higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

SUBJECT GUIDELINES

MATHEMATICAL LITERACY

NQF Level 4

IMPLEMENTATION: JANUARY 2015

INTRODUCTION

A. What is Mathematical Literacy?

Mathematical literacy is an attribute of individuals who are prepared and able to participate effectively in the modern world – a world characterised by numbers and numerically based arguments and data represented (and misrepresented) in a large variety of ways. The subject Mathematical Literacy develops this attribute in individuals – an attribute that involves managing situations and solving problems in everyday life, work, societal and lifelong learning contexts by engaging with mathematical concepts (numbers and measurements; patterns and relationships; finances; space, shape and orientation; and data) presented in a wide range of different ways.

B. Why is Mathematical Literacy important as a Fundamental subject?

In order to be a more effective self-managing individual, contributing worker, life-long learner and critical citizen in the modern world, people need to be able to engage with numbers and numerically based arguments and data represented (and misrepresented) in a large variety of ways that confront them on a day-to-day basis. Mathematical Literacy develops the knowledge, skills, values and attitudes that enable people to do so.

C. The link between Mathematical Literacy Learning Outcomes and the Critical And Developmental Outcomes

Mathematical Literacy aims to encourage students to:

- Develop logical thought processes.
- Develop analytical ability.
- Approach problem solving in a systematic manner.
- Identify and solve problems.
- Evaluate information critically.
- Be accurate.
- Work confidently with numbers.
- Interpret financial information and manage finances in a meaningful manner.

D. Factors that contribute to achieving Mathematical Literacy Learning Outcomes

- Interest in working with numbers and experience in and exposure to working with numbers.
- Experience working with a calculator, to work orderly, analytically, critically and evaluate critically.
- Accuracy when calculating, recording and analysing information will be an attribute.
- A learning enabling environment created by:
  - Encouraging an attitude of *"I can work with numbers, data and patterns"* in students.
  - Using different media and learning approaches to accommodate different learning styles.
  - Applying different strategies to develop and encourage creativity and problem solving capabilities.
  - Focusing on strategies that develop higher level cognitive skills such as analytical and logical thinking and reasoning.
  - Adopting a learning pace that will instill a sense of achievement rather than one of constant failure.
  - Practical, current and relevant examples and aids to enable students to apply abstract concepts in real everyday life situations.
  - Providing remedial and support interventions for those students that struggle to grasp fundamental outcomes.
  - Encouraging continuous work and exercise for students to develop a sense of achievement and success.

MATHEMATICAL LITERACY – LEVEL 4

CONTENTS

1 DURATION AND TUITION TIME

This is a one-year instructional programme comprising 200 teaching and learning hours. The subject may be offered on a part-time basis provided all the assessment requirements are followed.

Provision for students with special education needs (LSEN) must be catered for in a way that eliminates the barriers to learning.

2 SUBJECT LEVEL OUTCOMES AND FOCUS

SAQA Qualification ID: 50441

- Numbers are correctly used when working with problems in workplace, national and global contexts.
- Space shape and orientation calculations are correctly performed to solve problems in workplace, national and global contexts.
- Workplace based and national finances are recognised and dealt with in a responsible manner.
- Patterns and relationships are identified and used in varying quantities in workplace, national and global contexts.
- Collected and organised data obtained from numbers, tables and graphs are critically engaged with and communicated.

3 ASSESSMENT REQUIREMENTS

Information provided in this document on internal and external assessment aims to inform, assist and guide a lecturer to effectively plan the teaching of the subject.

The *Assessment Guidelines for Mathematical Literacy Level 4,* which compliments this document, provides detailed information to plan and conduct internal and external assessments and suggested mark allocations.

3.2 Internal assessment (25 percent)

Detailed information regarding internal assessment and moderation is outlined in the current ICASS Guideline document provided by the DHET

Proposed distribution of internal assessment components

3.2 External assessment (75 percent)

A National Examination is conducted in October or November each year by means of a paper(s) set and moderated externally.

Detailed information regarding external assessment and moderation is outlined in the *National Policy on the Conduct, Administration and Management of the Assessment of the National Certificate Vocational Gazette number 30287 dated 12 September 2007.*

4 WEIGHTED VALUES OF TOPICS

TOPICS	WEIGHTED VALUE	*TEACHING HOURS
1. Numbers	20	20
2. Space, Shape and Orientation	20	25
3. Finance	20	30
4. Patterns, Relationships and Representations	20	15
5. Data Handling	20	20
TOTAL	**100**	**110**

**Teaching Hours* refer to the minimum hours required for face to face instruction and teaching. This number excludes time spent on revision, test series and internal and external examination/assessment. The number of the allocated teaching hours is influenced by the topic weighting, complexity of the subject content and the duration of the academic year.

