Numeracy Booklet

A Guide to Numeracy in the Broad General Education

Dunoon Grammar School

Contents

Introduction

Welcome to our Numeracy booklet!

Being numerate helps us to function responsibly in everyday life and contribute effectively to society. It increases our opportunities within the world of work and establishes foundations which can be built upon through lifelong learning. Numeracy is not only a subset of mathematics; it is also a life skill which permeates and supports all areas of learning, allowing young people access to the wider curriculum.

We use Numeracy skills every day: from balancing our bank accounts, finding the "best buys" when doing the weekly shop, to measuring ingredients when baking a cake. At Dunoon Grammar School we understand that Numeracy is used in all aspects of life and therefore it is not only used in Maths lessons – it is used throughout our school.

We decided to produce this handy reference guide to support parents and carers when helping their children with homework or revision. It demonstrates how we teach the Numeracy skills used around the school and gives examples of their use in everyday life.

Where you see this symbol  in this booklet, the accompanying text is the thought process that goes along with the question.

As always, we encourage you to contact the school if you need further assistance.

Written and formatted with help from Inverclyde Academy and Rothesay Academy.

Practical Ideas

Practising numeracy skills around the home helps children to link what they are learning in school to the wider world and demonstrate how they are used in everyday life. Here are a few examples of how you help at home.

***Estimation and rounding*:**

- Roughly how long will take to drive/walk/cycle to…?
- Approximately, how much do you think this basket of shopping will cost?
- The website said 63,467 tickets have been sold for the Scotland rugby game at Murrayfield – how many is this to the nearest 10, 100, 1000?

***Number and number processes*:**

- There are 23 people coming to the party and each person is likely to eat three spring rolls from the buffet table. So how many do we need to buy?
- If a pack of 6 bottles of water costs £1.80, how much is each bottle?

***Fractions, decimal fractions and percentages*:**

- How many calories are in an eighth of this pizza, if there are 1040 in the whole pizza?
- How many extra grams did we get by buying the packet of cereal with 30% extra free?

***Money*:**

- Let's compare insurance quotes.
- Here's our new TV and Broadband bill, let's check it's correct.
- How many Euros will you get for the spending money you've saved up?
- How much does your mobile phone cost over the 24 month contract?

Time:

- Can you work out what time the chicken is due to come out of the oven?
- What time will the new Marvel film end if it starts at 5:45pm and lasts for 2 hour and 20 minutes?
- Look at the timetable and find which ferry we should get in order to be there on time.
- Look at the calendar and work out how many weeks are left until your birthday.

***Measurement*:**

- Can you weigh out these ingredients for me?
- Can you work out the half way height of the wall so we can paste the border on to it?
- How many packs of flooring do we need to replace the living room floor?
- Work out how many millimetres the sunflower has grown since last week.

***Information handling*:**

- Find me three different places on this news website where statistics have been used (e.g. bar/line/pie charts, frequency tables, averages).
- Chart the temperatures of each day of the summer holiday.

Estimating: Measure

Estimating measurements can be used in a lot of ways. To calculate the size of the walls in a room to estimate how many rolls of wallpaper or tins of paint are required when decorating, to calculate the size of carpets or flooring required for a room or to estimate the weight of luggage before travelling on holiday.

At First Level we expect pupils to be able to:

- Use knowledge of everyday objects to provide reasonable estimates of length, height, weight and volume.

At Second Level we expect pupils to be able to:

- Use comparative size of familiar objects to make reasonable estimates of length, height, weight and volume.

Examples

1. If the length of a ruler is 30cm, estimate the length of this pencil and desk

   Length of a pencil is approximately 10cm

   Length of a desk is approximately 1m

2. What is the weight of a bag of sugar?

   A bag of sugar weighs approximately 1kg

3. What is the area of the whiteboard in class?

   The area of a whiteboard is approximately 2m^2

4. What is the diameter of a 1p coin?

   The diameter of a 1p coin is approximately 15mm

5. If an angle had to be drawn to ± 2 degrees, what would be the largest and smallest acceptable angles in drawing 70^0?

   Largest acceptable angle = 72^o
   Smallest acceptable angle = 68^o

Estimating: Rounding

Numbers can be rounded to give an estimate.

A newspaper headline stated “Largs couple win £162 million in Euromillions lottery” when in fact they won £161,653,000. This is an example of rounding.

If a number is exactly half way between the two values for rounding (ends in a 5), we round up.

At First Level we expect pupils to be able to:

- Round 2 digit whole numbers to the nearest 10
- Round 3 digit whole numbers to the nearest 100

At Second Level we expect pupils to be able to:

- Round whole numbers and decimals up to 2 decimal places

At Third Level we expect pupils to be able to:

- Round any number up at least 3 decimal places or 3 significant figures

Examples

1. 385 → *390 (to the nearest ten)*

2. 347.6 → *348 (to the nearest whole number)*
   → *350 (to the nearest ten)*
   → *300 (to the nearest hundred)*

3. 7.51 → *7·5 (to 1 decimal place)*

4. 8.96 → *9·0 (to 1 decimal place)*

5. 323.7415 → *323·74 (to 2 decimal places)*
   → *320 (to 2 significant figures)*
   → *323·742 (to 3 decimal places)*
   → *324 (to 3 significant figures)*

Estimating: Calculations

Estimating when carrying out calculations makes those calculations easier as well as giving an approximate answer. While doing a weekly food shop, many people estimate the total by rounding each item in their basket to the nearest pound. Estimates are **NOT** exact.

At First Level we expect pupils to be able to:

- Estimate a calculation by rounding to the nearest whole number, 10 etc.

At Second Level we expect pupils to be able to:

- Estimate the cost of a shopping basket by rounding to the nearest pound or pairing to make pounds (eg 65p + 39p, 25p + 79p).

At Third Level we expect pupils to be able to:

- Estimate a calculation by rounding to one significant figure.

Examples

1. A woman buys various selection of meat costing £2.39, £5.72 and £1.98 in the butchers. Calculate the total bill.

Estimate £2 + £6 + £2 = £ 10

This calculation is done in your head, not on paper. That's the whole point of estimating.

