

After discussing rule for multiplying by 10, establish rule for multiplying by 100 and

1 000 after looking at examples learners explore the pattern which occurs when calculations are done

- Multiplying by 100, move each digit **2** places to the left.
- Multiplying by 1 000, move each digit **3** places to the left.

Remember to emphasise that

- adding two or three zeros when multiplying by 100 or 1000 rule will **only** work if a whole number is multiplied by 100 or 1000.

Again, through time and investigation learners may develop their own rules such as moving the point a certain number of places. This will aid all learners and in particular those who require visual aids. Although mathematically incorrect it does support learning.

We Do Not…

write £ and p together

like 9p is not £0. 09 p**.**

Basic Number Operations - Division

At **Second Level** we expect learners to explore the context in which problems involving decimal fractions occur and solve relate problems using a variety of methods.

This should include

- dividing H t U by a single digit at the initial stage of Second Level and then Th H t U by a single digit
- mentally dividing tenths by a single-digit number e.g. 4.2 ÷ 2
- dividing 4 digit numbers with at the most 1 decimal place in written form e.g.
  235 · 6 ÷ 2.

The order for teaching division of decimals is

- mental division of tenths by a single digit e.g.
  6 tenths divided by 2 equals 3 tenths or 0·3

  recording it as 0 · 6 ÷ 2 = 0 · 3.

- division of units and tenths, no carrying/exchange e.g.
  4 · 8 ÷ 4.

- division of units and tenths with carrying/exchange e.g.
  5 · 6 ÷ 2.

- division of tens, units and tenths with carrying/exchange e.g.
  53 · 9 ÷ 7 65 · 2 ÷ 4.

- division of whole numbers, answers in tenths e.g. 19 ÷ 5 = 3 · 8.
- learn the rule for dividing by 10

How we divide:

$$3\overline{)3.6} \quad 1.2$$

- Calculations are set out horizontally. 3.6 ÷ 3
- Decimal point is placed in a box on its own.
- Decimal point always lines up in question and answer: one above the other. It is **fixed** and never moves the digits around it moves.
- When dividing we start at the left and work our way towards the right.

The division algorithm

$$3\overline{)4.^{1}2} \quad 1\ 4$$

This is an extension to whole number division.

Using $4 \cdot 2 \div 3$ but written in the format

1. Start by putting the decimal point in the correct place in the answer space
2. Divide the units first. 4 units divided by 3 equals 1 unit and 1 left over. Exchange your 1 unit for 10 tenths, which makes 12 tenths.
3. Divide the tenths. 12 tenths divided by 3 equals 4 tenths.

Division of Whole Numbers answering in tenths

We expect learners to know that a whole number can be changed into a decimal by adding a decimal point and a zero, e.g.

12 is the same as $12 \cdot 0$

45 is the same as $45 \cdot 0$

Whole numbers encountered in division can become decimals if a remainder is found and the calculation continued as follows:

$12 \div 5$ should be recorded as $12 \cdot 0 \div 5$

$$5\overline{)1\,{}^{1}2\,.\,{}^{2}0} \quad \text{02.4}$$

Rule For Dividing By 10

Learners explore the pattern which occurs when calculations are carried out.

$135 \div 10 = 13.5$ $264 \div 10 = 26.4$

Discuss the pattern of the answers, then establish the rule for dividing by 10, **you must emphasise the digit shift**.

- To divide by 10, we move each digit one column to the right.
- Units digit moves into the tenths column, tens digit moves into the unit column and hundreds digit moves into the tens column.
- Divide 4 digit numbers with at most 2 decimal places by a single digit.

Many of the examples will use money and length

e.g. 16.34 ÷ 2 £ 3. 24 ÷ 3 4. 15 m ÷ 5

At **Third Level** we expect learners to

- continue to recall number facts quickly and accurately within calculations
- use a variety of methods to solve number problems in a familiar context, clearly communicating the process and solutions.
- mentally divide tenths by a single-digit number
- divide 4 digit numbers with at the most 1 decimal place in written form
  e.g. 235 · 6 ÷ 2.

- divide numbers with 2 decimal places, using order and method described
  e.g. 14·22 ÷ 3 £100·00 ÷ 8 123·45m ÷ 5.

- divide by a two digit number by using long division algorithm
- use the rule for dividing by 10 and extend and establish a new rule for 100. This should include numbers with 2 decimal places and dividing by 100.

Remember

Through time and investigation learners may develop their own rules such as moving the point a certain number of places. This will aid all learners and in particular those who require visual aids. Although mathematically incorrect it does support learning.

Discuss the pattern when dividing by 10, then establish the rule for 100, **emphasise the digit shift** e.g.

- To divide by 10, we move each digit one column to the right.

- Tens digit moves into the units column, units digit moves into the tenths column, tenths digit moves into the hundredths column,
  e.g. $15 \cdot 6 \div 10 = 1 \cdot 56$.

