

## 7.1.0 MATHEMATICS I

### 7.1.1 Introduction

This module unit is designed to equip the trainee with the relevant mathematical knowledge, skills, techniques and attitudes necessary to enhance better understanding of the respective trade area and also to develop the skills in solving related problems in world of work.

### 7.1.2 General Objectives

By the end of the module unit, the trainee should be able to:

- use mathematical concepts and techniques in solving problems related to respective trade area
- organise, draw simple deductions and conclusions from a given data
- interpret graphical representation of functions relevant to the respective trade area

### 7.1.3 Module Unit Summary and Time Allocation – (88 Hours)

Code	Sub-Module Units	Content	Total Hours
7.1.01	Number Systems	<ul style="list-style-type: none"><li>Types of Numbers: Natural Integers, Rational, Irrational</li><li>Place Value, Rounding Off, Significant Figures</li><li>Factors And Prime Numbers, GCF And LCM.</li><li>Powers, Fractions And Decimals</li></ul>	6
7.1.02	Indices And Logarithms	<ul style="list-style-type: none"><li>Powers</li><li>Laws of Indices</li><li>Indices Operations/Logarithms</li><li>Laws of Logarithms</li><li>Operations</li><li>Base e</li><li>Change of Base</li><li>Logarithmic Equations</li><li>Scientific Calculator</li></ul>	6
7.1.03	Algebra	<ul style="list-style-type: none"><li>Algebraic Expressions</li><li>Operations of Algebraic Expressions</li><li>Factorization of Algebraic</li></ul>	8

		<p>Expressions</p> <ul style="list-style-type: none"> <li>• Quadratic Expressions</li> <li>• Solution of Equations</li> <li>• Linear</li> <li>• Quadratic</li> <li>• Cubic and Polynomial</li> <li>• Partial Fractions</li> <li>• Simultaneous Equations <ul style="list-style-type: none"> <li>- Linear with 2 Unknowns</li> <li>- Linear with 3 Unknowns</li> <li>- Linear and Quadratic</li> </ul> </li> <li>• Transposition of Formulae</li> <li>• Evaluation of Polynomials</li> <li>• Division of Polynomials, Remainder and Factor Theorem</li> </ul>	
7.1.04	Geometry And Scale Drawing	<ul style="list-style-type: none"> <li>• Scale</li> <li>• Drawing Basic Figures Plane</li> <li>• Drawing of Solids</li> </ul>	8
7.1.05	Sequence And Series	<ul style="list-style-type: none"> <li>• Sequences, Arithmetic and Geometric Progressions</li> <li>• Series</li> <li>• Solution of Problems Related to Simple and Compound Interest</li> <li>• Convergent Series</li> </ul>	8
7.1.06	Graphs	<ul style="list-style-type: none"> <li>• Linear</li> <li>• Quadratic</li> <li>• Exponential...</li> <li>• Solution of Equations <ul style="list-style-type: none"> <li>- Linear</li> <li>- Quadratic</li> </ul> </li> <li>• Linear and Quadratic</li> <li>• Tangents</li> <li>• Determination of Laws</li> </ul>	8
7.1.07	Trigonometry	<ul style="list-style-type: none"> <li>• Angles <ul style="list-style-type: none"> <li>- Radian Measure</li> <li>- Minutes and Seconds</li> </ul> </li> <li>• Trigonometric Ratios and their Reciprocals</li> </ul>	10