5 CALCULATION OF THE FINAL MARK

Continuous assessment: X/100 x 25/1 = a mark out of 25 (a)

Examination mark: X/100 x 75/1= a mark out of 75 (b)

Final mark: (a) + (b) = a mark out of 100

All marks are systematically processed and accurately recorded to be available as hard copy evidence for, amongst others, moderation and verification purposes.

6 PASS REQUIREMENTS

The student must obtain a minimum of 30 percent in Mathematical Literacy. A pass will be condoned at 25 percent if it is the only subject preventing the student from passing Level 4.

7 SUBJECT AND LEARNING OUTCOMES

On completion of Mathematical Literacy Level 4, the student should have covered the following topics:

Topic 1: Numbers

Topic 2: Space, Shape and Orientation

Topic 3: Finance

Topic 4: Patterns, Relationships and Representations

Topic 5: Data Handling

Topic 1: Numbers

(Minimum of 20 hours face to face teaching which excludes time for revision, test series and internal and external examination)

Subject Outcome 1.1: Use numbers correctly when working with problems in the workplace and other areas of responsibility including national/global issues.

Learning Outcomes:

Students are able to:

- Revise numbers with the focus on activities to recognise and practically illustrate the use of different numbers.
  - Natural numbers
  - Whole numbers
  - Positive and negative numbers
  - Fractions
  - Decimals
  - Percentages
- Round off numbers (round up, down and off) according to the requirements of the context
- Investigate the possible effect of rounding values within a calculation on the final calculated answer.

  Example: When working with a scale of 1:20 000 000 on a map one mm error in measurement will result in an inaccuracy of 20 km.
- Apply addition and multiplication facts (distributive, associative properties, priority of operations) to simplify calculations where possible and useful.

  NOTE: BODMAS may be used

SO 1.2: Use an appropriate calculator to perform calculations and solve problems in a workplace and other areas of responsibility including national/global issues.

Learning Outcomes:

Students are able to:

- Recognise and practice the use of the following functions and characters on an appropriate calculator:
  - Addition
  - Subtraction
  - Multiplication and division
  - Percentages
  - Squares
  - Cubes
  - Square root
  - Cube root
  - Memory
  - "Clear" and "clear all" keys
  - Decimal signs
  - Separators
- Perform calculations with a calculator using positive and negative numbers.

  Range: Addition, subtraction, multiplication and division
- Use a calculator to perform the following calculations on fractions:
  - Addition, subtraction, multiplication, division.
  - Conversion from fractions to decimals.
  - Conversion from fractions to percentages.
  - Conversion between equivalent forms of fractions

    Note: Fractions include proper, improper fractions and mixed numbers.

    Examples used in problems include but are not limited to the following:

$\frac{1}{2}; \frac{1}{4}; \frac{3}{4}; \frac{1}{3}; \frac{2}{3}; \frac{1}{10}; \frac{1}{100}; 1\frac{1}{2}; \frac{7}{5}$; 4%; (0,04)

- Use a calculator to perform the following calculations on decimals:
  - Addition, subtraction, multiplication, division, squares, square roots, cube and cube roots.
  - Conversion from decimals to fractions.
  - Conversions from decimals to percentages
- Use a calculator to perform the following calculations on percentages:
  - Addition, subtraction, multiplication, division.
  - Conversion from percentages to decimals.
  - Conversion from percentages to fractions
- Perform calculations and conversions involving the following:
  - time values expressed and/or recorded on watches, clocks and stopwatches related to a workplace;
  - time values expressed in the different formats:
    - time of day formats (*e.g. 8 o'clock, 8:00 am, 8:00 pm, 20:00*)
    - time recording formats (*e.g. 1 h 12 min 20 sec*)
  - elapsed time

    Example: amount of time passed from Monday 8:35 pm to Wednesday 9:27 am, the difference in time between 1 h 23 min 12 seconds and 1 h 39 min 4 seconds.
  - calendars showing days, weeks and months;
  - transport timetables

    Example bus, train, taxi;
  - production timetables

    Example constructing a house, manufacturing a product
  - tide tables
- Perform conversions using known relationships for the following:
  - Distance: mm - cm - m - km;
  - Volume/Capacity: ml - l - kl;
  - Mass: mg - g - kg - t;
  - Time: seconds – minutes – hours - minutes
- Convert units of measurement using **given** conversion factors and/or tables for the following:
  - Cooking conversions:

    Example: Convert from spoons and cups to millilitres (ml).
  - Metric and imperial system conversions:

    Example: Convert from inches and feet to centimetres and metres and vice versa
  - Solid and liquid conversions:

    Example: *g and/or kg to ml and/or litre*
    - *between mm^3, cm^3 and m^3 to ml, litres and kilo litres; (Limited to examples of water as a liquid only)*
  - Area and volume conversions:

    Example: → between mm^2, cm^2 and m^2

    → between mm^3, cm^3 and m^3
  - Temperature conversions:

Example: Convert between °Celsius and °Fahrenheit using the following given formulae:

$$°F = (°C \times 1{,}8) + 32°$$
$$°C = (°F - 32°) \div 1{,}8$$

Subject Outcome 1.3: Solve problems in a workplace and other areas of responsibility including national/global issues.

Learning Outcomes:

Students are able to:

- Solve problems in different time notations.

  Range: Elapsed time, total hours worked per day, per week and per month.
- Solve problems involving different time zones across continents.
- Perform calculations involving ratios:
  - Equivalent ratios/simplifying ratios

    Example 1:50 = 2:100
  - Convert between different forms of a ratio

    Example: If the scale of a plan is 1:100 then 1 cm measured on the plan equals

    1 metre (100cm) in actual length
  - Divide or share an amount in a given ratio

    Example: How many ml of tint and peroxide will a hairdresser need to make a 100ml mixture if the tint and peroxide is mixed in a ratio 2:3?
  - Determine missing numbers in a ratio

    Example: If cement, sand and stone must be mixed in the ratio 1:2:2, how many wheel barrows of sand and stone must be mixed to make 40 wheel barrows of cement?
- Perform calculations involving the following proportions:
  - Direct/linear proportion

    Example1: If the cost of a trip is R5,00 per km, a 85 km trip will cost R5,00/km x 85 km = R425,00
    Example 2: If 50m^2 of carpeting costs R1 750,00, then 1m^2 of carpeting will cost R1 750,00 ÷ 50 = R35,00.
  - Indirect/inverse proportion

    Example: A soccer season ticket costs R800,00. If you watch only one game during the season, the cost per game is R800,00; for two games the effective cost per game is R400,00 and further reduces as the number of games watched increases.

    Note: Interpretation of graphs representing situations involving direct and inverse proportion and the illustration of the differences between the two types of proportion will be covered in the Topic 4 "Patterns, relationships and representations".
- Perform calculations involving the following rates:
  - consumption rates, e.g. kilometres per litre;
  - distance, time, speed rates e.g.: kilometres per hour;
  - cost rates e.g. rand per kilogram.
  - more complex rates *(e.g. the petrol consumption of a car expressed in litres/100km; the running speed of a marathon runner measured in min/km* with an awareness of:
    - the meaning of "/" as "per" and the relevance of this term in relation to the values in the rate (e.g. km/h means the distance in km travelled in 1 hour);

  - the difference between constant and average rates (e.g. the price of meat in R/kg is a constant rate while the speed of a car in km/h is an average rate;
  - how to write rates in unit form;
  - how to simplify and compare rates (e.g. is it more cost effective to buy a 1 kg tin of coffee that costs R67,00 or a 250 g tin that costs R18,00?

- Perform calculations to determine the benefits of buying in bulk and buying different sizes to select an appropriate option
  Example 1: buying in bulk versus buying per unit; 100 cold drinks vs. 1 cold drink.
  Example 2: Buying different sizes of a product; 500ml of milk vs. 2 litres of milk
- Solve problems using percentages:
  - Calculate a percentage of a value
    Example: If 15% discount is offered on a computer priced at R5000,00, VAT exclusive, how much discount will you receive on the VAT inclusive price?
  - Decrease and increase a value by a percentage.
    Example: If a litre of petrol that costs R9,20 increases in price by 7%, what will the new price of the petrol be?
  - Express a part of a whole as a percentage.
    Example: If 15 staff members of a certain company are absent from work, what percentage of the 135 staff employees were present?
  - Determine percentage increase and/or decrease.
    Example: If a person's salary is increased from R8500,00 to R8750,00 calculate the percentage increase.
  - Determine the original value from a value to which a percentage has been added or subtracted.
    Example 1: If the price of a pair of shoes after a discount of 15% is R212,50, what was the original price of the shoes?
    Example 2: VAT inclusive and VAT exclusive percentages

Topic 2: Space, Shape and Orientation

(Minimum of 25 hours face to face teaching which excludes time for revision, test series and internal and external examination)

Subject Outcome 2.1 Revise and acquire the correct vocabulary for space, shape and orientation.

