CDETB

An Bord Oideachais agus Oiliúna Chathair Bhaile Átha Cliath
City of Dublin Education and Training Board

Programme Module

Practical Mathematics in Use

leading to

Level 3 QQI Component: Functional Mathematics 3N0930

Please note the following prior to using this programme module descriptor:

- This programme module can be delivered as a stand alone module or as part of the:

  1. **Level 3 QQI Certificate in General Learning 3M0874**
  2. **Level 3 QQI Certificate in Employability Skills 3M0935**
  3. **Level 3 QQI Certificate in Information and Communication Technologies 3M0877.**

- Upon successful completion of this programme module the learner will achieve 5 credits towards the Level 3 QQI Certificates in General Learning, Employability Skills or Information and Communication Technologies.

- The learner needs to accumulate a minimum of 60 credits in order to achieve the Level 3 QQI Certificates in General Learning or Employability Skills or Information and Communication Technologies.

- Teachers/tutors should familiarise themselves with the information contained in CDETB's programme descriptor for Everyday Living Skills, Skills for the Workplace or Introduction to Information and Communication Technologies prior to delivering this programme module.

- In delivering this programme module teachers/tutors will deliver class content in line with the Guidelines for Teaching and Learning included in this programme module.

- In assessing the learner, teachers/tutors will assess according to the information included in this programme module. Teachers/tutors are required to devise Assessment Brief/s for the Collection of Work and Skills Demonstration.

- Where overlap is identified between the content of this programme module and one or more other programme module(s), teachers/tutors are encouraged to integrate the delivery of this content.

- Where there is an opportunity to facilitate the learner to produce one piece of assessment evidence which demonstrates the learning outcomes from more than one programme module, teachers/tutors are encouraged to integrate assessment.

Overview of the Programme Module

The Programme Module is structured as follows:

Section 1 to 8: contains important information for the teacher/tutor about the credit value, title, code, etc. of the programme module.

Section 9: details the learning outcomes prescribed for the programme module by QQI. These outcomes are set by QQI and cannot be changed in any way by the CDETB or individual teachers/tutors.

Section 10: outlines suggestions and guidelines for teaching the module. It contains useful information and ideas for teachers/tutors and can be helpful in clarifying learning outcomes.

Section 11: contains the relevant information in relation to the assessment of the module. As the teacher/tutor is the assessor of the work, this section is essential reading.

Section 11a specifically prescribes the way in which learners are required to present evidence for assessment.

Learner Marking Sheet: this is the marking sheet that must be attached to the assessment portfolio and signed by the teacher/tutor and the learner.

Programme Module	**Award**
1. Title of Programme Module Practical Mathematics in Use	**2. Component Name and Code** Level 3 Functional Mathematics 3N0930
3. Duration in Hours of Programme Module 50	**4. Credit Value** 5
5. Assessment Technique Collection of Work 100%	**6. Specific Requirements** None

7. Aims of the Programme Module

This programme module aims to provide the learner with the necessary knowledge, skills and competencies to be able to solve real life quantitative problems by applying practical mathematical techniques.

8. Objectives:

- to provide clarity around different kinds of numbers, including fractions, percentages, decimals, natural, integer, rational and real that people are exposed to everyday
- to use a calculator effectively and efficiently
- to consider the concept of algebra and its use in daily life
- to apply mathematical skills, in particular number and algebra skills, appropriately in a limited range of real-life situations.

9. Learning Outcomes of Level 3 Functional Mathematics 3N0930

The learner will be able to:

1 Number

1.1 describe the role and impact of number on daily life
1.2 describe the concepts of natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R)
1.3 describe the properties of addition and multiplication
1.4 describe the concept of number bases and their application in daily life
1.5 describe the concepts of part-whole, fractions, and decimals
1.6 demonstrate equivalence between simple fractions, decimals and percentages
1.7 express simple ratios as fractional ratios e.g. 1:2=1/3:2/3
1.8 calculate solutions to real life mathematical problems following the correct order of operations when applying the principal arithmetic operations, i.e. +, -, ×, ÷, to natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R)
1.9 use a calculator to perform operations requiring functions such as +, -, ×, ÷, %, memory keys and the clear key
1.10 give approximations to real life mathematical problems by using strategies including estimation, significant figures and rounding off large natural numbers
1.11 solve routine problems from a limited range of meaningful, real life situations by making sense of the situations mathematically, making an initial model of the situation, deciding on appropriate mathematical techniques and tools to use in the situation, applying mathematical techniques, examining patterns, relationships and assumptions and making adjustments to see their effect on the initial model, and discussing and presenting results and conclusions in relation to the situation

2 Algebra

2.1 describe the concept of algebra and its similarity to arithmetic
2.2 describe the properties of linear expressions, linear equalities and linear inequalities
2.3 write algebraic expressions for familiar real life situations
2.4 use language appropriate to algebra
2.5 simplify basic algebraic expressions by applying the principal arithmetic operations of +, -, x and ÷

algebraic expressions of one or two variables

2.6 solve simple algebraic equations and inequalities of 1 variable

2.7 transpose formulae and equations

2.8 solve simultaneous equations

2.9 solve routine problems from a limited range of meaningful, real life situations by making sense of the situations mathematically, making an initial model of the situation, deciding on appropriate mathematical techniques and tools to use in the situation, applying mathematical techniques, examining patterns, relationships and assumptions and making adjustments to see their effect on the initial model, and discussing and presenting results and conclusions in relation to the situation.