		<ul style="list-style-type: none"> <li>• Angles of Elevation and Depression</li> <li>• Sine Rule</li> <li>• Cosine Rule</li> <li>• Solution of Triangles</li> <li>• Graphs of Trigonometric Functions</li> <li>• Compound Angle Formula</li> <li>• Derivation of Double Angle Formula</li> <li>• Basic Trigonometric Equations <ul style="list-style-type: none"> <li>- Formula</li> <li>- Half Angle Formula</li> <li>- Tangent Rule</li> <li>- Factor Formula</li> <li>- Further Trigonometric Equations</li> <li>- Parametric Equations</li> <li>- Heron's Formula</li> </ul> </li> </ul>	
7.1.08	Latitudes And Longitudes	<ul style="list-style-type: none"> <li>• Latitudes and Longitudes</li> <li>• The Equator and the Greenwich Meridian</li> <li>• Distance Between Two Points Along Small and Great Circles</li> <li>• Time Between Longitude</li> <li>• Speed</li> </ul>	4
7.1.09	Coordinate Geometry And Loci	<ul style="list-style-type: none"> <li>• Polar Equations</li> <li>• Conversion of Cartesian to Polar and Vice Versa</li> <li>• Graphs of Polar Equations</li> <li>• Definitions of Locus in Relation Points, Lines, Planes, Ellipses, Parabola, Hyperbola</li> </ul>	5
7.1.10	Mensuration	<ul style="list-style-type: none"> <li>• Units of Measurements</li> <li>• Perimeter and Areas of Regular Figures</li> <li>• Volume of Regular Solids</li> <li>• Surface Areas of Regular</li> </ul>	6

		<p>Solids</p> <ul style="list-style-type: none"> <li>• Area of Irregular Figures</li> <li>• Area and Volumes using Pappus Theorem</li> </ul>	
7.1.11	Permutations, Combinations And Binomial Expansion	<ul style="list-style-type: none"> <li>• Definition of Terms – Permutation and Combination</li> <li>• Factorial Notation</li> <li>• Solving Problems Involving Permutations and Combinations</li> <li>• Binomial Expansion: <ul style="list-style-type: none"> <li>- Pascal Triangle</li> <li>- Binomial Theorem</li> <li>- Power Series Using Binomial Theorem</li> <li>- Roots of Numbers by Binomial Theorem</li> <li>- Apply Binomial Theorem to Approximations</li> </ul> </li> </ul>	5
7.1.12	Vectors	<ul style="list-style-type: none"> <li>• Vectors and Scalar in Two and Three Dimensions</li> <li>• Operations on Vectors: Addition and Subtraction</li> <li>• Position Vectors</li> <li>• Resolution of Vectors</li> <li>• Scalar Product</li> </ul>	6
7.1.13	Probability I	<ul style="list-style-type: none"> <li>• Definitions</li> <li>• Laws of Probability</li> <li>• Mutually Exclusive, Independent Events, Conditional Probability</li> <li>• Tree Diagram, Sample Point, Venn Diagram</li> </ul>	4
7.1.14	Statistics I	<ul style="list-style-type: none"> <li>• Data Arrangement</li> <li>• Representation of Data</li> <li>• Measures of Central Tendency</li> <li>• Measures of Dispersion</li> </ul>	4
<b>Total</b>			<b>88</b>

7.1.01 NUMBER SYSTEM

- 7.1.01T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- a) identify types of numbers
  - b) carry out arithmetic operations on numbers
  - c) state the place value of digit in a number
  - d) round off numbers
  - e) state accuracy to given significant figures
  - f) express numbers as product of prime factors
  - g) find the GCD and LCM of a set of numbers
  - h) perform operations on fractions and decimals

7.1.01C *Competence*  
The trainee should have the ability to perform arithmetic operations and numbers accurately

- Content*
- 7.1.01T1 Types of numbers: natural, integers, rational, irrational, decimals, fractions on numbers.
- 7.1.01T2 Arithmetic operations on numbers

- 7.1.01T3 Arithmetic operations on numbers
- 7.1.01T4 Place value of digits
- 7.1.01T5 Rounding off numbers
- 7.1.01T6 Prime factors
- 7.1.01T7 GCD and LCM
- 7.1.01T8 Fractional and decimal operations on fractions and decimals

7.1.02 INDICES AND LOGARITHMS

- 7.1.02T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- a) define an index of a number
  - b) state the laws of indices
  - c) perform indicial operations
  - d) write numbers in standard form
  - e) state laws of logarithms
  - f) perform logarithmic operations
  - g) Evaluate natural logarithms
  - h) convert numbers from one base to another
  - i) solve logarithmic equations base to another
  - j) use calculator/tables

7.1.02C *Competence*  
The trainee should have the ability to use logarithms to solve mathematical problems