Learning Outcomes:

Students are able to:

- Recognise and identify the following:
  - Shape: square; rectangle; triangle; circle; semi- circle
  - Space: cube; rectangular prism; triangular prism; cone; cylinder; sphere.
  - Attributes: length; breadth; height; side; base; perimeter; diagonal; area; angle; center; radius; diameter; circumference; volume; perpendicular; height; parallel lines.
    Note: The vocabulary listed should be assessed in the context of problems and not as dictionary definitions.

Subject Outcome 2.2 Perform space, shape and orientation calculations correctly to solve problems in workplace and other areas of responsibility including national/global issues.

Learning Outcomes:

Students are able to:

- Use the Theorem of Pythagoras to determine the length of the hypotenuse.
- Manipulate and apply the Theorem of Pythagoras to determine the lengths of the right angled sides of a right angled triangle.
- Use **given** formulae to calculate the following using appropriate conversions and rounding off.
  Note: Use π as 3,14.
  - Perimeter/Circumference: square; rectangle; triangle; circle.
    Example: Determine the quantity of fencing needed to fence the garden.
  - Area: square; rectangle; triangle; circle; semi-circle and other objects that can be decomposed into squares, rectangles, triangles and circles.
    Example: investigating the number and cost of the tiles needed to tile a floor, taking into consideration the space for grouting between the tiles and cut tiles;
  - Surface Area: cube, rectangular prism, triangular prism, cone, sphere and cylinder.
  - Volume: cube; rectangular prism; cylinder; sphere and other objects that can be decomposed into rectangular prisms, spheres and cylinders.
    Example 1: Determining the water that can be harvested using the roof of a house;
    Example 2: Investigating the size of a dam needed to service a village based on the number of people living in the village, each person's water usage and/or requirements, and data on the annual rainfall in the area.
- Manipulate given formulae to calculate the unknown values when the perimeter/circumference, area and volume of the following shapes are given:
  - square;
  - rectangle;
  - triangle;
  - circle;
  - semi-circle;
  - cube;
  - rectangular prism;
  - triangular prism;
  - cylinder;
  - sphere;
  - cone

Note: Manipulation of formulae for total surface area is not included.

Subject Outcome 2.3: Read, interpret and use representations to make sense of and solve problems in workplace and other areas of responsibility including national/global issues.

Learning Outcomes:

Students are able to:

- Use a given scale on a plan and/or map where the measurements are known to calculate actual length and distance.
- Calculate map and/ or plan measurements when actual lengths and distance are known using a given scale.
- Determine the scale of a map/plan or model derived from given information.

Example: If 1 cm on a map represents an actual distance of 10 km, determine the scale of the map.

- Use road, street and route maps (buses and trains) (taking into account the scale of the map) to determine the following:
  - A specific location
  - The distance between two positions
  - Routes to travel from one destination to another
  - The shortest and/or fastest and /or most appropriate mode of transport for a planned trip.
- Plan trips subjected to constraints (e.g. financial, time and/or availability) by choosing the most appropriate route and modes of transport using maps, route maps, bus /train/taxi/flight timetables, tariff tables, exchange rates (if necessary) and the AA fixed, running and operating cost tables if necessary . *Note: This can be integrated with the Topics Number and/or Finance.*
- Use different plans (e.g. floor/layout and house plans, seating plans) to determine:
  - Actual lengths/dimensions of objects shown on plans using measurement and a given scale (number or bar scale)
  - Positions
  - Quantities of material needed in complex projects (e.g. determining quantities of materials needed to build an RDP house)
- Sequence activities to complete a task in the most cost and/or time effective manner (e.g. make a dress; build a building; move contents of a house/office) using plans and/or diagrams

Subject Outcome 2.4: Use physical and diagrammatic representations to investigate problems and/or illustrate solutions in workplace and other areas of responsibility including national/global issues

Learning Outcomes:
Students are able to:

- Use various packaging arrangements of objects (e.g. blocks, balls, cans and boxes) to determine the most appropriate way to package the objects for optimal usage of space.

  Examples: Should balls be packaged into a cylindrical or rectangular container?

  What is the best packaging shape to use for fragile and irregular-shaped objects like a television set?
- Determine the number and placement of furniture in a venue considering free space for movement.
- Critique aspects of the lay-out and/or design of a structure and make suggestions for alterations.
- Build or draw diagrams of 3D scale models of objects from 2D plans (nets) of the object to visualise the object (e.g. build a model of a house from its plan).