Discuss the pattern when dividing a number by 100,

e.g. $1235 \div 100 = 12 \cdot 35$

$678 \div 100 = 6 \cdot 78$

Establish the rule of moving each digit 2 places to the right.

Discuss how this would work for numbers with decimal places; establish that the rule remains the same no matter which number you are dealing with.

You must emphasise the digit shift e.g.

- To divide by 100, we move each digit two columns to the right
- Hundreds digit moves into the units column, tens digit moves into the tenths column, units digit moves into the hundredths column, e.g. $156 \div 100 = 1 \cdot 56$
- If a number is single digit or a double digit, emphasise the need to fill the empty columns with a zero, e.g.
  $30 \div 100 = 0 \cdot 30$

Remember

Through time and investigation learners may develop their own rules such as moving the point a certain number of places. This will aid all learners and in particular those who require visual aids. Although mathematically incorrect it does support learning.

Fractions, Decimals and Percentages

At **Second Level** we expect learners to show the equivalent forms of simple fractions, decimals and percentages and use preferred form when solving a problem and explain their method choice. These should also be carried out in relation to everyday contexts and use calculations to solve related problems.

e.g. $\frac{3}{4} = 0.75 and 0.75 = 75\%$.

Converting fractions to decimals

To convert a fraction to a decimal you divide the numerator, top number, by the denominator, bottom number.

e.g.

$$\frac{\text{numerator}}{\text{denominator}} = \text{numerator} \div \text{denominator}$$

$$\frac{3}{8} = 3 \div 8 \Rightarrow 0.375$$

The following is a list of simple common equivalences that learners should learn:

$$\frac{1}{2} = 0.5$$

$$\frac{1}{4} = 0.25$$

$$\frac{3}{4} = 0.75$$

$$\frac{1}{3} = 0.333333$$

$$\frac{2}{3} = 0.666667$$

The fractions one third and two thirds are recurring decimals and if written as 0.33 and 0.67 are rounded to two decimal places. We normally say that a third as a decimal is 0.3 recurring or repeating and two third is 0.6 recurring or repeating

Notation for recurring numbers:

$$\frac{1}{3} = 0.\dot{3}$$

Converting a decimal back to a fraction

To change from a decimal to a fraction, it is important to read the decimal correctly to write the initial fraction then simplify it.

0.5 means 5 tenths therefore $0.5 = \frac{5}{10} \Rightarrow \frac{1}{2}$

0.45 means 45 hundredths therefore $0.45 = \frac{45}{100} \Rightarrow \frac{9}{20}$

0245 means 245 thousandths therefore $0.245 = \frac{245}{1000} \Rightarrow \frac{6}{25}$

Converting a fraction to a percentage

To convert from a fraction to a percentage, we must divide the numerator by the denominator and then multiply by 100.

e.g. $\frac{7}{10} \times 100 = 70\%$

Converting a percentage to a fraction

To convert from a percentage to a fraction, we divide it by 100, which enable us to write it as a fraction, and then simplify it.

e.g. $37\% = \frac{37}{100}$ $4\% = \frac{4}{100} \Rightarrow \frac{1}{25}$ divide top and bottom by 4

to fully simplify

Converting a decimal to a percentage

To change a decimal to a percentage we multiply the decimal by 100.

e.g. $0.4 \text{ becomes } 0.4 \times 100 = 40\%$

$2.01 \text{ becomes } 2.01 \times 100 = 201\%$

Converting a percentage to a decimal

To convert from a percentage to a decimal we divide the percentage by 100.

e.g. $34\% \Rightarrow 34 \div 100 = 0.34$

$2\% \Rightarrow 2 \div 100 = 0.02$

$125\% \Rightarrow 125 \div 100 = 1.25$

Percentages bigger than 100 do exist and in particular for percentage increase and calculating values after percentage has been added e.g. VAT included and you want to calculate value before VAT was added.

At **Third Level** we expect learners to carry out calculations using a wide range of fraction, decimals and percentages, using their answers to make informed choices for real-life situations.

At **Fourth Level** we expect learners to choose the most appropriate form of fractions, decimals and percentages to use when making calculations mentally, in written form or using technology then use their solutions to make comparisons, decisions or choices.

<u>WORKED EXAMPLES</u>

1. Find 36% of £200

100% is £200

10% is £20

30% is £60 (10%x 3)

5% is £10 (10% ÷ 2)

1% is £ 2 (10% ÷ 10)

36% is **£72** (30% + 5% + 1%)

OR 36 ÷ 100 x 200

=0.36 x 200

= £72

We Do Not…

use the % button on the calculator because of inconsistencies

2. Express two fifths as a percentage

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

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

Loss = £5000 – £3500 = £1500

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

4. Increase £350 by 15%

15% of 350 = 350 ÷ 100 x 15 = £52.50

To find the increase then add on for the new total £350 + £52.50 = £402.50

5. Paul's train fare has increased by 10%. The new cost is £8. 25. What did his fare cost price before the increase?

Old Price	+	Rise	=	New Price	**Calculators could be used.**
100%	+	10%	=	110%	
		110%	=	£8. 25	
		1%	=	£8. 25 ÷ 110	

1% = 0.075

100% = £7. 50

Rounding

At **Second Level** we expect learners to use their knowledge of rounding to routinely estimate the answer to a problem, then after calculating, decide if their answer is reasonable and share their finding with others.

