



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

SUBJECT GUIDELINES

MATHEMATICAL LITERACY

NQF LEVEL 2

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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 numericallybased 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 everydaylife, work, societal and lifelong learning contexts by engaging with mathematical concepts (numbers and measurements; patterns and relationships; finances; space, shape and orientation; and data and likelihood) presented in a wide range of different ways.

B. Why is Mathematical Literacy important as a Fundamental?

In order to be a more effective self-managing individuals, contributing workers, life-long learners and critical citizens in the modern world, people need to be able to engage with numbers and numericallybased 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 with numbers with confidence.
- Interpret financial information and manage personal 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 evaluatively.
- Accuracy when analysing, calculating and recording will be an attribute.

MATHEMATICAL LITERACY – LEVEL 2

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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 FOCUS

By becoming mathematically literate, students will be equipped with the knowledge and skills required to be more effective self-managing individuals, contributing workers, lifelong learners and critical citizens in the modern world – a world characterised by numbers and numerically based arguments and data represented (and misrepresented) in a large variety of ways.

3 ASSESSMENT REQUIREMENTS

3.1 Internal assessment (25 percent)

All internal assessments must be finalised by an assessor who has been certified as competent.

3.1.1 Theoretical component – 100% – assessment tasks in Mathematical Literacy will be contextually based.

3.1.2 Practical component – not applicable

3.1.3 Processing of internal assessment mark for the year

A year mark out of 100 is calculated by adding the marks of the internal continuous assessment.

3.1.4 Moderation of internal assessment mark

Internal assessment is subjected to internal and external moderation procedures as set out in the *National Examinations Policy for Further Education and Training College Programmes*.

3.2 External assessment (75 percent)

A National Examination is conducted in October or November each year by means of a paper(s) set externally and marked internally. At Level 2 and 3, the examination is moderated internally and at Level 4, the examination is moderated externally.

External assessment details are explained in *Assessment Guideline: Mathematical Literacy (Level 2)*.

4 WEIGHTED VALUES OF TOPICS

TOPICS	WEIGHTED VALUE
1. Numbers	20
2. Patterns and Relationships	20
3. Finance	20
4. Space, Shape and Orientation	20
5. Information Communicated Through Numbers, Graphs and Tables	20
TOTAL	100

5 CALCULATION OF THE FINAL MARK

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

6 PASS REQUIREMENTS

The student is required to obtain at least thirty (30) percent to pass the subject.

7 SUBJECT AND LEARNING OUTCOMES

On completion of Mathematical Literacy Level 2, the student should have covered the following topics:

Topic 1: Numbers

Topic 2: Patterns and Relationships

Topic 3: Finance

Topic 4: Space, Shape and Orientation

Topic 5: Information Communicated Through Numbers, Graphs and Tables

7.1 Topic 1: Numbers

Subject Outcome: Use numbers correctly when working with problems in personal and familiar contexts.

Assessment Standard: Numbers are used appropriately in context.

Students should be able to:

- Use numbers to count, order and estimate.
- Use positive and negative numbers as directional indicators.
- Use fractions, decimals and percentages as measures of parts of a whole.

Assessment Standard: Fractions, decimals and percentages are compared in terms of size and used in estimation.

Note: The fractions used in problems should be limited to those fractions that arise naturally in the context of the student – it is anticipated that these will include: $\frac{1}{2}; \frac{1}{4}; \frac{3}{4}; \frac{1}{3}; \frac{2}{3}; \frac{1}{10}; \frac{1}{100}$.

Assessment Standard: Find decimal equivalents of any fraction using a calculator.

Students should be able to:

- Convert between decimal fractions and percentages.

Assessment Standard: Different time notations are compared and understood.

Students should be able to:

- Write time using conventions: am/pm; 24 hour clock; analogue and digital.
- Convert between different time notations.

Subject Outcome: Perform calculations correctly to solve problems in personal and familiar contexts.

Assessment Standard: Calculations are performed correctly and with confidence.

Students should be able to:

- Perform calculations correctly by means of paper, mental and calculator methods.
- Round numbers (round up, down and off) according to the requirements of the context.
- Apply addition and multiplication facts (distributive and associative properties) to simplify calculations where possible and useful.
- Estimate to anticipate answers and evaluate the result of a calculation and measurement.
- Estimate unknowns as necessary to solve problems.
- Use the following functions on a basic calculator: addition; subtraction; multiplication and division; percentage; memory; and “clear” and “clear all” keys.