Topic 3: Finance
(A minimum of 30 hours face to face teaching which excludes time for revision, test series and internal and external examination)

3.1 Manage finances with confidence in workplace and other areas of responsibility including national/global issues.

Learning Outcomes:

- Recognise financial concepts related to business environments:

- Net income/pay/salary
- Taxable income
- Tax rates and tax brackets
- PAYE
- SITE
- UIF
- Gross income/pay/salary
- Deductions from income/pay/salary
- income tax, pension fund, medical aid membership fees, retirement annuity;

- Recognise financing concepts and methods related to business environments:
  - Loans, bonds, overdrafts, credit cards
  - Interest rates
  - Repayment amounts and periods
  - Hire purchase when buying vehicles (car, delivery truck/van) & residual value, real cost or total cost
  - Buying land/property and buildings
  - Trading on the stock market

  Note: Contexts are limited to those that deal with workplace, business, national and global finance and more complex financial scenarios.

  Examples of contexts in which national, global and more complex financial scenarios to be explored
- Identify documents relating to more complex financial environments including national and global situations:
  - Orders, quotations and invoices
  - Travel allowance and claim documentation
  - Cash flow, budgets and financial statements (income & expenditure statements and balance sheets)
  - Tax forms (e.g. tax deduction and tax rate tables, IRP 5 forms, employee income tax forms);
  - "Tax Pocket Guide" issued by SARS;
  - Loan documentation, including:
    - Agreements stating loan conditions (e.g. term, of the loan, interest rate, repayment periods);
    - Statements from banks and other loan institutions showing changes in a loan agreement (e.g. interest rate and monthly repayment changes).
  - Inflation data and graphs;
- Identify and list typical receipts, funding and income in a local national or global business:
  - Services rendered and /or sales of retail and/or manufactured goods
  - Interest received on savings and investments
  - Donations and sponsorships received
  - Rent received/ rent income
  - Loans received
  - Income from taxes (only in local and national governments)

- Identify and list typical payments and expenses in a local, national or global business:
  - Loan repayments
  - Running/operating expenses e.g. Monthly rent, electricity & water, telephone& cell phone; internet access, fees payable, e.g. bank fees, payments to local and national governments/municipalities
  - Insurance premiums e.g. vehicles/fleet owned by company, stock carried by company; import/export risks
- Draw two graphs on a system of axes indicating the total income and total costs in a business environment to illustrate and read break-even values either in units sold or in total income.

Note: Break-even point can always be expressed in two values, namely the number of items sold and the total income from sales. Determination of break-even values through algebraic calculations are excluded (i.e. solving equations simultaneously)

Note: Break-even values are used in order to make sense of:

- *investigation of the break-even values for a business with consideration of cost price, selling price, income and expenditure values*
- *situations involving an investigation of the values for which two or more different costing options are equal (e.g. different electricity or cell phone costing options).*

- Draw up a projected plan/budget/cash flow forecast for a business based on expected income and expenditure.

  Example: An annual/quarterly monthly budget/plan to show what is the expected income and turnover for a business

- Compare the projected values in the budget/cash flow forecast with the actual values recorded in the income and expenditure statements to identify and calculate variances for businesses

  Examples:

  A comparison of income/expenditure/profit values over two years;

  Budgets showing a comparison of projected versus actual income, expenditure and profit/loss values.

- Identify and explain possible causes for variances between actual and projected figures

  Note: Simulated examples can be used.

- Provide possible corrective methods of financial control and consider the importance of cutting on expenses and increasing income to provide for occasional future business expenses.
  Note: Limited to classroom discussions

Subject Outcome 3.2: Read, interpret and act on information regarding taxation and financial documents in workplace and other areas of responsibility including national/global issues

Learning Outcomes:

Students are to revise:

- VAT and the current VAT rate.
- The difference between a VAT "inclusive" value and a value "excluding" VAT.
- Calculation of the final price by adding 14% VAT to a price excluding VAT.
- Calculation of the amount of VAT that has been added to a VAT "inclusive" price.

  Note: The following methods may be used for calculations of VAT:

  - *Dividing the VAT "inclusive" value by 1,14*
  - *Identifying the VAT "inclusive" as being 114% and working out the "value excluding VAT" as 100%*

- Read and interpret a pay slip of an employee in a business to conclude on the following:
  - Calculation and deduction of UIF on the payslip
  - Amount of personal income tax deducted on the pay slip according to tax deduction tables and tax brackets
  - Verify the amount of income tax deducted on the pay slip according to tax deduction tables and tax brackets on the payslip
- Reflect on the impact of an increase in salary on the amount of tax payable

Subject Outcome 3.3: Perform calculations correctly to solve problems regarding interest in workplace and other areas of responsibility including national/global issues.

