



Ysgol Uwchradd Y Frenhines Elisabeth
Queen Elizabeth High School

NUMERACY POLICY

QUEEN ELIZABETH HIGH SCHOOL NUMERACY POLICY

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QUEEN ELIZABETH HIGH SCHOOL NUMERACY POLICY

Mission Statement

Q.E. High School is committed to continuing the good work achieved by our feeder primary schools. In particular, to raise the standards of numeracy of all our pupils, so that they develop the ability to use numeracy skills effectively in all areas of the curriculum. Also, to gain the confidence to use and transfer these skills in the demands of everyday life and lifelong learning.

• **Aims and Objectives**

It is the aim of the school to improve the numeracy skills of our pupils. A numerate pupil is one who:

- (i) Has a sense of size of a number and where it fits into the number system.
- (ii) Be able to use strategies successfully to solve number related problems mentally.
- (iii) Apply an appropriate method to help solve a problem, e.g. mental, oral and written methods.
- (iv) Make sense of number problems and identify and use the required Operations to solve them.
- (v) Explains their methods and reasoning using correct mathematical terms and vocabulary.
- (vi) Judges whether their answers are reasonable and have strategies for checking them where necessary.
- (vii) Makes sensible estimates of measurements and measure accurately using appropriate units of measurements.
- (viii) Can explain and make predictions from numerical data in a graph, chart or table.

Mathematics is the subject primarily concerned with the teaching of basic numeracy skills. Other subjects may need to introduce and use certain topics before they have been taught in mathematics lessons, and hence all subjects have a responsibility for the teaching of some mathematical content. It cannot be assumed that all pupils will meet the same mathematical topics at the same time or in the same year since the pupils are set in mathematics. Quite often pupils are taught in mixed ability groups in other subjects and classes could therefore contain pupils with a wide range of ability in mathematical skills. Teachers are aware of this issue and hence the instructions given to the pupils needs to be very clear to cater for all abilities.

- **Department Contributions**

It is the responsibility of teachers in all subject areas to develop pupils' confidence, competence, motivation and enjoyment of basic numeracy skills.

Numeracy skills have been reinforced by the following:

1. Liaison with departments to provide consistency across the curriculum. This is ongoing with the introduction of the LNF and Numeracy plc group which meet once every half-term.
2. The use of examples from other subject areas when teaching certain topics within mathematics.
3. The use of a common approach to methodology and the language of mathematics. This will be supported with Inset provided by the County Maths School Improvement officer.
4. Highlighting integral and age appropriate (see LNF) opportunities for the use of numeracy within their subject area. Looking at RICH tasks within each subject so that more than one Numeracy element is applied.
5. Ensuring that the materials presented to pupils will match their capability both in subject content and in numerical demands.

- **Department Guidelines**

Numeracy is different to Mathematics in that it is the application of the skills learned in Maths in a cross-curricular, real-life context, and not purely about the skills themselves.

Pupils are expected to apply and extend their numeracy skills across all subject areas.

The Numeracy framework has been designed to help staff gain precision in the expected progress of these skills in an age-appropriate context. It focuses on four strands which should only be included in subjects if and when appropriate.

Strand 1 – Developing numerical reasoning

This strand focuses on three elements:

- **Identify processes and connections** – to identify what processes are needed to solve a real-world problem.
- **Represent and communicate** – how to express their workings.
- **Review** – to draw their own conclusions.

Strand 2 – Using number skills

These are the skills needed for using and manipulating numbers when carrying out procedures. They will also include how to use checking strategies and specific context of money. This strand focuses on five elements:

- **Use number facts and relationships**
- **Fractions, decimals, percentages and ratio**
- **Calculate using mental and written methods**
- **Estimate and check**
- **Manage money**

Research has identified the need to have a consistent approach across the curriculum to developing pupils' mental and written strategies. Whole staff training is required to ensure that everyone is confident to deliver this if required.

