Bishopbriggs Academy

Numeracy

Common Language and Methodology

A guide for parents of pupils in the broad general education
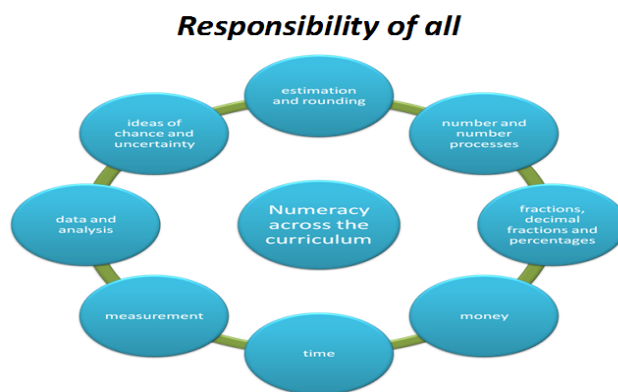
Contents

Introduction

What is Numeracy?
Numeracy is a skill which supports all areas of learning, allowing young people access to the wider curriculum and develops key skills for learning, life and work. In our everyday lives we will regularly be required to estimate, use number processes, work with fractions and percentages, manage money and time, make measurements and read information from charts and tables.

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.

What is the purpose of the booklet?
This booklet has been produced to give guidance to pupils and parents on the 8 key numeracy strands. It is designed to give an overview of each area and show examples of how this is taught across the school. Staff from all departments have been consulted during its production and will be issued with a copy of the booklet. It is hoped that using a consistent approach across all subjects will make it easier for pupils to progress.

How can it be used?
The booklet is designed as a reference guide when helping your child with homework or to reinforce numeracy ideas within teaching practice. The contents page outlines the 8 key numeracy areas and each section gives an outline and useful examples on each topic.

The booklet includes Numeracy skills useful in subjects other than Mathematics, such as Science, Business Studies, Geography, History and Modern Studies amongst others.

Numeracy Glossary
This has been developed for parents and carers and provides clear definitions of some of the commonly used terms in numeracy and mathematics:
https://education.gov.scot/parentzone/learning-at-home/supporting-numeracy/Numeracy%20and%20mathematics%20glossary

Numeracy Benchmarks
Benchmarks have been developed to provide clarity on the national standards expected within numeracy at each level.
Link to 'parentzone' Numeracy and mathematics glossary

Estimation & Rounding
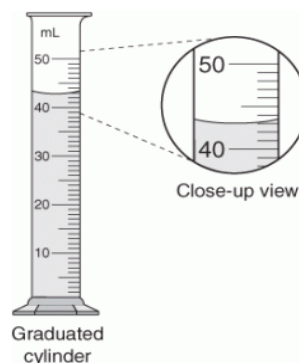
Accuracy and Tolerance

Why is this skill important?
In different contexts there will be different degrees of accuracy required, especially with measurements and real-life contexts.

What is this skill ?

Rounding Poem

Find your number,

Look right next door.

4 or less, just ignore.

5 or more, add 1 more.

Tolerance intervals are the differences between the greatest and least acceptable values of the measurement. Tolerance is the maximum range of variation allowed within particular situations and contexts and supports the understanding of inaccuracy.

Pupils should know that depending on the situation, degrees of accuracy in rounding may differ, e.g. when measuring the length and breadth of a room for a carpet, rounding up should be applied to ensure enough carpet is purchased.

Experiences and outcomes (Es+Os) are a set of clear and concise statements about children's learning and progression in each curriculum area. They are used to help plan learning and to assess progress.

Experiences and Outcomes	Level 3	Experiences and Outcomes	Level 4
Estimation and Rounding	I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem. *MNU 3-01a*	**Estimation and Rounding**	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*

Subject Examples

Example 1: S1 Science Cells and Microbes

The following diagram shows a virus and a bacterium:
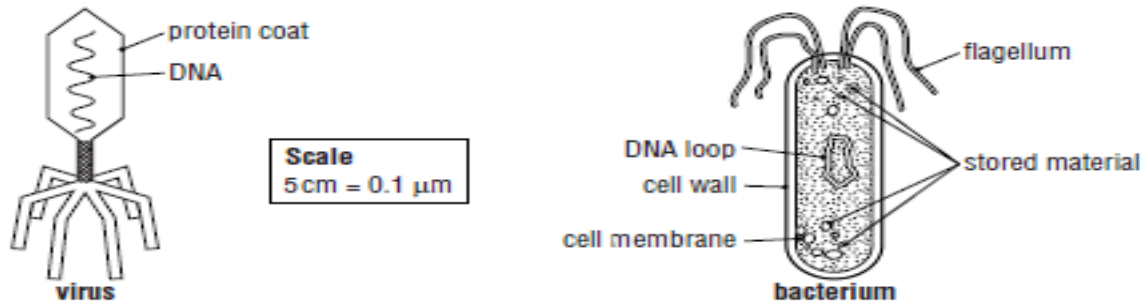
Measure the length of the virus and bacterium to the nearest cm. What is the approximate length, in μm, of the virus and the bacterium?

Answer: (*use a ruler to measure the length of the virus and the bacterium and then use the scale to convert to um*)

Example 2: S1 Geography

Measuring objects in class; use their original size to scale them down to fit onto a map.

Measure each object with your tape measure., **round to the nearest cm,**

Using a scale of 1cm : 10cm

Eg. Desk

What is the height of the desk in real life? _____cm

What is the width of the desk in real life? _____cm

Our scale is 1cm:10cm, so what would the height be on our map? _____cm

What would the width be on our map?   _____ cm

(*answer: use a metre stick or ruler to make the measurement and then round to nearest 10cm.*)

Links to Tutorials for Estimation and Rounding

Tutorials

https://www.bbc.co.uk/education/guides/zv3rd2p/revision

https://www.youtube.com/watch?v=fd-E18EqSVk

Maths Is Fun-Try It

www.mathsisfun.com

Getting to know BODMAS

http://mrnussbaum.com/orderops/

Measurement

1. Selecting and Converting Units

Why is this skill important?

Being able to convert between units enables you to use the most appropriate and efficient unit or measurement. It underpins the rules and concepts in many areas including Science, Engineering and Technology.

What is this skill?

Be able to apply multiplication and division facts (inverse operations) to whole numbers, fractions and decimal fractions.

Pupils should also be able to use the most appropriate unit of measurement in relation to individual contexts and when carrying out calculations.

2. Calculations involving measurements

Why is this skill important?