	<i>Content</i>
7.1.02T1	Definition of an index of a number
7.1.02T2	Laws of indices
7.1.02T3	Indicial operations
7.1.02T4	Numbers in standard form
7.1.02T5	Laws of logarithms
7.1.02T6	Logarithmic operations
7.1.02T7	Natural logarithms
7.1.02T8	Change of base
7.1.02T9	Logarithmic equations
7.1.02T10	Calculator/tables

### 7.1.03 ALGEBRA

7.1.03T0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: a) write statements in algebraic form b) simplify algebraic expressions c) factorise algebraic expressions d) change the subject of a formula e) divide polynomials f) solve equations g) obtain partial fractions from composite fractions h) solve simultaneous equation i) evaluate polynomials j) apply the remainder factor
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7.1.03C	<i>Competence</i> The trainee should have the ability to perform
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algebraic operations accurately

	<i>Content</i>
7.1.03T1	Statement in algebraic form
7.1.03T2	Simplification of algebraic expressions
7.1.03T3	Factorisation of algebraic expression
7.1.03T4	Transposition of formulae
7.1.03T5	Division of polynomials
7.1.03T6	Solution of equations - linear - quadratic - cubic
7.1.03T7	Partial fractions
7.1.03T8	Simultaneous equations - linear in 2 unknown - linear in 3 unknown - linear and quadratic
7.1.03T9	Evaluation of polynomials
7.1.03T10	Remainder and factor theorems

### 7.1.04 GEOMETRY AND SCALE DRAWING

7.1.04T0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to: a) conversion of scales b) draw plane figures to a given scale c) state the properties of different types of triangles d) solve problems involving angle properties of a circle
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e) draw regular solids

7.1.04C *Competence*  
The trainee should have the ability to use Geometry and draw regular solids

7.1.04T1 *Content*  
Scale  
7.1.04T2 Scale drawing  
7.1.04T3 Types of triangles  
7.1.04T4 Angle properties of a circle  
7.1.04T5 Simple solids: cube, cuboids, cylinder, cones, pyramids

### 7.1.05 SEQUENCE AND SERIES

7.1.05T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:  
a) distinguish between a sequence and a series  
b) solve problems related to series  
c) use series to calculate simple and compound interest  
d) determine series convergence

7.1.05C *Competence*  
The trainee should have the ability to solve problems related to sequence and series

7.1.05T1 *Content*  
A sequence and a series

7.1.05T2 Series  
- arithmetic progression  
- geometric progression

7.1.05T3 Simple and compound interest

7.1.05T4 Convergent series

### 7.1.06 GRAPHS

7.1.06T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:  
a) identify linear functions  
b) plot graphs of linear functions  
c) identify quadratic functions  
d) plot graphs of quadratic functions  
e) identify exponential functions  
f) plot graphs of exponential functions  
g) solve quadratic equations by graph  
h) solve simultaneous equations – two linear with two unknowns  
i) solve simultaneous equations – one linear one quadratic  
j) determine linear laws  
k) linearize non-linear laws  
l) determine non-linear laws

7.1.06C *Competence*  
The trainee should have the ability to:  
i) plot graphs of functions

- ii) solve equations by using graphs
- iii) determine laws

*Content*

- 7.1.06T1 Linear functions
- 7.1.06T2 Straight line graph
- 7.1.06T3 Quadratic functions
- 7.1.06T4 Graphs of quadratic functions
- 7.1.06T5 Exponential functions of the forms:
  - $y=ab^x$
  - $y=ax^b$
  - $y=ae^x$
- 7.1.06T6 Graphs of exponential functions
- 7.1.06T7 Graphical solution of simultaneous quadratic equations
- 7.1.06T8 Graphical solution of equations – two linear with two unknowns
- 7.1.06T9 Solve simultaneous equations – one linear one quadratic
- 7.1.06T10 Determine linear laws
- 7.1.06T11 Linearization
- 7.1.06T12 Determination of non-linear laws

**7.1.07 TRIGONOMETRY**

- 7.1.07T0 *Specific Objectives*  
 By the end of the sub-module unit, the trainee should be able to:
- a) convert angles from one measurement to another
  - b) define the trigonometric ratios and their reciprocals

