BISHOP'S HATFIELD GIRLS' SCHOOL

NUMERACY POLICY

Date of last review:	**Autumn Term 2014**
Date of next review:	**Autumn Term 2016**
School Based Policy	

Numeracy is a proficiency that is developed mainly in Mathematics but also in other subjects. It is more than an ability to do basic arithmetic.

- It involves developing confidence and competence with numbers and measures.
- It requires an understanding of the number system and a repertoire of mathematical techniques to solve problems.
- It requires an ability to solve quantitative and spatial problems in a range of contexts.
- It demands an understanding of the ways in which data are gathered by counting and measuring, and presented in graphs, diagrams, charts and tables.

Purpose of this policy

The aims of this policy are:

- to secure high standards in numeracy across the school.
- to set out the school's agreed approach to the teaching of numeracy skills.
- to record methods, vocabulary and notation that have been agreed.
- to assist the transfer of pupils' knowledge, skills and understanding between subjects.
- to indicate areas for collaboration between subjects.

General points

- **Numeracy is the responsibility of all teachers.**

- **Subjects across the curriculum provide important contexts for developing numeracy skills.**

- Pupils gain more and remember more when they understand the reasons for a mathematical method.
- Pupils should be encouraged to understand that there may be more than one method of calculation, but they should use the one that they are confident with.
- Regular use of correct mathematical terms encourages understanding e.g. ‘multiply’ instead of ‘timesing’, ‘rectangle’ never ‘oblong’.
- Methods of working should always be shown.

Number

Wherever possible, pupils should be encouraged to do straightforward calculations in their heads. They may then discuss their different methods of arriving at an answer. Asking pupils to explain their strategies leads to discussion, enhances understanding and develops further their skills in mental arithmetic and in speaking and listening [thus linking with Literacy across the Curriculum].

- In all arithmetic, the importance of place value (i.e. hundreds, tens and units) should be stressed.
- Gaps or commas may be used in large numbers to make the size of the number clear e.g. 432,070.
- When referring to decimals, say "three point one four" rather than "three point fourteen".
- An "equals" sign should appear only once in each line of working and logical sense should be preserved.

WRONG Area of triangle = 4 x 3 = 12 ÷ 2 = 6

CORRECT 4 x 3 = 12
12 ÷ 2 = 6 cm²

or Area = (4x3) ÷ 2
= 12 ÷ 2
= 6 cm²

- Common fraction, decimal and percentage equivalences should be known and practised.

Fraction	Decimal	Percentage
$\frac{1}{2}$	0.5	50 %
$\frac{1}{4}$	0.25	25 %
$\frac{3}{4}$	0.75	75 %
$\frac{1}{10}$	0.1	10 %
1 whole	1.0	100 %

- Pupils need to practise working out a percentage of an amount without using a calculator. They should be able to find 10% or 1% of a number and build up from there.
- Pupils should always be encouraged to calculate their own test marks as percentages.
- A billion is now accepted to be one thousand million (i.e. 1,000,000,000).

Use of Calculators

All pupils are expected to have their own calculator and we recommend the use of the Casio calculator which is sold in the school shop.

- Use of calculators allows freedom from repetitive or difficult calculations. Pupils should be encouraged to use them sensibly and not for working out simple calculations.
- It is good practice to always estimate answers before using a calculator.
- Sensible rounding is expected as appropriate for the given problem or situation.
- Pupils should always be encouraged to set down their method of working, whether using a calculator or not. Answers only are **not** acceptable.
- Avoid using the % button on a calculator – it only confuses.

Problem solving

In using Mathematics to solve problems, pupils use a variety of thinking skills which should be transferable to other subject areas. These include:

- breaking the problem down into manageable parts.
- giving a clear commentary on their work, including calculations and diagrams.
- using logical deduction.
- hypothesising.
- presenting a solution to a particular audience orally or in written form.
- reflecting and evaluating their solutions.

Algebra

- Take care when using terms like "cross multiply" and "swap sides-swap signs" as these can lead to misunderstandings. Emphasise "doing the same to both sides" or check with the group's Maths teacher first.

e.g.