Calculations involving perimeter, area and volume are needed in real life contexts and enable us to work out accurate amounts.

What is this skill?

Carrying out calculations using the four operations ($\div$,$+$, $-$, x) involving perimeter, area and volume. Using whole numbers, fractions, decimal fractions or percentages according to context.
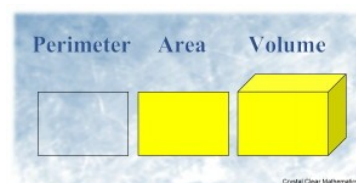
3. Formula and inter-relationships

Why is this skill important?

Formula is used to simplify the process of calculations and to calculate an unknown variable. Awareness of the interrelationship between different formulae supports further calculations to be made.

e.g. diameter=2 x radius
C=π D or C=2 π r

What is this skill?

Specific formulae are used to carry out calculations involving measurement. These provide a method for accurately and efficiently calculating perimeter, area and volume. Using knowledge of the formula to be able to undertake a number of related calculations associated with length, breadth, height, area and volume.

| Experiences and Outcomes	Level 3	Experiences and Outcomes	Level 4
Measurement	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**	**Measurement**	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**

Further Explanations

Area

Square centimetres (cm^2) can be used to measure area.

1 cm

1 cm
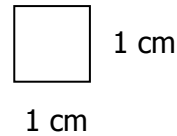
Square millimetres (mm^2) can be used to measure smaller areas. Such as a pin.

10 mm

10 mm
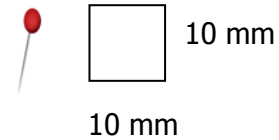
Square metres (m^2) can be used to measure larger areas.
Areas of land can be measured in hectares. 10 000 m^2 = 1 hectare.
The area of a country, or a forest, or the surface of an ocean can be measured in square kilometres (km^2).

Using Formulae
The following formulae can be used to calculate areas of well known shapes:

Area of triangle = ½bh = base × height

Area of circle = πr^2 = π × radius × radius

Area of kite and rhombus = $\frac{1}{2}d_1d_2$ = half the product of the diagonals

Area of parallelogram = bh = base × height

Volume

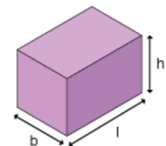1 cubic centimetre ($1cm^3$) = 1 millilitre
1000 millilitres = 1 litre
1000 litres = 1 cubic metre ($1m^3$)
The capacity of a vessel is the volume it can hold.

To calculate the volume of a cube or cuboid we use the following formulae:

Volume = lbh = length × breadth × height
or $V = Ah$ = area of base × height

To form a prism, take any two congruent (identical) faces and connect them by rectangles.
The diagram shows a triangular prism.

As with the cuboid, to calculate the volume of a prism we use the formulae:

$V = Ah$ = area of base × height

9
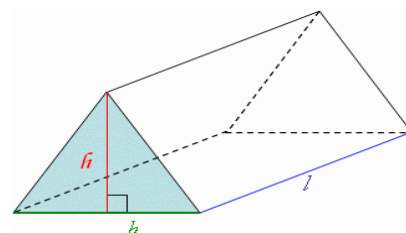
Subject Examples

Example 1:   S2 Science

Calculate the total area of the field.

Field

Answer: 25 x 40 = 1000 m^2

25m

40m
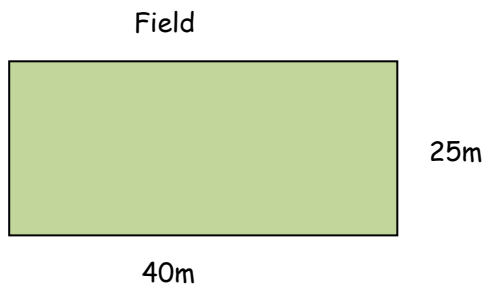
Calculate the total area of the quadrat.

5m

5m
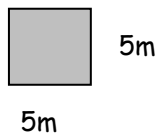
Answer: 5x5 = 25m^2

How many times bigger is the area of the field compared to the area of the quadrat?

Answer: 1000 ÷ 25 = 40

Links to Tutorials and Games for Measurement

Tutorials

http://www.bbc.co.uk/programmes/p017g77c

Games

https://www.funbrain.com/games/measure-it

http://www.ictgames.com/shape.htm

Number and Number Processes

Learners should be able to apply numeracy skills across a variety of real life contexts. This leads to them being numerate and being able to function responsibly in everyday life, contributing effectively to society and increasing their opportunities within the world of work.

1.Order of operations

Why is it important?
An understanding of "arithmetic" rules needs to be established to support carrying out calculations that involve more than one operation. This enables the development of more efficient calculations.

What is this skill?
Learners should be able to understand and apply the simple order of operations.



2. Negative numbers

Why is it important?
Understanding negative numbers is important for real life applications such as temperature measurements, graphs, charts and budgeting.

Integers
What is this skill?
The term integer is used when working with positive and negative whole numbers. Pupils should be able to use integer calculations in a context involving the four operations.
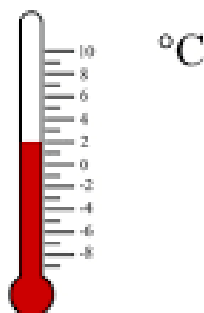
3. Fractions, decimal fractions and percentages

Why is it important?
Learners should be able to see fractions, decimal fractions and percentages as operators rather than just a number. They should be capable of solving problems involving fractions, decimal fractions and percentages using a wide variety of methods. This is an important life skill.

What is this skill?
Pupils should
- Be able to work with fractions using times tables skills.
- Understand the importance of place value in using decimal fractions and percentages in calculations.

Experiences and Outcomes	Level 3	Experiences and Outcomes	Level 4
Number and Number Processes	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	**Number and Number Processes**	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

Further Explanation

BODMAS

In a string of calculations with various steps, an order has been agreed.