This should include

e.g 74 to the nearest 10 → 70

386 to the nearest 10 → 390

347.5 to the nearest whole number → 348

347.5 to the nearest 10 → 350

347.5 to the nearest 100 → 300

At **Third Level** we expect learners to round a number to an appropriate degree of accuracy having taken into account the context of the problem.

e.g 7.51 to 1 decimal place → 7.5

8.96 to 1 decimal place → 9.0

3.14159 to 2 decimal places → 3.14

3.14159 to 3 decimal places → 3.142

3.14159 to 3 significant figures → 3.14

We always round up

for

5 and above

Estimating

At **Second Level** we expect learners to use their knowledge of sizes or places to assist them.

e.g. bag of crisps = 30g

bag of sugar = 1kg

area of an envelope = 80 cm^2 (8 x 10)

Volume of lemonade bottle = 1 litre

area of a whiteboard = $4m^2$ area of work surface = $6m^2$

diameter of 1p = 15mm height of a kitchen unit = 700mm

In real life, measurements of length are

used in a variety of ways: **Millimetres - mm**

e.g. DIY shops, worktop heights for

kitchen units, lengths of wood, etc

Centimetres – cm

e.g. clothes, curtains, body measurements etc

square metres – m^2

e.g. carpet, tiles, flooring etc

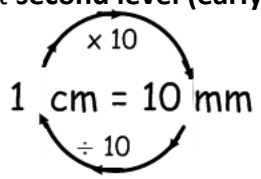
Conversion of units

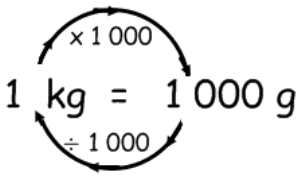
At S**econd Level** we expect learners to

- use the common units of measurement, convert between related units of the metric system and carry out calculations when solving problems.
- investigate its impact on the world, past, present and future.
- have worked with others to explore, and present our findings on, how mathematics impacts on the world and the important part it has played in advances and inventions.

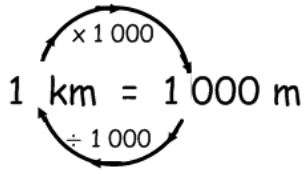
Worked Examples

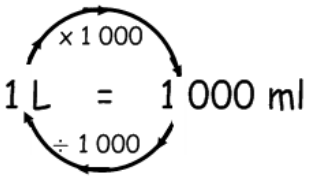
At **second level (early)** we expect learners to know that:-





1 minute	= 60 seconds
1 cm	= 0.01 m
1kg	= 1000 g
1 g	= 0.001 kg
1l	= 1 000ml
1ml	= 0.001 l
1l	= 1 000 cm^3
1 ml	= 1 cm^3
1cm	= 10 mm
1 mm	= 0.1 cm





1000 m = 1 km

Learners will use the following to convert units:

Time

Minutes to seconds – multiply the number of minutes by 60 to get total number of seconds,

e.g. 3 minutes 50 minutes

3 x 60 seconds = 180 seconds 50 x 60 seconds = 3 000 seconds

Seconds to minutes – divide the number of seconds by 60 to get number of minutes, e.g.

360 seconds 6000 seconds

360 ÷ 60 = 6 minutes 6 000 ÷ 60 = 100 minutes

Weight

Kilograms to grams – multiply the number of kilograms by 1 000 to get grams,

e.g. 5 kg 3.25kg

5kg x 1 000 = 5 000g 3.25 kg x 1 000 = 3 250g

Grams to kilograms – divide the number of grams by 1 000 to get kilograms,

e.g. 4 000g 1 576 g

4 000g ÷ 1 000 = 4kg 1 576 ÷ 1 000 = 1·576kg or 1kg 576g

Length

Millimetres to centimetres – divide the number of millimetres by 10 to get the number of cm, e.g. 57mm 160mm

57 ÷ 10 = 5·7cm 160 ÷ 10 = 16 cm

Centimetres to millimetres – multiply the number of centimetres by 10 to get the number of mm, e.g. 56cm 9.7 cm

56 x 10 = 560mm 9·7 x 10 = 97mm

Kilometres to metres – multiply the number of kilometres by 1 000 to calculate the number of metres,

e.g. 5 km 3km 560m

5 x 1 000 = 5 000m Change to a decimal first 3km 560m = 3·560km

3·560 x 1 000 = 3 560 m

Metres to kilometres – divide the number of metres by 1 000 to calculate the number of kilometres, e.g. 350m 15 000m

350 ÷ 1 000 = 0·350km 15 000 ÷ 1 000 = 15 km

At the **Second Level** (late), learners will be expected to know that:-

1 tonne = 1 000kg

1 inch (1in) = about 2½cm

1 foot (1ft) = about 30cm

1 pound (1lb) = about ½kg

1 pint = about ½litre

1 gallon = about 4 ½ litres

For Home Economics and for future life skills the following are more accurate conversions:-

1 litre = 1.75 Pints/Fluid Ounces

1Kg = 2.2 Pounds/Ounces

Learners will use the following rules to convert units of weight.