Delivery Strategies and Learning Activities

The programme module could be delivered through classroom-based learning activities, team work, group discussions, one-to-one tutorials, field trips, case studies, role play and other relevant activities.

10. Guidelines for Teaching and Learning

Please note: the following guidelines suggest a sequence for the teaching of this module. In some cases, this may differ from the sequence of learning outcomes outlined in section 9.

UNIT I: NUMBER

Number in Daily Life

Learning Outcome 1.1: Describe the role and impact of number on daily life.

*In order to help the learner achieve **Learning Outcome 1.1** in particular, consider doing the following:*

discuss with the learner the role number plays in daily life and the impact it makes on the learner's life, for example,

- using an alarm clock
- using the timer on the cooker
- reading time on a watch,
- rounding a date on a calendar,
- checking up the mileage of your car
- getting petrol at the filling station
- attending to a roll call at school
- getting scores in the class exams
- scoring in a game
- betting on a horse race
- preparing a recipe in the kitchen
- exchange currency
- visiting banks, shopping centres, railways, post offices, insurance companies,
- taking part in recreational activities, for example video games, computer games, puzzles, riddles.

Real Life Mathematics

Learning Outcome 1.11: Solve routine problems from a limited range of meaningful, real life situations by making sense of the situations mathematically, making an initial model of the situation, deciding on appropriate mathematical techniques and tools to use in the situation, applying mathematical techniques, examining patterns, relationships and assumptions and making adjustments to see their effect on the initial model, and discussing and presenting results and conclusions in relation to the situation.

Learning Outcome 2.9: Solve routine problems from a limited range of meaningful, real life situations by making sense of the situations mathematically, making an initial model of the situation, deciding on appropriate mathematical techniques and tools to use in the situation, applying mathematical techniques, examining

patterns, relationships and assumptions and making adjustments to see their effect on the initial model, and discussing and presenting results and conclusions in relation to the situation.

*In order to help the learner achieve **Learning Outcome 1.11 & 2.9** in particular, consider doing the following:*

- in learning about numbers and algebra, facilitate the learner to solve meaningful, real-life problems, to include:
  - making sense of the situations mathematically
  - making an initial model of the situation
  - deciding on appropriate mathematical techniques and tools to use in the situation
  - applying mathematical techniques
  - examining patterns, relationships and assumptions
  - making adjustments to see their effect on the initial model
  - discussing and presenting results and conclusions in relation to the situation

- facilitate the learner in solving some of the following problems:
  - planning a journey (time, budget, distances)
  - budgeting (money, estimations, decimals, ratios)
  - calculating loan repayments (interest rates (percentages), decimals, addition, multiplication, using a calculator)
  - planning to bake something or planning a meal

Explaining Natural Numbers (N), Integers (Z), Rational Numbers (Q), and Real Numbers (R) .
Learning Outcome 1.2: Describe the concepts of natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R)

*In order to help the learner achieve **Learning Outcome 1.2** in particular, consider doing the following:*

- explain to the learner that, in mathematics, **natural numbers** (N) are the ordinary counting numbers, for example, 1, 2, 3 etc. (sometimes zero is also included but negative numbers are not)

  Natural numbers have two main purposes:
  - counting, for answering the question 'how many?'
  - ordering, for example, which box contains the largest amount of Ping-Pong balls? Which contains the least amount? Place the other boxes in a sequence going from least to most?

- facilitate the learner to think about times when they count things in their everyday life, for example, shopping, at the bank, at sports, cooking, woodwork, other things of interest to the learner

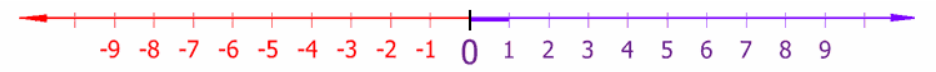
- complete some examples of counting, for example,
  - 24 + 46 = ____
  - 57 + 96 = ____
  - 234 + 245 = ____

- ask the learner to put a list of 10 numbers in an increasing or decreasing order and discuss with the learner how this would be difficult to do without natural numbers

- explain to the learner that **Integers** are formed by the natural numbers (N) including 0 (0, 1, 2, 3, etc.) together with the negative natural numbers (−1, −2, −3, etc).
  They are numbers that can be written without a fractional or decimal component, and fall within a set,

for example, {-3, -2, -1, 0, 1, 2, 3}

They can be represented using a number line as follows:



- review a list of numbers with the learner and group those that are integers into one list and those that are not into a second list, for example,
  - 5, 77, and −79 are integers
  - 1.4 and 2 ¼ are not integers

- explore with the learner where they may use negative numbers, for example, using temperature in the context of the fridge, going on holidays, driving in cold weather

- facilitate the learner to use the integers number line to complete a number of calculations, for example,
  - 2 + 5
  - 5 – 3
  - 6 – 8
  - 8 – 1