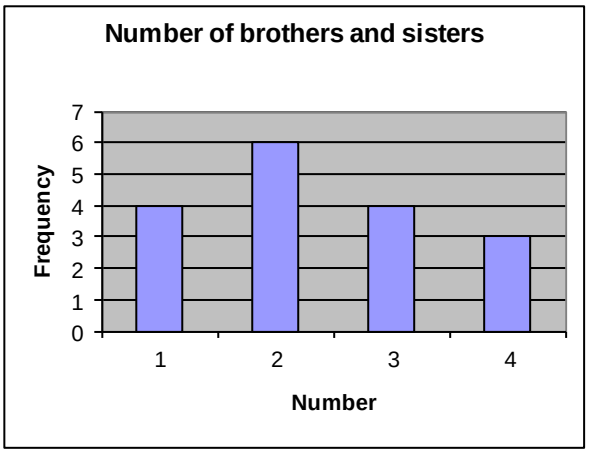
$$\begin{aligned} & 3x - 8 = x + 2 \\ (-x) \quad & \\ & 2x - 8 = 2 \\ (+8) \quad & \\ & 2x = 10 \\ (\div 2) \quad & \\ & x = 5 \end{aligned}$$

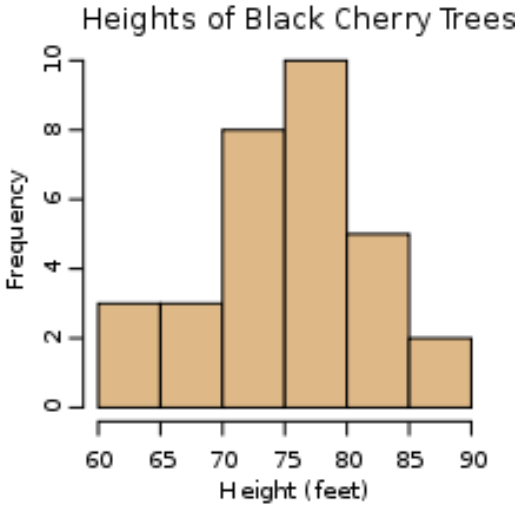
- Running through a formula with "easy" numbers may aid pupil understanding.
- Trial and improvement is an acceptable mathematical method of solving equations.
- Working should develop down the page, with equals signs in line.

Handling Data

- Always use degrees when constructing pie charts; label sectors with the type of data, e.g. blue.
- All graphs should be drawn in pencil, have a title and labelled axes and units clearly marked.
- When interpreting graphs, make sure pupils know what one "tiny square" represents on **each** axis.
- Pupils should be taught to use a suitable scale for each graph axis (not necessarily the same on each axis) so that the graph fills the page. Scales do **not** have to start from zero, but pupils must appreciate when this is appropriate.
- Bar charts are used to display discrete data (data which is counted e.g. shoe sizes) and should really have a gap between each bar. Histograms have no gaps and are used to display continuous data (data which is measured e.g. heights).

Note the labelling of the axes:





- After drawing a scatter diagram, a line of best fit may be drawn to show the relationship between variables. It must be drawn with a ruler to follow the trend of the points but does not need to go through (0,0).
- There are three main types of average: mean, median and mode. Please use these correct terms, not just the word “average”.

Mean	Total of values ÷ Number of values
Median	Middle value when placed in order of size
Mode	Most common data item

- The range is a measure of the spread of the data; in Maths, it is calculated as the difference between the largest and the smallest values and is given as a single figure.
- Probabilities should be written as fractions, decimals or percentages and definitely **not** as "1 in 7" or "1:7".
- When reading off the gradient of a line, ensure that pupils have a full appreciation of the scale on each axis.
- Line graphs should be either straight lines drawn with a ruler and pencil **or** smooth curves drawn with a pencil and no ruler.

Shape, Space and Measures

- Pupils need opportunities to **estimate** mass/time/length/capacity as well as measuring accurately.
- Units of measurement must always be given e.g. 20 minutes, 36 euros, 0.8 cm^3. Pupils should be aware of imperial units and the rough conversions to the most common metric units e.g.