Strand 3 – Using measuring skills

These are the skills needed to be able to choose and use suitable units and instruments, read with appropriate accuracy numbers on a range of measuring instruments, and use standard units of length, capacity, mass and time. This will also include converting one metric unit to another and knowing the rough metric equivalence of imperial units in daily use. Also calculating areas and volumes using appropriate methods and formulae. This strand focuses on four elements:

- **Length, weight/mass, capacity**
- **Time**
- **Temperature**
- **Area and volume. Angle and position.**

Strand 4 – Using data skills

These are the skills needed to draw and interpret frequency tables, construct and interpret bar charts, pie charts, pictograms and line graphs. This will also include extracting and interpreting information present in tables and lists. As well as calculating averages - mean, median and mode and finding the range of a set of data. More advanced skills will allow pupils to draw conclusions and hypotheses from the results. This strand focuses on three elements:

- **Collect and record data**
- **Present and analyse data**
- **Interpret results.**

USE OF CALCULATORS

- We do NOT allow year 7 to use calculators in Mathematics.
- Pupils should always be encouraged to perform 'basic' calculations without the use of a calculator.
- However, when appropriate, pupils should be encouraged to use a calculator efficiently, making use of brackets, memory, etc.
- When calculators are used, pupils should be encouraged to make an estimate that allows them to check the reasonableness of their answer.

QUEEN ELIZABETH HIGH SCHOOL NUMERACY ACROSS THE CURRICULUM

- **Cross Curricular Guidance**

The following information and guidelines are there to help provide consistency across the curriculum.

Methods

See appendix 1

- **Literacy and Numeracy Framework**

With the introduction of the LNF we have made a more recent audit focusing on KS3. This has been tracked using tables created by the county.

See appendix 2

QUEEN ELIZABETH HIGH SCHOOL **Application of Number(AoN)**

- The Application of Number Essential Skill is monitored by C. Dixon. We currently enter pupils for the WJEC examination board.
- In July of Year 10 pupils take part in a collapsed timetable for a fortnight. During this time AON is delivered through the Maths department. This is the time when the majority of our pupils achieve the qualification having developed an understanding and experienced mathematical problem solving exercises across the curriculum throughout KS3 and KS4. Around two-thirds of the year group are entered for level 2 while the bottom 2 sets (for each half of the year group) are entered for level 1.
- All pupils are given the opportunity to achieve the AON qualification and so the AON coordinator monitors those who have not managed to achieve the qualification in year 11. Further opportunities are then given at year 12 and 13 to achieve this accreditation.
- Teachers in the Mathematics department have gained Accredited Centre Status for both level 1 and level 2 AON.

QUEEN ELIZABETH HIGH SCHOOL NUMERACY INTERVENTION GROUPS

To raise numeracy standards in KS3 we have introduced a new intervention program from September 2012.

On entry to the school in September, numeracy tests are given to pupils and those achieving less than the required standard score are identified as needing help. These tests include the PIM and MIDYIS. As well as these we will also use the results from the National Numeracy Tests that pupils sat in May.

After informing parents, help is given to develop their numeracy skills during the year so as to improve the confidence of pupils so that they can access Maths lessons and those subjects that require a Numeracy application. Help is given in a variety of ways as follows.

There are two intervention groups to improve Numeracy in school. These are through The Numeracy Workshop with Mrs. Judith Talbot and Success Maker (SM) with Mrs. Linda Preece. The Numeracy Workshop group is primarily made up of pupils who have scored below 80 on the Standardised scores whereas the SM group is targeting the next band of pupils. Year 7,8 and 9 pupils are either withdrawn from some lessons or during registration depending on their test scores.

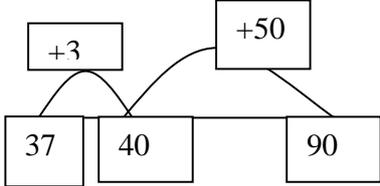
We monitor progress of these pupils in Maths lessons and record it through half-term tests, and the results are also available to the Intervention teachers. Following the numeracy tests in September, we review the situation regularly and adjust the groups if needed. All pupils in the intervention groups are WRAT tested every 3 months. Both intervention teachers are in regular contact with the class teachers. We are in the process of piloting an exit strategy for those pupils we feel are ready to move out of these intervention groups. This will involve re-testing to check the progress that has been made.