Example

a) $15 + 6 \times 4$ b) of $60 - 10$

c) $(13 + 27) \div (2 \times 5)$

a) Multiply first $15 + 6 \times 4 = 15 + 24 = 39$

b) Of first   of $60 - 10 = 20 - 10 = 10$
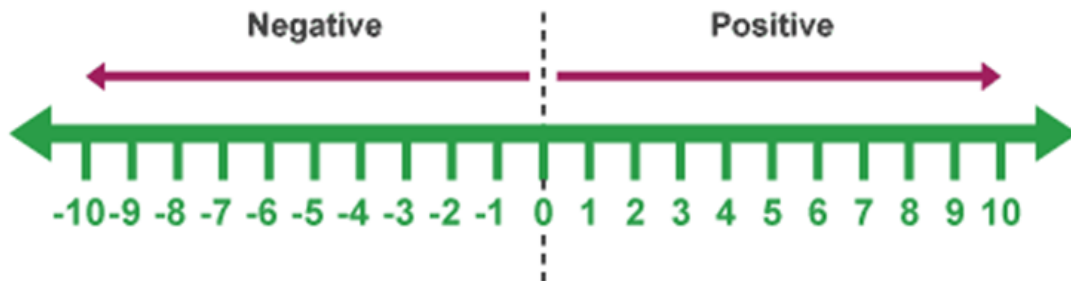
c) Brackets first $(13 + 27) \div (2 \times 5) = 40 \div 10 = 4$

B R A C K E T	O F	D I V I D E	M U T I P L Y	A D D	S U B T R A C T
BRACKET	OF	DIVIDE	MUTIPLY	ADD	SUBTRACT

Further Explanation

<u>Integers</u>

When adding and subtracting with integers you should consider a number line and the direction you must move.

e.g.

    4 + 3 means start at 4 and move 3 places up the number line to 7

    4 + (- 3) means start at 4 and move 3 places down the number line to 1

    -5 - 9 means start at -5 and move 4 places down to -9

    -5 - (-4) means start at -5 and move 4 places up to -1

When we multiply or divide two numbers the following rules apply.

- With the **same** sign, the result is **positive**

- With **opposite** signs, the result is **negative**

Example

$$-5 \times (-9) = 45$$

$$8 \times (-7) = -56$$

$$-50 \div (-5) = 10$$

$$30 \div (-6) = -5$$

Subject Examples

Example 1: S1 Science

Elements which have a melting point above room temperature (25° C) will be solids at room temperature.
Elements which have a boiling point below room temperature (25° C) will be gases at room temperature.
Elements which have a melting point below room temperature (25° C) **and** a boiling point above room temperature (25° C) will be liquids at room temperature.

Identify whether these elements will be a solid, liquid or gas at room temperature

a)   Caesium melting point 28^0C, boiling point 671^0C *Answer: solid*

b)   Neon melting point -249^0C, boiling point -246^0C *Answer: gas*

c)   Mercury melting point -39^0C, boiling point 357^0C *Answer: liquid*

Fractions, Decimal Fractions and Percentages

$\frac{3}{100}$ 0.03

3%
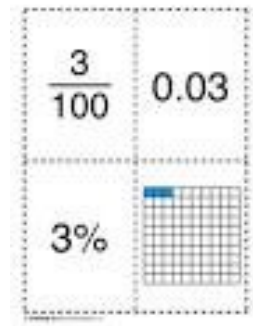
1. Equivalent forms

Why is it important?
This simplifies the process of carrying out calculations that involve fractions, decimals fractions and percentages.

What is this skill?
Simplifying fractions makes the calculation process more efficient e.g. 1/2 and 2/4 are equivalent.

2. Relationships that link fractions, decimal fractions and percentages

Why is it important?
It allows for different ways to solve problems efficiently, including mental calculations. Being able to carry out calculations and move between different forms is an important skill.

What is this skill?
Learners should be able to change between fractions, decimal fractions and percentages. Learners should be able to choose the most appropriate form to display the answer which will depend on context of the question or problem.

Fractions Decimals Percentages

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

3. Linking fractions to ratio and proportion

Can you identify the ratio of sand to lime in the mortar mixes shown below?

Ratio
What is this skill?
Learners should understand how to express fractions as ratios. They should know how to construct a ratio from a problem in context.

= 4:1

= 3:1

= 3:2

Proportion
What is this skill?
Two variables are proportional if a change in one is always accompanied by a change in the other.

= 4:2

 eg. A quantity increases so the other increases in proportion.

Experiences and Outcomes	Level 3
Fractions, Decimal Fractions and Percentages	I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and informed choices for real-life situations. MNU 3-07a I can show how quantities that are related can be increased or decreased proportionally and apply this to solve problems in everyday contexts. MNU 3-08a

Experiences and Outcomes	Level 4
Fractions, Decimal Fractions and Percentages	I can choose the most appropriate form of fractions, decimal fractions and percentages to use when making calculations mentally, in written form or using technology, then use my solutions to make comparisons, decisions and choices. MNU 4-07a Using proportion, I can calculate the change in one quantity caused by a change in a related quantity and solve real-life problems. MNU 4-08a

Fractions: Further Explanations

When fractions are worth the same, we say they are **equivalent**. We can find a fraction that is equivalent to a given fraction by multiplying both numerator and denominator by the same number.

numerator
denominator
$$\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}$$

When the numerator is smaller than the denominator, the fraction is called a **proper** fraction.
When the numerator is larger than the denominator, the fraction is called an **improper** fraction.
When a number is made up of a whole part and a fractional part it is called a **mixed number**.

Smaller ⟶ $\frac{3}{5}$ ⟵ Larger

Proper
Fraction

Larger (or equal) ⟶ $\frac{9}{5}$ ⟵ Smaller (or equal)

Improper
Fraction

$2\frac{1}{3}$

Mixed
Fraction

Further Explanation: Fractions

i.) To add or subtract common fractions we make sure they have a **common denominator**. To keep the calculation simple we use the **lowest common denominator.**

a) Express $5\dfrac{1}{3}$ as an improper fraction.

$$5\frac{1}{3}=5+\frac{1}{3}=\frac{5}{1}+\frac{1}{3}=\frac{5\times 3}{1\times 3}+\frac{1}{3}=\frac{15}{3}+\frac{1}{3}=\frac{16}{3}$$

b) Express $\dfrac{28}{5}$ as a mixed number

$$\frac{28}{5}=28\div 5=5 \quad \text{remainder } 3 = 5\frac{3}{5}$$

ii) To multiply fractions we simply multiply numerators together and multiply denominators together.

a) $$\frac{3}{4}-\frac{1}{8}=\frac{3\times 2}{4\times 2}-\frac{1}{8}=\frac{6}{8}-\frac{1}{8}=\frac{5}{8}$$

b) $$\frac{2}{3}+\frac{3}{5}=\frac{2\times 5}{3\times 5}+\frac{3\times 3}{5\times 3}=\frac{10}{15}+\frac{9}{15}=\frac{19}{15}=1\frac{4}{15}$$

iii.) We can change any division for an equivalent multiplication.

$$\boxed{\frac{a}{b}\div \frac{c}{d}=\frac{a}{b}\times \frac{d}{c}}$$

$$\frac{2}{3}\times \frac{3}{7}=\frac{2\times 3}{3\times 7}=\frac{6}{21}=\frac{2}{7}$$

iv.) To multiply or divide with mixed numbers we must first express them as improper fractions.

$$\frac{9}{10}\div \frac{3}{4}=\frac{9}{10}\times \frac{4}{3}=\frac{36}{30}=1\frac{6}{30}=1\frac{1}{5}$$

Further Explanation: Percentages

Percentage increase or decrease can be calculated quickly with the help of a calculator.