Mass	1 kg	is about	2.2 pounds
Length	30 cm	is about	1 foot
	2.5 cm	is about	1 inch
	8 km	is about	5 miles
Capacity	1 litre	is about	1.75 pints

- The word "similar" has a specific meaning in Mathematics. It is used to describe objects that are exactly the same shape, but not necessarily the same size - one object is an exact scaled version of the other e.g. an enlarged photograph.
- "Congruent" means the same size and shape.
- Try not to add to the confusion of mass and weight.
  The mass of an object is the same anywhere in the universe. Weight is caused by the pull of gravity. A 1 kg mass will weigh less on the moon than it does on earth because the force of gravity pulling on it is less.
- Bearings are always measured from North, in a clockwise direction and given as three figures e.g. 043º.

Cross Curricular links

Members of the Mathematics, Psychology, Science and Geography departments meet as required to discuss teaching points and the overlap and timing of schemes of work.

Conclusion

Please:

- Be aware of the numeracy used in your lessons.
- Promote high standards of numeracy.
- Talk to the Mathematics Faculty about where you are using Numeracy in your curriculum area.
- Ask us if you need some help.
- Be positive about Mathematics.

Examples of Numeracy used across the curriculum

This list gives a few examples of some of the types of Numeracy that are used in each faculty area.

English

- Timelines, tension graphs, Venn diagrams, bar charts, pie charts e.g. to chart movement through a text and analyse characters.
- Interpreting information given in tables.
- Ordering points in essay planning or longer pieces of structured writing.
- Ordering and sequencing the parts of a story or play.
- Rhyme and verse patterns e.g. sonnets.
- Analysing data and using statistics to reinforce argument and provide evidence for opinions.
- In some schemes of work, pupils work with imaginary budgets, deadlines, etc.

Humanities

- Counting years and understanding BC, AD, CE, BCE.
- Time lines and chronology of events.
- Interpreting and displaying data in History and Politics e.g. Statistics and voting patterns, percentages and effectiveness of the army versus casualty rates and weapons provisions.
- Year 7 Humanities map skills.
- Year 8 Tourism uses a budget sheet for planning a holiday and pupils draw climate graphs (bar and line graphs).
- Geography fieldwork at GCSE and A level uses many charts, graphs and statistical techniques to interpret data e.g. pie charts, kite graph, logarithmic graphs, the use of the Mann Whitney test and Spearman's rank correlation.

Languages

- Ordinal and cardinal numbers.
- Arithmetic practised in other languages.
- Exchange rates and currency.
- Measures, using both imperial and metric.
- Time, using 12 and 24 hour clock and using the calendar.
- Interpreting data and using surveys.

Science

- Measures and units.
- Decimals, percentage, ratio and proportion e.g. embryo growth and genetics.
- Equations and rearranging formulae.
- Estimation of appropriate size of answer, rounding and accuracy.
- Line graphs, lines of best fit.
- Averages and data analysis.
- Understanding and using statistical tests in Psychology.

Design

- Equations and formulae e.g. in spreadsheets.
- Collecting and interpreting data from surveys and questionnaires.
- Profit margins.
- Transformations – art grid work.
- Three dimensional work in solids and shapes.
- Lines, angles and tessellations.
- Measures, estimating, scaling and proportion.
- Ratio for colour mixing.

Creative Arts

- Rotation using angles and bearings and reflection.
- Scaling and proportion.
- Diagrammatic representations of the actors within space for stage plotting.
- Time graphs e.g. the development of tension within a performance.
- Patterns and musical form for music and dance.
- Fractions for rhythms.
- Spatial awareness in dance, drama and P.E.
- Measures in P.E. for time, distance, pulse and recovery rate.

MULTIPLICATION

1. You need to know your multiplication tables !

2. To work out 43 x 8 you could

split it up

40 x 8 = 320
3 x 8 = 24 +
344

use doubling

43 x 2 = 86
43 x 4 = 172
43 x 8 = 344

calculate

43
x 8
344

3. To work out 783 x 6 you could use a grid

	700	80	3
6	4200	480	18

4200
480
+ 18
4698

4. To work out 73 x 24 you might use a grid

	20	4
70	1400	280
3	60	12

1400
280
60
+ 12
1752

or calculate

73
x 24
292 73 x 4
1460 73 x 20
1752

DIVISION

1. Try to use your multiplication tables

   $37 \div 4 = 9$ rem. 1

2. You may know about "chunking"

   $196 \div 6$

6 ⟌	196	
	120	6 x 20
	76	
	- 60	6 x 10
	16	
	- 12	6 x 2
	4	32

   So $196 \div 6 = 32$ rem. 4

3. Or calculate

   $657 \div 9$

$$9 \overline{)\,6\;5^{2}7} \quad 7\;3$$

4. Remember to put a zero when you can't divide

   $2432 \div 4$

$$4 \overline{)\,2\;4\;3^{3}2} \quad 6\;0\;8$$

PERCENTAGES

'Out of'