Calculate

$$\begin{array}{r} 2\cdot 39 \\ 5\cdot 72 \\ +\ 1\cdot 98 \\ \hline £\ 10^{2}\cdot 0^{1}9 \end{array}$$

Answer £10·09

2. Tickets for a concert were sold over 4 days. The number of tickets sold each day was recorded. How many tickets were sold in total?

Monday	Tuesday	Wednesday	Thursday
486	205	197	321

Estimate 500 + 200 + 200 + 300 = 1200

Calculate

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

Answer 1209 tickets

3. A bar of chocolate has a mass of 42g. There are 48 bars of chocolate in a box. What is the total mass of chocolate in the box?

Estimate *50 x 40 = 2000g*

Calculate

$$\begin{array}{rrrr} & & 4 & 8 \\ & \times & 4 & 2 \\ \hline & & {}^{1}9 & 6 \\ 1 & {}^{3}9 & 2 & 0 \\ \hline 2 & 0 & 1 & 6 \end{array}$$

Answer *2016g*

Subtraction

Subtraction is one of the four basic operations in numeracy, the opposite process to addition.

At First Level we expect pupils to be able to:

- Subtract three digit whole numbers using decomposition (written method).
- Check answers by addition.

At Third Level we expect pupils to be able to:

- Subtract numbers with up to 3 decimal places using decomposition (written method).
- Subtract numbers with up to 3 decimal places mentally

Examples

Written Method

1. Calculate

(a) 271 – 38 (b) 400 – 74

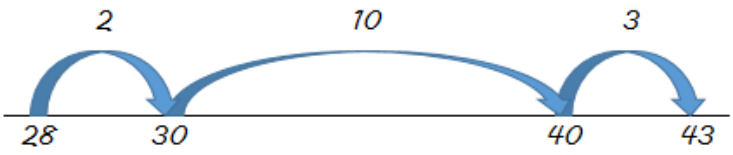
$$\begin{array}{r} 2\,\overset{6}{\cancel{7}}\,1 \\ -\;3\;8 \\ \hline 2\;3\;3 \end{array}$$

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

Mental Strategies

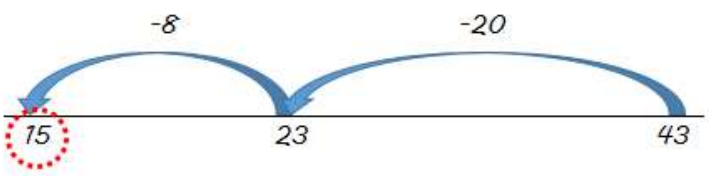
2. Calculate 43 – 28

Strategy 1: count on from 28 till you reach 43



2 + 10 + 3 = 15

Strategy 2: subtract 20 then subtract 8



Answer = 15

Multiplication & Division

Multiplication and division are two of the basic operations within numeracy. Pupils should realise the connection between both multiplication and division: $4 \times 5 = 20$ and $20 \div 5 = 4$

At First Level we expect pupils to be able to:

- Use a range of strategies to determine multiplication facts (counting in jumps, repeated addition)

At Second Level we expect pupils to be able to:

- Provides and answer as a decimal when dividing by a whole number, for example, 43 ÷ 5 = 8.6.

At Third Level we expect pupils to be able to:

- Know all their times tables (for multiplying and dividing) up to the 12 times table.
- Solve multiplication and division calculations with up to three decimal places.

Examples

1. Find 39 x 6

Mental Strategies

Strategy 1: Find 30 x 6 and 9 x 6 then add the two answers together

30 x 6 = 180, 9 x 6 = 54, 180 + 54 = 234

Strategy 2: Find 40 x 6 and 1 x 6 the subtract the two answers

40 x 6 = 240, 1 x 6 = 6, 240 - 6 = 234

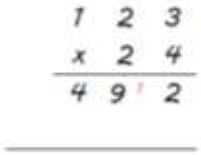
Written Calculation

$$\begin{array}{r} 3\ 9 \\ \times\ 6 \\ \hline {}^{5}\ 4 \end{array} \qquad \begin{array}{r} 3\ 9 \\ \times\ 6 \\ \hline 2\ 3^{5}\ 4 \end{array}$$

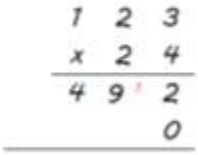
6 x 9 = 54, write the 4, carry the 5

6 x 3 = 18, add the 5, 18 + 5 = 23

2. Find 123 x 24



123 x 4 following steps shown before

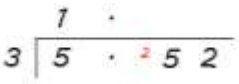


Add a zero as we are multiplying by 20 not 2

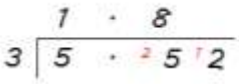
123 x 2 with answers one place to the left

Add the two answers together

3. Calculate 5.52 ÷ 3



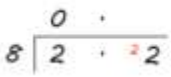
3 "goes into" 5 one time, remainder 2



3 "goes into" 25 eight times, remainder 1

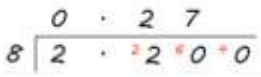
3 "goes into" 12 four times

4. Calculate 2.2 ÷ 8

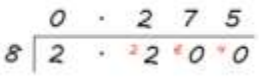


8 "goes into" 2 zero times, remainder 2

8 "goes into" 22 two times, remainder 6
Add the zero to continue the calculation



8 "goes into" 60 seven times, remainder 4
Add the zero to continue the calculation



8 "goes into" 40 five times, zero remainder

Multiplication & Division by Multiples of 10, 100 and 1000

Multiplying and dividing by 10, 100 and 1000 is commonly misunderstood – we do not just add or remove 0s. It may look like this but this is not mathematically correct.

At First Level we expect pupils to be able to:

- Multiply and divide whole numbers by 10, 100 1000 with whole number answers.

At Second Level we expect pupils to be able to:

- Multiply and divide numbers with up to 3 decimal places by 10, 100 1000.
- Multiply and divide numbers with up to 3 decimal places by multiples of 10, 100 1000.