Weight

Pounds (lbs) to kilograms – divide the number of pounds (lbs) by 2 to calculate the number of kilograms (not exact answers), e.g.

16 lbs	56 lbs
16 ÷ 2 = about 8kg	56 ÷ 2 = about 28 kg

Kilograms to pounds – multiply the number of kilograms by 2 to calculate the number of pounds (lbs) (answer will not be exact), e.g.

18kg	162kg
18 x 2 = 36 lbs	162 x 2 = 324 lbs

Kilograms to tonnes – divide the number of kilograms by 1 000 to calculate the number of tonnes, e.g.

450kg	6 700kg
450 ÷ 1 000 = 0·450 tonnes	6 700 ÷ 1 000 = 6·7 tonnes

Tonnes to Kilograms – multiply the number of tonnes by 1 000 to calculate the number of kilograms, e.g.

7 tonnes	90·5 tonnes
7 x 1 000 = 7 000 kg	90·5 x 1 000 = 90 500kg

Volume

Pints (pt) to litres – divide the number of pints by 2 to calculate the number of litres (not exact answers), e.g.

16 pints	200 pints
16 ÷ 2 = 8 litres	200 ÷ 2 = 100 litres

Litres to pints – multiply the number of litres by 2 to calculate the amount of pints (not exact answers), e.g.

5 litres	75 litres
5 x 2 = 10 pints (approx)	75 x 2 = 150 pints (approx)

Gallons to Litres – multiply the number of gallons by 4·5 to calculate the number of litres (answers will be approximate) e.g.

10 gallons	26 gallons
10 x 4·5 = 45 litres	26 x 4·5 = 117 litres

Litres to Gallons – divide the number of litres by 4·5 to calculate the number of gallons (answers will be approximate) e.g.

9 litres 54 litres

9 ÷ 4·5 = 2 gallons 54 ÷ 4·5 = 12 gallons.

Time Calculations

At **Second Level** we expect learners to

- make time calculations while using and interpreting paper and electronic time-tables and schedules for planning events and activities.
- carry out practical tasks and investigations for timed events and explain which units of time would be appropriate to use.
- use simple time periods to make an estimate of how long a journey would take using there knowledge of the link between time, speed and distance.

At **Level 3** we expect learners to use simple time periods to work out how long a journey will take, the speed travelled or the distance covered, using their knowledge of the link between time, speed and distance

- convert between the 12 hour and 24 hour clock e.g. 2327 = 11.27pm.
- calculate duration in hours and minutes by counting up to the next hour then on to the required time
- convert between hours and minutes e.g multiply by 60 for hours into minutes.

<u>Worked Examples</u>

How long is it from 0755 to 0948?

0755 → 0800 0900 → 0948 →

(5 mins) (1 hr) (48 mins)

Total 1 hr 53 minutes.

We Do Not…

Teach time as a subtraction.

Change 120 seconds into minutes

There are 60 seconds in a minute

120 seconds = 120 ÷ 60 = 2 minutes

Change 6 minutes into hours

There are 60 minutes in an hour

6 minutes = 6 ÷ 60 = 0.1 hours

Change 48 hours into days

There are 24 hours in a day

48 hours = 48 ÷ 24 = 2 days

Time Calculations

Change 21 days to weeks

There are 7 days in a week

21 days = 21 ÷ 7 = 3 weeks

We Do Not…

Put a point in 24 hour time.

Change 104 weeks into years

There are 52 weeks in the year

104 days = 104 ÷ 52 = 2 years

Change 12 hour to 24 hour clock time

am = ante-meridian pm = post meridian

Converting 12 hour to 24 hour Times

8.00am ⟶ 0800 hrs (times remains the same)

11.00pm ⟶ 2300 hrs (add 12 to the hours)

- There are always four digits in 24 hour time

How many years from 89BC until 123AD

- BC = Before Christ (Before the year 0 when Jesus Christ was born)
- AD = Anno Domini (After the year 0 when Jesus Christ was born)

89BC ⟶ 0 ⟶ 123AD

89years 123years Total 89 + 123 = 212 years

Speed, Distance and Time

At **Third and Fourth Level** we expect learners to use the link between speed, distance and time to carry out related calculations.

Worked Examples

How long will it take to travel 6km at a speed of 3km/h?

Time = Distance ÷ Speed

Time = 6 ÷ 3

Time = 2 hours

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

What is the speed when the distance travelled is 70km and the time taken is 2 hours?

Speed = Distance ÷ Time

Speed = 70 ÷ 2

Speed = 35km/h

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

What distance will be travelled if the speed is 5 km/h and the time taken is 3 hours?