Appendix 1

Methods

Below, are examples of problems involving the four operations, how they are taught, and approached by pupils at different stages in their school lives. It is important to remember that pupils on entry to secondary school, may still be using these earlier methods of calculation

Addition and Subtraction

| Addition | Subtraction |
|--|---|
| <p>Example : $29 + 39 = 30 + 40 - 2$ $= 70 - 2$ $= \mathbf{68}$</p> <p>or</p> $29 + 39 = 20 + 30 + 9 + 9$ $= 50 + 18$ $= 50 + 10 + 8$ $= 60 + 8$ $= \mathbf{68}$ | <p>Example : $90 - 37 = 90 - 40 + 3$ $= \mathbf{53}$</p> <p>or</p>  |
| <p>Example: $8642 + 753$</p> $\begin{array}{r} 8000 + 600 + 40 + 2 \\ \quad 700 + 50 + 3 \\ \hline 8000 + 1300 + 90 + 5 \end{array}$ <p>$= \mathbf{9395}$</p> <p>or</p> $8000 + (600 + 700) + (40 + 50) + (2 + 3)$ $= 8000 + 1300 + 90 + 5$ $= \mathbf{9395}$ <p>or</p> $\begin{array}{r} 8642 \\ + 753 \\ \hline \mathbf{9395} \\ 1 \end{array}$ <p>By this time they understand carrying</p> | <p>Example: $2410 - 482$</p> $\begin{array}{r} 1000 \quad 1300 \quad 100 \quad 10 \\ 2000 + 400 + 10 + 0 \\ - \quad \quad 400 + 80 + 2 \\ \hline 1000 + 900 + 20 + 8 \end{array}$ <p>$= \mathbf{1928}$</p> <p>or</p> $\begin{array}{r} \overset{1}{2} \overset{13}{4} \overset{10}{1} \overset{1}{0} \\ - \quad \quad 4 \quad 8 \quad 2 \\ \hline \mathbf{1 \quad 9 \quad 2 \quad 8} \end{array}$ <p>By now they understand borrowing</p> |

Multiplication is usually associated with the idea of repeated addition,

e.g. $7 \times 6 = 6 + 6 + 6 + 6 + 6 + 6 + 6 = 42$

Division is associated with repeated subtraction or sharing,

e.g. $42 \div 7 = 42 - 7 - 7 - 7 - 7 - 7 - 7 - 7 = 0$ (42 shared equally 6 times)

| Multiplication | Division | | | | | | | | | |
|---|--|-----------|----------|-----------|-----|----|----------|-----|----|--|
| <p>Pupils will be taught multiplication tables up to 10 x 10 and associated facts,</p> <p>e.g. If $7 \times 9 = 63$ then $9 \times 7 = 63$ and $63 \div 9 = 7$ and $63 \div 7 = 9$</p> <p>Also $6 \times 4 = 24$ Halving and Doubling $3 \times 8 = 24$</p> <p>And to work out $20 \times 30 = (2 \times 10) \times (3 \times 10)$ Using $= 2 \times 3 \times 10 \times 10$ multiples $= 6 \times 10 \times 10$ of 10 $= 600$</p> | <p>Recognition that division is the inverse of multiplication,</p> <p>e.g. $63 \div 9 = 7$ became $7 \times 9 = 63$</p> | | | | | | | | | |
| <p>Example: 24×16 $24 \times 10 = 240$ And $24 \times 6 = (20 \times 6) + (4 \times 6)$ $= 144$ So $240 + 144 = \mathbf{384}$</p> <p>or</p> <table border="1" data-bbox="233 1671 761 1787"> <tr> <td>x</td> <td>20</td> <td>4</td> </tr> <tr> <td>10</td> <td>200</td> <td>40</td> </tr> <tr> <td>6</td> <td>120</td> <td>24</td> </tr> </table> <p>$24 \times 16 = 200 + 120 + 40 + 24$ $= \mathbf{384}$</p> | x | 20 | 4 | 10 | 200 | 40 | 6 | 120 | 24 | <p>Short division</p> <p>Write down the tables to assist you here.</p> <p>$1 \times 15 = 15$ $2 \times 15 = 30$ $3 \times 15 = 45$ $4 \times 15 = 60$ $5 \times 15 = 75$</p> <p>$\underline{\quad} 28 \text{ r } 12$ $15) 432$</p> |
| x | 20 | 4 | | | | | | | | |
| 10 | 200 | 40 | | | | | | | | |
| 6 | 120 | 24 | | | | | | | | |

| | |
|---|--|
| <p>Standard method- long multiplication</p> $ \begin{array}{r} 24 \\ \times 16 \\ \hline 144 \quad (6 \times 24) \\ 240 \quad (10 \times 24) \\ \hline \mathbf{384} \end{array} $ | |
|---|--|

