

# Free-standing Mathematics Units

DRAFT



Qualifications and  
Curriculum Authority

## Free-standing Mathematics Units and the Key Skills

1998 - 1999

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## 1. Overview

### 1.1 Free-standing Mathematics Units

Free-standing Mathematics Units aim to encourage students to include appropriate mathematics as part of their study programme.

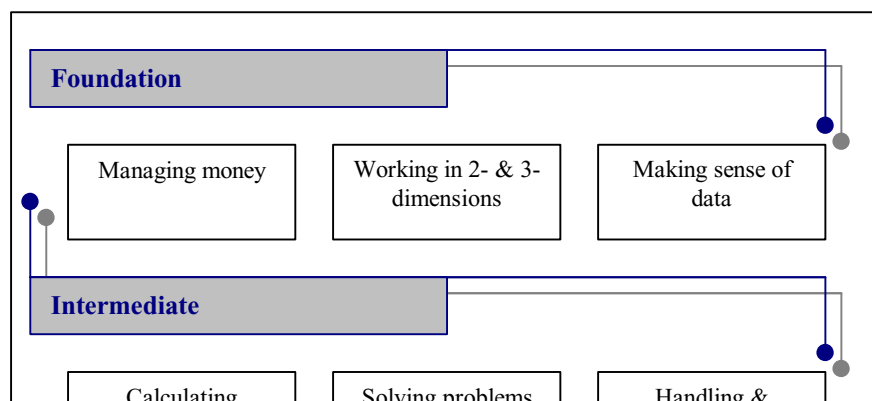
Units are available at three levels:

- Foundation  
(includes mathematics up to approximately Level 6 of the National Curriculum)
- Intermediate  
(includes mathematics beyond Level 6 of the National Curriculum)
- Advanced  
(includes mathematics equivalent to that found in GCE AS /A Levels in mathematics)

Each unit

- requires about 60 hours of study;
- allows students to study principles and develop applications of specific aspects of mathematics to some depth, drawing upon and enhancing other areas of their work, studies or interests;
- is assessed by equally weighted elements of portfolio evidence and written examination.

Framework of units available in the first year of the pilot, September 1998 - August 1999



***Materials / publications available***

The following is a list of further publications/materials about Free-standing Mathematics Units that are available at 30<sup>th</sup> September 1998:

- Free-standing Mathematics Units Foundation Level Specifications
- Free-standing Mathematics Units Intermediate Level Specifications
- Free-standing Mathematics Units Advanced Level Specifications
- Free-standing Mathematics Units Specifications: Making connections in mathematics & Understanding mathematical thinking
- Free-standing Mathematics Units Teacher Information – Pilot Year 1998-9
- Free-standing Mathematics Units – Student Information

***1.2 Key Skills***

There are certain skills that are recognised by educationalists, employers and students themselves as being of crucial importance to students' and workers' abilities to carry out their studies or work. These have been identified as 'Key Skills' and it is expected that an increasing number of students will demonstrate their competence in these throughout their school and college courses and in their employment. During the period of the pilot of Free-standing Mathematics Units, the specification and assessment of the 'Key Skills' are undergoing extensive development and piloting. This document therefore attempts to clarify the position of Free-standing Mathematics Units vis-à-vis the Key Skills of Application of Number, Communication and Information Technology as they are currently specified for the majority of users.

Free-standing Mathematics Units allow many opportunities for students to gather evidence towards each of the Key Skills. The following sections of this guide highlight how the work of students can contribute towards their gathering of Key Skill evidence.

## 2.1 Foundation Level Units

### Free-Standing Mathematics Units at Foundation Level mapped to Application of Number Key Skills specifications at Levels 1 and 2.

Students completing Free-standing Mathematics Units at Foundation Level will provide evidence that will contribute to Application of Number in the following areas at Levels 1 and 2.

Note that 4 indicates that a performance criterion or technique will certainly be covered whereas (4) indicates that it may or may not be covered depending on the work submitted by individuals. Other performance criteria and techniques are not likely to be demonstrated by students in completing their work towards the particular Free-standing Mathematics Unit.

<b>Element 1.1 Collect and record data</b>	<i>Managing money</i>	<i>Working in 2- and 3-dimensions</i>	<i>Making sense of data</i>
<b>Performance criteria</b> A student must:			
1 choose and use a <b>technique</b> which suits the task	4	4	4
2 perform the <b>technique</b> to the <b>level of accuracy</b> required	4	4	4
3 record data in the required <b>units</b> using an appropriate format	4	4	4
4 make sure that records are accurate and complete	4	4	4
<b>Techniques</b>			
use simple fractions to describe situations	4	4	4
use simple decimal fractions to describe situations	4	4	4
use simple percentages to describe situations	4	4	4
use simple ratios to describe situations	4	4	4
use negative numbers to describe situations	4		
estimate quantities and proportions	4	4	4
choose and use an appropriate measuring instrument		4	
design and use a data collection sheet	(4)	(4)	4
obtain data from written sources	4		4
obtain data from people			
<b>Levels of accuracy</b>			
rounding to the nearest tenth, unit, ten (given the required accuracy)	4	4	4
<b>Units</b>			
of money	4		

<b>Element 1.2 Tackle problems</b>	<i>Managing money</i>	<i>Working in 2- and 3- dimensions</i>	<i>Making sense of data</i>
<b>Performance criteria</b> A student must:			
1 choose and use a <b>technique</b> which suits the problem	4	4	4
2 perform the <b>technique</b> in a correct order	4	4	4
3 work to the <b>level of accuracy</b> required	4	4	4
4 use mathematical terms correctly	4	4	4
5 carry out calculations correctly	4	4	4
6 use <b>checking procedures</b> to confirm the results of calculations	4	4	4
7 check that results make sense in respect of the problem being tackled	4	4	4
<b>Techniques</b>			
addition, subtraction, multiplication and division of whole numbers	4	4	4
addition and subtraction of decimal fractions	4	4	4
finding a simple fraction of a quantity	4	4	4
finding a simple percentage of a quantity	4	4	4
using simple formulae expressed in words	4	4	4
use common units of length, area		4	
find perimeters of simple shapes		4	
find areas of simple plane shapes		4	
find volumes of simple shapes		4	
convert between common units of measurements using conversion factors		4	
identify mode and range			4
calculate and use the mean			4
<b>Levels of accuracy</b>			
rounding to the nearest tenth, unit, ten (given the required accuracy)	4	4	4
<b>Checking procedures</b>			
carry out approximate calculations	4	4	4
estimate calculations	4	4	4
carry out inverse operations	4	4	4

<b>Element 1.3 Interpret and present data</b>	<i>Managing money</i>	<i>Working in 2- and 3- dimensions</i>	<i>Making sense of data</i>
<b>Performance criteria</b> A student must:			
1 identify and <b>explain the main features</b> of the data	4	4	4
2 choose and use a <b>technique</b> which presents the data effectively	4	4	4
3 follow <b>conventions</b> for presenting the data	4	4	4

use given units	4	4	4
use given scales	4	4	4

<b>Element 2.1 Collect and record data</b>	<i>Managing money</i>	<i>Working in 2- and 3- dimensions</i>	<i>Making sense of data</i>
<b>Performance criteria</b> A student must:			
1 make decisions about what data should be collected	4	4	4
2 choose and use techniques which suit the task	4	4	4
3 perform the techniques in a correct order	4	4	4
4 choose and work to an appropriate level of accuracy	4	4	4
5 record data in appropriate units and in an appropriate format	4	4	4
6 make sure that records are accurate and complete	4	4	4
<b>Techniques</b>			
use fractions to describe situations	4	4	4
use decimal fractions to describe situations	4	4	4
use percentages to describe situations	4	4	4
use ratios to describe situations	4	4	4
use negative numbers to describe situations	4		(4)
estimate quantities and proportions	4	4	4
choose and use measuring instruments		4	
choose and use appropriate units of measurement		4	4
design and use a data collection sheet	(4)	(4)	4
obtain data from written sources	4		4
obtain data from people			
work with discrete and grouped data			
<b>Levels of accuracy</b>			
work with large and small numbers	4	4	4
round to an appropriate number of decimal places	4	4	4
set and work within tolerances		4	(4)
<b>Units</b>			
of money	4		
of physical dimensions		4	(4)
of another property			(4)



<b>Element 2.2 Tackle problems</b>	<i>Managing money</i>	<i>Working in 2- and 3- dimensions</i>	<i>Making sense of data</i>
<b>Performance criteria</b> A student must:			
1 choose and use <b>techniques</b> which suit the problem	4	4	4
2 perform the <b>techniques</b> in a correct order	4	4	4
3 choose and use appropriate units	4	4	4
4 choose and use an appropriate <b>level of accuracy</b>	4	4	4
5 use mathematical terms correctly	4	4	4
6 carry out calculations correctly	4	4	4
7 use <b>checking procedures</b> to confirm the results of calculations	4	4	4
8 check that results make sense in respect of the problem being tackled	4	4	4
<b>Techniques</b>			
addition, subtraction, multiplication and division of numbers of any size	4	4	4
calculations with decimal fractions	4	4	4
calculations with fractions	4	4	4
calculations with percentages	4	4	4
finding and comparing ratios	4	4	4
using simple formulae expressed in words and symbols	4	4	4
use common units of length, area, volumes		4	
find perimeters of simple shapes		4	
find areas of simple plane shapes		4	
find volumes of simple shapes and cylinders		4	
convert between common units of measurements using conversion factors and formulae		4	
identify mode and range			4
calculate and use the mean			4
<b>Levels of accuracy</b>			
rounding to the nearest tenth, unit, ten, number of decimal places	4	4	4
<b>Checking procedures</b>			
carry out approximate calculations	4	4	4
estimate calculations	4	4	4
carry out inverse operations	4	4	4

<b>Element 2.3 Interpret and present data</b>	<i>Managing money</i>	<i>Working in 2- and 3-dimensions</i>	<i>Making sense of data</i>
<b>Performance criteria</b> A student must:			
1 identify and <b>explain the main features</b> of the data	4	4	4
2 choose and use <b>techniques</b> which presents the data effectively	4	4	4
3 follow <b>conventions</b> for presenting the data	4	4	4
4 present the results with an appropriate <b>level of accuracy</b>	4	4	4
5 explain how the results make sense in respect of the problem being tackled	4	4	4
<b>Explain the main features</b>			
express relationships and patterns in words	4	4	4
express relationships and patterns in symbols		4	
express relationships involving rates	(4)	(4)	(4)
<b>Techniques</b>			
make decisions about most appropriate techniques	4	4	4
use probability to describe situations			
construct and interpret plans and drawings (including 2-D representation of 3-D situations)		4	
construct and interpret pictograms, bar charts and pie charts	4		4
construct and interpret multiple line graphs	4	4	4
interpret mode, median, mean, range			4
<b>Conventions</b>			
select and use appropriate axes	4	4	4
select and use appropriate labels	4	4	4
<b>Levels of accuracy</b>			
select and use appropriate units	4	4	4
select and use appropriate scales	4	4	4

## 2.2 Intermediate Level Units

### Free-standing Mathematics Units at Intermediate Level mapped to Application of Number Key Skills specifications at Levels 2 and 3.