Distance = Speed x Time

Distance = 5 x 3

Distance = 15 km

$$\text{distance} = \text{speed} \times \text{time}$$

In Physics the letter

v is used for speed

instead of s

Ratio and Proportion

At **Third Level** we expect learners to show how quantities that are related can be increased or decreased proportionally and apply this to solve problems in everyday life.

WORKED EXAMPLES

1. a) The ratio of square to triangles b) The ratio of circles to squares.

2 : 1 4 : 2

2 : 1

2. In a class the ratio of girls to boys is 2 : 5. How many boys are there if there as 16 girls?

Girls : Boys

2 : 5

8 x 16 : 40 x 8

At **Fourth Level** we expect learners to use proportion to calculate the change in one quantity caused by a change in a related quantity and solve real-life problems.

WORKED EXAMPLES:

<u>Direct Unitary Method</u>

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

Bananas		cost (pence)
5	→	80
1	→	80 ÷ 5 = 16
3	→	16 x 3 = 48

Inverse Unitary Method

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

Speed (m/h)		Time (minutes)
60	→	30
1	→	30 x 60 = 1800 minutes
50	→	1800 ÷ 50 = 36 minutes

Statistics - Data Analysis

Type of Data

Discrete data can only have a finite or limited number of possible values, things that can be counted. Number of learners in a class is an example of **discrete** data.

Continuous data can have an infinite number of possible values within a selected range, things that are measured. e.g. temperature, height, length.

Data which is non-numerical e.g. favourite TV programme, favourite flavour of crisps, favourite colours.

Tally Chart/Frequency Table

At **First Level** we expect learners to collect information in a number of ways and to sort it in a logical, organised way using their own and others criteria.

A tally chart is used to collect and organise data before representing it in a graph or chart.

The example below is the number of hours exercise taken by a class in a week.

Number of hours exercise	**Tally**	**frequency**
1	**II**	**2**
2	**~~IIII~~ II**	7
3	**~~IIII~~ III**	8
4	**III**	3
5	**~~IIII~~**	5
	Total	**25**

At **Fourth Level** we expect learners to compare numerical information in real-life contexts by using the mean (average), median, mode and range of sets of numbers.

This should include

- Analyse ungrouped data using a tally table and frequency column or ordered data set.
- Calculate range of a data set. This is used in both maths and biology.
- Range = Maximum value – Minimum value, as in Biology.
- Calculate the mean (average) of a data set.
- Use a stem and leaf diagram.
- Calculate the mean (average) from grouped data.
- Find the median – the middle of an ordered data set.
- Find the mode – the most common value of a data set.
- Obtain these values from an ungrouped frequency table.

Statistics - Data Analysis

At **Second Level onwards** we expect learners to collate, organise and communicate the results of investigations and surveys in an appropriate way using an extended range of table, charts, diagrams, graphs and available technology.

Stem-and-leaf diagram

A stem-and-leaf diagram is another way of displaying discrete or continuous data. A stem-and-leaf diagram needs a title, a key and should be ordered. It is useful for finding the median and mode. If we have two sets of data to compare we can draw a back-to-back stem-and-leaf diagram.

The following marks were obtained in a test marked out of 50. Draw a stem and leaf diagram to represent the data.

3, 23, 44, 41, 39, 29, 11, 18, 28, 48.

Split the data into a stem and a leaf. Here the tens part of the test mark is the stem. The unit's part of the test mark is called the leaf.

Unordered stem-and-leaf diagram

Stem and leaf showing test marks out of 50

0	3
1	1 8
2	3 9 8
3	9
4	4 1 8

Ordered stem and leaf diagram.

0	3
1	1 8
2	3 8 9
3	9
4	1 4 8

1| 3 means 13 out of 50

n = 10

1| 3 means 13 out of 50

n = 10

Statistics – Graphs and Charts

At **all levels** we expect learners to

- use a pencil and a ruler.
- give the graph a title.
- label both the x and y axes.
- label the bars in the centre of the bar (each bar has an equal width).
- label the frequency (up the side) on the lines not on the spaces.
- make sure there are even spaces between the bars and leave a space between the first bar and the y axis.
- use, where appropriate, computer packages.
- When using a graduated axis, the intervals must be evenly spaced.

In addition to the above we expect learners

- at **Second Level and Third Level** I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs making effective use of technology.

Bar Graph Worked Examples:

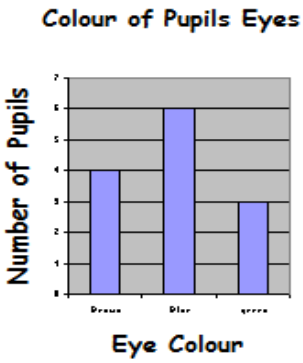
This should include bar graphs with frequency graduated

- in single units and discrete information
- in multiple units and discrete information

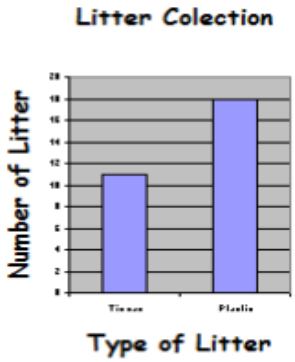
- in simple fractions or decimals and continuous data that has been grouped.