Example

Toby was 135 cm tall last year but has increased in height by 8% this year. How tall is Toby now? I bought a car for £18 500. It has since depreciated by 14%. How much is it worth now?

　　100% + 8% = 108% = 1·08
　　So Toby's height = 1·08 × 135 = 145·8 cm

　　100% - 14% = 86% = 0·86
　　Value of car = 0·86 × 18 500 = £15 910

We can also express one quantity as a percentage of another.

Example

Sharon scored 54 out of 75 in her French assessment. To gain a grade A she must score over 70%. Has Sharon achieved a grade A?

Without a calculator we can use equivalent fractions

$$\frac{54}{75} = \frac{18}{25} = \frac{72}{100} = 72\%$$

With a calculator we can simply divide

$$\frac{54}{75} = 54 \div 75 = 0\cdot72 = 72\%$$

As Sharon scored more than 70%, she achieved a grade A.

Further Explanation Ratio

It is important that pupils can carry out calculations involving ratios. The ratio is used to share quantities in unequal amounts.

Example

To make juice a ratio of concentrate to water of $2:3$ is used. How much concentrate is required for 15 litres of juice?

The mixture is 2 parts concentrate and 3 parts water, making a total of 5 parts.
Each part is worth 15 litres ÷ 5 = 3 litres.
So 2 × 3 = 6 litres of concentrate are required.

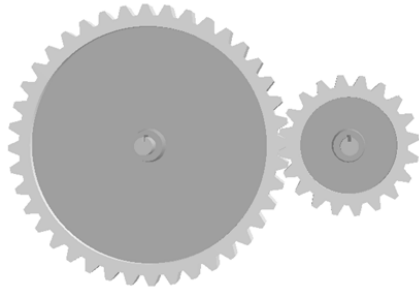When two quantities change in the same ratio, the quantities are said to be **directly proportional**.

Subject Examples

Example 1 : Design and Technology

Calculating velocity ratio
The **velocity ratio** is the ratio of the input speed compared to the output speed. We can calculate the velocity ratio using the following formula:

Example:

Input gear   Output gear
40 teeth   20 teeth

Velocity Ratio   = $\dfrac{\text{No of teeth on output gear}}{\text{No of teeth on input gear}}$

Velocity Ratio   = $\dfrac{20}{40}$

Velocity Ratio   = $\dfrac{1}{2}$

To write this as a ratio:

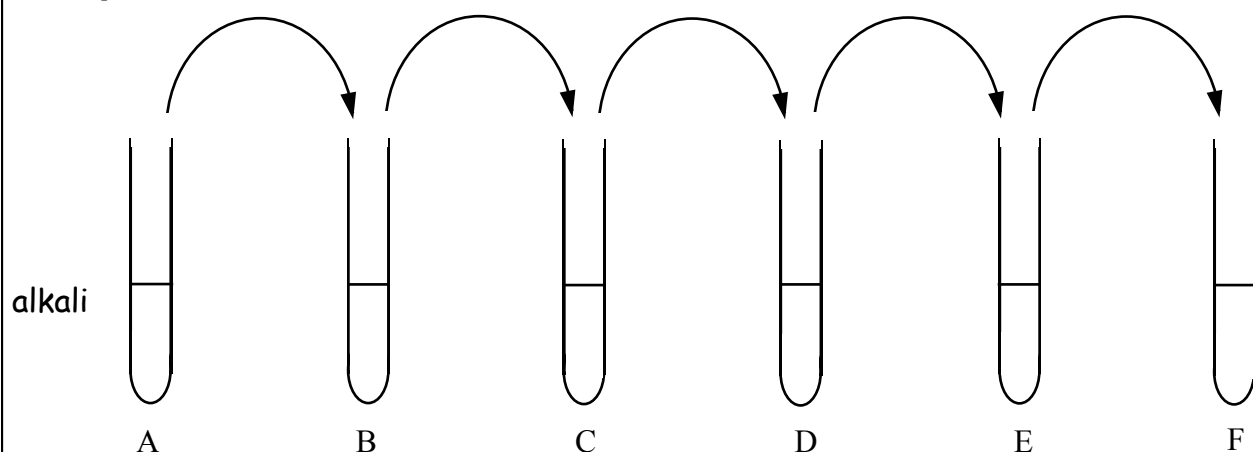Velocity Ratio   =   input : output

Velocity Ratio   =   1 : 2

The input gear has twice the number of teeth that the output gear has. This means that the output gear will turn twice the speed of the input gear.

Subject Examples

Example 2 : S1 science

alkali

    A   B   C   D   E   F

Each arrow represents the removal of 1 cm^3 from the preceding test tube to the next with the addition of 9 cm^3 of water. This is a dilution of 1:10

Diluting an acid _____ the pH towards 7 and no further.

Diluting an alkali _____ the pH towards 7 and no further.

Links to Tutorials and Games for Fractions and Percentages

Fractions

Tutorials
http://www.bbc.co.uk/skillswise/topic/fractions

Simplifying Fractions: **https://www.youtube.com/watch?v=AtBUQH8Tkqc&t=34s**

Adding and Subtracting Fractions: **http://www.bbc.co.uk/programmes/p00rjk0m**

Multiplying Fractions: **http://www.bbc.co.uk/programmes/p00rjjt7**

Decimal Fractions: **https://www.mathsisfun.com/definitions/decimal-fraction.html**

Games

http://www.mathplayground.com/fractions_add.html

Percentages

Tutorials
http://www.visnos.com/demos/percentage-fraction-decimals-grid

http://www.bbc.co.uk/skillswise/topic/percentages

Games
http://www.bbc.co.uk/skillswise/game/ma18comp-game-percentages-and-fractions-side-by-side

https://www.mathplayground.com/visualpercent.html

Money

1.   Understanding money in a digital world

Why is it important?
There is an ever increasing variety of digital payment methods
which learners should be aware of.

