

# Unit 48: Mathematics for IT Practitioners

Unit code:	L/601/7655
QCF Level 3:	BTEC Specialist
Credit value:	10
Guided learning hours:	60

---

## Aim and purpose

The aim of this unit is to develop learner skills in mathematical techniques including matrices, series and probability. Learners will also apply number systems including binary and hexadecimal and interpret data they have gathered for a defined purpose.

## Unit introduction

Learners will gain an understanding of the mathematics needed along with experience of applying mathematics to IT problems using techniques encompassing basic arithmetic to the collating and interpretation of larger datasets. This will provide a base for learners to enhance their current skills and then apply them to other areas of the course, such as programming or networking. Learners will discover the use of analytical skills in order to apply them to realistic IT problems.

This unit starts by exploring matrices and looks at how they relate to arrays as used in programming. This is followed by sequences and series, probability and recursion. Recursive algorithms are investigated in areas such as sorting and searching for data. Number systems, including binary and hexadecimal are investigated along with their application in areas such as Multipurpose internet Mail Extensions (MIME) and IP addressing.

Finally, the gathering and interpretation of data is carried out in the context of statistically analysing data for a defined purpose.

## Learning outcomes and assessment criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

### On completion of this unit a learner should:

Learning outcomes	Assessment criteria
1 Be able to apply matrix methods	1.1 demonstrate how matrices can be used to represent ordered data 1.2 perform add, subtract and scalar multiplication operations on a matrix 1.3 multiply two matrices 1.4 find the inverse and transpose of a matrix 1.5 apply matrix techniques to solving simultaneous linear equations
2 Be able to apply sequences and series, probability and recursion	2.1 apply sequence and series, probability and recursion techniques to develop solutions to a range of problems
3 Be able to apply number systems	3.1 carry out basic operations on number systems 3.2 carry out conversion operations between number systems
4 Be able to interpret data	4.1 plan for and gather data for a defined purpose 4.2 interpret trends and/or patterns in data

## Unit content

---

### 1 Be able to apply matrix methods

*Matrices:* method of representing ordered data; relationship with computer program variable arrays; index notation

*Operations:* add, subtract, scalar multiplication; multiply two matrices; inverse; transpose

*Techniques:* solving simultaneous linear equations; vector transformation and rotation; maps and graphs

### 2 Be able to apply sequences and series, probability and recursion

*Sequences and series:* nth term of a sequence; generation of recurrence relationship; arithmetic and geometric sequences and series; sum to n terms of an arithmetic and geometric series; sum to infinity of a geometric series;  $\Sigma$  notation

*Probability:* events eg union, intersection, complementary, mutually exclusive, independent; space diagrams eg sum of scores when two dice are thrown; visualising events using Venn Diagrams; tree diagrams

*Recursion:* series eg Fibonacci, factorial, natural numbers; termination condition; recursive algorithms eg factorial, quicksort, binary search

### 3 Be able to apply number systems

*Number systems:* binary, octal, denary and hexadecimal; conversion between number systems; basic operations eg addition, division, multiplication, subtraction on number systems

*Applications:* eg ASCII code (binary), MIME (hex), file permissions in Unix (octal); IP addressing v4 and v6; subnet addressing; subnet masking; class A, B and C addresses; Classless Inter Domain Routing (CIDR)

### 4 Be able to interpret data

*Representing data:* comparing data sets using back-to-back stem and leaf diagrams eg pulse rates of learners before and after exercise; mean; median; mode; interquartile ranges; histograms; variance; standard deviation

*Gathering data:* methods of gathering quantity data eg measurements, questionnaires, surveys; extraction of required information from raw data; limitations of data gathered

*Interpreting data:* eg analysing summary data, proving hypotheses, identifying trends and patterns

## Essential guidance for tutors

---

### Delivery

The learning outcomes could be delivered in the order presented however some of the content relates to isolated sets of skills and knowledge and the order could be varied.

It is likely that learners will come to this unit with a wide variety of prior knowledge and experience. For this reason it is suggested that the unit is flexibly delivered using workshops. This allows all learners to progress and accumulate expertise at different rates and to a different extent.

Necessarily, some of the content at this level is theoretical. Learners might not understand some of the practical applications until they study at a higher level. Where possible, connections with IT-related applications should be made to provide the content of exercises and assignments. It is recommended that any data sets provided should relate to real-life scenarios.

For learning outcome 1 it is important to relate the use of matrices to IT, for example in areas such as computer graphics where matrices can be used to project three dimensional objects onto two dimensional computer screens and in electronics where circuit components and their input/output voltages and resistance can be represented by matrices.

Learning outcome 2 leads to recursion and recursive algorithms used in programming. Examples include calculating factorials and using search and sort programmes. These could be demonstrated using an appropriate programming language or using pseudo code.