Students completing Free-standing Mathematics Units at Intermediate Level will provide evidence that will contribute to Application of Number in the following areas at Levels 2 and 3.

Note that 4 indicates that a performance criterion or technique will certainly be covered whereas (4) indicates that it may or may not be covered depending on the work submitted by individuals. Other performance criteria and techniques are not likely to be demonstrated by students in completing their work towards the particular Free-standing Mathematics Unit.

<b>Element 2.1 Collect and record data</b>	<i>Calculating finances</i>	<i>Solving problems in shape &amp; space</i>	<i>Handling &amp; interpreting data</i>	<i>Using algebra, functions &amp; graphs</i>	<i>Making connections in mathematics</i>
<b>Performance criteria</b> A student must:					
1 make decisions about what data should be collected	4	4	4	4	4
2 choose and use techniques which suit the task	4	4	4	4	4
3 perform the techniques in a correct order	4	4	4	4	4
4 choose and work to an appropriate level of accuracy	4	4	4	4	4
5 record data in appropriate units and in an appropriate format	4	4	4	4	4
6 make sure that records are accurate and complete	4	4	4	4	4
<b>Techniques</b>					
use fractions to describe situations	4	4	4	4	4
use decimal fractions to describe situations	4	4	4	4	4
use percentages to describe situations	4	4	4	4	(4)
use ratios to describe situations	4	4	4	4	(4)
use negative numbers to describe situations	4		(4)	4	(4)
estimate quantities and proportions	4	4	4	4	

<b>Element 2.2 Tackle problems</b>	<i>Calculating finances</i>	<i>Solving problems in shape &amp; space</i>	<i>Handling &amp; interpreting data</i>	<i>Using algebra, functions &amp; graphs</i>	<i>Making connections in mathematics</i>
<b>Performance criteria</b> A student must:	4	4	4	4	4
1 choose and use techniques which suit the problem	4	4	4	4	4
2 perform the techniques in a correct order	4	4	4	4	4
3 choose and use appropriate units	4	4	4	4	4
4 choose and use an appropriate <b>level of accuracy</b>	4	4	4	4	4
5 use mathematical terms correctly	4	4	4	4	4
6 carry out calculations correctly	4	4	4	4	4
7 use <b>checking procedures</b> to confirm the results of calculations	4	4	4	4	4
8 check that results make sense in respect of the problem being tackled	4	4	4	4	4
<b>Techniques</b>					
addition, subtraction, multiplication and division of numbers of any size	4	4	4	4	4
calculations with decimal fractions	4	4	4	4	4
calculations with fractions	4	4	4	4	4
calculations with percentages	4	4	4	4	4
finding and comparing ratios	4	4	4	4	4
using simple formulae expressed in words and symbols	4	4	4	4	4
use common units of length, area, volumes		4		(4)	(4)
find perimeters of simple shapes		4			
find areas of simple plane shapes		4			
find volumes of simple shapes and cylinders		4			
convert between common units of measurement using conversion factors and formulae		4		(4)	
identify mode and range			4		
calculate and use the mean			4		
<b>Levels of accuracy</b>					
rounding to the nearest tenth, unit, ten, number of decimal places	4	4	4	4	4

<b>Element 2.3 Interpret and present data</b>	<i>Calculating finances</i>	<i>Solving problems in shape &amp; space</i>	<i>Handling &amp; interpreting data</i>	<i>Using algebra, functions &amp; graphs</i>	<i>Making connections in mathematics</i>
<b>Performance criteria</b> A student must:					
1 identify and <b>explain the main features</b> of the data	4	4	4	4	4
2 choose and use <b>techniques</b> which presents the data effectively	4	4	4	4	4
3 follow <b>conventions</b> for presenting the data	4	4	4	4	4
4 present the results with an appropriate <b>level of accuracy</b>	4	4	4	4	4
5 explain how the results make sense in respect of the problem being tackled	4	4	4	4	4
<b>Explain the main features</b>					
express relationships and patterns in words	4	4	4	4	4
express relationships and patterns in symbols		(4)		4	4
express relationships involving rates	(4)	(4)	(4)	(4)	(4)
<b>Techniques</b>					
make decisions about most appropriate techniques	4	4	4	4	4
use probability to describe situations	4		4		
construct and interpret plans and drawings (including 2-D representation of 3-D situations)		4			
construct and interpret pictograms, bar charts and pie charts	4		4		
construct and interpret multiple line graphs	4		4	(4)	
interpret mode, median, mean, range			4		
<b>Conventions</b>					
select and use appropriate axes	4		4	4	4
select and use appropriate labels	4	4	4	4	4
<b>Levels of accuracy</b>					
select and use appropriate units	4	4	4	4	4
select and use appropriate scales	4	4	4	4	4

<b>Element 3.1 Collect and record data</b>	<i>Calculating finances</i>	<i>Solving problems in shape &amp; space</i>	<i>Handling &amp; interpreting data</i>	<i>Using algebra, functions &amp; graphs</i>	<i>Making connections in mathematics</i>
<b>Performance criteria</b> A student must:					
1 make decisions about what data should be collected	4	4	4	4	4
2 choose and use techniques which suit the task	4	4	4	4	4
3 perform the techniques in a correct order	4	4	4	4	4
4 choose and work to an appropriate level of accuracy	4	4	4	4	4
5 record data in appropriate units and in an appropriate format	4	4	4	4	4
6 make sure that records are accurate and complete	4	4	4	4	4
7 identify sources of errors and their effects	4	4	4	4	4
<b>Techniques</b>					
use fractions to describe situations	4	4	4	4	4
use decimal fractions to describe situations	4	4	4	4	(4)
use percentages to describe situations	4	4	4	(4)	(4)
use ratios to describe situations	4	4	4	(4)	(4)
use negative numbers to describe situations	4	(4)	(4)	(4)	(4)
estimate quantities and proportions	4	4	4	4	
choose and use measuring instruments		4			
choose and use appropriate units of measurement	4	4	4	4	4
design and use data collection procedures	4		4	(4)	
obtain data from written sources	4		4	(4)	
obtain data from people			(4)		
work with discrete and continuous data	4		4	4	4
handle large data sets					
<b>Levels of accuracy</b>					
work with numbers of any size	4	4	4	4	4
round to an appropriate number of decimal places	4	4	4	4	4
set and work within tolerances		4		4	

<b>Element 3.2 Tackle problems</b>	<i>Calculating finances</i>	<i>Solving problems in shape &amp; space</i>	<i>Handling &amp; interpreting data</i>	<i>Using algebra, functions &amp; graphs</i>	<i>Making connections in mathematics</i>
<b>Performance criteria</b> A student must:					
1 choose and use <b>techniques</b> which suit the problem	4	4	4	4	4
2 perform the <b>techniques</b> in a correct order	4	4	4	4	4
3 choose and use appropriate units	4	4	4	4	4
4 choose and use an appropriate <b>level of accuracy</b>	4	4	4	4	4
5 use mathematical terms correctly	4	4	4	4	4
6 carry out calculations correctly	4	4	4	4	4
7 use <b>checking procedures</b> to confirm the results of calculations	4	4	4	4	4
8 check that results make sense in respect of the problem being tackled	4	4	4	4	4
9 identify the effects of any accumulating errors in calculations	4	4	4	4	4
<b>Techniques</b>					
addition, subtraction, multiplication and division of numbers of any size	4	4	4	4	4
calculations with decimal fractions	4	4	4	4	4
calculations with fractions	4	4	4	4	4
calculations with percentages	4	(4)	4		
finding and comparing ratios	4	4	(4)		
using simple formulae expressed in words and symbols	4	4	4	4	4
use powers and roots	4	(4)	4	4	4
use common units of length, area, volumes		4			
find perimeters of simple shapes		4			
find areas of simple plane shapes		4			
find volumes of simple shapes and cylinders		4			
carry out calculations involving compound measures	4	4		4	(4)
convert between common units of measurements using conversion factors and formulae (within and between systems)	4	4	(4)	4	(4)
identify mode and range			4		

<b>Element 3.3 Interpret and present data</b>	<i>Calculating finances</i>	<i>Solving problems in shape &amp; space</i>	<i>Handling &amp; interpreting data</i>	<i>Using algebra, functions &amp; graphs</i>	<i>Making connections in mathematics</i>
<b>Performance criteria A student must:</b>					
1 identify and <b>explain the main features</b> of the data	4	4	4	4	4
2 choose and use techniques which present the data effectively	4	4	4	4	4
3 follow <b>conventions</b> for presenting the data	4	4	4	4	4
4 present the results with an appropriate <b>level of accuracy</b>	4	4	4	4	4
5 explain how the results make sense in respect of the problem being tackled	4	4	4	4	4
<b>Explain the main features</b>					
express relationships and patterns in words	4	4	4	4	4
express relationships and patterns in symbols	4	4		4	4
express relationships involving rates	(4)		(4)	4	4
express relationships as equations and inequalities		4		4	4
<b>Techniques</b>					
make decisions about most appropriate techniques	4	4	4	4	4
use probability to describe situations	4	4	4		
construct and interpret plans and drawings (including 2-D representation of 3-D situations)		4			
construct and interpret network diagrams					
construct and interpret pictograms, bar charts, pie charts, histograms and scatter diagrams	4	4	4		
construct and interpret multiple line graphs	(4)		(4)	4	
interpret and compare modes, medians, means, range			4		
work with inter-quartile range			4		
<b>Conventions</b>					
select and use appropriate axes	4		4	4	4
select and use appropriate labels	4	4	4	4	4



### ***2.3 Advanced Level Units***

#### **Free-standing Mathematics Units at Advanced Level mapped to Application of Number Key Skills specifications at Levels 3 and 4.**

Students completing Free-standing Mathematics Units at Advanced Level will provide evidence that will contribute to Application of Number in the following areas at Levels 3 and 4.