What is this skill?

- **Payment methods**
Pupils should understand the difference between a credit and a debit card.

- **Online Shopping**
Pupils should understand the various methods of paying for goods online and be able to compare different costs to 2 decimal places.

- **Online Banking**
Pupils should
  - be able to keep track of bank balances and transactions by understanding how to read a bank balance statement.
  - Be able to understand how to login to secure websites
  - Understand the importance of online security.

- **Best Value**
Pupils should be able to use the internet to compare the best cost for different products to 2 decimal places.

2. Understanding risks and rewards

Why is it important?
Learners must be able to budget and consider future expenditure in order to make informed choices.

What is this skill?
Pupils should understand the risks and reward of borrowing, saving and investing. They should already have an understanding of:

- The terms save, invest and borrow
- The concept of debt
- How to carry out calculations to 2 decimal places
- How to use percentages to calculate interest and compare cost

- **Risks and rewards of online shopping**

Pupils should be aware of hidden costs especially regarding delivery costs and use their literacy skills to identify these.

- **Risks and rewards of Personal financial products**

Pupils should

- be able to make informed choices regarding bank accounts, insurance products, credit/debit cards, investments and loans.
- They should understand financial terms, be able to calculate percentages and understand the concept of insurance. They should also be able to recognise misleading information to inform choices.

- **Risks and Rewards of Borrowing**

Pupils should

- understand when borrowing money is beneficial as well as recognise some of the dangers to borrowing, such as high levels of interest.
- Use knowledge of percentages to calculate interest and apply as interest

Experiences and Outcomes	Level 3	Experiences and Outcomes	Level 4
Money	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	**Money**	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

Money: Some Definitions

i. Wages and salaries – hourly rates, Annual/Monthly/Weekly Pay

People are paid in all sorts of different ways. Some are paid hourly, some weekly, some monthly and some receive an annual (or yearly) salary – divided by 12 and paid monthly.

Remember -

There are 52 weeks in a year and 12 months in a year.

Annual, per annum and p.a. mean yearly.

ii. Bonuses, Piecework, Commission

People can earn more money by receiving a bonus or a wage rise.

A bonus is where you receive payment for working extra hard or because the company you work for is doing well.

A wage rise means you receive an increase in wages, usually given as a percentage increase.

Commission is often paid to salespersons who usually receive a fairly low basic wage. The commission is calculated as a percentage of the sales they make and is received as a kind of bonus.

iii. Overtime

Overtime is when you work more hours than your basic number of hours. This is often calculated as double time ($2 \times$ normal rate of pay) or as time and a half ($1\cdot5 \times$ normal rate of pay)

iv. Gross Pay, Deductions and Net pay

Gross pay is the amount that your employer pays you.
Deductions are taken from your gross pay and include items like superannuation, national insurance and income tax.
Net pay is what you take home after deductions are made.

v. Foreign exchange

Many countries use different currencies. To change from £'s to another currency you must multiply. To change from another currency back to £'s you should divide.

Example

If £1 = 1·25 US Dollar then £250 = 250 × 1·25 = \$312·50

If £1 = 9·76 Honk Kong Dollar then \$2928 = 2928 ÷ 9·76 = £300

Money: Some definitions continued

vi. Best Buys
When budgeting at home, most people consider how to save money when shopping.
Looking for best buys is a good way to save money.

Example
A bottle of lemonade can be purchased in two different sizes.

500ml
40p

2 litres
£1·45

By calculating the cost of 100ml of lemonade for each size of bottle, we can decide which is the better buy.
40p ÷ 5 = 8p per 100ml or   145p ÷ 20 = 7·25p per 100ml
So the larger bottle is the better buy.

vii. Best Deal – plumber's service, call out charges, etc.
Most people shop around to find the best deal for service providers like plumbers, joiners, etc.
Many of the service industry will charge a call-out charge, then a rate per hour and finally parts or items that need purchased.

viii. Credit and Debit cards
Credit cards are a way of paying for something by borrowing money. Credit card companies charge a percentage of what you borrow each month if your account is in arrears – you owe money.
Debit cards are bank related and money comes straight from your bank.

Subject examples

Example 1: S1 Business Enterpris

ITEM	COST (£)	Unit Size	Value of Stock £
Lean Beef Burger	1·50	50	
Chicken Burger	1·20	70	
Flavoured Frozen Yoghurt (Strawberry, Chocolate, Caramel)	0·75	80	
Vanilla Frozen Yoghurt	0·65	100	

Calculate the total value of all of Helens Stock, for example Helen will have 100 units of vanilla frozen yoghurt in stock so total value is 100 x £0·65 = £65·00

Example 2: S2 Business enterprise

We now want to calculate the profit from all of the stalls last year. Enter the following information into a new spreadsheet.

Stall	Income	Cost	Profit
Gift Gazebo	£27·50	£16	
Christmas Corner	£34	£12	
Santa's Little Helpers	£42	£22	

Answer (gift gazebo £27·50 -£16 = £11·50)

Example 3: S1 science

You are going to investigate how much electrical energy you use in your home.
Preparation : The first thing you need to do is find electricity meter in your home. This is usually located underneath your stairs and will always be hidden away in a cupboard.

Meter Readings

Over the next six weeks you will create an electrical energy journal. Every Saturday morning you will take readings from the black box above and make a note of the kWh value. This number will then be multiplied by the current cost of 1 unit of electricity (in pence) to work out the total expenditure over the 6 **week period.**

Date	Electrical Energy Usage (kWh)	Electrical Energy Expenditure (£)

Links to Tutorials and Games for Money

Tutorials

http://www.bbc.co.uk/skillswise/topic/money

Games

http://www.ictgames.com/moneyPage.htm

Time

Why is it important?

Using information from a variety of sources to plan and schedule events and activities, including journeys, for personal lives and for work and leisure is an important life skill. Calculating journey times is an introduction to establishing the relationship between time, speed and distance and sets the foundation for more complex calculations and estimation.

Time management is an essential skill for life, learning and work. Time management is important in business in terms of meeting deadlines for submitting projects and in life for coordinating leisure activities.
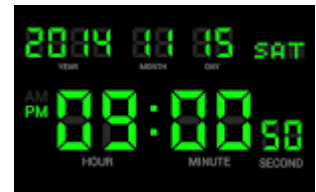
What is this skill?
Pupils will be expected to be able to demonstrate skill in the following six areas:
- **Converting units of time**
- **Time calculations including more complex durations**
- **Calendars and timetables**
- **Journey times**
- **Using appropriate units of time**
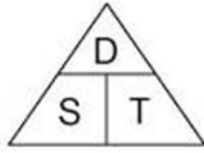- **Time/speed/distance**

Pupils should

- Be able to perform distance/speed/time calculations they should use the standard formula to calculate the unknown value when given the other two.