A Bar Chart is a way of displaying discrete or non-numerical data. They can be drawn both vertically and horizontally.

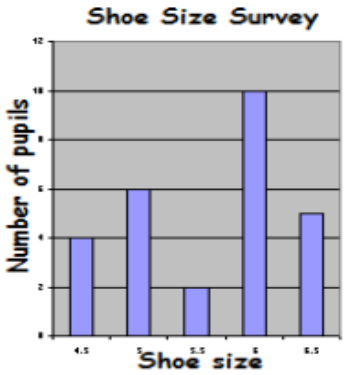
First Level



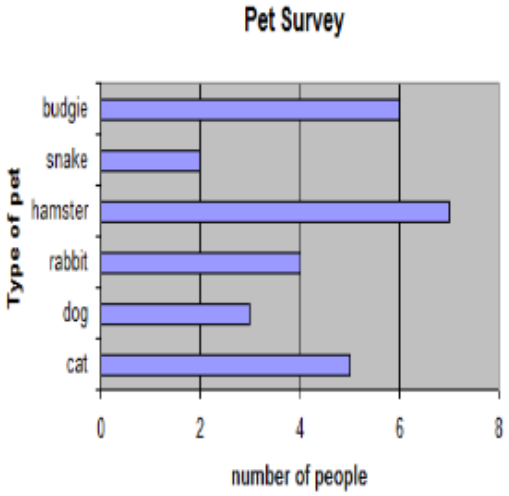
Second Level



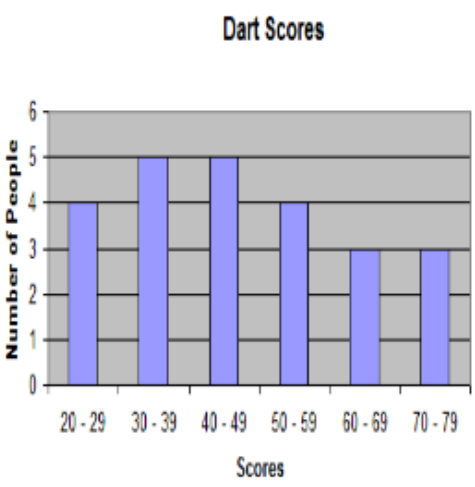
Third Level



Second Level



Third Level



Line Graphs Worked Examples:

At **all levels** we expect learners to

- use a pencil and a ruler.
- give the graph a title
- label both the x and y axes.
- choose an appropriate scale for the axes to fit the paper
- number the lines **not** the spaces
- plot the points neatly (using a cross or dot)
- fit a suitable line

This should include

- if necessary, to make use of a jagged line to show that the lower part of a graph has been missed out. This is called a staggered zero.
- the use of scattergraphs which should include line of best fit and correlation**.**

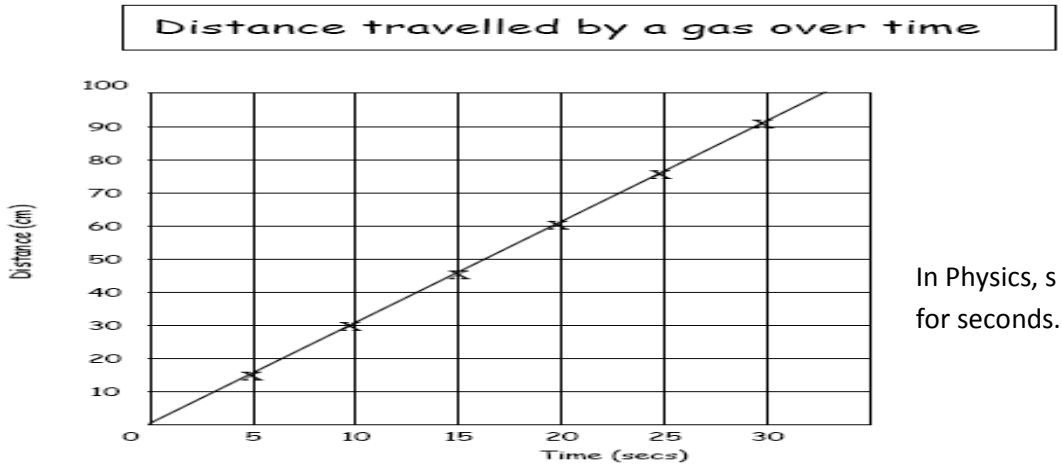
In science they use these techniques but there are slight differences in terminology

- Physics use a line or curve of best fit so do Maths at credit and Higher levels.
- Chemistry and Biology join the points (crosses or dots) on the graph