Multiplying and dividing by 10, 100 and 1000

When you multiply a number by 10 the digits all move up to the next place value column. Try 27.34 x 10 on a calculator and see what happens. An easy way to visualise this is to imagine moving the decimal point **one** place to the **right**.

When you multiply by 100, imagine the decimal point moving 2 places to the right and if you multiply by 1000, imagine it moving over 3 places to the right.

The same rules apply with **division** but the decimal point moves to the **left** instead.

Multiplying and dividing by multiples of 10, 100 and 1000

A multiple of 10 is any number that ends with one 0.

A multiple of 100 is any number that ends with two 0's.

A multiple of 1000 is any number that ends with three 0's.

Some multiples of 10	*20, 50, 70*
Some multiples of 100	*300, 400, 900*
Some multiples of 1000	*2000, 7000, 8000*

When you multiply a number by a multiple of 10, 100 or 1000, first multiply by the first digit then multiply that answer by 10, 100 or 1000.

Same rules apply with division.

Examples

1. Multiply 82.56 by 10, 100 and 1000

82·56 x 10 = 8 2 5 · 6
82·56 x 100 = 8 2 5 6 ·
82·56 x 1000 = 8 2 5 6 0 ·

2. Divide 82.56 by 10, 100 and 1000

$82{\cdot}56 \div 10 = 8{\cdot}256$

$82{\cdot}56 \div 100 = 0{\cdot}8256$

$82{\cdot}56 \div 1000 = 0{\cdot}08256$

3. Calculate 35 x 30

$$\begin{array}{r} 35 \\ \times\ 3 \\ \hline 105 \end{array}$$

$105 \times 10 = 1050$

4. Calculate 38.4 x 600

Follow the same process, just line up the decimal points!

$$\begin{array}{r} 38{\cdot}4 \\ \times\ 6 \\ \hline 230{\cdot}4 \end{array}$$

$230{\cdot}4 \times 100 = 23040$

5. Calculate 45 ÷ 20

$45 \div 2 \div 10$

$= 22{\cdot}5 \div 10$

$= 2{\cdot}25$

6. Work out 660 ÷ 30

$660 \div 3 \div 10$

$= 220 \div 10$

$= 22$

Negative Numbers

Negative numbers are sometimes referred to as integers (technically negative and positive whole numbers).

At Second Level we expect pupils to be able to:

- Order numbers less than zero
- Be able to read negative numbers from a scale.
- Use negative numbers in context.

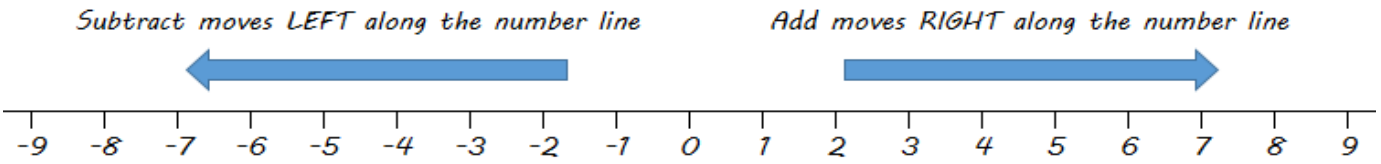
At Third Level we expect pupils to be able to:

- Perform calculations with negative numbers using the four operations (+, −,×,÷).

Number lines are useful when performing calculations involving negative numbers.

Adding and Subtracting

When adding numbers using a number line we move to the right and when subtracting we move to the left. However if we add or subtract a negative number we move in the OPPOSITE direction.



Multiplying and Dividing

Multiply/divide the numbers parts first, then decide which sign your answer should be using the following rules:

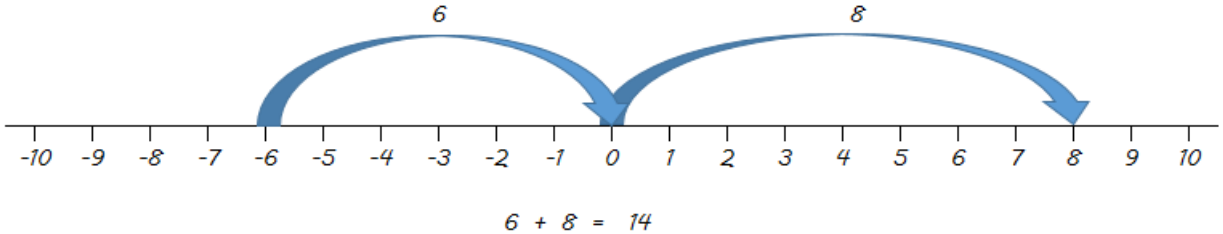
If the signs of the numbers are the **SAME**, the answer will be **POSITIVE**.

If the signs of the numbers are **DIFFERENT**, the answer will be **NEGATIVE**.

Examples

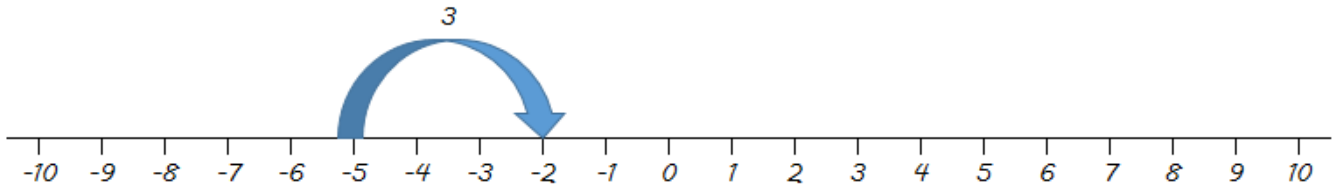
1. What is the difference between (– 6) and 8?

Using one of the number lines we travel from (-6) to 0 and work out how many we've jumped, then do the same from 0 to 8, then add the jumps together. So the answer is 14.