- Know units of time e.g. s, min , h

- Know units of speed, e.g. mph, km/h

- Know units of distance e.g. metres, miles, kilometres

- Experience a range of approaches to calculating speed, distance or time.

- Understand and use timetables and calendars to represent time durations.

- Understand the difference between 12 hour and 24 hour notation.

- Be able to convert times into a common unit, e.g. 2hrs and 90 mins = 2 hours and 1.5 hours.

Experiences and Outcomes	Level 3	Experiences and Outcomes	Level 4
Time	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	**Time**	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

Subject Examples

Distance, Speed and Time

The triangle above is a useful way of remembering the following three formulae:

| Distance = Speed × Time | Speed = Distance ÷ Time | Time = Distance ÷ Speed |

It is also worth remembering:

30 minutes = half an hour = 0·5 hour
15 minutes = a quarter of an hour = 0·25 hour
45 minutes = three quarters of an hour = 0·75 hour

Example 1: (Maths)

A journey of 112 km lasts 1 hour and 45 minutes. Calculate the average speed of the journey.

1 hour 45 minutes = 1·75 hour

Speed = Distance ÷ Time = 112 ÷ 1·75 = 64 km/h

Any time given in hours and minutes can be converted to hours by simply dividing the minutes by sixty.

Example
        3 hour 48 minutes = 3 + (48 ÷ 60) = 3 + 0·8 = 3·8 hour

Example 2: (P.E)

David and Rebecca are keen athletes. David enjoys training on track and Rebecca prefers cross country. David can cover 10, 000 metres in an average time of 37 minutes. Rebecca regularly runs 12 km in an average time of 48 minutes. David thinks he has a faster average speed. Is he correct?

38 minutes = 37 × 60 = 2220 seconds
48 minutes = 48 × 60 = 2880 seconds

David's average speed = Distance ÷ time = 10 000 ÷ 2220 = 4· 5045...m/s = 4·5 m/s to 1 d.p.
Rebecca's average speed = Distance ÷ time = 12 000 ÷ 2880 = 4· 1666....m/s = 4·2 m/s to 1 d.p.
David is correct as 4·5 is greater than 4·2

Data and Analysis

## 1. Collect and organise
Why is it important?
Collecting and organising data and information supports decision making relevant to the situation. Data must be displayed in an appropriate way in order to best suit the purpose.

What is this skill?
Gathering information from a variety of sources and organising it in a way that suits the audience. This should support interrogation and analysis.

Pupils should
- Be aware of the need to effectively organise and collect information and use the correct vocabulary.
- Know that data must be sourced and organised into an appropriate format.
- Know how to design a survey appropriate to level, e.g. question(s), organising response(s)
- Have experience of different types of chart/ graph of appropriate complexity.
- Understand that the purpose of displaying data graphically is to ease Communication such as using a bar graph, pie chart, scatter plot or line graph.
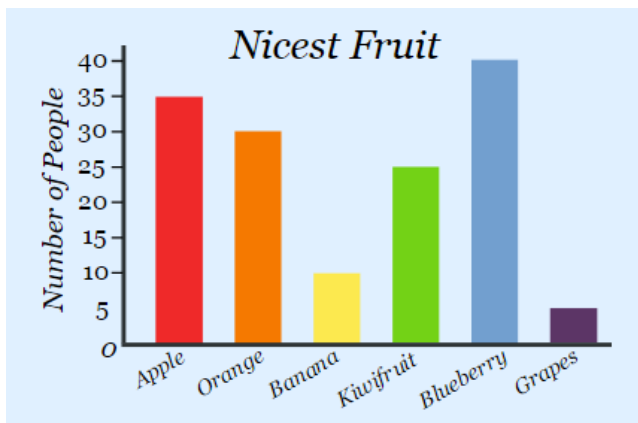
Most people said blueberries were the nicest fruit.

I am getting better at learning my facts!
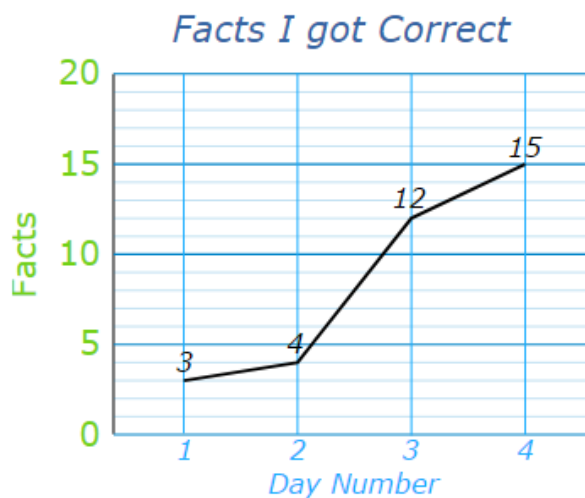
2. Analyse, Communicate and Draw Conclusions

What is this skill?

Simple interrogation of data is reading and extracting key information from tables, charts, graphs etc. This enables decisions around the validity and reliability of the data, e.g. In relation to sample size. Crit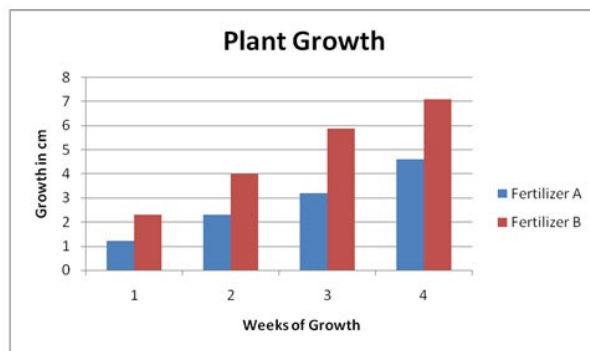ical analysis is an in depth scrutiny of data which could include looking at trends, correlations and relationships between data.

Plant Growth

Knowing how to draw conclusions from data helps make informed choices. Statistical calculations support the evaluation and interpretation of data and draw conclusions from data.