- highlight for the learner that a **rational number is any number that can be made by dividing one integer by another**

- **explain that a rational number** is described as a number that can be written as a simple fraction (i.e. as a **ratio**). The word “rational” comes from "ratio", for example,
  - **1.5** is a rational number because 1.5 = **3/2** (it can be written as a fraction)
  - 1/2 is a rational number (1 divided by 2, or the ratio of 1 to 2)
  - 0.75 is a rational number (3/4)
  - 1 is a rational number (1/1)
  - 2 is a rational number (2/1)
  - 2.12 is a rational number (212/100)
  - -6.6 is a rational number (-66/10)

- explore with the learner when they might use rational numbers in daily life

- **explain that Real numbers** can be thought of as points either on or between integers on an infinitely long number line.

- explore with the learner when they would use real numbers, for example, dividing dinner portions in the kitchen, in cooking, in making something in woodwork, giving pocket money to children (€21:60 between three children)

- On a number line as above ask the learner to locate real numbers, for example,
  - ½
  - ¼
  - ¾
  - -1 ½

- highlight for the learner that these are simple fractions, where the numerator and denominator are both integers

- explore with the learner where they might use simple fractions, for example, in cooking, in discussing distance for a trip or discussing time.

Properties of Addition and Multiplication
Learning Outcome 1.3: Describe the properties of addition and multiplication.

*In order to help the learner achieve **Learning Outcome 1.3** in particular, consider doing the following:*

- explore with the learner the four major properties or laws when you are adding or multiplying expressions. They are:
  - P**roperty of Zero**, to include:
    - Addition Property of Zero

    When zero is added to any number, the resulting sum is that number, for example:
    5 + 0 = 5; 0 + 2 = 2
    - Multiplication Property of Zero

    When zero is multiplied by any number, the resulting product is zero, for example:
    5 X 0 = 0; 0 X 2 = 0

  - **Commutative Property** - the order in addition and multiplication does not matter, to include:
    - Commutative Property of Addition

    When adding any 2 or more numbers, changing the order does not change the sum.
    3+ 4 = 4 + 3
    7 = 7
    - Commutative Property of Multiplication

    When multiplying any 2 or more numbers, changing the order does not change the product.
    3X 4 = 4 X 3
    12 = 12

  - **Associative Property** - that grouping location does not matter when adding or multiplying, to include:
    - Associative Property of Addition

    When adding 3 or more numbers, changing the grouping does not change the sum, for example:
    (3 + 4) + 5 ∴ 7 + 5 = 12
    3+ (4 + 5) ∴ 3 + 9 = 12
    - Associative Property of Multiplication

    When multiplying any 3 numbers, changing the grouping does not change the product, for example:
    (3 X 4)5 ∴ 12 X 5 = 60
    3(4 X 5) ∴ 3 X 20 = 60

  - **Distributive Property** - multiplying an expression times the sum of expressions is the same as multiplying the expression times each item in the sum, for example
    3(2 + 5) = 3 X 2 + 3 X 5

Number Bases
Learning Outcome 1.4: Describe the concept of number bases and their application in daily life.

*In order to help the learner achieve **Learning Outcome 1.4** in particular, consider doing the following:*

- explore with the learner the concept of number bases, where the base (or radix) of a number system is the number of different symbols available to represent any digit within that system, for example,
    - The decimal system (Base 10) has a radix of 10. Decimal uses different combinations of 10 symbols to represent any value (i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9). We are used to dealing with numbers in the decimal system, where we use a base of 10, counting up from 0 to 9 and then resetting our number to 0 and carrying 1 into another column. This is probably a result of having ten fingers.
    - The octal system (Base 8) has a radix of 8, counting from 0 up to 7 and then resetting to 0 and carrying 1. So the number 10 in this system would mean 8 in the decimal system.

- explore with the learner different situations where people use other number bases in ordinary life, for example,
    - an hour is divided into 60 minutes, 120 minutes is two hours, 180 minutes is three hours, and so on
    - twelve inches = one foot
    - sixteen ounces = one pound
    - fourteen pounds = one stone
    - dozens
    - the binary computer system (1,0) - Computers work using electronic circuits which can only be switched to on or off. When a key is pressed on a keyboard the character or number has to be converted into a sequence of 1's and 0's so that the computer can open or close its electronic switches in order to process the data. Because only two possible symbols can be used this is called a Binary system. This system works to a base of 2

Fractions and Decimals
Learning Outcome 1.5: Describe the concepts of part-whole, fractions, and decimals.

*In order to help the learner achieve **Learning Outcome 1.5** in particular, consider doing the following:*

- discuss with the learner part-whole fractions, where a fraction is a number that is the portion or part of a whole

  For example nearly all students can do decimal/fractions when counting money or making change. The relation of parts (cents) to wholes (euros) is a lot more concrete to them.