Note that 4 indicates that a performance criterion or technique will certainly be covered whereas (4) indicates that it may or may not be covered depending on the work submitted by individuals. Other performance criteria and techniques are not likely to be demonstrated by students in completing their work towards the particular Free-standing Mathematics Unit.

<b>Element 3.1 Collect and record data</b>	<i>Working with algebraic &amp; graphical techniques</i>	<i>Modelling with calculus</i>	<i>Using &amp; applying statistics</i>	<i>Understanding mathematical thinking</i>
<b>Performance criteria</b> A student must:				
1 make decisions about what data should be collected	4	4	4	4
2 choose and use techniques which suit the task	4	4	4	4
3 perform the techniques in a correct order	4	4	4	4
4 choose and work to an appropriate level of accuracy	4	4	4	4
5 record data in appropriate units and in an appropriate format	4	4	4	4
6 make sure that records are accurate and complete	4	4	4	4
7 identify sources of errors and their effects	4	4	4	4
<b>Techniques</b>				
use fractions to describe situations	4	4	4	4
use decimal fractions to describe situations	4	4	4	4
use percentages to describe situations	4	(4)	4	(4)
use ratios to describe situations	4	(4)	4	(4)
use negative numbers to describe situations	4	4	(4)	(4)
estimate quantities and proportions	4	(4)	4	
choose and use measuring instruments	(4)	(4)	(4)	
choose and use appropriate units of measurement	4	(4)	4	
design and use data collection procedures	4		4	
obtain data from written sources	(4)		4	
obtain data from people	(4)		4	
work with discrete and continuous data	4	4	4	4
handle large data sets			4	
<b>Levels of accuracy</b>				
work with numbers of any size	4	4	4	4
round to an appropriate number of decimal places	4	4	4	4
set and work within tolerances	(4)	(4)	(4)	

<b>Element 3.2 Tackle problems</b>	<i>Working with algebraic &amp; graphical techniques</i>	<i>Modelling with calculus</i>	<i>Using &amp; applying statistics</i>	<i>Understanding mathematical thinking</i>
<b>Performance criteria</b> A student must:				
1 choose and use <b>techniques</b> which suit the problem	4	4	4	4
2 perform the <b>techniques</b> in a correct order	4	4	4	4
3 choose and use appropriate units	4	4	4	4
4 choose and use an appropriate <b>level of accuracy</b>	4	4	4	4
5 use mathematical terms correctly	4	4	4	4
6 carry out calculations correctly	4	4	4	4
7 use <b>checking procedures</b> to confirm the results of calculations	4	4	4	4
8 check that results make sense in respect of the problem being tackled	4	4	4	4
9 identify the effects of any accumulating errors in calculations	4	4	4	4
<b>Techniques</b>				
addition, subtraction, multiplication and division of numbers of any size	4	(4)	4	
calculations with decimal fractions	4	(4)	4	4
calculations with fractions	4	(4)	4	4
calculations with percentages	4	(4)	4	
finding and comparing ratios	4	(4)	4	
using simple formulae expressed in words and symbols	4	4	4	4
use powers and roots	4	4		4
use common units of length, area, volumes	(4)	(4)	(4)	
find perimeters of simple shapes				
find areas of simple plane shapes				
find volumes of simple shapes and cylinders				
carry out calculations involving compound measures	(4)	(4)	(4)	(4)
convert between common units of measurements using conversion factors and formulae (within and between	(4)	(4)		

<b>Element 3.3 Interpret and present data</b>	<i>Working with algebraic &amp; graphical techniques</i>	<i>Modelling with calculus</i>	<i>Using &amp; applying statistics</i>	<i>Understanding mathematical thinking</i>
<b>Performance criteria</b> A student must:				
1 identify and <b>explain the main features</b> of the data	4	4	4	4
2 choose and use <b>techniques</b> which presents the data effectively	4	4	4	4
3 follow <b>conventions</b> for presenting the data	4	4	4	4
4 present the results with an appropriate <b>level of accuracy</b>	4	4	4	4
5 explain how the results make sense in respect of the problem being tackled	4	4	4	4
<b>Explain the main features</b>				
express relationships and patterns in words	4	4	4	4
express relationships and patterns in symbols	4	4	(4)	4
express relationships involving rates	(4)	4	(4)	(4)
express relationships as equations and inequalities	4	4	(4)	4
<b>Techniques</b>				
make decisions about most appropriate techniques	4	4	4	4
use probability to describe situations			4	
construct and interpret plans and drawings (including 2-D representation of 3-D situations)				
construct and interpret network diagrams				
construct and interpret pictograms, bar charts, pie charts, histograms and scatter diagrams			4	
construct and interpret multiple line graphs	(4)		(4)	
interpret and compare modes, medians, means, range			4	
work with inter-quartile range			4	
<b>Conventions</b>				
select and use appropriate axes	4	4	4	4

<b>Element 4.1 Collect and record data</b>	<i>Working with algebraic &amp; graphical techniques</i>	<i>Modelling with calculus</i>	<i>Using &amp; applying statistics</i>	<i>Understanding mathematical thinking</i>
<b>Performance criteria</b> A student must:				
1 plan an appropriate strategy for the task	4	4	4	4
2 make and justify decisions about how and what data should be collected	4	4	4	4
3 choose and use in a correct order the techniques which suit the task	4	4	4	4
4 choose and work to an appropriate level of accuracy	4	4	4	4
5 record data in appropriate units and in an appropriate format	4	4	4	4
6 make sure that records are accurate and complete	4	4	4	4
7 identify sources of errors and their effects	4	4	4	4
8 evaluate decisions made in collecting and recording data	(4)	(4)	4	(4)
<b>Techniques</b>				
use fractions to describe situations	4	4	4	4
use decimal fractions to describe situations	4	4	4	(4)
use percentages to describe situations	4	(4)	4	(4)
use ratios to describe situations	4	(4)	4	(4)
use negative numbers to describe situations	4	4	(4)	(4)
use numbers of any size to describe situations	4	4	(4)	(4)
use estimates to judge quantities and proportions	(4)	(4)	4	(4)
use estimates to check results	(4)	(4)	4	(4)
use estimates to predict outcomes	(4)	(4)	4	(4)
use estimates to predict probable effects of errors in data collection	(4)	(4)	4	(4)
choose and use measuring instruments	(4)	(4)	4	(4)
choose and use appropriate units of measurement	(4)	(4)	4	(4)
select an appropriate sample	(4)	(4)	4	(4)
design and use data collection procedures	(4)	(4)	4	(4)
obtain data from written sources	(4)	(4)	4	(4)
obtain data from people	(4)	(4)	4	(4)
work with discrete and continuous data	4	4	4	(4)
work with bivariate data			4	(4)
handle large data sets			4	
<b>Levels of accuracy</b>				
choosing and using an appropriate level of	4	4	4	(4)

<b>Element 4.2 Tackle problems</b>	<i>Working with algebraic &amp; graphical techniques</i>	<i>Modelling with calculus</i>	<i>Using &amp; applying statistics</i>	<i>Understanding mathematical thinking</i>
<b>Performance criteria</b> A student must:				
1 plan an appropriate strategy for the <b>problem</b>	4	4	4	4
2 formulate the <b>problem</b> in mathematical terms	4	4	4	4
3 choose and use in a correct order <b>techniques</b> which suit the problem	4	4	4	4
4 choose and use appropriate units and appropriate <b>levels of accuracy</b>	4	4	4	4
5 use mathematical terms correctly	4	4	4	4
6 carry out calculations correctly	4	4	4	4
7 use <b>checking procedures</b> to confirm the results of calculations	4	4	4	4
8 check that results make sense in respect of the <b>problem</b> being tackled	4	4	4	4
9 identify the effects of any accumulating errors in calculations	4	4	4	4
10 evaluate decisions made in tackling the <b>problem</b>	4	4	4	4
<b>Techniques</b>				
addition, subtraction, multiplication and division of numbers of any size	4	(4)	4	4
calculations with decimal fractions	4	4	4	4
calculations with fractions	4	4	4	4
calculations with percentages	4	(4)	4	4
calculations with ratios	4	(4)	4	4
working with formulae expressed in words	4	4	4	4
working with formulae expressed in symbols	4	4	4	4
use powers and roots	4	4	4	4
construction and use of graphs	4	4	4	4
use direct and inverse proportion	4			4
use networks	(4)			
calculate using common units of measurement	4	4	4	4
solve problems in two dimensions	4	(4)		(4)
solve problems in three dimensions	4	(4)		(4)
carry out calculations involving compound measures	(4)	(4)	(4)	(4)
convert between common units of measurements using scales and tables	(4)	(4)	(4)	(4)