Pupils should
- Understand and interpret information from displays. When considering the data, have an awareness of reliability and validity, e.g. What is the sample size? Is the conclusion valid?
- Have knowledge and understanding of different comparison techniques.
- Understand, interpret and compare various graphs and charts, e.g. pie charts, bar graphs, line graphs or scatter graphs.

3. Reliability, Validity and Bias

What is this skill?

Reliability is the credibility of the source and the method used to collect data. Reliability is a necessary ingredient for determining the overall validity of an investigation or survey and enhancing the strength of the results. Bias is who or what is included in the intended sample. A biased sample can result in inaccurate data. The size of the group can have an impact on the validity of the survey.

Pupils should
- Know how to obtain information from real life sources e.g. survey, questionnaire or experiment.
- Demonstrate awareness that not all information is equally reliable (people may lie, experimental error in equipment).
- Know how to design, interpret and display surveys and draw conclusions from their data and graph.
- Understand different types of average and how these can be misleading.
- Be able to use calculations to interpret data and be able to demonstrate knowledge of how to make predictions based on the data supplied.
- Be aware of the word bias.
- Be aware of sample size, experimental error and rogue results and the impact of this on the reliability.

Experiences and Outcomes	Level 3	Experiences and Outcomes	Level 4
Data and Analysis	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	**Data and Analysis**	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

Data Analysis: Further Explanation

Collecting Data

Raw data, which has not been organised in any way, can often look untidy and take a long time to read through. A stem and leaf diagram is an easy way to organise numerical data.

Example

A survey of the ages of cinema goers was taken. The following data was collected:

32 28 9 25 17 45 64 23 19 17 30 49 11
15 36 36 39 40 22 31 34 38 20 23 41 8

This can be organised using an ordered stem and leaf diagram.

```
0      8 9
1      1 5 7 7 9
2      0 2 3 5 8
3      0 1 2 4 6 6 8 9
4      0 1 5 9
5
6      4
```

$n = 26$

1 9 represents 19

Analysing Data

Data can be organised and displayed in a variety of forms including compound bar and line graphs, stem and leaf charts, scatter graphs and pie charts.

Example

A good way to investigate the relationship between two quantities is to draw a scatter graph.

(a)   (b)   (c)
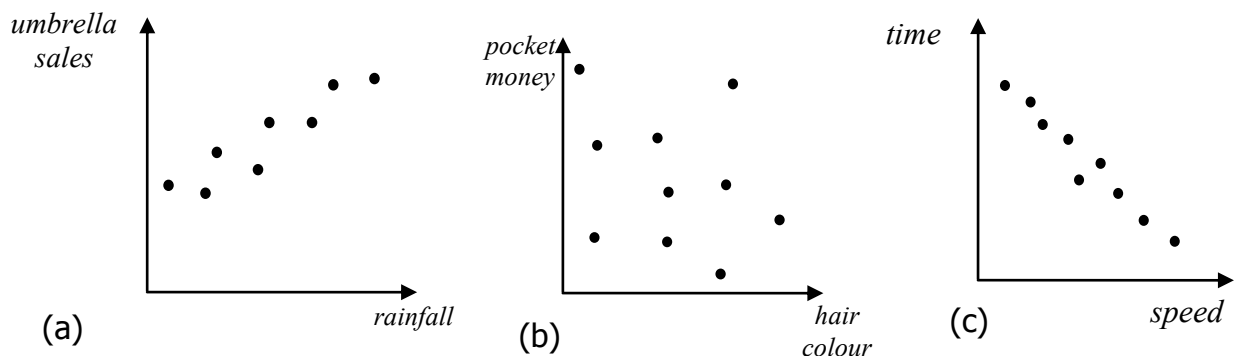
These scatter graphs in (a) shows two quantities which increase together. We say there is a positive correlation between the two quantities.

The scatter graph in (b) shows no correlation.

The scatter graph in (c) shows a negative correlation between the two quantities, as one quantity tends to decrease as the other increases.

Data and Analysis: Further Explanation continued

Summarising and Comparing Data

Data which can be counted or measured can be summarized by calculating a single number to represent the data set – a number whose value can be considered *typical* of the set in some way.

This kind of number is called an **average**.

There are three types of average.

Mean – $\dfrac{\text{sum of data values}}{\text{number of data values}}$

Median – the value that splits the data set, when ordered, into two equal halves. It is less affected than the mean by an addition of an extremely large or small value to the data set.

Mode – the value that occurs most often. It is also less sensitive than the mean. When the data is not numerical, the mode is the only average which can be found. It may be that there is no score which occurs most often.
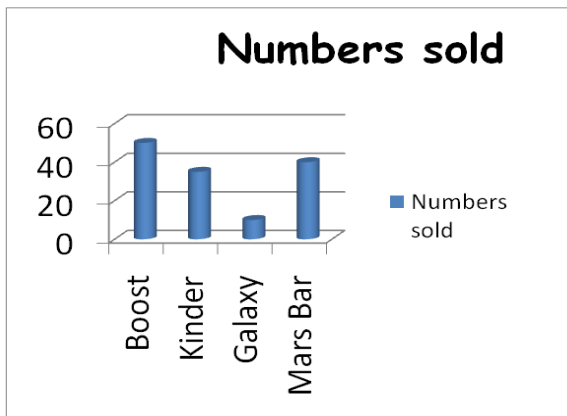
It is also useful to know how spread out the data values are. The **range** is a measure of spread. It is the difference between the highest and lowest values.

Subject Examples
Example 1: Modern Studies

Numbers sold

60	
40	
20	
0	■ Numbers sold

Boost Kinder Galaxy Mars Bar

1. Mars bars are more popular than Boost.
2. The least popular bar of chocolate is Galaxy.
3. Kinder sold more than triple the number of bars compared to galaxy.
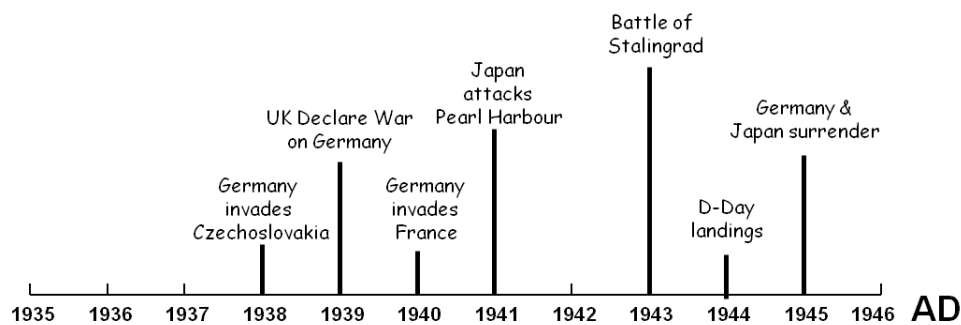4. Kinder chocolate is more popular than Galaxy.