Second and Third Level

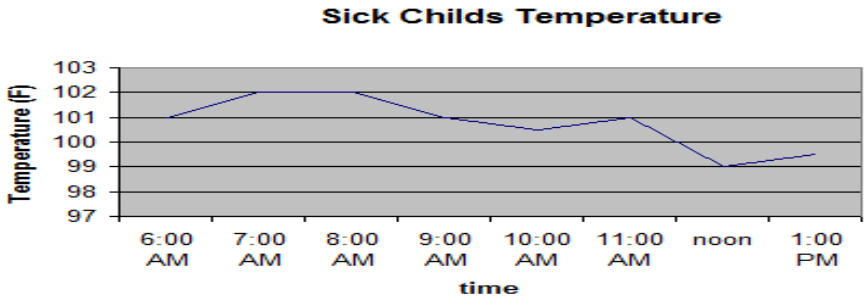
The distance a gas travels over time has been recorded in the table below:

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



In Physics, s is used instead of secs for seconds.

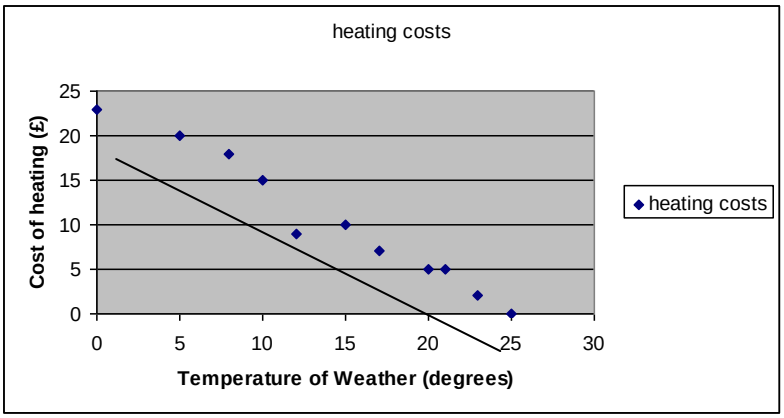
Second and Third level



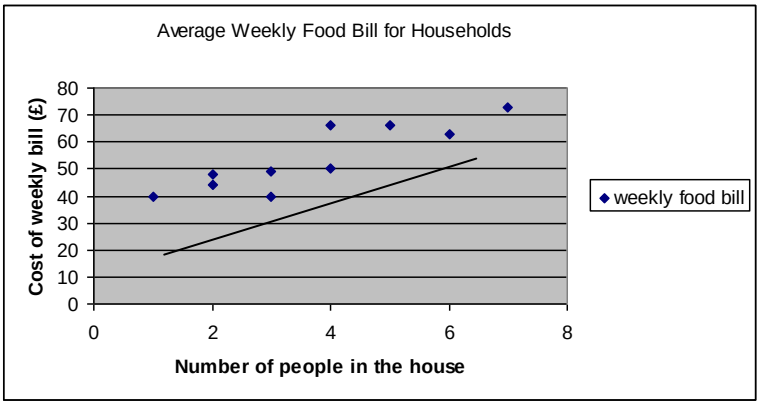
Correlation in scatter graphs is described in qualitative terms.

e.g.

Negative correlation - “The warmer the weather, the less you spend on heating”



Positive correlation- “The more people in your family, the more you spend on food”



Pie Charts Worked Examples:

At all levels we expect learners to

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

In addition to the above we expect learners to

- construct pie charts involving simple fractions or decimals
- construct pie charts of data expressed in percentages
- construct pie charts of raw data

Third Level

40% of pupils travel to school on the bus, 25% walk, 20% by car and 15% cycle.

Draw a pie chart to display this data.

10% of $360^o = 36^o$

5% of $360^o = 18^o$

Car 20% $2 \times 10\% = 2 \times 36^o = 72^o$

Cycle 15% $3 \times 5\% = 3 \times 18^o = 54^o$

Third Level

20 pupils were asked "What was their favourite subject?"

The responses of the pupils were 6 liked Maths, 4 English, 3 Science and 7 Art.

Draw a pie chart to display this data.

$360^\circ \div 10 = 18^\circ$

Maths 6 $6 \times 18^o = 108^o$

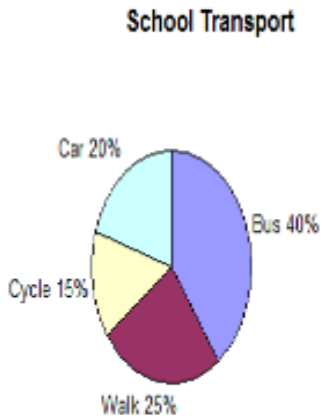
English 4 $4 \times 18^o = 72^o$

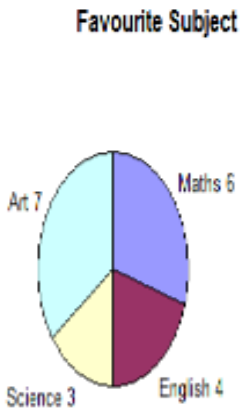
Science 3 $3 \times 18^o = 54^o$

Walk25% 5 x 5% = 5 x 18^{o} = 90^{o}

Art 7 7 x 18^{o} = 126^{o}

Bus 40% 4 x 10% = 4 x 36^{o} = 144^{o}





After constructing simple pie charts by hand learners should be encouraged to use suitable computer packages, e.g. excel, to construct pie charts from raw data.