Assessment Standard: Problems dealing with ratio/proportion and rate and percentage are solved.

Students should be able to:

- Solve problems that involve ratio/proportion (linear and inverse) and rate and percentage.

Subject Outcome: Identify and use appropriate measuring tools and techniques to solve problems in personal and familiar contexts.

Assessment Standard: Measuring instruments are selected and used to make direct measurements of length; weight; volume/capacity, temperature; and time intervals to levels of precision appropriate to the context.

Students should be able to:

- Estimate anticipated measurements where possible based on a sense or "feel" for different dimensions (i.e. have a "feel" of dimensions in relation to common objects).
Instruments include ruler and measuring tape; scale; measuring jugs and cups; thermometer; and watch and stopwatch.

Assessment Standard: Correct formulae are selected and used to calculate measurements and solve problems.

Students should be able to:

- Calculate the following measurements using formulae as necessary:
 - Area: rectangle; triangle; circle
 - Volume: rectangular prisms; cylinders
 - Time: elapsed time
 - Distance (using scale) and direction: report the solution with a number of decimal places and in units appropriate to the problem
- Calculate indirect measurements from information available.

Assessment Standard: Conversion between units is performed as needed.

Students should be able to:

- Perform conversions using known relationships between: mm – cm – m – km; ml – l; g – kg – t; second – minute – hour – day.

Assessment Standard: Rates are appropriately applied and used to solve contextual problems.

Students should be able to:

- Calculate values using rates including:
 - conversion rates, e.g. grams to kilograms;
 - consumption rates, e.g. kilometres per litre;
 - distance, time, speed rates, e.g. kilometres per hour;
 - cost rates, e.g.: rand per kilogram.
- Determine rates from given values/relationships.

7.2 Topic 2: Patterns and Relationships

Subject Outcome: Identify and extend patterns for different relationships in personal and familiar contexts.

Assessment Standard: Numerical and geometric patterns are investigated and extended.

Students should be able to:

- Identify patterns which 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; and
 - Patterns associated with inverse and direct proportion relationships.
- Use both the relationship between consecutive terms and the relationship between the term's position and its value to find missing/additional terms in a pattern.

Assessment Standard: Patterns are described in words and through formulae.

Students should be able to:

- Describe patterns in words (spoken and written) and through algebraic descriptions of them (formulae).

Assessment Standard: Patterns are generated from descriptions of them.

Students should be able to:

- Generate numerical and geometric patterns from descriptions given in words (instructions) and formulae.

Subject Outcome: Identify and use information from different representations of relationships of patterns to solve problems in personal and familiar contexts.

Assessment Standard: Information is identified and selected from different representations of relationships to solve problems.

Students should be able to:

- Identify and select information including:
 - dependent variables for given independent variables; and
 - independent variables for given dependent variables from the following representations of relationships: tables, graphs and formulae and equations

Assessment Standard: Formulae are used with confidence.

Students should be able to:

- Use formulae supplied to determine dependent variables for given independent variables and determine independent variables for given dependent variables; by performing appropriate operations including: basic arithmetic operations, calculations with exponents, square and cube roots and solving equations.

Subject Outcome: Translate between different representations of relationships in personal and familiar contexts.

Assessment Standard: Representations of relationships are converted from one form to another to reveal features of patterns and relationships to solve problems.

Students should be able to:

- Translate between representations of relationships as follows:
 - Complete a table of values by reading values from the graph.
 - Complete a table of values for formulae and descriptions of relationship.
 - Plot a graph from the values in a table of values.

Assessment Standard: Representations of relationships are selected and developed to solve a problem and communicate or illustrate a result.

Students should be able to:

- Choose and develop a representation from among tables and graphs that most effectively communicates and illustrates a result or finding.

7.3 Topic 3: Finance

Subject Outcome: Manage finances with confidence in personal and familiar context.

Assessment Standard: Sources of personal income are identified, recorded and managed.

Students should be able to:

- Distinguish between fixed (salary; rental) income and variable (interest; commission; sales) income.
Sources of income include: salary, wages, commission and gifts or pocket money.
- Account for how or where income is kept (bank account; cash).
Sources of income are categorised as fixed/ or variable.
- Maintain records of income (e.g. recorded in a note book or filed).

Assessment Standard: Personal expenses are listed and managed.