- highlight for the learner that the key to understanding fractions is knowing how to represent part of the whole

  Sometimes the whole will be a pizza, a measuring cup, or a bar . When we talk about fractions, we talk about PARTS of a WHOLE. Sometimes we have wholes and fractional parts. The WHOLE is **always** divided into EQUAL parts

- explore with the learner the concept of decimals

  The word "Decimal" really means "based on 10" (From Latin *decima*: *a tenth part*). We sometimes say "decimal" when we mean anything to do with our numbering system, but a "Decimal Number" usually means there is a Decimal Point

- discuss with the learner the concept of Place Value

To understand decimal numbers it is important to first know about Place Value. When writing numbers, the **position** (or "**place**") of each number is important, for example, in the number 327:

- the "7" is in the **Units** position, meaning just 7 (or 7 "1"s)
- the "2" is in the **Tens** position meaning 2 tens (or twenty)
- the "3" is in the **Hundreds** position, meaning 3 hundreds

- highlight for the learner that as we move left, each position is 10 times bigger - from Units, to Tens, to Hundreds and as we move right, each position is 10 times **smaller** - from Hundreds, to Tens, to Units
- explore with the learner what happens when we move past Units and what is 10 times smaller than Units
- explain to the learner what is meant by a Decimal Point
- facilitate the learner to explore numbers with smaller and smaller values, from **tenths**, to **hundredths**, and so on, for example, a number like 200.125
- highlight for the learner that our Decimal System lets us write numbers as large or as small as we want, using the decimal point. Numbers can be placed to the left or right of a decimal point, to indicate values greater than one or less than one
- facilitate the learner to think about Decimal Numbers ... as a Whole Number Plus Tenths, Hundredths, etc, for example, What is 13.76?
  - on the left side is "13", that is the whole number part
  - there are two digits on the right side, the 7 is in the "tenths" position, and the 6 is the "hundredths" position
  - so, 13.76 is "13 and 7 tenths and 6 hundredths"
- explore with the learner where they may see decimals, for example, money.

Equivalence between Fractions, Decimals and Percentages
Learning Outcome 1.6: Demonstrate equivalence between simple fractions, decimals and percentages.

*In order to help the learner achieve **Learning Outcome 1.6** in particular, consider doing the following:*

- demonstrate for the learner how to show equivalence between percentages and decimals by converting from percentage numbers to decimal numbers, for example, by moving the decimal point two places to the right, so 25% would become 0.25 or 75% would become 0.75
- facilitate the learner to use this knowledge to convert back from decimal numbers to percentages, for example, 0.80 is 80%, 0.50 is 50%
- demonstrate for the learner how to show equivalence between fractions and decimals by converting fractions into decimals, for example, for ¼ , divide the 1 (numerator) by the 4(denominator) which would be 0.25
- facilitate the learner to use their calculator to complete a number of conversions of fractions into decimals
- explore with the learner where they may see percentages or hear them referred to, for example, when shopping in the sales, mortgage interest rates, in banking

- discuss with the learner how percentages are written, for example, 50%, 25%, 20%, 10%

- facilitate the learner to identify if there is a fraction which is the same as 50%, 25%, and other simple fractions:
    - demonstrate for the learner how to convert simple percentages to fractions, for example, for 20%, put the given % over 100, so 20/100 or 2/10 or 1/5
    - demonstrate for the learner how to demonstrate equivalence between fractions and percentages by converting simple fractions to percentages, for example: for 2/5, divide the top of the fraction by the bottom, so 0.4, multiply by 100, so 0.4*100 = 40, and add a percentage sign, so 40%

- give the learner time to practice this by asking them to convert a number of percentages into fractions and a number of fractions into percentages

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Ratios

Learning Outcome 1.7 : Express simple ratios as fractional ratios e.g. 1:2=1/3:2/3.

*In order to help the learner achieve **Learning Outcome 1.7** in particular, consider doing the following:*

- explore with the learner the concept of ratios, for example, ratios are used to show the relationship between two numbers and can be written in the form of a fraction

  Fractions can then be thought of as ratios. Mathematically they are represented by separating each quantity with a colon, for example the ratio 2:3, which is read as the ratio "two to three"

- highlight for the learner that a fraction is an example of a specific type of ratio, in which the two numbers are related in a part-to-whole relationship, rather than as a comparative relation between two separate quantities

  A fraction is a quotient of numbers, the quantity obtained when the numerator is divided by the denominator. Thus 3⁄4 represents three divided by four, in decimals 0.75, as a percentage 75%.

- facilitate the learner to express simple ratios as fractional ratios, for example, I have two bags of marbles; one has 12 marbles; the other has 4.
  The ratio is 12 to 4 (12:4 or 12/4) ∴ 3/1 (3:1 or 3/1).
  We may have wanted to name the smaller bag first. Then the ratio is 1 to 3.

Using a Calculator for Real Life Mathematical Problems

Learning Outcome 1.8: Calculate solutions to real life mathematical problems following the correct order of operations when applying the principal arithmetic operations, i.e. +, -, ×, ÷, to natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R).

Learning Outcome 1.9: Use a calculator to perform operations requiring functions such as +, -, ×, ÷, %, memory keys and the clear key.