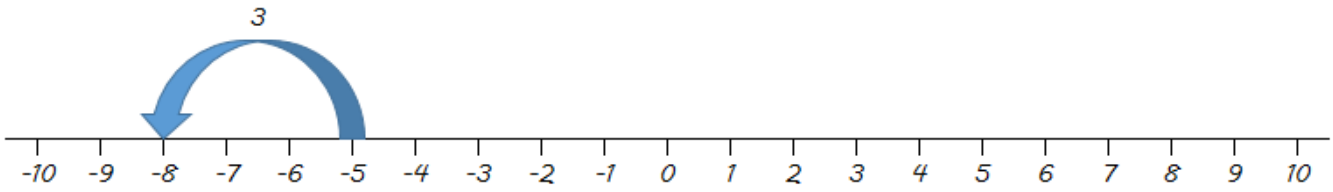
2. Calculate (-5) + 3

We start at (-5) on the number line and move 3 places to the right because the value is increasing. So (-5) + 3 = (-2).



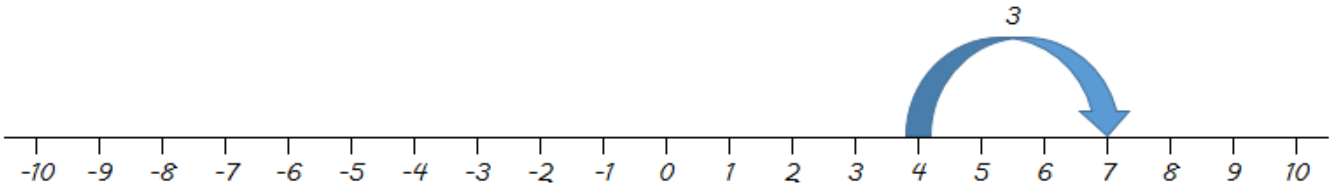
3. Find (-5) – 3

We start at (-5) on the number line and move 3 places to the left because the value is decreasing. So (-5) - 3 = -8.



4. Calculate 4 - (-3)

We start at 4 on the number line. As we are subtracting a negative number, we know we need to move RIGHT by 3. The negative sign ends up reversing the operation, so 4 - (-3) is the same as 4 + 3 = 7.



5. Calculate (-5) x 4

(-5) x 4 = -20

Negative answer because the signs are **different**

6. Calculate (-6) x (-2)

(-6) x (-2) = 12

Positive answer because the signs are the **same**

Fractions

At First Level we expect pupils to be able to:

- Understand the meaning of a fraction and be able to find $\frac{1}{2}$ or $\frac{1}{4}$ using concrete materials.
- Calculate simple fractions such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ or $\frac{1}{10}$ of whole numbers.

At Second Level we expect pupils to be able to:

- Create equivalent fractions.
- Order fractions using equivalence.
- Express fractions in their simplest form.

At Third Level we expect pupils to be able to:

- Add and subtract common fractions.
- Calculate fractions such as $\frac{2}{3}$, $\frac{3}{4}$, $\frac{7}{10}$ of whole numbers.
- Use the equivalences of widely used fractions to find a fraction of a quantity mentally, using written methods and with a calculator.
- Use equivalence of all fractions, decimals and percentages, add and subtract fractions with and without a calculator.

At Fourth Level we expect pupils to be able to:

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

Simplifying or finding Equivalent Fractions

This isn't technically a numeracy outcome but is important when dealing with fractions.

The top of a fraction is called the **NUMERATOR**, the bottom is called the **DENOMINATOR**.

To simplify a fraction we simply divide both the top number and the bottom number of the fraction by the same number. The answer is a fraction that is equal to the one you started with.

This can be done repeatedly until the top and bottom numbers are the smallest possible numbers – the fraction is then said to be in its "simplest form".

Finding a fraction of an amount

To find a fraction of an amount we divide the amount by the bottom number and multiply by the top number.

Examples

1. Simplify $\frac{20}{25}$

20 and 25 are both in the 5 times table, so divide each by 5

$$\frac{20}{25} = \frac{4}{5}$$

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

$$\frac{72}{84} = \frac{36}{42} = \frac{18}{21} = \frac{6}{7}$$

72 and 84 are both in the 2 times table, so divide each by 2

36 and 42 are both in the 2 times table, so divide each by 2

18 and 21 are both in the 3 times table, so divide each by 3

3. What fraction of the flag is shaded?

Answer = $\frac{6}{12} = \frac{1}{2}$

4. Calculate $\frac{1}{3}$ of 12

$\frac{1}{3}$ *of 12 = 12 ÷ 3 = 4*

5. Find $\frac{3}{4}$ of 200

Divide by 4 (bottom), multiply by 3 (top)

$\frac{3}{4}$ *of 200*

= 200 ÷ 4 x 3

= 50 x 3

= 150

Adding & Subtracting Fractions

6. Find $\frac{3}{9}+\frac{2}{9}$

$= \frac{5}{9}$

7. Find $\frac{14}{10}-\frac{8}{10}$

$= \frac{6}{10} = \frac{3}{5}$

When the denominators are the same, just add or subtract the numerators

8. Find $\frac{1}{3}+\frac{2}{5}$

$$= \frac{1}{3}\times\frac{2}{5} = \frac{5+6}{15} = \frac{11}{15}$$

X

Multiply the two denominators together (3 x 5) then multiply the right denominator by the left numerator (5 x 1) and then the left denominator by the right numerator (3 x 2)

9. Find $2\frac{1}{4}+4\frac{2}{3}$

$$= 2+4+\left(\frac{1}{4}\times\frac{2}{3}\right) = 6\frac{3+8}{12} = 6\frac{11}{12}$$

X

Multiplying & Dividing Fractions

To multiply two or more fractions together, multiply the numerators together and then the denominators.

To divide fractions, turn the second fraction upside down then multiply them as normal.

10. Find $\frac{2}{3}\times\frac{3}{4}$

$= \frac{6}{12}$

$= \frac{1}{2}$

11. Find $\frac{3}{4}\div\frac{2}{5}$

$= \frac{3}{4}\times\frac{5}{2}$

$= \frac{15}{8} = 1\frac{7}{8}$

12. Find $4\frac{2}{3}\times 2\frac{1}{2}$

$= \frac{14}{3}\times\frac{5}{2}$

$= \frac{70}{6} = 11\frac{4}{6} = 11\frac{2}{3}$

Percentages

Percentages and fractions are linked and pupils should understand how they are linked.