Learning Outcomes:

Students are able to:

- Perform simple and compound interest calculations without the use of formulae (manually) using a basic calculator, pen and paper, and/or spreadsheets
- Interpret and use tables showing compounded values

  Note: students are not expected to work with formulae. Rather, the focus is on developing an understanding of the concept of a compounding calculation, e.g. where the values used in a calculation draw on answers/values from a previous calculation.
- Make sense of graphs showing loan/bond and investment scenarios:
  - Investigate the effect of changes in the interest rate on the cost of a loan/bond
  - Investigate the effect of changes in the interest rate on the final/projected value of an investment.
  - Investigate the effect of changes in the monthly repayment amount on the real cost of a loan/bond

    Note: Cost saving effects of paying off a loan/bond in a shorter period of time.
- Investigate the effect of changes in the monthly investment amount on the value of the final investment.

  Note: Use a table or spreadsheets to construct a model of a loan scenario; investigate the impact of increasing monthly repayments on the real cost of the loan or investigate the impact of changes in the interest rate on the loan.

Subject Outcome 3.4: Apply tariff systems in a workplace and other areas of responsibility including national/global issues.

Learning Outcomes:

Students are able to:

- Investigate the following tariff systems:
  - Telephone tariffs (e.g. cell phone and land/fixed line)
  - Transport tariffs (e.g. bus, taxi and train tariffs)
  - Municipal tariffs (e.g. electricity, water, sewage, refuse removal)
  - Bank fees for different bank accounts
  - Rental options, e.g. hiring of a photocopier rather than buying one
- Calculate the cost and compare two or more different options available for different system from scenarios, time tables and brochures.
- Draw graphs to represent the different options of costs, indicating the intersections and interpret the graphs

Subject Outcome 3.5: Investigate, explain and graphically represent inflation

Learning Outcomes:

Students are able to:

- Revise the concept and explanation of *inflation.*
- Compare the national inflation rates over a period of time (two to three years)
- Explain the impact of fluctuating national inflation rates on a business as an external factor. (CPIX)

  Example:

  Explain the impact of inflation on a business in the following scenario:

***Purchasing power**, e.g. M&M Incorporated spends an average of R195000 on stock purchases in a financial year. If the purchasing price for stock items increases at the rate of inflation, 6%, what effect would this have on the purchasing power of the business?*

***Costing:** What effect will it have on the cost price of stock items in the business?*

***Profitability:** What can the business do to ensure the profit is not negatively influenced?*

Topic 4: Patterns, Relationships and Representations

(A minimum of 15 hours face to face teaching which excludes time for revision, test series and internal and external examination)

Subject Outcome 4.1: Identify relationships and complete patterns to solve problems in workplace context.

Learning Outcomes:

Students are able to:

- Describe features of patterns and/or relationships in words including the following:
  - Dependent and independent variables
  - Direct/linear and indirect/inverse proportion
  - Increasing and/or decreasing relationships

    Example: Consider a cell phone contract where the cost of talking on the phone is R1,50 per minute. In this scenario, cost is dependent on the amount of time spent talking on the cell phone; also, the relationship between cost and talk time is an increasing relationship, with cost increasing at a fixed rate of R1,50 per minute
- Use given information to establish a specific pattern

  Patterns include:
  - Constant difference patterns (arithmetic progressions) e.g. the cost of a number of items;
  - Constant ratio patterns (geometric progressions) e.g. fixed deposit bank account with a fixed interest rate;
  - Patterns associated with inverse and direct proportion relationships.
  - Situations in which there is no mathematical relationship between the independent and dependent variable but in which a trend can be identified.

    Example: Number of products sold at different prices against income received

- Use a range of techniques to determine missing and/or additional terms in a pattern, including:
  - the relationship between consecutive terms;
  - the formulae provided for calculations

  Example: The following table shows the cost of fuel. There are two ways to determine the pattern in the values in the following table:

Litres	0	1	2	3	4
Cost	R0,00	R8,00	R16,00	.....	.....

Method 1:

The difference between consecutive cost values is R8,00.To find the cost of buying 3 litres of petrol you can add R8,00 to the cost of buying 2 litres (i.e. R16,00) to get R16,00 + R8,00 = R24,00

Method 2:

The relationship between litres of petrol and cost is R8,00 per litre of petrol. The cost of filing a car with 3 litres of petrol is R8,00/ℓ × 3 ℓ = R24,00.

- Derive own formula from written content (not necessarily containing numbers)
  Note: Limited to linear equations
  Example:

  A taxi driver charges a fixed cost of R12,00 plus R10,00 for every kilometre travelled. Write a formula in words and in symbols to represent the cost.