*In order to help the learner achieve **Learning Outcomes 1.8 and 1.9** in particular, consider doing the following:*

- discuss with the learner some situations where s/he may find it helpful to use a calculator to keep track of numbers or money, for example,
    - on a shopping trip to the supermarket use a calculator as to track the total cost of items as they are placed in the shopping trolley or basket
    - calculate the cost of an item when VAT @21% is to be paid on top of the listed price of goods or

services
  - examine a payslip to confirm whether deductions and total sums are correct
  - analyse the nutritional values on the box of a given food item and work out how much of this food item would be required to provide a daily allowance of fat or protein or carbohydrate for an adult woman or man
  - other situations of interest to the learner

- in completing these calculations, demonstrate for the learner how to represent the calculations on paper and how to transfer the calculation from paper to the calculator, to include using the following functions:
  -  plus
  -  minus
  -  multiplication
  -  division
  -  percentage
  -  input a number into memory
  -  recall a number from memory
  -  clear a number from memory
  -  clear the current calculation

- facilitate the learner to use the calculator to complete a number of personally relevant calculations, for example,
  - hourly net pay from their total net pay
  - the repayments on a loan or mortgage over a number of years
  - the best value in goods for sale in local shops considering special offers or sale prices
  - the total cost of a holiday, taking into account the cost of flights, hotels, food etc.

Approximating Numbers
Learning Outcome 1.10: Give approximations to real life mathematical problems by using strategies including estimation, significant figures and rounding off large natural numbers.

*In order to help the learner achieve **Learning Outcomes 1.10** in particular, consider doing the following:*

- explain to the learner what approximation means , for example, an inexact representation of the sum of something in the form of a number that is close enough to be useful

- discuss with the learner when (for example, in describing time, temperature, budgets, crowds) and why (for example, save time, save money, save you making mistakes on calculator) they would use approximations in real life

- explore with the learner what strategy can be used to give an accurate approximation, to include:
  - using estimation (finding a number that is **close enough** to the right answer), for example:
    - how much a bill would be
    - what the area of a room is

- how many kilometres a journey is
- how many people were in a room
- how many cars were in the street
- how many boxes were on the shelf
- how many seagulls were on the beach

- using significant figures, for example,
  - if calculating how much it will cost for 5 jumpers when one costs €25.45, the significant number is €25 so to approximate the cost it would be €25*5
- using rounding off of large natural numbers to reduce the number of significant digits in a number, for example,
  - rounding to the nearest 10, for example, 83 rounded to the nearest ten is 80, because 83 is closer to 80 than to 90
  - rounding to the nearest whole number, for example, 5.9 rounded to the nearest whole number is 6 because 5.9 is nearer 6 than 5
  - if the number, large of decimal, ends in 5 then you round upwards, if less than 5 then round downwards

- facilitate the learner to give an approximate figure for a number of simple calculations, using both significant figures and rounding off large natural numbers, for example,
  - if a watch reads the following times what is the approximate times?
    12:57, 2:08, 15:44
  - what are the approximate totals of the following sums?
    4×5.9, 6×4.1, 5×3.9
  - round the following to the nearest 10:
    67, 109, 123, 455.

UNIT 2: ALGEBRA

Concept of Algebra

Learning Outcome 2.1 Describe the concept of algebra and its similarity to arithmetic.

*In order to help the learner achieve **Learning Outcomes 2.1** in particular, consider doing the following:*

- explore with the learner the concept of Algebra and its similarity to arithmetic, for example, Algebra is a branch of mathematics that substitutes letters for numbers which can then be added, subtracted, multiplied, and divided, as with numbers, for example:
  - $a+b=c$
  - $a \times b=ab$
  - $a \div b=\frac{a}{b}$
  - $a-b=c$

Linear Equations

Learning Outcome 2.2: Describe the properties of linear expressions, linear equalities and linear inequalities.

*In order to help the learner achieve **Learning Outcomes 2.2** in particular, consider doing the following:*

- explore with the learner the properties of Linear Equations, to include:

Addition property of linear equations: If any number is added to both sides of an equation, then the equality

of the equation remains unchanged, for example, if **x = y** then **x + a = y + a**

Subtraction property in solving linear equations: If any number is subtracted from both sides of an equation, then the equality of the equation remains unchanged, for example, if **x = y**, then **x - a = y – a**

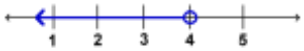
Multiplication and division property:

If **a = b**, then **a × c = b × c** and **a ÷ c = b ÷ a**, where a is a non-zero constant

- facilitate the learner to Solve Linear Equations
- explore with the learner Linear Equalities and Linear Inequalities

  Maths problems containing <, >, <=, and >= are called inequalities. A solution to any inequality is any number that makes the inequality true

- facilitate the learner to show the solution to an inequality by graphing it on a number line, for example,
  Graph: x < 4



- explore with the learner the properties of linear inequalities, to include:

  - **Property 1** We may add the same number to both sides of an inequality, and the sense will not change, for example,
    If a>b then a + c > b + c
  - **Property 2** We may multiply both sides of an inequality by the same positive number, and the sense will not change, for example,
    If a > b and c > 0 then ca > cb
  - **Property 3** If we multiply both sides of an inequality by the same negative number, the sense of the inequality changes, for example,
    If a > b and c < 0 then ca < cb
  - **Property 4** If we change the signs on both sides of an inequality, then the sense of the inequality will change, for example,
    If –a < -b then a > b

Writing and using Algebraic Expressions

Learning Outcome 2.3: Write algebraic expressions for familiar real life situations.