At Second Level we expect pupils to be able to:

- Calculate simple percentages of an amount (with and without a calculator).

At Third Level we expect pupils to be able to:

- Convert between fractions, percentages and decimals.
- Convert between percentages and fractions to carry out calculations.

At Fourth Level we expect pupils to be able to:

- Calculate a percentage increase or decrease.
- Express one value as a percentage of another.

Common Percentages

Most pupils find it useful to learn the common percentages listed in the table below.

Percentage	Fraction	Decimal
1%	$\frac{1}{100}$	0.01
10%	$\frac{1}{10}$	0.1
$12\frac{1}{2}\%$	$\frac{1}{8}$	0.125
20%	$\frac{1}{5}$	0.2
25%	$\frac{1}{4}$	0.25
$33\frac{1}{3}\%$	$\frac{1}{3}$	0.333…..
50%	$\frac{1}{2}$	0.5
$66\frac{2}{3}\%$	$\frac{2}{3}$	0.666….
75%	$\frac{3}{4}$	0.75

Calculating Percentages

When calculating percentages, pupils have several methods to choose from including using fractions, using basic percentage values and using a calculator.

Examples

1. Calculate 25% of £640

25% = $\frac{1}{4}$

$\frac{1}{4}$ of £640 = 640 ÷ 4 = £160

2. Calculate 30% of £6000

10% = 6000 ÷ 10 = £600

30% = 3 x £600 = £1800

3. Calculate 7% of 300m

1% = 300 ÷ 100 = 3m

7% = 7 x 3 = 21m

4. Calculate 36% of £400

10% = 400 ÷ 10 = £40

1% = 400 ÷ 100 = £4

30% = 3 x 40 = £120

6% = 6 x 4 = £24

36% = 30% + 6% = £120 + £24 = £144

Using a calculator makes the working easier *36% of £400 = 400 ÷ 100 x 36 = £144*

5. Express $\frac{3}{5}$ as a percentage

$\frac{3}{5} = \frac{6}{10} = \frac{60}{100} = 60\%$

Make the fraction "over 100"

6. Express $\frac{21}{24}$ as a percentage using a calculator

21 ÷ 24 x 100 = 87·5%

Ratio

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 amounts of each quantity, or to share a total into parts.

The order in which a ratio is written is important.

At Third Level we expect pupils to be able to:

- Express quantities as a ratio and simplify when required.
- Split a given amount using a ratio

Writing Ratios

When we write ratios we write the items and quantities in the same order

For example, the instructions to make diluting juice says mix ten parts water to one part concentrate.

The ratio of water to concentrate is 10 : 1 (said “10 to 1”).

However, the ratio of concentrate to water is 1 : 10 (said “1 to 10”).

Simplifying Ratios

Ratios can be simplified in much the same way as fractions.

To simplify a ratio we simply divide each quantity by the same number. This can be done repeatedly until each quantity is the smallest possible numbers – the ratio is then said to be in its “simplest form”.

Using Ratios

It is possible to use ratios to calculate one quantity if you know another and are given the ratio. To do this figure out what the original ratio is multiplied by to get to the given quantity. Then multiply the other quantity by this amount.

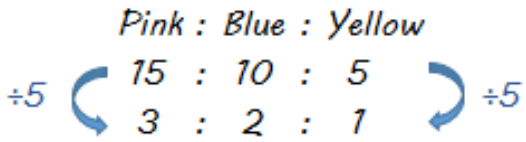
Sharing in a Given Ratio

It is possible to split a total quantity in a given ratio by calculating the total number of “parts”, working out the value of each “part” then finding the value of each section of the ratio.

Examples

1. In a bag of balloons there are 15 pink, 10 blue and 5 yellow balloons.

   White the ratio of balloons in its simplest form.



2. The ratio of fruit to nuts in a chocolate bar is 3 : 2. If a bar contains 15g of fruit, what weight of nuts will it contain?

	Fruit		Nuts		
x5	3	:	2	x5	The bar contains 10g of nuts
	15	:	10		

3. Daniel and Lana earn money by washing cars. By the end of the day they have made £40. As Lana did more of the work, they decided to share profits in the ratio 3 : 2. How much money did each receive?

Total number of parts	2	+	3	=	5
Each part is worth	40	÷	5	=	£8
Daniel gets	8	x	2	=	£16
Lana gets	8	x	3	=	£24

Check 16 + 24 = 40

Proportion

Proportion is when one quantity increases or decreases based on another quantity.

Direct proportion is when both values increase steadily (if one apple costs 30p, 2 apples costs 60p, 3 apples costs 90p, etc).

Indirect proportion is when as one value increase steadily, the other decreases steadily (or vice versa). For example, if it takes 2 men 10 hours to lay a driveway it would take 4 men 5 hours.

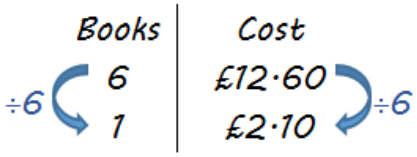
At Third Level we expect pupils to be able to:

- Solve problems where quantities are increased or decreased proportionally

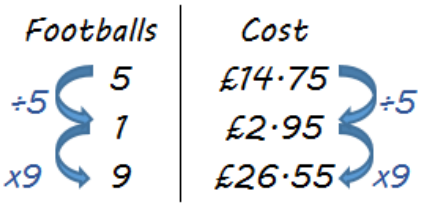
Working for proportion is best set out in a table and it is always a good idea to calculate the unitary cost/value (for one item).

Examples

1. If 6 identical books cost £12.60. What is the cost of 1 book?

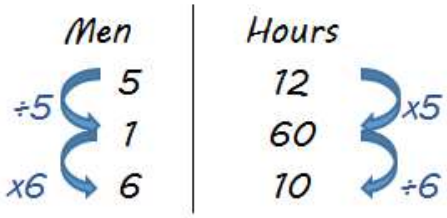


2. If 5 footballs cost £14.75, how much will 9 footballs cost?



First, find the cost of 1
Then the cost of 9

3. If 5 men take 12 hours to paint a fence, how long will it take 6 men?



First, find the time for 1
Then the time for 6

Money

As can be seen from previous topics, money calculations are embedded throughout Numeracy.