Students should be able to:

- Distinguish between fixed expenses (repayments; rent) and variable or occasional expenses (services (electricity, water, sewerage); haircuts; entertainment; food). Expenses include:
 - living expenses (food; rental; clothing etc.);
 - accounts (services – water; electricity; etc.);
 - bank/loan repayments;
 - salary/wage deductions;
 - entertainment; and
 - savings.
- Understand the importance of saving for future or occasional expenses.
Expenses are categorised as fixed and variable.
- Maintain records of expenses (e.g. recorded in a note book or filed).

Assessment Standard: Personal finances are planned for and monitored.

Students should be able to:

- Develop and maintain income and expenditure statements.
- Develop budgets based on previous income and expenditure statements.
- Develop a budget for personal activities (e.g. ingredients for a recipe; materials for a DIY project; planning a trip or excursion).
- Explain variations between budgeted and actual income and expenditure.

Subject Outcome: Read, interpret and act on financial information presented in documents in a personal and familiar context.

Note: Documents include pay slip; cheque; receipt; bank statement and accounts.

Assessment Standard: Documents are read and appropriate information is identified and selected.

Students should be able to:

- Identify balance on a statement and distinguish between credit and debit. Identify the following:
 - income/credit and expenses/debit;
 - balance;
 - beneficiaries/recipients;
 - payments due; and
 - date/time period.
- Identify the minimum payment required on an account.
- Determine how much a particular bus, plane or train trip will cost.

Assessment Standard: Information from documents is selected and interpreted to answer questions relating to a context. Financial documents are completed.

Students should be able to:

- Analyse which transactions contribute most significantly to bank charges on a bank statement.
Documents include: cheques; withdrawal/deposit slips; other documents related to personal finance (e.g. account application forms).
- Calculate the credit available on an account.
- Distinguish between valid and stale cheques.
- Decide which taxi, bus, train or plane trip is most cost or time effective from rates and timetable brochures.

7.4 Topic 4: Space, Shape and Orientation

Subject Outcome: Use and apply the vocabulary of space, shape and orientation appropriately.

Assessment Standard: The vocabulary of space; shape and orientation is applied correctly.

Note: It is assumed that the knowledge listed in the Assessment Standards will be taught in an integrated way with the other Space, Shape and Orientation Subject Outcomes. The vocabulary listed should be assessed in the context of problems and not as dictionary definitions.

Students should be able to:

- Know and use the following vocabulary:
 - Space: block; rectangular prism; pyramid; cone; cylinder; sphere; cube; prism; base
 - Shape: rectangle; square; triangle; circle;
 - Attributes: length; breadth; height; side; perimeter; diagonal; area; angle; centre; radius; diameter; circumference; volume; perpendicular; parallel; scale; column; row; co-ordinates/grid reference; weight (mass);
 - Representation: grid; map; plan; scale drawing; diagram;
 - Time: 24 or 12 hour clocks and conventions.

Subject Outcome: Perform space, shape and orientation calculations correctly to solve problems in personal and familiar contexts.

Note: Space; shape and orientation provide a context for the attainment of the Subject Outcomes, Assessment Standards and Learning Outcomes of the calculations and measurement topic.

Assessment Standard: Space, shape and orientation calculations are performed to solve problems in personal contexts.

Students should be able to:

- Calculate the following with appropriate conversions and rounding (see Numbers):
 - Area: rectangle; triangle; circle
 - Volume: rectangular prisms; cylinders
 - Time: elapsed time
 - Distance (using scale) and direction.

Subject Outcome: Read, interpret and uses representations to make sense of and solve problems in personal and familiar contexts.

Assessment Standard: Information required is read from representations and used.

Students should be able to:

- Use maps (e.g. road maps) to determine:
 - location; and
 - distance between two positions using the scale of the map.
- Use plans (e.g. layout and house plans) to determine:
 - dimensions; and
 - positions.
- Use diagrams (e.g. assembly diagrams such as those found in manuals and brochures) to:
 - identify parts and objects; and
 - follow instructions.

Subject Outcome: Makes physical and diagrammatic representations to investigate problems and illustrate solutions in personal and familiar contexts

Note: In terms of investigation, physical representations – models – are made for two distinct reasons:

1. 3D-scale models made from 2D-diagrams or plans can help with the visualisation of the object – e.g. when designing buildings etc.
2. Scale models (including maps and diagrams) can help to investigate problems and develop solutions (e.g. how best to pack a container; how best to arrange furniture in a room; how to design space to accommodate particular furniture).

Modelling – the use of models to investigate problems – is an important skill and attribute of mathematically literate persons.

Assessment Standard: Diagrammatic and physical representations of shapes and objects are made to investigate problems.