At **Fourth Level** we expect learners to select appropriately from wide range of tables, charts, diagrams and graphs when displaying discrete, continuous or grouped data.

Probability

At **Second Level** we expect learners to conduct simple experiments involving chance and communicate predictions and findings using vocabulary of probability.

At **Third Level** we expect learners to find the probability of a simple event happening and explain why it should be considered when making choices.

Probability can be expressed as a fraction, decimal, percentage or ratio. We find probability as a fraction by using the following:

$$P(\text{event}) = \frac{\text{Number of Favourable outcomes}}{\text{Total number of possible outcomes}}$$

At **Fourth level** we expect learners to apply probability to determine how many times an event will occur and use the information to predict, risk assess and make decisions.

Whole School Calendar of Specific Identified Numeracy Activities Across the Curriculum

The following calendar details specific Cfe numeracy experience and outcomes that have been identified and can be demonstrated in other curricular areas.

The department of Mathematics and Numeracy will encourage students and staff to recognise numeracy as a core skill by developing and reinforcing the identified experiences and outcomes prior to them taking place in other faculties.

All pupil material should be stored in the **Red Numeracy Box**

Calendar S1-S2

Curricular Area	Organiser	Experience and Outcome	I Can Statement	Activity	When
Health and Wellbeing	Number and Number Processes	MNU 3-03a	I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions.	Score keeping, team and competition organisation and results recording.	Various times throughout team games and badminton block.
Health and Wellbeing	Measurement	MNU 3-11a	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.	Pupils complete assessment booklets measuring and recording personal results/placing for events in the athletics block.	S1 –S3 during practical athletics block.
Science	Measurement	MNU 3-11a	I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the	Pupil complete activity on reading volumes accurately using correct scales and units from measuring cylinders.	S1 August - October

			task and using a formula to calculate area or volume when required.		
Curricular Area	Organiser	Experience and Outcome	I Can Statement	Activity	When
HE	Fractions, decimal fractions and percentages.	MNU 3-08a	I can show how quantities that are related can be increased or decreased proportionally and apply this to solve problems in everyday context.	Learner measures and is aware of ratio/proportion of quantities for recipes. Recorded in pupil log.	Ongoing.
Social Subjects	Number and Number processes	MNU 3-03a	I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions.	Pupils complete an exercise on scale from GeogScot 1 as part of their OS map skills unit applying multiplication/division to solve problems.	S1 October
Science	Data and Analysis	MNU 3-20a	I can work collaboratively, making use of technology, to source information presented in a range of ways, interpret what it conveys and discuss whether	Faculty produced S1 problem solving assessment for individual learner completion where learner interprets information from bar graphs and draws conclusions.	S1 Nov - Feb

			I believe the information to be robust, vague or misleading.		
Social Subjects	Data and Analysis	MNU 3-20a	I can work collaboratively, making 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	Faculty produced task sheet for individual learner completion. Pupils collect weather data for one week and process information into various graphs, charts and tables.	S1 Nov - Jan
Curricular Area	Organiser	Experience and Outcome	I Can Statement	Activity	When
Computing and Business	Money	MNU 3-09b	I can budget effectively, making use of technology and other methods, to manage money and plan for future expenses.	Learner produced spread sheet created in personal finance section.	S2 Jan - Feb
Social Subjects	Data and Analysis	MNU 3-20a	I can work collaboratively, making use of technology, to source information presented in a range of ways,	Learners produce graphs of hot climates using data from hot desert area climate data and interpret and draw conclusions from graph.	S2 April-May

			interpret what it conveys and discuss whether I believe the information to be robust, vague or misleading.		
HE	Estimation and Rounding Number and Number processes	MNU 3-01a MNU 3-03b	I can round a number using an appropriate degree of accuracy having taken into account the context of the problem. I can continue to recall number facts quickly and use them accurately when making calculations.	Learner costs recipes/ingredients to make batches. Recorded in pupil log.	S1 May
Science	Data and Analysis	MNU 3-20a	I can work collaboratively, making 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.	Faculty produced end of "Elements and Compounds" assessment for individual learner completion.	S1 May - June

Curricular Area	Organiser	Experience and Outcome	I Can Statement	Activity	When
Computing and Business	Number and Number processes	MNU 3-03a	I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions.	Faculty produced homework and assessment on binary code where learners apply knowledge conversions of units and binary base 2.	S2 Aug - Nov
HE	Fractions, decimal fractions and percentages.	MNU 3-08a	I can show how quantities that are related can be increased or decreased proportionally and apply this to solve problems in everyday context.	Learner measures and is aware of ratio/proportion of quantities for recipes. Recorded in pupil log.	Ongoing.