At First Level we expect pupils to be able to:

- Identify and use all coins and notes up to £20.
- Uses a variety of coins and notes up to £20 to pay for items and calculate change.

At Second Level we expect pupils to be able to:

- Add, subtract, multiply and divide (by a single digit) and calculate simple shopping bills.
- Compare prices and costs and determines affordability within a given budget.
- Understand the meaning of and be able to calculate profit and loss.

At Third Level we expect pupils to be able to:

- Demonstrate an understanding of best value in relation to contracts and services.

At Fourth Level we expect pupils to be able to:

- Demonstrate an understanding of personal finance (including personal finances, credit cards and savings, insurances etc.).

Time Calculations

This is a topic in numeracy that pops up in and out of school all the time.

At First Level we expect pupils to be able to:

- Tell the time using analogue and digital clocks in five minute intervals.

At Second Level we expect pupils to be able to:

- Convert between 12 hour and 24 hour times, e.g. 22:08 = 10.08pm.
- Convert between commonly used time intervals, e.g. days, hours, minutes and seconds.
- Read a variety of timetables.
- Calculate the duration in hours and minutes by drawing a time line or by counting up to the next hour then on to the required time.
- Use decimals for time in seconds i.e. 3 minutes 23.4 seconds.

At Third Level we expect pupils to be able to:

- Calculate time intervals across hours and days.

At Fourth Level we expect pupils to be able to:

- Express hours and minutes as a decimal fraction of an hour.
- Calculate time intervals across hours, days and months.

Conversion between 12 hour and 24 hour clock

When using 12 hour clock pupils must use AM or PM to show if the time is before noon (AM) or after noon (PM).

When writing 24 hour clock pupils must never use AM or PM but instead use four digits. Any time before 10AM will have a leading zero and any time after 12 noon will have 12 added to the hours.

Calculating and using a time interval

When undertaking any calculations involving a time interval, we teach pupils to use a time line.

Changing between minutes and decimal fractions of an hour

This is important when using time in calculations involving speed and distance (see the next section).

To change from minutes to hours we multiply by 60. To change from hours to minutes we divide by 60.

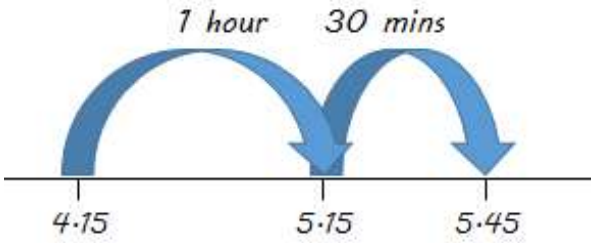
Examples

1. Convert between 12 hour and 24 hour time for:

(a)	9.15AM	0915
(b)	8.40PM	2040
(c)	12.05AM	0005
(d)	0455 hours	4·55AM
(e)	2120 hours	9·20PM

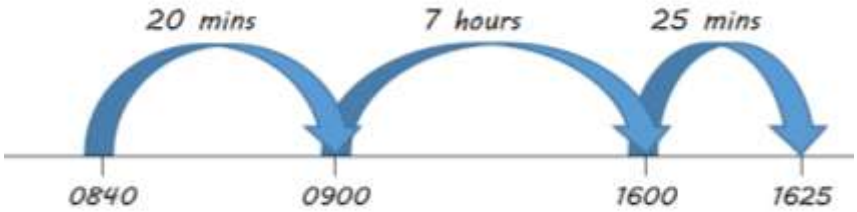
No AM or PM
Add 12 to the hours
12AM is 0000
Remember the AM or PM
Subtract 12 from the hours

2. How long is it from 4.15PM to 5.45PM?



1 hour 30 minutes

3. How long is it from 0840 to 1625?



7 hours 45 minutes

4. Change 2 hours 36 minutes into decimal time.

36 ÷ 60 = 0·6 so 2 hours 36 minutes = 2·6 hours

5. Change 1.3 hours into hours and minutes.

0·3 x 60 = 18 so 1·3 hours = 1 hour 18 minutes

Speed, Distance & Time

By using knowledge of time, pupils can apply it to calculations involving speed and distance.

At Second Level we expect pupils to be able to:

- Estimate the duration of a journey.

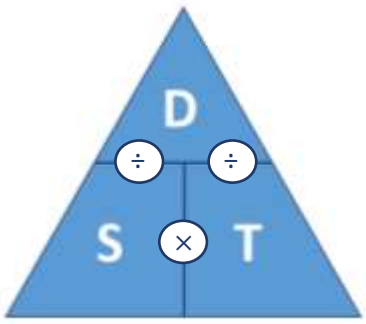
At Third Level we expect pupils to be able to:

- Calculate the distance travelled during a journey, the average speed an object and how long a journey takes using simple fractional hours.

At Fourth Level we expect pupils to be able to:

- Calculate the distance travelled during a journey, the average speed an object and how long a journey takes using complex fractional hours.

To calculate distance, speed or time pupils must first know what formula to use. To help them, they can use the DST triangle.



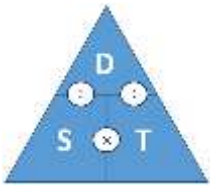
$D = S \times T$

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

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

Examples

1. A runner can run at a pace of 4 miles per hour. What distance does she cover is she runs at that pace for 2 hours 30 minutes?