<b>Element 4.3 Interpret and present data</b>	<i>Working with algebraic &amp; graphical techniques</i>	<i>Modelling with calculus</i>	<i>Using &amp; applying statistics</i>	<i>Understanding mathematical thinking</i>
<b>Performance criteria</b> A student must:				
1 plan an appropriate strategy for presenting <b>data</b>	4	4	4	4
2 identify and explain the <b>main features and trends</b> of the <b>data</b>	4	4	4	4
3 choose and use <b>techniques</b> which presents the <b>data</b> effectively	4	4	4	4
4 follow <b>conventions</b> for presenting the <b>data</b>	4	4	4	4
5 present the results with an appropriate <b>level of accuracy</b>	4	4	4	4
6 draw and justify appropriate conclusions from the data	4	4	4	4
7 explain how the results make sense in respect of the problem being tackled	4	4	4	4
8 evaluate decisions made in interpreting and presenting <b>data</b>	4	4	4	4
<b>Explain the main features</b>				
express relationships and patterns in words	4	4	4	4
express relationships and patterns in symbols	4	4	(4)	4
express relationships involving rates	(4)	4	(4)	(4)
express relationships as equations and inequalities	4	4	(4)	4
expressing relationships using diagrams, formulae and graphs	4	4	4	4
<b>Techniques</b>				
interpret and present the results of calculations	4	4	4	4
use probability to describe situations			4	
express possible outcomes using probability			4	
interpret and present upper and lower bounds of results	4	4	4	(4)
use formulae to express results	4	4	(4)	4
construct and interpret plans and drawings (including 2-D representation of 3-D situations)				
construct and interpret network diagrams				
construct and interpret pictograms, bar charts, pie charts, histograms and scatter diagrams, cumulative frequency diagrams			4	
construct and interpret graphs	4	4	(4)	4

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## ***Communication and Information Technology***

At each level, the specifications of the Communication Key Skill highlight four main areas in which students are expected to demonstrate competence. These areas are identified as the *elements* of the specifications and they are:

1. Take part in discussions
2. Produce written material
3. Use images
4. Read and respond to written materials

Students working with greater sophistication in these areas will be able to demonstrate their competence at higher levels of the Key Skill. For example, one will expect a student operating at the lower levels of the Key Skill to be able to communicate their work to others familiar with the subject whereas one will expect students operating at higher levels to be able to communicate their work to others who are not familiar with the subject.

In the Information Technology Key Skill, students are expected to demonstrate competence in these elements:

1. Prepare information
2. Process information
3. Present information
4. Evaluate the use of information technology

Again, students working with greater sophistication will be able to demonstrate their competence at higher levels. For example, students operating at lower levels of the Key Skill will be able to use information technology to present information to meet given requirements whereas those operating at higher levels will be able to make decisions about appropriate formats and to use a wide range of techniques in completing the presentation.

The efforts that students put into their work toward a Free-standing Mathematics Unit will allow them the opportunity to demonstrate the competencies required at the different levels of the Communication and Information Technology Key Skills. In some areas certain competencies will be demonstrated by necessity while, elsewhere the potential will exist for others to be demonstrated. The following tables highlight likely and potential coverage of these Key Skills for each Free-standing Mathematics Unit.



**Foundation Unit: Managing Money**

<b>Communication Levels 1 and 2</b>	
<i>1 Take part in discussions</i>	<p>Students working on this unit will have the opportunity to explain their ideas to each other informally as they develop material for their portfolios. They will also, as part of their work, have one-to-one discussions with the teacher to report on progress so far and to agree further action. More formally, they could be asked to make brief oral reports of their work to the rest of the group. Those not making the presentation on that occasion could be asked to summarise other contributions to confirm their understanding. Students should be encouraged to use appropriate vocabulary and to explain their ideas clearly.</p> <p>For Level 2, students may be able to present their work, or respond to the work of others, in such a way that discussion is moved on, eg by asking or responding to follow-up questions.</p>
<i>2 Produce written material</i>	<p>Students are required to produce a variety of written materials for their portfolios. These include materials using pre-set formats, for example order forms, and freer writing, such as reports on costs or prices, where the students would decide the format. Students could check their own work and that of others. There is emphasis in this unit on the use of computers to produce spreadsheets, tables and charts, but parts of the work could be done in handwriting if required. Students would be expected to make appropriate use of notation and to pay attention to spelling and grammar.</p> <p>For Level 2, students may be able to produce oral or written reports that use specialist vocabulary with precision and use paragraphs and sentences appropriately to highlight important points.</p>
<i>3 Use images</i>	<p>This unit requires that students use and interpret a variety of images in their work. Written or oral reports will include at least some tables, graphs or spreadsheet printouts. It may also be appropriate for a student to include a photograph or sketch of the topic of the report (eg a picture of a car in a report on financing the purchase or running of a car) in order to provide visual interest. Students should be encouraged to select the most appropriate form of presentation for the purpose.</p> <p>Level 2: no extra performance criteria specified.</p>
<i>4 Read and respond to</i>	<p>Students have to extract relevant information from leaflets, bills, supermarket shelves, etc, to provide data for calculations and reports. Such information will be</p>

<b>Information Technology Levels 1 and 2</b>	
<i>This unit requires students to use a basic calculator and computer spreadsheet proficiently</i>	
<i>1 Prepare information</i>	<p>Students are required to use a computer extensively in this unit, including selecting data and recording it in tables and spreadsheets. Students will use software to support their work but are expected to be able to format tables and spreadsheets to suit their data. They may also make some use of word processing software in the preparation of their portfolios, though this is not a requirement.</p> <p>For Level 2, students are likely, in this unit, to store their input systematically and make backup copies</p>
<i>2 Process information</i>	<p>Students taking this unit will satisfy all performance criteria for this element. In producing portfolio evidence, they will process information to find or compare costs, involving the use of formulae in spreadsheets.</p> <p>For Level 2, students will combine information from different sources in making their comparisons. This could involve importing information from different sources and of different types.</p>
<i>3 Present information</i>	<p>Students' portfolios must include well presented reports giving details of the calculations made and conclusions reached. This will often involve the use of tables and, possibly, charts. Work will be suitably saved and backed up.</p> <p>Level 2: no extra performance criteria for this element.</p>
<i>4 Evaluate the use of information technology</i>	<p>This element of the Key Skill requires students to reflect on their use of IT. This would not normally be something that one would expect students to do within their work for a Free-standing Mathematics Unit. However, as highlighted above, in the production of portfolio evidence for the unit students will have many opportunities to demonstrate competence with IT, and may therefore wish to evaluate their use of IT within this setting.</p>

## Foundation Unit: Working in 2 and 3 Dimensions

Communication Levels 1 and 2	
<p>1 <i>Take part in discussions</i></p>	<p>Students working on this unit will have the opportunity to explain their ideas in small group work as they develop material for their portfolios. They will also have one-to-one discussions with the teacher to report on progress so far and agree further action. More formally, they could be asked to make brief oral reports of their work to the rest of the group. Those not making the presentation on that occasion could be asked to summarise other contributions to confirm their understanding. Students should be encouraged to use appropriate vocabulary and to explain their ideas clearly.</p> <p>For Level 2, students may be able to present their work, or respond to the work of others, in such a way that discussion is moved on, eg by asking or responding to follow-up questions.</p>
<p>2 <i>Produce written material</i></p>	<p>Students are required to produce a variety of written materials for their portfolios. This is unlikely to include the use of pre-set formats unless the teacher chooses to provide them for students, but will certainly include following conventions such as those required for the drawing of accurate plans. As well as producing work of their own, students could be asked to check the work of others. Parts of students' portfolios are likely to be completed in handwriting. Students would be expected to make appropriate use of notation and to pay attention to spelling and grammar.</p> <p>For Level 2, students may be able to produce oral or written reports that use specialist vocabulary with precision and use paragraphs and sentences appropriately to highlight important points.</p>
<p>3 <i>Use images</i></p>	<p>This unit requires that students use and interpret a variety of images of 2 and 3 dimensional objects in their work. A written or oral report would include diagrams of various kinds and could include photographs or scanned images. Students should be encouraged to select the most appropriate form of presentation for the purpose.</p> <p>Level 2: no extra performance criteria specified.</p>
<p>4 <i>Read and respond to written materials</i></p>	<p>Students have to select extract relevant information from real objects, sketches, plans, written descriptions, etc, to provide data for further work. Extracting suitable information will involve reading and measuring.</p>

<b>Information Technology Levels 1 and 2</b>	
<i>This unit does not require students to use computers although there are opportunities for them to do so</i>	
<i>1 Prepare information</i>	<p>Students could enter, for example, the dimensions of an object into a spreadsheet and use it to convert the measurements ready for a scale drawing to be made.</p> <p>For Level 2, students could store their input systematically and make backup copies.</p>
<i>2 Process information</i>	<p>Students could process information as indicated above, for example, or to work out the total cost for making an object.</p> <p>For Level 2, students could combine information from different sources to compare objects. This could involve importing information from different sources and of different types.</p>
<i>3 Present information</i>	<p>Students' portfolios must include well presented reports giving details of the calculations made and conclusions reached. This could involve the use of word processing and/or the use of a drawing package.</p> <p>Level 2: no extra performance criteria for specified for this element.</p>
<i>4 Evaluate the use of information technology</i>	<p>This element of the Key Skill requires students to reflect on their use of IT. This would not normally be something that one would expect students to do within their work for a Free-standing Mathematics Unit. However, as highlighted above, in the production of portfolio evidence for the unit students will have many opportunities to demonstrate competence with IT, and may therefore wish to evaluate their use of IT within this setting.</p>