Strategies for Mental Arithmetic

Much number work depends on knowledge of tables. Here is a summary of strategies that pupils should be able to do.

| Table | Method | Extending strategy For bigger numbers |
|--------------|---|---|
| x2 | Double | $78 \times 2 = (70 \times 2) + (8 \times 2)$ $= 140 + 16$ $= 156$ |
| x3 | Double and add the number | $55 \times 3 = (55 \times 2) + 55$ $= 110 + 55$ $= 165$ |
| x4 | Double and double again | $29 \times 4 = (29 \times 2) \times 2$ $= 58 \times 2$ $= 116$ |
| x5 | Multiply by 10 and then halve | $28 \times 5 = (28 \times 10) \div 2$ $= 280 \div 2$ $= 140$ |
| x6 | Multiply by 5 and add the number | $28 \times 6 = (28 \times 5) + 28$ $= 140 + 28$ $= 168$ |
| x7 | Double, double and double again and then take away the number | $24 \times 7 = (24 \times 2 \times 2 \times 2) - 24$ $= (48 \times 2 \times 2) - 24$ $= (96 \times 2) - 24$ $= 192 - 24 = 168$ |
| x8 | Double, double and double again | $65 \times 8 = 65 \times 2 \times 2 \times 2$ $= 130 \times 2 \times 2$ $= 260 \times 2 = 520$ |
| x9 | Multiply by 10 and then take away the number | $49 \times 9 = (49 \times 10) - 49$ $= 490 - 49$ $= 441$ |
| x10 | Move the numbers one place to the left | $95 \times 10 = 950$ $2.75 \times 10 = 27.5$ |

Guidelines for Constructing Graphs and Charts

Students should be encouraged to:

- . use a sharp pencil.
- . label both axes and give a title
- . label lines not spaces, unless a bar-chart with discrete data
- . use equally spaced intervals
- . use convenient scales
- . draw graphs on squared or graph paper
- . to draw graphs of a sensible size (they tend to make them too small)
- . If axes do not start from zero, a break represented by a zig-zag line should be shown on the axis.

Pupils should be exposed to Bar Charts, Pie Charts, Pictograms, Line graphs and Cumulative frequency curves. Histograms are only attempted by higher level students.

Bar Charts

These are the diagrams typically used to compare categories and most frequently used in areas of the curriculum other than mathematics. The way in which the graph is drawn depends on the type of data to be processed. Graphs should be drawn with gaps between the bars if the data categories are not numerical (colours, makes of car, names of pop star, etc), or are discrete data. In cases where there are gaps in the graph the horizontal axis will be labelled beneath the columns. All bars should be of equal width.

Discrete data

Data is described as discrete if specific values only can be used, eg. shoe size is discrete as sizes such as 4.8 and 5.77 cannot exist.

Continuous data

Data is described as continuous if all values can exist, eg. height and weight are continuous data as potentially any value could be measured.

Pie Charts

These are typically used to compare categories as fractions of the whole data. The way in which pupils should be expected to work out angles for a pie chart are as follows: they should first work out the share of 360 to be allocated to **one** item and then multiply this by its frequency.

e.g. 180 pupils were asked their favourite core subject.

Each pupil has $360 \div 180 = 2^\circ$ of the pie chart.

Pie charts should have each sector labelled and have an overall title. Alternatively a key could be provided.

Scatter graphs

These are typically used to see if one measurement varies with another measurement. Each measurement is plotted on its own axis i.e. one on the x axis and one on the y axis. If possible a "line of best fit" should be drawn.

There are three types of correlation: positive, negative and none. This is determined by the pattern/trend that the points make. The "line of best fit" does not have to go through (0,0) and should be one straight line.

A positive correlation between the two variables occurs when one variable increases as the other increases e.g. ice cream sales and temperature. Negative correlation depicts one variable increasing as the other decreases. No correlation comes from a random distribution of points.

Appendix 2

The following tracking sheets for years 7,8 and 9 have been completed from a whole school audit for the Numeracy framework:

Review Date: 23rd January 2014

To be Reviewed: January 2015