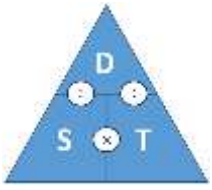
$D = S \times T$

$= 4 \times 2{\cdot}5$

$= 10$ miles

Divide the minutes part of the time by 60 to convert to hours

2. A bus travelled a total distance of 90 miles at an average speed of 40 miles per hour. How long did the journey take?



$T = D \div S$

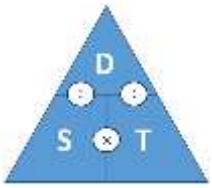
$= 90 \div 40$

$= 2{\cdot}25$ hours

$= 2$ hours 15 minutes

Multiply 0·25 by 60 to convert to minutes

3. A train travelled a total distance of 195 miles in 3 hours 15 minutes. What was the average speed?



$S = D \div T$

$= 195 \div 3{\cdot}25$

$= 60mph$

Divide the minutes part of the time by 60 to convert to hours

Units of Measurement

Measurement is a key aspect of numeracy and can be easily used in everyday life.

At First Level we expect pupils to be able to:

- Record measurements of length, height, weight and volume using standard units.
- Convert between common units of measurement using only whole numbers e.g. 52cm = 520mm

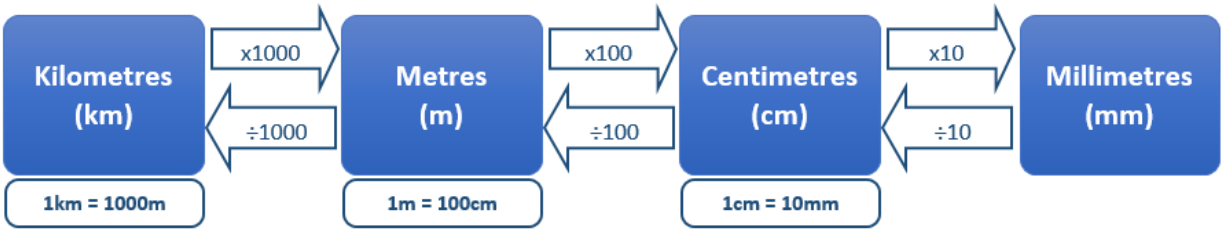
At Second Level we expect pupils to be able to:

- Convert between common units of measurement using decimal notation e.g. 5.2cm = 52mm

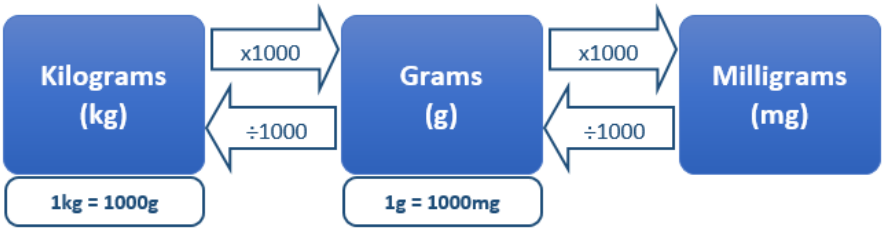
At Third Level we expect pupils to be able to:

- Choose appropriate units for length, area and volume when solving problems.

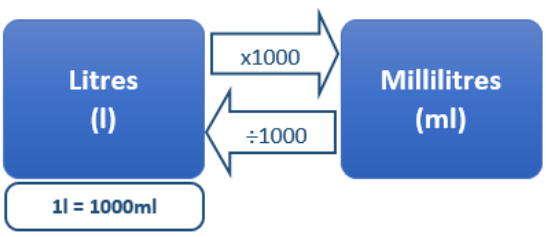
Units of Length



Units of Mass



Units of Volume



$1cm^3 = 1ml$ and

$1000cm^3 = 1000ml = 1l$

Information Handling

Pupils must be able to construct or interpret data from a range of different types of graphs and tables.

At First Level we expect pupils to be able to:

- Display data using bar graphs and tables.
- Include suitable title, labelling and appropriate scale when constructing graphs.

At Second Level we expect pupils to be able to:

- Display data using bar graphs, line graphs, frequency tables and pie charts.
- Include suitable title, labelling and appropriate scale when constructing graphs.
- Analyse and interpret a variety of graphs.
- Draw conclusion about the reliability of data.

At Third Level we expect pupils to be able to:

- Source information to construct graphs.
- Determine if data is robust, vague or misleading.

At Fourth Level we expect pupils to be able to:

- Use appropriate language when describing data and graphs.
- Select the most appropriate graph to display data.

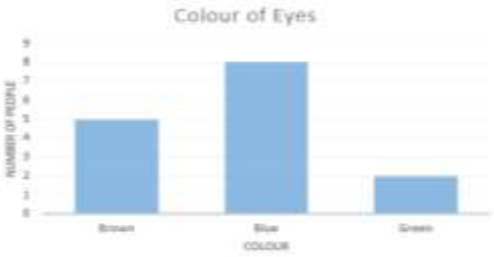
Frequency Tables

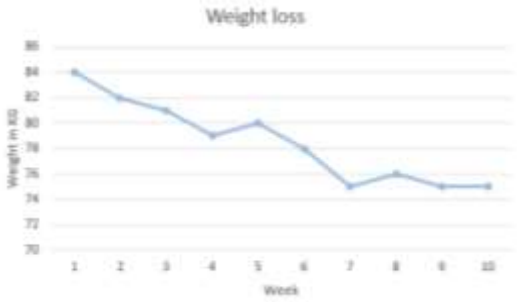
Frequency tables allow us to group data in order to interpret the data easier. We use tally marks to make counting much easier.

Shoe size	Tally	Frequency
4	II	2
5	IIII	4
6	𝍸 I	6
7	III	3

Bar Graphs

Bar graphs are used to display discrete data (data that can be grouped). These graphs can be horizontal or vertical, must have spaces between the bars and the bars must be all the same width. Bar graphs must have a chart title as well as a label on both axes and units (if applicable).