## Foundation Unit: Making Sense of Data

Communication Levels 1 and 2	
<p>1 <i>Take part in discussions</i></p>	<p>Students working on this unit will have the opportunity to explain their ideas in small groups whilst working together to develop material for their portfolios. They will also have one-to-one discussions with the teacher to report on progress so far and to agree further action. More formally, they could be asked to make brief oral reports of their work to the rest of the group. Those not making the presentation on that occasion could be asked to summarise other contributions to confirm their understanding. Students should be encouraged to use appropriate vocabulary and to explain their ideas clearly.</p> <p>For Level 2, students may be able to present their work, or respond to the work of others, in such a way that discussion is moved on, eg by asking or responding to follow-up questions.</p>
<p>2 Produce written material</p>	<p>Students are required to produce a variety of written materials for their portfolios. These would include the use of pre-set formats only if the teacher chose to provide such formats. Written materials produced by students could be hand-written or word-processed and would include tables and charts. Students could be asked to check the work of others as well as their own. Students would be expected to make appropriate use of notation and to pay attention to spelling and grammar.</p> <p>For Level 2, students may be able to produce oral or written reports that use specialist vocabulary with precision and use paragraphs and sentences appropriately to highlight important points.</p>
<p>3 <i>Use images</i></p>	<p>This unit requires that students use and interpret a variety of images in their work. A written or oral report would include at least some tables, graphs of various kinds, or spreadsheet printouts. It may be also appropriate to include a sketch or photograph. Students should be encouraged to select the most appropriate form of presentation for the purpose.</p> <p>Level 2: no extra performance criteria specified.</p>
<p>4 <i>Read and respond to written materials</i></p>	<p>The unit requires students to extract relevant information from leaflets, survey data, etc to provide information for calculations and reports. Such information will be in a variety of forms including tables and charts and will include redundant and irrelevant information, requiring a selection to be made.</p>

<b>Information Technology Levels 1 and 2</b>	
This unit requires students to use a basic calculator and computer spreadsheet proficiently	
<i>1 Prepare information</i>	<p>Students are required to use a computer extensively in this unit, including selecting data and recording it in tables and spreadsheets. Students will use software to support their work but are expected to be able to format the tables and spreadsheets to suit the data. They are also likely to make some use of word processing software in the preparation of their portfolios, though this is not a requirement.</p> <p>For Level 2, students could store their input systematically and make backup copies.</p>
<i>2 Process information</i>	<p>Students taking this unit will satisfy all performance criteria for this element. In producing their portfolio evidence, they will process information using spreadsheet functions to calculate statistics and present data.</p> <p>For Level 2, students could combine information from different sources in making their reports. This could involve importing information from different sources and of different types.</p>
<i>3 Present information</i>	<p>Students' portfolios must include well presented reports giving details of the calculations made and conclusions reached, and using charts to illustrate data. Work will be suitably saved and backed up.</p> <p>Level 2: no extra performance criteria for this element.</p>
<i>4 Evaluate the use of information technology</i>	<p>This element of the Key Skill requires students to reflect on their use of IT. This would not normally be something that one would expect students to do within their work for a Free-standing Mathematics Unit. However, as highlighted above, in the production of portfolio evidence for the unit students will have many opportunities to demonstrate competence with IT, and may therefore wish to evaluate their use of IT within this setting.</p>

**Intermediate Unit: Calculating finances**

<b>Communication Levels 2 and 3</b>	
<i>1 Take part in discussions</i>	<p>There is potential to develop activities in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present some of their portfolio evidence to a small group. Such a verbal report will suffice as the ‘report’ required as portfolio evidence if accompanied by documentary evidence as required by the unit’s specifications. It will be particularly useful if students are given the opportunity to take part in a discussion / question &amp; answer session at the end of their presentation. This will allow them the possibility of taking part in one-to-one discussions as required by the Key Skill’s specifications.</p> <p>For level 3, it may be possible for students to create opportunities for others to contribute in question-and-answer sessions or in group presentations.</p>
<i>2 Produce written material</i>	<p>This unit allows students many opportunities to contribute to this element. It is likely that students will be able to produce both written work that follows structured formats (such as when completing invoices, spreadsheets etc.) and which is given structure by the students themselves Even though the focus of the work is mathematics it is expected that the written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolios if they were to make mistakes with these aspects of their work).</p> <p>Level 3: no extra performance criteria specified.</p>
<i>3 Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>For example, it is clear that students should select, produce and use appropriate diagrams (charts, tables, graphs and statistical diagrams) with which to illustrate their work. Their use of such images can be included in both written reports and presentations made verbally. Students could additionally be encouraged to illustrate their reports with other images such as photographs and pictures of the situations they are investigating.</p> <p>Level 3: No extra performance criteria specified</p>
<i>4 Read and respond to</i>	<p>It is likely that students will be able to demonstrate competence in this area. The starting point or introductory activity leading to the production of portfolio</p>

<b>Information Technology Levels 2 and 3</b>	
<i>This unit requires students to use a basic calculator and computer spreadsheet proficiently</i>	
<i>1 Prepare information</i>	<p>This unit clearly allows students to demonstrate their capabilities in this area. Students should show that they are able to select appropriate information for processing by spreadsheet. Students should then be able to enter, edit and correct data within a computer spreadsheet. Further processing is likely to involve calculation using source data and the production of suitable diagrammatic and graphical displays.</p> <p>There will also be the potential for students to produce their reports using word-processing and/or desktop publishing software if they wish. This may allow them to be involved in the appropriate manipulation of graphics as well as text.</p> <p>At Level 3, this unit gives students the opportunity to configure spreadsheets, for example, to aid the input of information.</p>
<i>2 Process information</i>	<p>Students will clearly be able to demonstrate their competence in this area of the Key Skill when completing tasks for their portfolio evidence. The use of spreadsheets to carry out and display the results of calculations will allow students to demonstrate many of the demands of this element of the Key Skill. For example, students will by necessity be involved in the processing of numerical information that will require selection and inputting of data, its editing, sorting, calculation and possibly reformatting (e.g display of numerical data as currency). The unit demands the display of the results of such processing in diagrammatic form, and analysis and written summary of findings. These aspects of work produced for portfolio evidence will allow students to meet many of the further demands of the element of the Key Skill.</p> <p>At Level 3, students could choose to use some automated routines in the production of work for their portfolios.</p>
<i>3 Present information</i>	<p>The portfolio evidence that students produce for this unit will allow them to contribute effectively to aspects of this area of the Key Skill. Students are required to use spreadsheets to carry out part of their portfolio work; this is clearly an effective piece of software with which to work in this area of mathematics, and will allow them to satisfy some of the demands of the Key Skill. To satisfy further demands and to produce portfolio evidence of the high quality, students may consider preparing their reports with software that allows them to</p>



**Intermediate Unit: Solving problems in shape & space**

<b>Communication Levels 2 and 3</b>	
1 <i>Take part in discussions</i>	<p>There is potential to develop activities in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present some of their portfolio evidence to a small group. The portfolio evidence required for this unit is such that a presentation of this type will not be sufficient to satisfy the demands made (e.g. sketches, drawings and solutions to problems are all required). However, students could be encouraged to make a final presentation of their work in this way – this may be useful if students, for example, have been working on a design brief. If students are given the opportunity to take part in a discussion or question-and-answer session at the end of such a presentation, they may be able to demonstrate other competencies required in this element of the Key Skill.</p> <p>For Level 3, it may be possible for students to encourage the participation of others in group discussions.</p>
2 <i>Produce written material</i>	<p>This unit allows students the opportunity of demonstrating their competence with this aspect of the Key Skill.</p> <p>Students are required to provide a written analysis of the mathematics of a spatial situation as part of their portfolio evidence – this will allow them to prepare a report in a freely-structured format as required at Level 3 of the Key Skill. Solutions that are produced to spatial problems may also allow students to contribute to this element; this will particularly be the case if students include their solutions within a written report of a situation they have investigated.</p> <p>Even though the focus of the student's work is mathematics it is expected that their written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolio if they were to make mistakes with these aspects of their work).</p> <p>No further performance criteria specified for Level 3</p>
3 <i>Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>To complete their portfolio students are required to produce sketches and accurate drawings together with solutions to problems and written accounts describing geometrical situations. These activities will provide many opportunities for students to illustrate their work with images of different types. Students could be encouraged to use images other than those they produce to illustrate their work.</p> <p>Within the contexts of their work students will come to select the images that are most appropriate for different situations. Students may elect to use IT when producing some of their images.</p>

<b>Information Technology Levels 2 and 3</b>	
This unit requires students to use a basic scientific calculator proficiently. Students may wish to develop some of the required portfolio evidence using drawing packages, design software or dynamic geometry software.	
<i>1 Prepare information</i>	<p>Students will be able to contribute to this element of the Key skill only if they choose to use computer software to produce output for their portfolio. The software that they use could allow them to produce drawings or they may use word-processing or desktop publishing software to produce a final piece of work. It is most likely that students would elect to use this latter type of software in producing their account of how geometrical terms and ideas can be used to describe spatial situations. If they choose to do this, students may well wish to include graphics within their text. In producing a technical drawing using computer software, students will need to incorporate text, graphics and numerical information.</p> <p>At Level 3, some students may choose to develop their own templates for the production of reports or drawings.</p>
<i>2 Process information</i>	<p>Again, students will be able to contribute to this element of the Key Skill only if they choose to use computer software to produce output for their portfolio. As above, students may be expected to be involved with the processing of graphics, text and numerical data if they choose to develop a drawing using appropriate software. If they choose to produce a report using word-processing or desktop publishing software, they may be able to demonstrate competence in combining text, graphics and possibly numerical information into a single output.</p> <p>At Level 3, students have the opportunity to use, for example, drawing macros, in the production of portfolio work.</p>
<i>3 Present information</i>	<p>As with the first two elements of the Key Skill students may be able to demonstrate competence in this area if they choose to produce final output of a drawing or report using computer software. Either type of output may involve students in combining textual, graphical and numerical data in a single output.</p> <p>At Level 3, students could select the most appropriate form of presentation for the task.</p>
<i>4 Evaluate the use of information technology</i>	<p>This element of the Key Skill requires students to reflect on their use of IT. This would not normally be something that one would expect students to do within their work for a Free-standing Mathematics Unit. However, as highlighted above, in the production of portfolio evidence for the unit students may have many opportunities to demonstrate competence with IT, and may therefore wish to evaluate their use of IT within this setting.</p>