Learning Outcome 2.4: Use language appropriate to algebra

*In order to help the learner achieve **Learning Outcomes 2.3 & 2.4** in particular, consider doing the following:*

- facilitate the learner to writing algebraic expressions, for example:
  - A number increased by nine is fifteen (y + 9 = 15)
  - Twice a number is eighteen (2n = 18)
  - Four less than a number is 20 (x – 4 = 20)
  - A number divided by six is eight (k/6 = 8)
  - Twice a number, decreased by twenty nine is seven (2t – 29 = 7)
  - Thirty two is twice a number increased by eight (32 = 2a + 8)
  - Twelve is sixteen less than four times a number (12 = 4x – 16)
  - Mary is x years old. In thirteen years she will be twenty-four years old (x + 13 = 24)
  - Each piece of chocolate costs 25 cents. The price of h pieces of chocolate is €2.00 (25h = 200 or

.25h = 2.00)
  - Suzanne made a withdrawal of d euro from her savings account. Her old balance was €350, and her new balance is €280 (350 - d = 280)
  - A large pizza pie with 15 slices is shared among p students so that each student's share is 3 slices (15/p = 3)

- facilitate the learner to writing algebraic expressions and apply them to familiar real life situations, for example:
  - Mary has €17 in her piggy bank. How much money does she need to buy a game that costs €68?

- Facilitate the learner to be familiar with and use language appropriate to algebra where appropriate.

Simplifying basic algebraic expressions
Learning Outcome 2.5: Simplify basic algebraic expressions by applying the principal arithmetic operations of +, -, x and ÷ algebraic expressions of one or two variables.

*In order to help the learner achieve **Learning Outcomes 2.5** in particular, consider doing the following:*

facilitate the learner to simplify basic algebraic expressions, to include:
  - those that can be simplified immediately without any preparation, for example,
    $2x + 3y - 2 + 3x + 6y + 7$
  - those that require preparation before being simplified, for example,
    $3b - (4b - 6b + 2) + b$

Algebraic expressions contain alphabetic symbols as well as numbers. When an algebraic expression is simplified, an equivalent expression is found that is simpler than the original. This usually means that the simplified expression is smaller than the original.

Solving algebraic equations
Learning Outcome 2.6: Solve simple algebraic equations and inequalities of 1 variable.
Learning Outcome 2.7: Transpose formulae and equations.

*In order to help the learner achieve **Learning Outcomes 2.6 and 2.7** in particular, consider doing the following:*

- facilitate the learner to solve algebraic equations by transposing them (to rearrange them for the purposes of solving them), to include:
  - identifying for the learner that addition and subtraction are inverse operations - they undo each other (i.e., 10 + 9 - 9 = 10), for example,
    - x + 79 = 194
      x + 79 – 79 = 194 – 79
      x = 115
  - identifying for the learner that when solving equations, multiplication and division are inverse operations, therefore they undo each other (i.e., (4 * 8)/8 = 4), for example,
    - 6x = 36
      6x/6 = 36/6
      x = 6
    - x/5 = 10
      5(x/5) = 10(5)
      5x/5 = 50
      x = 50

- highlighting for the learner the importance of applying the operation to both sides of the equation

- transposing commonly used formulae, for example,
  - A = lw is the formula for the area, A, of a rectangle of length l and width w. In the formula A is expressed in terms of l and w. It can be re-arranged as follows:

  - A = lw

    A/l = lw/l
    A/l = w
    w = A/l

- exploring with the learner the principles for inequalities.

  As with equations, inequalities also have principles dealing with addition and multiplication. They are outlined below.

  - **Addition Principle for Inequalities** - If $a > b$ then $a + c > b + c$, for example:

    x + 3 > 6
    x + 3 - 3 > 6 - 3
    x > 3
  - **Multiplication Principle for Inequalities** - If $a > b$ and c is positive, then $ac > bc$. If $a > b$ and c is negative, then $ac < bc$ (notice the sign was reversed)

Simultaneous equations

Learning outcome 2.8 solve simultaneous equations.

*In order to help the learner achieve **Learning Outcomes 2.8** in particular, consider doing the following:*

- Facilitate the learner to solve simultaneous equations using either Elimination or Substitution.

11.a Specific Information Relating to the Assessment Techniques

The assessor (teacher/tutor) is required to devise Assessment Brief/s for the Collection of Work and Skills Demonstration. In devising the Assessment Brief/s, care should be taken to ensure that the learner is given the opportunity to show evidence of ALL learning outcomes. Each learner is required to work alone in completing the Collection of Work. There is no facility for this Collection of Work to be completed as a group.

Evidence that the learner has achieved the learning outcomes may take a variety of forms including tutor verification of the learner's contribution, learner worksheets, diagrams, cloze tests, multiple choice statements, visual presentation or other appropriate evidence in the form of written, oral, graphic, audio, visual or any combination of these. Any audio or visual evidence must be provided in a suitable format. All of the evidence must be retained in the learner's assessment portfolio.