- c) draw graphs of trigonometric functions
- d) solve problems related to trigonometric ratios
- e) calculate angles of elevation and depression
- f) derive the sine and cosine rule
- g) solve problems using the cosine and sine rule
- h) derive compound angle formula
- i) use the compound angle formula in solving problems
- j) deduce the double angle formula
- k) solve problems using the double angle formula
- l) derive the trigonometric identities

- 7.1.07C *Competence*  
 The trainee should have the ability to:
- i) draw graphs of trigonometric functions
  - ii) solve problems related to trigonometric ratios
  - iii) derive the trigonometric identities

- Content*
- 7.1.07T1 Conversion of angles
    - radian measure
    - minutes and seconds
  - 7.1.07T2 Trigonometric ratios and their reciprocals
  - 7.1.07T3 Graphs of trigonometric functions



- 7.1.07T1 Equations involving trigonometric ratios
- 7.1.07T1 Angles of elevation and depression
- 7.1.07T1 Sine and Cosine rule
- 7.1.07T1 Use of sine and cosine rules
- 7.1.07T1 The compound angle formula
- 7.1.07T1 Using the compound angle formula
- 7.1.07T1 Double angle formula
- 7.1.07T1 Using the double angle formula
- 7.1.07T1 Trigonometric identities
- t-formulae
  - factor formulae
  - half-angle formulae
  - tangent rule

## 7.1.08 LATITUDES AND LONGITUDES

- 7.1.08T *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- a) differentiate between latitudes and longitudes
  - b) identify the Equator and the Greenwich Meridian
  - c) determine the distance between two points along the small and great circles
  - d) calculate time between longitudes
  - e) calculate speed

- 7.1.08C *Competence*  
The trainee should have the ability to:

- i) identify equator and greenwich meridian
- ii) determine distance between two points along the small and great circles
- iii) calculate time and speed between latitudes

### *Content*

- 7.1.08T1 Latitudes and longitudes
- 7.1.08T2 The equator and the Greenwich Meridian
- 7.1.08T3 Distance between two points along small and great circles
- 7.1.08T4 Time between longitudes
- 7.1.08T5 Speed

## 7.1.09 COORDINATE GEOMETRY AND LOCI

- 7.1.09T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- a) define polar equations
  - b) convert polar equations to Cartesian equations and vice versa
  - c) plot graphs of polar equations
  - d) define the locus of a point
  - e) determine the locus of points in relation to other points,

lines, planes,  
ellipses, parabola  
and hyperbola

using Pappus  
theorem

7.1.09C *Competence*  
The trainee should have the  
ability to determine the  
locus of points in relation  
to other points, lines,  
planes, ellipses, parabola  
and hyperbola

7.1.11C *Competence*  
The trainee should have  
the ability to solve  
problems in  
combinations and  
binomial exercises

*Content*  
7.1.09T1 Definition of polar  
equations  
7.1.09T2 Conversion of polar  
equations to Cartesian  
equations and vice versa  
7.1.09T3 Graphs of polar  
equation  
7.1.09T4 Definition of a locus of  
a point  
7.1.09T5 Locus of points

*Content*  
7.1.10T1 Units of measurement  
7.1.10T2 Perimeter and area of  
regular figures  
7.1.10T3 Volume of regular  
solids  
7.1.10T4 Surface area of regular  
solids  
7.1.10T5 Area of irregular figures  
- Trapezoidal rule  
- Simpson's rule  
7.1.10T6 Pappus theorem

## 7.1.10 MENSURATION

7.1.10T0 *Specific Objectives*  
By the end of the sub-  
module unit, the trainee  
should be able to:  
a) state different units of  
measurements  
b) calculate perimeters  
and areas of regular  
figures  
c) determine volumes of  
regular solids  
d) calculate surface areas  
of regular solids  
e) calculate areas of  
irregular figures  
f) determine area and  
volume of solids

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## 7.1.11 PERMUTATIONS, COMBINATIONS AND BINOMIAL EXPANSION

7.1.11T0 *Specific Objectives*  
By the end of the sub-  
module unit, the trainee  
should be able to:  
a) define permutation  
and combinations  
b) simplify problem  
using factorial  
notation  
c) determine binomial  
coefficients  
d) deduce the binomial  
theorem