Learning outcome 3 covers number systems and their application in areas such as MIME encoding and IP addressing. The latter could be covered by exploring, for example, their internal centre network and the addressing scheme, subnet addresses and subnet masks that are used.

Learning outcome 4 is about gathering and interpreting data using a range of methods. This might involve gathering more than one data set. For example, using supplied data about a group of before and after they went on a diet to interpret this data using back-to-back stem and leaf diagrams; then carrying out measurements on a group of learners and using histograms, variance and standard deviation to interpret the data. Learners should be made aware of the different types of software that could be used to interpret the data and these should be demonstrated and used if available.

## Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments. The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
<b>Introduction to the unit</b>
<p>Introduction to matrices, operations. Use in simultaneous equations, transformations and rotations, maps and graphs. Relating use to IT eg computer graphics, electronics.</p>
<p>Introduction to sequences and series including APs and GPs. Introduction to probability, Venn Diagrams, tree diagrams. Introduction to recursion; factorial notation; search and sort programmes. Use of pseudo code to or programming languages to demonstrate algorithms.</p>
<p>Introduction to number systems; converting between number systems eg decimal to binary/octal/hex; operations on number systems eg adding binary/octal/hex numbers. Applications of number systems eg ASCII, IP addressing.</p>
<p>Introduction to representing data; stem and leaf diagrams; median; mode; interquartile ranges; histograms; variance; standard deviation. Introduction to gathering data eg surveys, measurements, questionnaires. Interpreting data eg using spreadsheet, tables, graphs.</p>

## Assessment

To achieve a pass grade, learners must achieve all criteria listed on the grading grid. For 1.1- 3.2 these could be given as a series of tasks or exercises. Centres must bear in mind that this qualification is criterion referenced and learners must be able to demonstrate competence in all of the mandatory content areas.

4.1 – 4.2 could be based on a small-scale project involving the learners planning and gathering information for a particular purpose, for example based on height/weight/journey time/pulse rates/exam marks etc.

**Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications**

This unit forms part of the BTEC in IT sector suite. This unit has particular links with:

Level 1	Level 2	Level 3
	Mathematics for IT	

This unit maps to some of the underpinning knowledge from the following areas of competence in the Level 3 National Occupational Standards for IT (ProCom):

- 4.2 Data Analysis
- 5.2 Software Development.

**Essential resources**

Text books and/or worksheets with a wealth of examples that learners can utilise.

**Employer engagement and vocational context**

In supporting the outcomes from other units, this unit can be used to support the creation of a software application in a vocational context where part of the application may use one (or more) of the mathematical outcomes from this unit.

**Indicative reading for learners**

A large number of Advanced GCE and upper tier GCSE Mathematics texts are available and most are appropriate. However relevant sections will need to be referred to. In addition, a number of CD or web based self-teach materials have been published for CGSE and Advanced GCE and many of these will be appropriate.

**Websites**

- [www.gcseguide.co.uk/standard\\_deviation.htm](http://www.gcseguide.co.uk/standard_deviation.htm)
- [www.wikipedia.org](http://www.wikipedia.org)

## Functional Skills – Level 2

Skill	When learners are ...
<b>Mathematics - Representing</b>	
Select a range of mathematics to find solutions	interpreting trends and/or patterns in data; recognising the factors influencing the validity of information derived from collected data; reflecting on the results of a study that involved the collection and analysis of data
<b>Mathematics - Analysing</b>	
Apply a range of mathematics to find solutions	demonstrating how matrices can be used to represent ordered data; performing add, subtract and scalar multiplication operations on a matrix; multiplying two matrices; finding the inverse and transpose of a matrix; applying matrix techniques to solving simultaneous linear equations; applying sequence and series, probability and recursion techniques to develop solutions to a range of problems; carrying out basic operations on number systems; carrying out conversion operations between number systems.

Skill	When learners are ...
<b>Mathematics - Interpreting</b>	
Interpret and communicate solutions to multistage practical problems in familiar and unfamiliar contexts and situations	demonstrating how matrices can be used to represent ordered data; performing add, subtract and scalar multiplication operations on a matrix; multiplying two matrices; finding the inverse and transpose of a matrix; applying matrix techniques to solving simultaneous linear equations; applying sequence and series, probability and recursion techniques to develop solutions to a range of problems; carrying out basic operations on number systems; carrying out conversion operations between number systems
Draw conclusions and provide mathematical justifications	demonstrating how matrices can be used to represent ordered data; performing add, subtract and scalar multiplication operations on a matrix; multiplying two matrices; finding the inverse and transpose of a matrix; applying matrix techniques to solving simultaneous linear equations; applying sequence and series, probability and recursion techniques to develop solutions to a range of problems; carrying out basic operations on number systems; carrying out conversion operations between number systems.