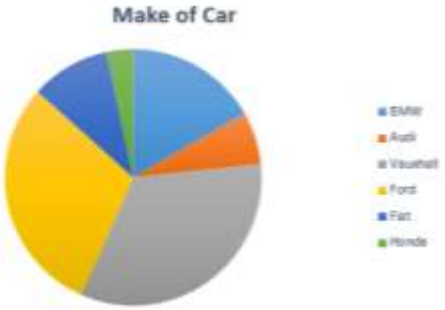


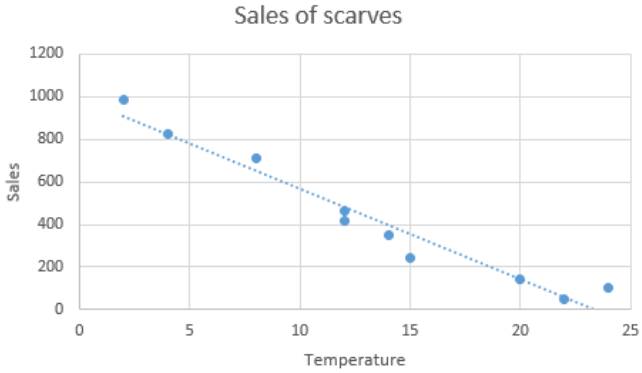
Line Graphs

Line graphs are used to display continuous data. These graphs consist of a series of points that are joined up. Line graphs must have a chart title as well as a label on both axes and units (if applicable).

Pie Charts

Pie charts are used to display one set of data as a fraction of a total. These graphs are circular, must have a key or each sector must be labelled. Pie charts must have a chart title.





Scatter Graphs

Scatter graphs are used to display the relationship between two variables in order to see if a relationship exists. This relationship is called correlation. Scatter diagrams must have a chart title as well as a label on both axes and units.

Examples

1. A class had the following shoe sizes
   5 5 5 6 4 3 5 6 6 6 7 4 7 5 6 7 6

   Express this information in a frequency table.

Shoe Size	Tally	Frequency
3	I	1
4	II	2
5	𝍸	5
6	𝍸 I	6
7	III	3

2. Draw a frequency table for homework marks for Mr Smith's Maths class.

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

Mark	Tally	Frequency
16 - 20	II	2
21 - 25	𝍸 III	8
26 - 30	𝍸 III	8
31 - 35	𝍸	5
35 - 40	III	3
41 - 45	II	2
46 - 50	II	2

3. The bar graph shows the size of pupil's feet in a PE class.

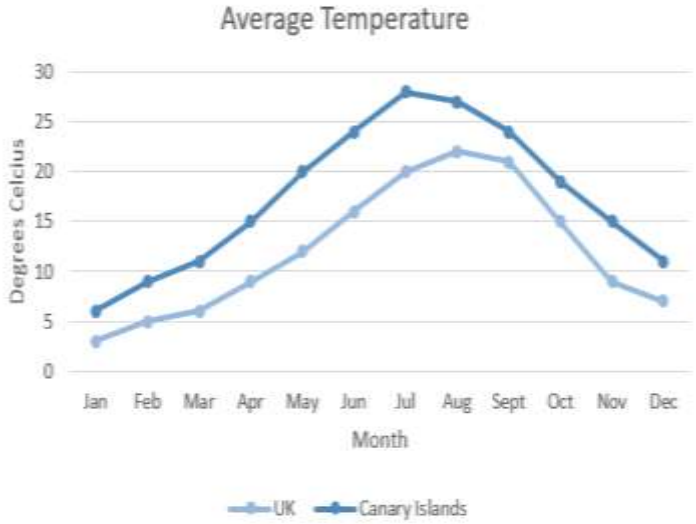
(a) What is the most common shoe size?

Size 7

(b) How many people had size 9 feet?

Seven

4. The average daily temperature in the UK and the Canary Islands is show in the line graph below.



(a) What month is the maximum temperature in the UK?

August

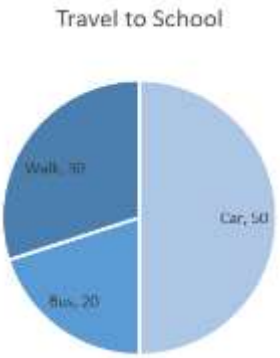
(b) What month is the maximum temperature in the Canary Islands?

July

(c) Describe the trend of the temperature in the Canary Islands.

The temperature in the Canary Islands climb to a maximum in July then starts falling. The temperature in the Canary Islands is always hotter than the UK.

5. The pie chart shows the mode of transport pupils take to school.



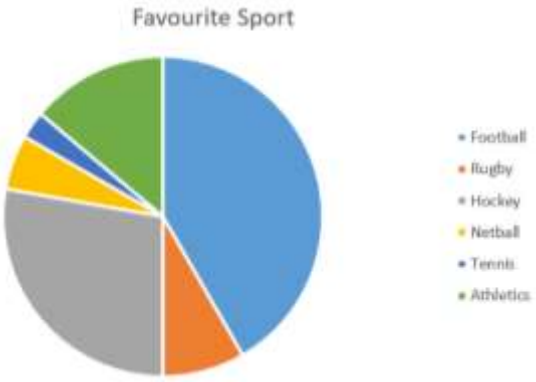
(a) What mode of transport is the least used?

Bus

(b) What fraction of pupils took the car to school?

$\frac{50}{100} = \frac{1}{2}$

6. The pie chart below shows the favourite sports of a PE class.



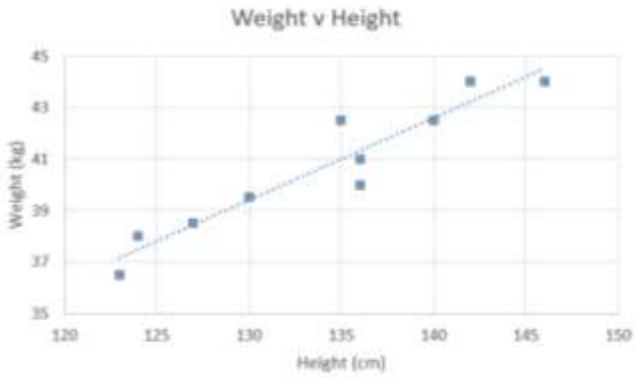
(a) What is the most liked sport?

Football

(b) List the sports in order of popularity (starting with the least favourite).

Tennis, Netball, Rugby, Athletics, Hockey, Football

7. The scatter graph shows the relationship between height and weight of ten pupils in a class.



(a) Describe the correlation.

Positive correlation

(b) Use the line of best fit to estimate the weight of a person who is 135cm tall.

41 kg