- Construct patterns from given formulae and represent these patterns in a table.

  Example:

  A quotation states that the cost of hiring a photocopier is R1 500,00 per month and an additional R0,50 per copy.

  The following table can be constructed to represent the relationship between number of copies and cost.

Pages photocopied	*0*	*10*	*20*
Total monthly cost	*R1500*	*R1505*	*R1510*

- Identify and extend numerical patterns arising from formula.

  Example:
  The following formula can be used to determine the cost per day for a business selling products:
  Cost per day = [daily rent + (number of products x cost per product)]
  Use the formula to construct a table indicating how the cost varies as the number of products increases.
  Cost per product = R 50,00
  Daily rent = R150 per day

Number of products	0	1	5	10	....
Total cost per day	R150,00	R 200,00	R 400,00	R 650,00	.....

Subject Outcome 4.2: Move between different representations of relationships in workplace contexts.

Learning Outcomes:

Students are able to:

- Move between representations of relationships as follows:
  - complete a table of values by reading values from the graph;
  - complete a table of values from given formulae and/or descriptions of relationships.
- Draw graphs of one or two relationships on a system of axes by:
  - plotting points from a given table of values
  - plotting points from values calculated using given equations;
  - constructing axes with an appropriate scale chosen for both the vertical and horizontal axes
  - labeling the vertical and horizontal axes and the graph appropriately;

- Identify and distinguish between dependent and independent variables.
- Identify and select the following information when working with relationships represented in tables, equations, graphs and formulae:
  - dependent variables for given independent variables
  - independent variables for given dependent variables
- Describe relationships represented in tables and/or graphs for:
  - Direct/Linear relationships.
  - Indirect/inverse relationships.
- Use formulae supplied to determine:
- The value of the dependent variable for given value(s) of the independent variable using substitution
- The value of the independent variable for given value(s) of the dependent variable using simple algebraic manipulation to solve only linear equations.

Topic 5: Data Handling

(A minimum of 20 hours face to face teaching which excludes time for revision, test series and internal and external examination)

The philosophy underlying this topic is to develop the ability in students to critically engage with and communicate data. Some experience in collecting, organising and interpreting data is required. However the focus should be on interpreting information rather than gathering and/or generating it.

To develop a healthy and critical approach towards arguments based on data, students should be aware that data can be represented and interpreted (and misrepresented) in different ways.

Subject Outcome 5.1: Collect and organise data to answer questions in a workplace based context.

Learning Outcomes:

Students are able to:

- Describe key concepts relating to information/data collection and handling:

  Range: research question, population, target and sample population, survey, questionnaire, tally, bias/subjectivity, reliability of information, sample size, interview, observation, misrepresentation, outlier.
  Note: Examples of data relating to the workplace may be:
  - *sales figures for a business;*
  - *profile of shoppers at a shopping centre;*
  - *vehicle statistics (as an indication of income level) of shoppers at a shopping centre;*
  - *price history data for grocery items;*
  - *data on toilet, water and electricity facilities for a shopping centre*
- Investigate how data has been collected, organised, summarised and represented to reveal possible sources of error/bias, misrepresentation or misinterpretation.

  Students should ask questions about:
  - *The size of the sample*
  - *The representivity of the sample*
  - *The methods used for collecting data*
  - *The neutrality of the data collection process*
  - *The way in which the data was sorted and/or grouped*

- *The sizes of the groups used in grouping the data*
- *The range (spread) of the data and what it says about the data*
- *Whether the data collected was fact or opinion*

- Develop a set of questions to obtain two sets of data.

  Note: Keep in mind that the way in which questions are phrased can impact on the data collected and the outcome/findings of the investigation.
- Justify the use of an appropriate instrument for collecting data.
  Instruments include:
  -Observation
  -Interview
  -Questionnaire/survey
  Note: Consider the following when selecting an appropriate instrument:
  - *The advantages and disadvantages of each instrument.*
  - *The selection of a representative sample from a population.*
  - *The impact of the choice of sample on the reliability of the data collected.*
- Organise data restricted to two categories using tally and frequency tables (e.g. sort data of employees according to gender and age)
- Group data using intervals (e.g. it is often appropriate to group age groups test scores in the mark intervals “18-28”, “29-39”, etc.)

Subject Outcome 5.2: Represent and interpret given data in various forms in workplace contexts.