- e) obtain binomial series using binomial expansion
  - f) approximate roots and errors using binomial theorem
- 7.1.11C *Competence*  
The trainee should have the ability to approximate roots and errors using binomial theorem

- 7.1.11T1 *Content*  
Definitions of permutation and combination
- 7.1.11T2 Factorial notation
- 7.1.11T3 Binomial expansion
- coefficients using
  - Pascal's triangle
  - binomial theorem
- 7.1.11T4 Deduction of binomial theorem from Pascal's triangle
- 7.1.11T5 Power series using binomial theorem
- 7.1.11T6 Approximations, roots and errors using binomial theorem

## 7.1.12 VECTORS

- 7.1.12T0 *Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- a) define a vector
  - b) represent a vector by a directed straight line
  - c) add vectors
  - d) subtract vectors

- e) write a vector in terms of components
- f) multiply a vector with a scalar
- g) write a vector in terms of component unit vectors
- h) set up the coordinate system for representing vectors
- i) obtain the direction cosines of a vector
- j) calculate the scalar product

- 7.1.12C *Competence*  
The trainee should have the ability to calculate scalar products

### *Content*

- 7.1.12T1 Definition of scalar product
- 7.1.12T2 Vector representation
- 7.1.12T3 Addition of vectors
- 7.1.12T4 Subtraction of vectors
- 7.1.12T5 Components of a vector
- 7.1.12T6 Scalar multiplication
- 7.1.12T7 Components of a vector in terms of unit vectors
- 7.1.12T8 Vectors in space
- 7.1.12T9 Direction cosines
- 7.1.12T10 Scalar/dot product of two vectors

## 7.1.13

### 7.1.13T0

## PROBABILITY I

- Specific Objectives*  
By the end of the sub-module unit, the trainee should be able to:
- a) define the term probability

- b) state and apply the laws of probability
- c) distinguish between mutually exclusive, dependent and independent events
- d) compute conditional probabilities
- e) use tree diagram to solve probability problems
- f) draw probability space of a given case
- g) pick a sample point from probability space
- h) draw a Venn diagram for a given situation

7.1.13C

*Competence*

The trainee should have the ability to:

- i) use tree diagram to solve probability problems
- ii) draw Venn diagram for a given situation
- iii) pick a sample point from probability space

*Content*

- 7.1.13T1 Definition of probability
- 7.1.13T2 Laws of probability
- 7.1.13T3 Mutually exclusive, dependent and independent events
- 7.1.13T4 Conditional probabilities
- 7.1.13T5 Probability tree diagrams
- 7.1.13T6 Probability space

7.1.13T7

Sample point

7.1.13T8

Venn diagram

7.1.14

**STATISTICS I**

7.1.14T0

*Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) distinguish between discrete and continuous data
- b) construct frequency distribution tables
- c) construct cumulative frequency table
- d) determine class boundaries, class intervals, central values
- e) represent data graphically
- f) determine measures of central tendency
- g) determine measures of dispersion

7.1.14C

*Competence*

The trainee should have the ability to:

- i) construct frequency distribution, cumulative frequency tables
- ii) represent data graphically
- iii) determine measures of central tendency and dispersion

	<i>Content</i>
7.1.14T1	Types of data
7.1.14T2	Frequency table grouped/ungrouped data
7.1.14T3	Cumulative frequency table
7.1.14T4	Class boundaries, class intervals, central values
7.1.14T5	Histogram, frequency polygons, bar groups, pie charts, pictograms
7.1.14T6	Mean, mode, median
7.1.14T7	Range, variance and standard deviation

*Suggested  
Teaching/Learning  
Methods*

- Demonstration
- Group work
- Discussion
- Working out  
problems

*Suggested  
Teaching/Learning  
Resources*

- Charts
- Number line
- Factor tree diagrams
- Bells
- Alarm
- Flickering lights

*Suggested Assessment  
Methods*

- Oral tests
- Written
- Number games
- Quizzes