**Intermediate Unit: Handling & interpreting data**

Communication Levels 2 and 3	
<i>1 Take part in discussions</i>	<p>There is potential to develop activities in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present any of their portfolio evidence to a small group. Such a verbal report may suffice as the ‘report’ required as portfolio evidence if accompanied by sufficient documentary evidence. However, it should be noted that the amount of documentation required is substantial and perhaps students would be best encouraged first of all to develop a written report which they may then choose to present verbally. If this is the case, it will be particularly useful if students are given the opportunity to take part in a discussion or question-and-answer session at the end of their presentation.</p> <p>If a number of students have produced reports based on the same theme, or on data that they gathered collectively, they could have a semi-formal discussion at which they present and discuss their main findings. Such an activity would allow them to show substantial evidence of their competence in this element of the Key Skill.</p> <p>At level 3, students have the opportunity in such discussions to support the contributions of others.</p>
<i>2 Produce written material</i>	<p>This unit allows students many opportunities to contribute to this element.</p> <p>It is likely that students will be able to produce both written work that follows structured formats (such as when completing questionnaires or certain types of data collection forms) and which is given structure by the students themselves as required at level 3 of the Key Skill.</p> <p>Even though the focus of the student’s work is mathematics, it is expected that their written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolio if they were to make mistakes with these aspects of their work).</p> <p>Level 3: No extra performance criteria specified.</p>
<i>3 Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>For example, it is clear that students should select, produce and use appropriate diagrams (charts, tables, graphs and statistical diagrams) with which to illustrate their work. Their use of such images can be included in both written reports and presentations made verbally. Students could be encouraged to illustrate their reports with other images such as photographs and pictures of the situations they are investigating.</p> <p>When writing a report that critically examines and discusses the statistical work of others, students should have scope to consider critically the use of images by others. This is a demand of the unit and students’ consideration of alternative</p>

<b>Information Technology Levels 2 and 3</b>	
This unit requires students to use a basic calculator and computer spreadsheet proficiently	
<i>1 Prepare information</i>	<p>This unit clearly allows students to demonstrate their capabilities in this area. It is likely that students will have to select appropriate information from sources available to them for processing by spreadsheet. Students should then be able to enter, edit and correct data within their spreadsheet. Further processing will require students to carry out calculations with their data and produce suitable diagrammatic / graphical displays.</p> <p>When carrying out their critical appraisal of the statistical work of others, students will need to select the information (textual, graphical and numerical) on which to base their analysis. It is possible that they will choose to use IT to assist them in the reinterpretation of information.</p> <p>There will also be the potential for students to produce their reports using word-processing and/or desktop publishing software if they wish. This again may allow them to be involved in the appropriate manipulation of numbers and graphics as well as text.</p> <p>At Level 3, students could develop their own templates or style sheets to aid the input of data or the production of reports.</p>
<i>2 Process information</i>	<p>Students will clearly be able to demonstrate their competence in this area of the Key Skill when completing tasks for their portfolio evidence.</p> <p>The use of spreadsheets to carry out and display the results of calculations will allow students to demonstrate effectively many of the demands of this element of the Key Skill. For example, students will by necessity be involved in the processing of numerical information; this will require selection and inputting of data, and its editing, sorting, calculation and possibly reformatting (eg display of numerical data as currency). The unit demands the display of the results of such processing in diagrammatic form, and analysis and written summary of findings. These aspects of work produced for portfolio evidence will allow students to meet many of the further demands of the element of the Key Skill.</p> <p>At Level 3, there is opportunity for students to use automated routines for the analysis of data.</p>
<i>3 Present information</i>	<p>The portfolio evidence that students produce for this unit will allow them to contribute effectively to aspects of this area of the Key Skill.</p> <p>Students are required to use spreadsheets to carry out part of their portfolio work; this is clearly a powerful and effective piece of software with which to work in this area of mathematics, and will allow them to satisfy some of the demands of the Key Skill. To satisfy further demands and to produce portfolio evidence that is of high quality, students may consider preparing their reports with software that</p>

**Intermediate Unit: Using algebra, functions and graphs**

<b>Communication Levels 2 and 3</b>	
<i>1 Take part in discussions</i>	<p>There is potential to develop activities in the teaching of this unit in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present a summary of some of their portfolio evidence to a small group.</p> <p>Such a verbal report may suffice, as the ‘report’ required for a student’s portfolio evidence if it is accompanied by sufficient documentary evidence. Because of the nature of this unit it will probably be best if work of this type concentrates on summarising and reporting findings rather than going in to detail about the mathematical processes used. It will be particularly useful if students are given the opportunity to take part in a discussion or question-and-answer session at the end of their presentation. This will allow them the possibility of taking part in one-to-one discussions as required by the Key Skill specifications.</p> <p>At Level 3, students participating in discussions or presentations could create opportunities for others to contribute.</p>
<i>2 Produce written material</i>	<p>This unit allows students opportunities to contribute to this element of the Key Skill.</p> <p>The written work that students are likely to produce for their portfolios will most likely be structured by themselves (suggesting competence at Level 3) and is likely to be summarising in nature and consequently brief. Such work that summarises and draws conclusions about situations that the student has investigated will be satisfactory in meeting the demands of the Key Skill.</p> <p>Even though the focus if the student’s work is mathematics it is expected that their written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolio if they were to make mistakes with these aspects of their work).</p> <p>No further performance criteria specified. for Level 3</p>
<i>3 Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>The unit requires students to produce and present appropriate graphs to illustrate their findings. Students should be aware of, and use, graphical techniques to ensure that their findings are illustrated as clearly as possible.</p> <p>Students could be encouraged to illustrate their reports with other images such as photographs and pictures of the situations they are investigating.</p> <p>Level 3: no extra performance criteria specified.</p>
<i>4 Read and respond to written</i>	<p>It is possible to present the starting point for the production of portfolio evidence so that it allows students the opportunity of selecting and extracting from sources the information that they need. You should expect students to summarise and</p>

<b>Information technology Levels 2 and 3</b>	
<p><i>This unit requires students to use a scientific calculator proficiently. Students are also required to be familiar with using either a graphic calculator or graph plotting facilities on a computer. If students wish to illustrate work that they produce using word-processing or desktop publishing software, they will need to consider how they can import images of their graphs into such packages.</i></p> <p><i>The Key Skills specifications do not mention the use of graphic calculators as being a possible medium that students can use to demonstrate competence in their handling of numerical data. However, the use of such technology should prove acceptable as the facilities within such calculators allows students to demonstrate many of the inputting, processing and outputting skills that they would use with a spreadsheet on a computer, for example.</i></p>	
<p><i>1 Prepare information</i></p>	<p>This unit will allow students to demonstrate their capabilities in this area when students are preparing data to be able to produce graphs using either a graphic calculator or computer software. They will need to select the appropriate information and enter it in the correct form..</p> <p>There will also be the potential for students to produce their reports using word-processing and/or desktop publishing software if they wish. This may allow them to be involved in the appropriate preparation of text and additionally numerical data and graphical output.</p> <p>At Level 3, there are opportunities to develop, for example, spreadsheet templates that would aid the input of experimental data.</p>
<p><i>2 Process information</i></p>	<p>Students will clearly be able to demonstrate their competence in this area of the Key Skill when completing tasks for their portfolio evidence using either graphic calculators or graph-plotting software on a computer.</p> <p>Students may use such IT to carry out calculations as well as to display their results. Such processing will allow students to effectively demonstrate many of the demands of this element of the Key Skill.</p> <p>The unit demands the display of the results of investigations in graphical form and the analysis and written summary of findings. These aspects of work produced for portfolio evidence using, for example, word-processing or desktop publishing software, will allow students to meet many of the further demands of the element of the Key Skill.</p> <p>At Level 3 there are opportunities to use and create automated routines for manipulating and presenting algebraic and experimental data..</p>
<p><i>3 Present information</i></p>	<p>The portfolio evidence that students produce for this unit will allow them to contribute effectively to aspects of this area of the Key Skill.</p> <p>The graphical work demanded by the unit can be effectively produced using a graphic calculator or graph plotting software on a computer. Output obtained in this way will allow students to satisfy some of the demands of the Key Skill. To satisfy further demands, and to produce portfolio evidence that of high quality, students may consider preparing their reports with software that allows them to</p>

## Intermediate Unit: Making Connections in Mathematics

Communication Levels 2 and 3	
1 <i>Take part in discussions</i>	<p>There is potential to develop activities in the teaching of this unit in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present a summary of some of their portfolio evidence to a small group.</p> <p>Such a verbal report may suffice as the ‘report’ required for portfolio evidence if it is accompanied by sufficient documentary evidence. Because of the nature of this unit, it will probably be best if work of this type concentrates on summarising and reporting findings rather than going into detail about the mathematical processes used. It will be particularly useful if students are given the opportunity to take part in a discussion or question-and-answer session at the end of their presentation. This will allow them the possibility of taking part in one-to-one discussions as required by the Key Skill’s specifications.</p> <p>At Level 3, students participating in discussions or presentations could create opportunities for others to contribute.</p>
2 <i>Produce written material</i>	<p>This unit allows students opportunities to contribute to this element of the Key Skill.</p> <p>The written work that students are likely to produce for their portfolios will most likely be structured by the themselves (suggesting competence at Level 3) and is likely to be summarising in nature and consequently brief. Such work that summarises and draws conclusions about situations that the student has investigated will be satisfactory in meeting the demands of the Key Skill.</p> <p>Even though the focus of the work is mathematics it is expected that written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolio if they were to make mistakes with these aspects of their work).</p> <p>No further performance criteria specified. for Level 3</p>
3 <i>Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>There is a clear demand by the unit for students to produce and present appropriate diagrams and graphs to illustrate their findings. Students should be aware of, and use, drawing and graphical techniques to ensure that their findings are illustrated as clearly as possible.</p> <p>Students could be encouraged to illustrate their reports with other images such as photographs and pictures of the situations they are investigating.</p> <p>Level 3: no extra performance criteria specified.</p>
4 <i>Read and respond to written</i>	<p>It is likely that students will be able to demonstrate competence in this area.</p> <p>It is possible to present the starting point for the production of portfolio evidence to allow students to select and extract from sources the information that they need.</p>