Question: Write down which two statements are **exaggerating**. Explain why using evidence from the graph.

Example 2: History
You can show both chronological order and the gap between different events by drawing a timeline.
There are four essential rules to remember when drawing timelines. Follow these four rules to ensure that your timeline can be interpreted.

1) Spaces: each space along your time line should be equal as they represent the same amount of time

2) Scale: When you draw a timeline you should write down a scale. In this example the scale is one space for each year. If you were drawing a timeline showing 100 years, a sensible scale would be 1cm for every 10 years.

3) Years: So people understand what period your time line represents you need to label the years below it. You should label if the timeline represents BC (BCE), AD (CE) or both. The label for BC always goes on the left and for AD it goes on the right.

4) Events: Individual events can be placed on the timeline by using vertical stalks. Periods of time can be shown by using horizontal bars.

```
                                              Battle of
                                              Stalingrad
                                  Japan
                                  attacks
               UK Declare War    Pearl Harbour            Germany &
                on Germany                                Japan surrender

      Germany            Germany
      invades            invades              D-Day
   Czechoslovakia        France               landings
```

1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 **AD**

Timeline Scale: 1 space = 1 year

Subject Examples

Example 3 : English

Using data sourced from articles as evidence in discursive writing/debates
"A 2013 internet survey conducted by Knowthenet, sates that, '...2,001 respondents aged 13 to 19 showed that teens are suffering online abuse in silence as most are not reporting it.' It also states that up to 60% of victims never report this to the site itself. This shows that many people who are bullied do not even report the fact that they are bullied, so the number of victims we have on record could be far higher. "

Example 4: S1 Science

Task 1

The table below shows energy resources used by the USA to meet the total energy demands of its nation.

Use the information in the table to plot a **bar graph** of the results

Energy Resource	% of total
Oil	37
Gas	24
Coal	23
Renewable	16

Helpful hints

- Energy resources should go on the bottom

- % of total should go up the side

Links to Tutorials for Data and Analysis

Tutorials

http://www.bbc.co.uk/skillswise/topic/graphs-and-charts

https://www.bbc.co.uk/education/topics/zvpfb9q

http://www.mathsisfun.com/data/scatter-xy-plots.html

Ideas of Chance and Uncertainty

Why is it important?
Calculating theoretical probability helps build an understanding of the consequences of events and likelihood of an event occurring.
A numerical representation can be used to determine the likelihood of an event happening to inform decision making. Understanding and being able to quantify risks helps us to make more informed decisions.
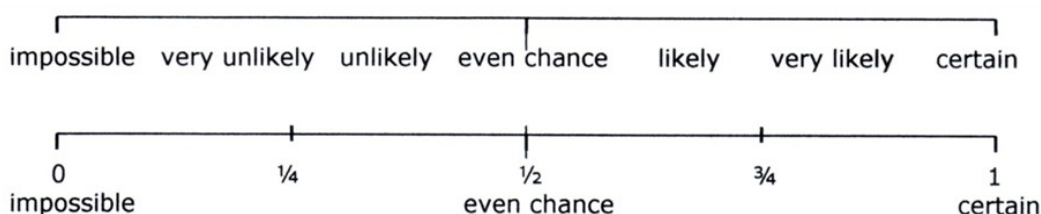
Probability
What is this skill?
A probability scale is used to numerically represent the probability of an event occurring. The numerical representation can be in the form of fractions, decimal fractions or percentages within a scale of 0-1 or 0-100%. If an event is certain to happen, it has a probability of 1.
If an event is impossible, it has a probability of 0.

impossible   very unlikely   unlikely   even chance   likely   very likely   certain

0	¼	½	¾	1
impossible		even chance		certain

Risk
What is this skill?
The ability to assess risk involves considering all the possible outcomes and planning for them. This would include understanding of chance experiments involving repeated trials often with the use of technology.

Pupils should
- Know and understand appropriate vocabulary for probability, e.g. impossible, possible, certain.
- Know that probability can be represented by a numerical scale from 0 to 1 inclusive.
- Understand the concepts of mathematical certainty and impossibility.
- Be able to describe a simple outcome's probability by placing it on the scale, with divisions appropriate to level.
- Calculate the probability of an event using the formula:
  Probability of an event = number of ways that event can occur
                         total number of different outcomes
- Awareness of the concept of risk, and how this affects real life, e.g. Insurance.
- Understand chance and experiments.
- Understand sample size and its relationship to reliability and validity.

Further Explanantion

What is the probability of scoring less than 3 on a dice?

Number of ways that event can occur = 2 (i.e. scoring 1 or 2)
Total number of different outcomes = 6 (i.e. scoring 1, 2, 3, 4, 5, or 6)

Probability of scoring less than a 3 $\dfrac{2}{6} = \dfrac{1}{3}$

Experiences and Outcomes	Level 3	Experiences and Outcomes	Level 4
Ideas of Chance and Uncertainty	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	**Ideas of Chance and Uncertainty**	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

Subject Examples

S1 Science

1. SpongeBob SquarePants recently met SpongeSusie Roundpants at a dance.
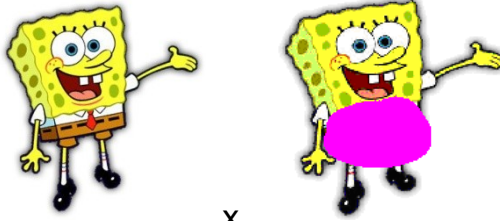
x

Square shape (E) is Dominant to round shape (e).

SpongeBob has inherited Ee for his square shape, and SpongeSusie ee for the round shape.

Use the Punnett square and letters to show the possibilities that would result if SpongeBob and SpongeSusie had children.

Answer

	E	**e**
e	Ee	ee
e	Ee	ee

2. What are the **chances** of a child with a square shape?

_____2__ out of ___4

Simplifies to 1 out of 2

Links to Tutorials and Games for Ideas of Chance and Uncertainty

Tutorials

http://www.bbc.co.uk/skillswise/topic/probability

https://www.bbc.co.uk/education/clips/z2xrxsg

Games

https://www-k6.thinkcentral.com/content/hsp/math/hspmath/ca/common/itools_int_9780153616334_/probability.html