Students should be able to:

- Make 2D scale cut outs of the top view of 3D objects to investigate packing problems (e.g. arranging furniture in a room).
- Make 3D scale models of objects from 2D plans of the object to visualise the object (e.g. make a model of a house from its plan).

Assessment Standard: Diagrammatical representations are used to illustrate solutions.

Students should be able to:

- Make rough sketches of objects and areas to make scale drawings (e.g. rough maps and plans).
- Make maps, plans and diagrams according to scale from rough sketches and/or objects.

7.5 Topic 5: Information Communicated Through Numbers, Graphs and Tables

Note: The philosophy that underlies this topic is to develop in individuals the ability to critically engage with information (communicated through numbers or graphs and tables) so they can be more effective, self-managing individuals; contributing workers; life-long students and critical citizens.

In order to understand how information (communicated through numbers/graphs and tables) is generated, individuals should have some experience with collecting, organising and interpreting information. However, it is not anticipated that individuals in their daily lives will regularly be involved in these processes and so the Subject Outcomes and Assessment Standards focus on interpreting information rather than gathering and generating it.

To develop a healthy cynicism toward arguments based on information (communicated through numbers or graphs and tables) individuals should be aware that information can be represented and interpreted (and misrepresented) in different ways.

Subject Outcome: Collect and organise information to answer questions in personal and familiar contexts.

Notes: Students should recognise that the method of information collection; the sample used, the method(s) used to summarise the information and the choice of representation will all influence the answer to the initial question.

Students should realise that collecting and comparing prices from a range of shops for a possible purchase is as much an information activity as conducting a census.

Assessment Standard: Information is collected to answer questions.
Students should be able to:

- Develop sets of questions for collecting information, aware that the way in which the questions are posed will influence the answer.
- Compile and use an information collection tool (e.g. survey; questionnaire; tally list) to collect information.
- Select appropriate samples from the population for collecting data – aware of the impact that the choice of sample will have on the information collected.

Assessment Standard: Collected information is organised, summarised and represented.

Students should be able to:

- Organise information using tables.
- Summarise information by calculating the mean, median and mode, aware of how the choice of summary statistic will affect the answer to the question.
- Represent information using tables; pie charts; bar graph; line and broken line graph as appropriate to the information collected, aware of how the choice of representation will affect the impression it creates.

Assessment Standard: Information represented in different ways is interpreted to answer questions.

Students should be able to:

- Use summarised and represented information to develop and substantiate answers to the questions that led to the collection of the information.

Subject Outcome: Critically interprets information presented (and misrepresented) in various forms in personal and familiar contexts.

Assessment Standard: Information represented through graphs, tables and statistics is read and interpreted.

Students should be able to:

- Read and select information from tables and graphs to answer questions.
- Correctly interpret the meaning of the following statistics in text: mean; median; mode.

Assessment Standard: Information represented through graphs, tables and statistics is critically analysed.

Students should be able to:

- Recognise how the choice of representation and statistic(s) affects the impressions created and conclusion(s) that can be drawn.

Notes: Students should know that pie charts reveal relationships between different characteristics of the information but do not reveal the population or sample size; bar graphs reveal the population or sample size but do not show the relationship as effectively; the choice of scale on the axes and the point at which the axes cross, etc. impact on the impression created by the graph; tables will often have more information than graphs but trends or patterns are less easy to observe.

- Ask questions about the information collection, organisation, summarising and representation processes to reveal sources of error, bias or misinterpretation.

Notes: Students should know to ask questions about which statistic was used in text that uses the word “average”; the range of the information; what was done with outliers in the information; the size of the sample; how representative the sample is; how the information was grouped; the method of information collection; the neutrality of the information collection process and whether the information collected was fact or opinion.

8 RESOURCE NEEDS FOR TEACHING MATHEMATICAL LITERACY – LEVEL 2

- **Physical resources:**
 - Black board or white board
 - Overhead projector
 - Desks and tables for students
- **Media:**
 - Daily newspapers
 - Magazines
- **Human resources:**

Lecturers should have:

 - minimum of Grade 12 Mathematics, preferably more;
 - diploma or degree in education;
 - training in outcomes-based education;
 - been declared competent as an assessor and moderator;
 - interest and understanding of the field in which presenting Mathematical Literacy e.g. hair care; agriculture; business management; and
 - enthusiasm for Mathematical Literacy.
- **Financial 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 refer to percentage and interest rate, textbooks, etc.
 - Files for Portfolio of Evidence (PoE) of each learner