Collection of Work	**100%**

The Collection of Work may be produced throughout the duration of this programme module. It must be clearly indicated where evidence covers more than one learning outcome.

In compiling the Collection of Work, the learner should be accommodated to demonstrate the practical application of number to personally relevant situations. The assessor may set a context and require a learner to complete a number of tasks based on that context or the assessor may integrate the following tasks in a real life quantitative problem to be solved by the learner.

In compiling the Collection of Work, the learner will include evidence that demonstrates the following throughout:

- accuracy of calculations
- correct order of operations
- the application of principal mathematical functions: addition, multiplication, subtraction and division
- the use of Natural Numbers (N), Integers (Z), Rational Numbers (Q), Real Numbers (R), Common Simple Fractions, Decimal Numbers

Evidence of the following must be included in the Collection of Work:

- the ability to use a calculator to perform addition, multiplication, subtraction and division. The memory function and clear key should also be used

- problem solving skills, to include:
  - approximating using significant figures and rounding off large natural numbers
  - demonstrating equivalence between simple fractions, decimals and percentages
  - application of number bases in daily life
  - expression of ratios as fractional ratios
  - calculation of solutions for real-life mathematical problems
  - simplifying basic algebraic expressions of one or two variables by applying the arithmetic operations +, -, X and ÷
  - solving simple algebraic equations and inequalities of 1 variable
  - solving simultaneous equations
  - transposing formulae and equations
  - solving routine problems, using number AND algebra, for a limited range of real life situations by
    - making sense of the situations mathematically
    - making and initial model of the situation

        - deciding on appropriate mathematical techniques and tools to use in the situation
        - application of mathematical techniques
        - examination of patterns, relationships and assumptions
        - making adjustments to see their effect on the initial model
        - discussion and presentation of results and conclusions in relation to the situation
- an understanding of:
    - the role and impact of number in daily life
    - the difference between Natural Numbers (N), Integers (Z), Rational Numbers (Q) and Real Numbers (R)
    - the concept of number bases
    - the properties of addition and multiplication
    - the concept of part-whole, fractions and decimals
    - the concept of algebra to include:
        - its similarity to arithmetic
        - properties of linear expressions, linear equalities and linear inequalities
        - appropriate language used in algebra
        - how algebraic expressions can be written for real-life situations

11.b Assessment - General Information – Functional Mathematics 3N0930.

All instructions for the learner must be clearly outlined in an Assessment Brief.

Mapping Each Learning Outcome to an Assessment Technique	
Learning Outcome **Number**	**Assessment Technique**
1.1 Describe the role and impact of number on daily life.	Collection of Work
1.2 Describe the concepts of natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R).	Collection of Work
1.3 Describe the properties of addition and multiplication.	Collection of Work
1.4 Describe the concept of number bases and their application in daily life.	Collection of Work
1.5 Describe the concepts of part-whole, fractions, and decimals.	Collection of Work
1.6 Demonstrate equivalence between simple fractions, decimals and percentages.	Collection of Work
1.7 Express simple ratios as fractional ratios e.g. 1:2=1/3:2/3.	Collection of Work
1.8 Calculate solutions to real life mathematical problems following the correct order of operations when applying the principal arithmetic operations, i.e. +, -, ×, ÷, to natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R).	Collection of Work
1.9 Use a calculator to perform operations requiring functions such as +, -, ×, ÷, %, memory keys and the clear key.	Collection of Work
1.10 Give approximations to real life mathematical problems by using strategies including estimation, significant figures and rounding off large natural numbers.	Collection of Work
1.11 Solve routine problems from a limited range of meaningful, real life situations by making sense of the situations mathematically, making an initial model of the situation, deciding on appropriate mathematical techniques and tools to use in the situation, applying mathematical techniques, examining patterns, relationships and assumptions and making adjustments to see their effect on the initial model, and discussing and presenting results and conclusions in relation to the situation.	Collection of Work
Algebra	
2.1 Describe the concept of algebra and its similarity to arithmetic.	Collection of Work
2.2 Describe the properties of linear expressions, linear equalities and linear inequalities.	Collection of Work
2.3 Write algebraic expressions for familiar real life situations.	Collection of Work
2.4 Use language appropriate to algebra.	Collection of Work
2.5 Simplify basic algebraic expressions by applying the principal arithmetic operations of +, -, x and ÷ algebraic expressions of one or two variables.	Collection of Work

2.6 Solve simple algebraic equations and inequalities of 1 variable.	Collection of Work
2.7 Transpose formulae and equations.	Collection of Work
2.8 Solve simultaneous equations.	Collection of Work
2.9 Solve routine problems from a limited range of meaningful, real life situations by making sense of the situations mathematically, making an initial model of the situation, deciding on appropriate mathematical techniques and tools to use in the situation, applying mathematical techniques, examining patterns, relationships and assumptions and making adjustments to see their effect on the initial model, and discussing and presenting results and conclusions in relation to the situation.	Collection of Work

Grading

At Level 3 a learner is graded as Successful or Referred.