<b>Information technology Levels 2 and 3</b>	
<p><i>This unit requires students to use a scientific calculator proficiently. Students are also required to be familiar with using either a graphic calculator or graph plotting facilities on a computer. If students wish to illustrate work that they produce using word-processing or desktop publishing software, they will need to consider how they can import images of their graphs into such packages.</i></p> <p><i>The Key Skills specifications do not mention the use of graphic calculators as being a possible medium that students can use to demonstrate competence in their handling of numerical data. However the use of such technology should prove acceptable as the facilities within such calculators allows students to demonstrate many of the inputting, processing and outputting skills that they would use with a spreadsheet on a computer, for example.</i></p>	
<p><i>1 Prepare information</i></p>	<p>This unit will allow students to demonstrate their capabilities in this Key Skill area when students prepare data for diagrams and graphs using either a graphic calculator or computer software.</p> <p>They will need to select the appropriate information and enter it in the correct form. There will also be the potential for students to produce their reports using word-processing and/or desktop publishing software if they desire. This may allow them to be involved in the appropriate preparation of text and additionally numerical data and graphical output.</p> <p>At Level 3, there are opportunities to develop, for example, spreadsheet templates or drawing macros that would aid the input of data.</p>
<p><i>2 Process information</i></p>	<p>Students will clearly be able to demonstrate their competence in this area of the Key Skill when completing tasks for their portfolio evidence.</p> <p>Students may use such IT to carry out calculations as well as to display their results. Such processing will allow students to effectively demonstrate many of the demands of this element of the Key Skill.</p> <p>The unit demands the display of the results of investigations in diagrammatic and graphical forms and the analysis and written summary of findings. These aspects of work produced for portfolio evidence using, for example, word-processing or desktop publishing software, will allow students to meet many of the further demands of the element of the Key Skill.</p> <p>At Level 3 there are opportunities to use and create automated routines for manipulating and presenting data.</p>
<p><i>3 Present information</i></p>	<p>The portfolio evidence that students produce for this unit will allow them to contribute effectively to aspects of this area of the Key Skill.</p> <p>The diagrammatic and graphical work demanded by the unit can be effectively produced using a computer. Output obtained in this way will allow students to satisfy some of the demands of the Key Skill. To satisfy further demands of the Key Skill, and indeed to produce portfolio evidence of the high quality, students may consider preparing their reports with software that allows them to combine in the most effective way text, graphics and numerical information. For example, they</p>



**Advanced Unit: Working with algebraic & graphical techniques**

<b>Communication Level 3</b>	
1 <i>Take part in discussions</i>	<p>There is potential to develop activities in the teaching of this unit in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present a summary of some of their portfolio evidence to a small group or they could explain their findings to just one other person, such as a teacher who has not previously been involved with their work. Such verbal reports may suffice as the 'report' required for portfolio evidence if accompanied by sufficient documentary evidence. However, because of the level of this unit and the complexity of the work required it is probably best if a verbal report is a presentation of an existing written report. Because of the nature of this unit, it will probably be best if a presentation of this type concentrates on summarising and reporting findings rather than going into detail about the mathematical processes used. It will be particularly useful if students are given the opportunity to take part in a discussion or question-and-answer session at the end of any presentation they give, so that they can then take part in one-to-one discussions as required by the Key Skills specifications.</p>
2 <i>Produce written material</i>	<p>The written work that students are likely to produce in response to the portfolio demands of the unit will meet the demands of the Key Skill in this element at Level 3. In particular as the reports produced for the unit will be structured by the students there will be evidence that they are working at the higher levels of the Key Skill. The demands of the Key Skill are particularly likely to be met where students relate their use of mathematics to real situations, write about their interpretation of such situations, summarise findings and draw conclusions. It is likely that the reports produced by students for their portfolios will satisfy the demands of the Key Skill in working with complex subjects.</p> <p>Although the focus of students' work is mathematics, it is expected that their written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolio if they were to make mistakes with these aspects of their work).</p>
3 <i>Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>The unit requires students to produce and present appropriate graphs to illustrate their findings. Students should be aware of, and use, graphical techniques to ensure that their findings are illustrated as clearly as possible.</p> <p>The graphs, tables and diagrams that illustrate reports within their portfolios will provide students with evidence of working within complex subject areas.</p> <p>Students could be encouraged to illustrate their reports with other images such as photographs and pictures of the situations they are investigating.</p>

<b>Information Technology Level 3</b>	
<p><i>This unit requires students to make proficient use of a graphic calculator or graph plotting facilities on a computer. If students wish to illustrate work that they produce using word-processing or desktop publishing software, they will need to consider how they can import images of graphs into such packages.</i></p> <p><i>The Key Skills specifications do not mention the use of graphic calculators as being a possible medium that students can use to demonstrate competence in their handling of numerical data. The use of such technology, however, should prove acceptable as the facilities within such calculators allows students to demonstrate many of the inputting, processing and outputting skills that they would use with a spreadsheet on a computer. for example.</i></p>	
<p><i>1 Prepare information</i></p>	<p>This unit will allow students to demonstrate their capabilities in this area when they prepare data to plot graphs using either a graphic calculator or computer software.</p> <p>They will need to select the appropriate information and enter it in the correct form. They should be able to edit, correct and sort such data effectively.</p> <p>There will also be potential for students to produce their reports using word-processing and/or desktop publishing software if they wish. This may allow them to be involved in the appropriate preparation of text, graphics and numerical data.</p> <p>It is possible that students will wish to use a spreadsheet for some of their data processing in this unit although it is likely that they will use other software to produce their final output.</p>
<p><i>2 Process information</i></p>	<p>Students will clearly be able to demonstrate their competence in this area of the Key Skill when completing tasks for their portfolio evidence using either graphic calculators or graph-plotting software on a computer.</p> <p>Students may use such IT to carry out calculations as well as displaying their results. Such processing will allow students to effectively demonstrate many of the demands of this element of the Key Skill.</p> <p>The unit demands the display of the results of investigations in graphical form and the analysis and written summary of findings. These aspects of work produced for portfolio evidence using, for example, word-processing or desktop publishing software will allow students to meet many of the further demands of this element of the Key Skill.</p>
<p><i>3 Present information</i></p>	<p>The portfolio evidence that students produce for this unit will allow them to contribute effectively to aspects of this area of the Key Skill.</p> <p>The graphical work demanded by the unit can be effectively produced using a graphic calculator or graph plotting software on a computer. Students will need output of such graphical work, which may come directly from a printer attached to either graphic calculator or computer. Output obtained in this way will allow students to satisfy some of the demands of the Key Skill. To satisfy further demands and to produce portfolio evidence of high quality students may</p>

## Advanced Unit: Modelling with calculus

Communication Level 3	
<i>1 Take part in discussions</i>	<p>There is potential to develop activities in the teaching of this unit in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present a summary of some of their portfolio evidence to a small group or they could explain their findings to just one other person such as a teacher who has not previously been involved with their work.</p> <p>Such a verbal report may suffice as the ‘report’ required for portfolio evidence if accompanied by sufficient documentary evidence. However, because of the level of this unit and the complexity of the work required it is probably best if the verbal report is a presentation of an existing written report. Because of the nature of this unit it will probably be best if work of this type concentrates on summarising and reporting findings rather than going in to detail about the mathematical processes used. It will be particularly useful if students are given the opportunity to take part in a discussion or a question and answer session at the end of any presentation they give.</p>
<i>2 Produce written material</i>	<p>The written work that students are likely to produce in response to the portfolio demands of the unit will meet the demands of the Key Skill in this element at Level 3. In particular as the reports produced for the unit will be structured by the students themselves there will be evidence that they are working at the higher levels of the Key Skill. The demands of the Key Skill are particularly likely to be met where students relate their use of mathematics to real situations, write about their interpretation of such situations, summarise findings and draw conclusions. It is likely that the reports produced by students for their portfolio will satisfy the demands of the Key Skill in working with complex subjects.</p> <p>Even though the focus if the student’s work is mathematics it is expected that their written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolio if they were to make mistakes with these aspects of their work).</p>
<i>3 Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>The unit requires students to produce and present appropriate graphs to illustrate their findings. Students should be aware of, and use, graphical techniques to ensure that such illustrations are as clear as possible.</p> <p>The graphs, tables and diagrams that illustrate their reports within their portfolios will provide evidence of working within complex subject areas.</p> <p>Students could be encouraged to illustrate their reports with other images such as photographs and pictures of the situations they are investigating.</p> <p>In instances where students have made a presentation of their work to others (as in</p>