Learning Outcomes:

Students are able to:

- Arrange two sets of collected data to calculate the following measures of central tendency and spread: *(keeping in mind that the choice of summary affects the answer to the question.)*
  - mean
  - median
  - mode
  - range
- Interpret the calculated or given measures of central tendency and select the preferred answer most suitable/appropriate to the situation.
- Represent two sets of collected data using:
  - vertical and horizontal bar graphs
  - histograms
  - compound/double bar graphs
  - vertical and horizontal stacked bar graphs
  - line and broken line graphs

  Note:

  Realise that each type of representation offers a different picture of the data and certain types of representations are more appropriate for particular types of data e.g. Although it would be possible to use a pie chart to show the monthly rainfall in a town, it would be difficult to identify trends in the rainfall pattern from this chart. A bar graph and especially a line graph would allow for a much more in-depth analysis of the trends in the rainfall data.

Students *are not expected to draw pie charts in an examination. Rather, they must be able to interpret and read values from a pie chart and, if necessary, explain how the sizes of the different segments of a pie chart have been determined.*

- Read and critically interpret data from representations (i.e. pie charts, vertical and horizontal bar graphs, histograms, compound/double bar graphs, vertical and horizontal stacked bar graphs, line and broken line graphs) containing data in order to answer questions relating to the data.

- Identify trends and draw conclusions from data represented in graphs and tables.
- Recognise how the choice of representation affects the impressions created and conclusion(s) that can be drawn.
  Note: Realise the effect that the scale of the axes and the point at which the axes cross have on the impression created.

Subject Outcome 5.3: Interpret the implications of the expressions of likelihood in workplace context.

Note: The expression" likelihood" is also known as " chance" and/or more formally as "probability"

Learning Outcomes:

Students are able to:

- Recognise the difference between the following terms:
  - Event
  - Outcome/result
  - Random and non-random events
  - Probability/likelihood
  - Probability scale
  - Independent and dependent events
  - Predictions
  - Theoretical probability
  - Experimental probability

  Note: Explore likelihood in scenarios involving the following:
  - *Games using coins and a dice;*
  - *Weather predictions*
  - *Tests where there is a chance of inaccurate results;*
  - *Cosmetic and other products making statements regarding likelihood.*
- Recognise that likelihood is expressed as a scale that ranges between:
  - 0 (events that cannot take place – impossible events); and
  - 1 or 100% (events certain to take place)
- Recognise that the likelihood of an event is expressed using fractions, percentages and decimal notations.
- Recognise that expressions of likelihood are only predictions about the outcome of an event.
  Example: Although there is always a chance that someone may win a lottery, this does not mean that there will always be a winner every time the lottery is played

- Recognise that expressions of likelihood are predictions about the future based on events of the past.
  Example: Car insurance rates for people between the ages of 18 and 25 years are generally higher than those for people between the ages of 30 and 55 years. This is because historically there have been more motor vehicle accidents involving 18 to 25 year olds than 30 to 55 year olds.

- Recognise that expressions of likelihood can only predict the trend of an outcome over a long period of time (for a very large number of trials) and cannot accurately predict the outcome of single events.
  Example: Even though people aged 18 to 25 years are deemed more likely to be involved in a motor vehicle accident than any other age group, this does not necessarily mean that it is not possible that another age group might experience a higher number of crashes during the course of a year. However, based on trends in the past, it is more likely that people aged 18 to 25 years will be involved in an accident.

8 RESOURCE NEEDS FOR TEACHING MATHEMATICAL LITERACY – LEVEL 4

- ***Physical resources:***
  - Black board or white board
  - Overhead projector
  - Desks and tables for students
- ***Media:***
  - Daily newspapers
  - Magazines
- ***Human resources:***
  Lecturers should have:
  - relevant diploma or degree or equivalent recognised qualification and appropriate teaching experience to teach Mathematical Literacy Level 4;
  - interest and understanding of the field in which presenting Mathematical Literacy e.g. hair care; agriculture; business management; and
  - enthusiasm for Mathematical Literacy.
- ***Other resources (consumables, individual tools/equipment requirements, learning materials/resources)***
  - Basic calculators, rulers and measuring tapes
  - Measuring jugs, scales and scissors
  - Compass, stopwatch and clock and graph paper
  - Glue and string, elastic bands and paper clips
  - National, regional and local road maps (world map for tourism)
  - Timetables for trains, busses, aeroplane, etc.
  - Tournament logs and results, recipe books, banking brochures, etc.
  - Municipal tariff tables and municipal utility account statements
  - Nutritional panels from food packages and sales brochures offering different options
  - Articles and advertisements from the media that are supported by graphs and tables, advertisements from the media that refers to percentage and interest rate, textbooks, etc.
  - Manuals and or brochures to assemble a product
  - Files for Portfolio of Evidence (PoE) of each student.