Successful means that ALL the learning outcomes from the Component Specification have been demonstrated to an appropriate standard in the learner's portfolio of assessment.

Referred means that the portfolio of assessment needs further work by the learner before s/he can demonstrate the standard and achieve certification from QQI.

Level 3 Functional Mathematics 3N0930	Learner Marking Sheet

Learner's Name: _____ Learner's PPSN: _____

The learner will be able to	Evidence of the following is included in the assessment portfolio:	✓ If present in portfolio	Please indicate where evidence is to be found
1.1 describe the role and impact of number on daily life	• description of: ○ the role of number in daily life ○ the impact of number on daily life		
1.2 describe the concepts of natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R)	• description of the concept of: ○ Natural Numbers (N) ○ Integers (Z) ○ Rational Numbers (Q) ○ Real Numbers (R)		
1.3 describe the properties of addition and multiplication	• description of the properties of: ○ addition ○ multiplication		
1.4 describe the concept of number bases and their application in daily life	• description of: ○ he concept of number bases ○ application of number bases in daily life		
1.5 describe the concepts of part-whole, fractions, and decimals	• description of the concepts of: ○ part-whole ○ fractions ○ decimal		
1.6 demonstrate equivalence between simple fractions, decimals and percentages	• demonstration of equivalence between: ○ simple fractions and decimals ○ simple fractions and percentages ○ decimals and percentages		
1.7 express simple ratios as fractional ratios e.g.	• expression of simple ratios as fraction ratios		

1:2=1/3:2/3			
1.8 calculate solutions to real life mathematical problems following the correct order of operations when applying the principal arithmetic operations, i.e. +, -, ×, ÷, to natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R)	• calculation of solutions to real life mathematical problems following the correct order of operations when applying the principal arithmetic operations to natural numbers (N), integers (Z), rational numbers (Q) and real numbers (R) ○ + ○ - ○ X ○ ÷		
1.9 use a calculator to perform operations requiring functions such as +, -, ×, ÷, %, memory keys and the clear key	• use of the following functions on a calculator: ○ + ○ - ○ X ○ ÷ ○ M (memory keys) ○ C (clear key)		
1.10 give approximations to real life mathematical problems by using strategies including estimation, significant figures and rounding off large natural numbers	• use estimation to give approximations • use significant figures to give approximations • use rounding off of large numbers to give approximations		
1.11 solve routine problems from a limited range of meaningful, real life situations by making sense of the situations mathematically, making an initial model of the situation, deciding on appropriate mathematical techniques and tools to use in the situation, applying mathematical techniques, examining patterns, relationships and assumptions and making adjustments to see their effect on the initial model, and discussing and presenting results and conclusions in relation to the situation	• solve routine problems for a limited range of meaningful, real-life situations to include: ○ making sense of the situations mathematically ○ making and initial model of the situation ○ deciding on appropriate mathematical techniques and tools to use in the situation ○ application of mathematical techniques ○ examination of patterns, relationships and assumptions ○ making adjustments to see their effect on the initial model ○ discussion and presentation of results and conclusions in relation to the situation		
2.1 describe the concept of algebra and its similarity to arithmetic	• description of: ○ the concept of algebra		

	○ the similarity of algebra to arithmetic		
2.2 describe the properties of linear expressions, linear equalities and linear inequalities	• description of the properties of: ○ linear expressions ○ linear equalities ○ linear inequalities		
2.3 write algebraic expressions for familiar real life situations	• write at least 5 algebraic expressions for familiar real-life situations		
2.4 use language appropriate to algebra	• use of appropriate language for algebra		
2.5 simplify basic algebraic expressions by applying the principal arithmetic operations of +, -, x and ÷ algebraic expressions of one or two variables	• simplification of at least 5 basic algebraic expressions of one or two variables by applying the principal mathematical operations ○ + ○ - ○ x ○ ÷		
2.6 solve simple algebraic equations and inequalities of 1 variable	• solve at least 5 algebraic equations of 1 variable • solve at least 5 algebraic inequalities of 1 variable		
2.7 transpose formulae and equations	• transpose ○ at least 5 examples of formulae and equations		
2.8 solve simultaneous equations	• solve at least 5 simultaneous equations		
2.9 solve routine problems from a limited range of meaningful, real life situations by making sense of the situations mathematically, making an initial model of the situation, deciding on appropriate mathematical techniques and tools to use in the situation, applying mathematical techniques, examining patterns, relationships and assumptions and making adjustments to see their effect on the initial model, and discussing and presenting results and conclusions in relation to the situation.	• solve routine problems for a limited range of meaningful, real-life situations to include: ○ making sense of the situations mathematically ○ making and initial model of the situation ○ deciding on appropriate mathematical techniques and tools to use in the situation ○ application of mathematical techniques ○ examination of patterns, relationships and assumptions ○ making adjustments to see their effect on the initial model ○ discussion and presentation of results and conclusions in relation to the situation.		

This is to state that the evidence presented in the attached portfolio is complete and is the work of the named learner.

Learner's Signature: _____ Date: _____

Assessor's Signature: _____ Date: _____

External Authenticator's Signature: _____ Date: _____