<b>Information Technology Level 3</b>	
<p><i>This unit requires students to make proficient use of a graphic calculator or graph plotting facilities on a computer. If students wish to illustrate work that they produce using word-processing or desktop publishing software they will need to consider how they can import images of graphs into such packages.</i></p> <p><i>The Key Skills specifications do not mention the use of graphic calculators as being a possible medium that students can use to demonstrate competence in their handling of numerical data. However the use of such technology should prove acceptable as the facilities within such calculators allows students to demonstrate many of the inputting, processing and outputting skills that they would use with a spreadsheet on a p.c. for example.</i></p>	
<p><i>1 Prepare information</i></p>	<p>This unit will allow students to demonstrate their capabilities in this area when they are preparing data to plot graphs using either a graphic calculator or computer software.</p> <p>They will need to select the appropriate information and enter it in the correct form. They should be able to edit, correct and sort such data effectively.</p> <p>There will also be the potential for students to produce their reports using word-processing and/or desktop publishing software if they wish. This may allow them to be involved in the appropriate preparation of text and numerical data.</p> <p>It is possible that students will wish to use a spreadsheet for some of their data processing in this unit although it is likely that they will use other software to produce their final output.</p>
<p><i>2 Process information</i></p>	<p>Students will clearly be able to demonstrate their competence in this area of the Key Skill when completing tasks for portfolio evidence using either graphic calculators or graph-plotting software on a computer.</p> <p>Students may use such IT to carry out calculations as well as displaying their results. Such processing will allow students to effectively demonstrate many of the demands of this element of the Key Skill.</p> <p>The unit demands the display of the results of investigations in graphical form and the analysis and written summary of findings. These aspects of work produced for portfolio evidence using, for example, word-processing or desktop publishing software, will allow students to meet many of the further demands of this element of the Key Skill.</p>
<p><i>3 Present information</i></p>	<p>The portfolio evidence that students produce for this unit will allow them to contribute effectively to aspects of this area of the Key Skill.</p> <p>The graphical work demanded by the unit can be effectively produced using a graphic calculator or graph plotting software on a computer. Students will need output of such graphical work, which may come directly from a printer attached to either the graphic calculator or computer. Output obtained in this way will allow students to satisfy some of the demands of the Key Skill. To satisfy further demands, and to produce portfolio evidence that is of high quality, students may</p>

## Advanced Unit: Using &amp; applying statistics

<b>Communication Level 3</b>	
1 <i>Take part in discussions</i>	<p>There is potential to develop activities in the teaching of this unit in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present a summary of any of their portfolio evidence to a small group or they could explain their findings to just one other person such as a teacher who has not previously been involved with their work.</p> <p>Such verbal reports may suffice as a 'report' required for a student's portfolio evidence if accompanied by sufficient documentary evidence. However, because of the level of this unit and the complexity of the work required it is probably best if a verbal report is a presentation of an existing written report. Because of the nature of this unit, it will probably be best if work of this type concentrates on summarising and reporting findings rather than going in to detail about the mathematical processes used. It will be particularly useful if students are given the opportunity to take part in a discussion or question-and-answer session at the end of any presentation they give.</p>
2 <i>Produce written material</i>	<p>This unit allows students opportunities to contribute to this element of the Key Skill.</p> <p>The written work that students are likely to produce in response to the portfolio demands of the unit will meet the demands of the Key Skill in this element at Level 3. In particular as the reports produced for the unit will be structured by students there will be evidence that they are working at the higher levels of the Key Skill. The demands of the Key Skill are particularly likely to be met where students relate their use of mathematics to real situations, write about their interpretation of such situations, summarise findings and draw conclusions. It is likely that the reports produced by students for their portfolios will satisfy the demands of the Key Skill in working with complex subjects.</p> <p>Although the focus of the work is mathematics, it is expected that written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolio if they were to make mistakes with these aspects of their work).</p>
3 <i>Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>The unit requires students to produce and present appropriate graphs to illustrate their findings. Students should be aware of, and use, graphical techniques to ensure that such illustrations are as clear as possible.</p> <p>The graphs, tables and diagrams that illustrate reports within their portfolios will provide evidence of working within complex subject areas.</p> <p>Students could be encouraged to illustrate their reports with other images such as photographs and pictures of the situations they are investigating.</p>

<b>Information Technology Level 3</b>	
<p><i>This unit requires students to make proficient use of a graphic calculator or graph plotting facilities on a computer. If students wish to illustrate work that they produce using word-processing or desktop publishing software they will need to consider how they can import images of graphs into such packages.</i></p> <p><i>The Key Skills specifications do not mention the use of graphic calculators as a possible medium to demonstrate competence in the handling of numerical data but this should prove acceptable as the facilities within such calculators allow students to show many of the inputting, processing and outputting skills that would use with a spreadsheet, for example.</i></p>	
1 <i>Prepare information</i>	<p>This unit will allow students to demonstrate their capabilities in this area when they prepare data to plot graphs using either a graphic calculator or computer software.</p> <p>They will need to select the appropriate information and enter it in the correct form. They should be able to edit, correct and sort such data effectively.</p> <p>There will also be the potential for students to produce their reports using word-processing and/or desktop publishing software if they wish. This may allow them to be involved in the appropriate preparation of text and numerical data.</p> <p>It is possible that students will wish to use a spreadsheet for some of their data processing in this unit although it is likely that they will use other software to produce their final output.</p>
2 <i>Process information</i>	<p>Students will clearly be able to demonstrate their competence in this area of the Key Skill when completing tasks for their portfolio evidence using either graphic calculators or graph-plotting software on a computer.</p> <p>Students may use such IT to carry out calculations as well as displaying their results. Such processing will allow students to effectively demonstrate many of the demands of this element of the Key Skill.</p> <p>The unit requires the display of the results of investigations in graphical form and analysis and written summary of findings. These aspects of work produced for portfolio evidence using, for example, word-processing or desktop publishing software, will allow students to meet many of the further demands of this element of the Key Skill.</p>
3 <i>Present information</i>	<p>The portfolio evidence that students produce for this unit will allow them to contribute effectively to aspects of this area of the Key Skill.</p> <p>The graphical work demanded by the unit can be effectively produced using a graphic calculator or graph plotting software on a computer. Students will need output of such graphical work, which may come directly from a printer attached to either the graphic calculator or computer. Output obtained in this way will allow students to satisfy some of the demands of the Key Skill. To satisfy further demands, and to produce portfolio evidence that of high quality, students may consider preparing their reports with software that allows them to combine text</p>

**Advanced Unit: Understanding Mathematical Thinking**

<b>Communication Level 3</b>	
1 <i>Take part in discussions</i>	<p>There is potential to develop activities in the teaching of this unit in such a way that they allow students to show their competence in this area of the Key Skill.</p> <p>For example, students could be asked to present a summary of any of their portfolio evidence to a small group or they could explain their findings to just one other person such as a teacher who has not previously been involved with their work.</p> <p>Such verbal reports may suffice as a ‘report’ required for a student’s portfolio evidence if accompanied by sufficient documentary evidence. However, because of the level of this unit and the complexity of the work required it is probably best if a verbal report is a presentation of an existing written report. Because of the nature of this unit, it will probably be best if work of this type concentrates on summarising and reporting findings rather than going in to detail about the mathematical processes used. It will be particularly useful if students are given the opportunity to take part in a discussion or question-and-answer session at the end of any presentation they give.</p>
2 <i>Produce written material</i>	<p>This unit allows students opportunities to contribute to this element of the Key Skill.</p> <p>The written work that students are likely to produce in response to the portfolio demands of the unit will meet the demands of the Key Skill in this element at Level 3. In particular as the reports produced for the unit will be structured by students themselves there will be evidence that they are working at the higher levels of the Key Skill. The demands of the Key Skill are particularly likely to be met where students relate their use of mathematics to real situations, write about their interpretation of such situations, summarise findings and draw conclusions. It is likely that the reports produced by students for their portfolio will satisfy the demands of the Key Skill in working with complex subjects.</p> <p>Although the focus the work is mathematics, it is expected that written work will follow correct spelling, punctuation and grammar conventions (although one would not penalise students heavily in the grading of their portfolio if they were to make mistakes with these aspects of their work).</p>
3 <i>Use images</i>	<p>Students will clearly be able to demonstrate competence in this aspect of the Key Skill.</p> <p>There is a clear demand in the unit for students to produce and present appropriate graphs to illustrate their findings. Students should be aware of, and use, graphical techniques to ensure that such illustrations are as clear as possible.</p> <p>The graphs, tables and diagrams that illustrate their reports within their portfolio will provide evidence of working within complex subject areas.</p> <p>Students could be encouraged to illustrate their reports with other images such as</p>

<b>Information Technology Level 3</b>	
<p><i>This unit requires students to make proficient use of a graphic calculator or graph plotting facilities on a computer. If students wish to illustrate work that they produce using word-processing or desktop publishing software they will need to consider how they can import images of graphs into such packages.</i></p> <p><i>The Key Skills specifications do not mention the use of graphic calculators as a possible medium to demonstrate competence in the handling of numerical data but this should prove acceptable as the facilities within such calculators allow students to show many of the inputting, processing and outputting skills that would use with a spreadsheet, for example.</i></p>	
1 <i>Prepare information</i>	<p>This unit will allow students to demonstrate their capabilities in this area when they prepare data to plot graphs using either a graphic calculator or computer software.</p> <p>They will need to select the appropriate information and enter it in the correct form. They should be able to edit, correct and sort such data effectively.</p> <p>There will also be the potential for students to produce their reports using word-processing and/or desktop publishing software if they wish. This may allow them to be involved in the appropriate preparation of text and numerical data.</p> <p>It is possible that students will wish to use a spreadsheet for some of their data processing in this unit although it is likely that they will use other software to produce their final output.</p>
2 <i>Process information</i>	<p>Students will clearly be able to demonstrate their competence in this area of the Key Skill when completing tasks for portfolio evidence using either graphic calculators or graph-plotting software on a computer.</p> <p>Students may use such IT to carry out calculations as well as displaying their results. Such processing will allow students to effectively demonstrate many of the demands of this element of the Key Skill.</p> <p>The unit demands the display of the results of investigations in graphical form and analysis and written summary of findings. These aspects of work produced for portfolio evidence using, for example, word-processing or desktop publishing software, will allow students to meet many of the further demands of this element of the Key Skill.</p>
3 <i>Present information</i>	<p>The portfolio evidence that students produce for this unit will allow them to contribute effectively to aspects of this area of the Key Skill.</p> <p>The graphical work demanded by the unit can be effectively produced using a graphic calculator or graph plotting software on a computer. Students will need output of such graphical work, which may come directly from a printer attached to either the graphic calculator or computer. Output obtained in this way will allow students to satisfy some of the demands of the Key Skill. To satisfy further demands, and to produce portfolio evidence that of high quality, students may consider preparing their reports with software that allows them to combine text, graphics and numerical information in the most effective way. For example, they</p>