This is used to make a fraction into a percentage, for example when you want to make a test mark into a percentage, or find out what percentage of the class like chips.

I got 24 out of 70 for my test

$$\frac{24}{70} = 24 \div 70 = 0.3428\ldots = 34\ \%$$

21 out of 30 like chips

$$\frac{21}{30} = \frac{7}{10} = 0.7 = 70\ \%$$

% of

This is used to find a percentage of an amount.

What is 20 % of £3.40 ?

10 % of £3.40 is 34p
20 % of £3.40 is 68p

What is 23 % of 70 kg ?

0.23 x 70 = 16.1 kg.

% change

Example – A bus fare of £1.20 goes up to £1.35. What percentage increase is this ?

Increase = 135p – 120p = 15p

$$\%\ \text{change} = \frac{\text{change}}{\text{original amount}} \times 100$$

$$= \frac{15}{120} \times 100$$

$$= 12.5\ \%$$

OR

120 —x 1.125→ 135 (112.5%)

=> 12.5% increase

PIE CHARTS

To draw a pie chart, using degrees, you need to work out how many degrees there are for each person.

There are 360º in a full circle or pie.

Example 1 If 30 people are represented by 360º

then 1 person is represented by $\frac{360^\circ}{30} = 12^\circ$

Example 2 If 240 people are represented by 360º

then 1 person is represented by $\frac{360^\circ}{240} = 1.5^\circ$

Example 3

120 girls in Year 8 chose their activities for a P.E. lesson.

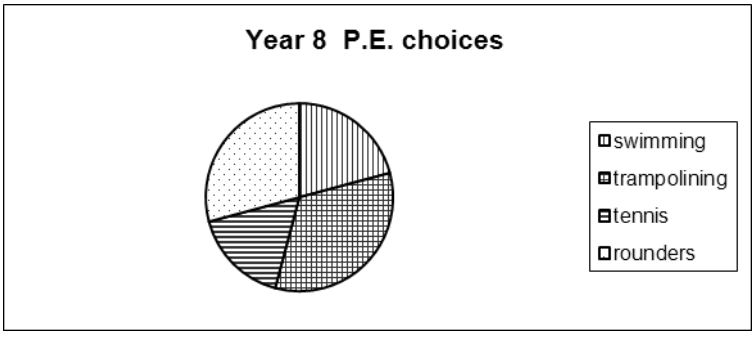
- 25 chose swimming
- 40 chose trampolining
- 20 chose tennis
- 35 chose rounders

Work out the angles for a pie chart.

120 girls have 360º

1 girl has $\frac{360^\circ}{120} = 3^\circ$

swimming	25 x 3	=	75º
trampolining	40 x 3	=	120º
tennis	20 x 3	=	60º
rounders	35 x 3	=	105º +
	Check		360º



WEIGHTS AND MEASURES

	Metric	Imperial
Length	10 millimetres = 1 centimetre 100 centimetres = 1 metre 1000 metres = 1 kilometre	12 inches = 1 foot 3 feet = 1 yard 1760 yards = 1 mile

1 inch is about 2.54 cm
30 cm is about 1 foot
1 metre is about 39 inches
8 km is about 5 miles

Mass	1000 grams = 1 kilogram 1000 kilograms = 1 tonne	16 ounces (oz) = 1 pound (lb) 14 pounds = 1 stone 2240 pounds = 1 ton

1 kilogram is about 2.2 pounds

Volume or capacity	1 cubic cm. (cm^3) = 1 millilitre (ml) 1000 millilitres = 1 litre 1000 cm^3 = 1 litre	8 pints = 1 gallon

1 litre is about 1.75 pints
4.5 litre is about 1 gallon