



Revised National Curriculum Statement Grades R-9 (Schools)

Mathematics



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This document must be read as part of the
Revised National Curriculum Statement Grades R-9 (Schools).

This Revised National Curriculum Statement Grades R-9 (Schools) includes:

1. An Overview
2. Eight Learning Area Statements:
 - Languages
 - Mathematics
 - Natural Sciences
 - Social Sciences
 - Arts and Culture
 - Life Orientation
 - Economic and Management Sciences
 - Technology

HOW TO USE THIS BOOK

- For general information see:
 - *Introducing the National Curriculum Statement* in Chapter 1 – This will provide information on Outcomes-based Education, the Revised Curriculum Statement Grades R-9 (Schools), and Learning Programmes.
 - *Introducing the Learning Area* in Chapter 1 – This will provide an introduction to the Learning Area Statement including its features, scope and Learning Outcomes.
 - *Learner Assessment* – This chapter provides guidelines to assessment principles in Outcomes-based Education, discusses continuous assessment, and provides examples of record-keeping.
 - The *Reference Lists* provide both a general *Curriculum and Assessment Glossary* and a specific *Learning Area Glossary*.
- The body of this book is divided into several chapters. There is one chapter for each of the Phases of the General Education and Training Band – Foundation Phase, Intermediate Phase, Senior Phase. Each of these chapters has a brief introductory section, followed by the Assessment Standards for the Phase. There is also a chapter on Learner Assessment.
- The Assessment Standards for each Phase are presented in a way that makes it possible to track progression. That is, similar Assessment Standards for each grade are lined up with each other so that the teacher will be able to compare progression over the years. This results in some blank spaces, as not every Assessment Standard has its match in every grade.
- Certain symbols are used throughout this book to guide the reader in finding the information she or he is looking for. These symbols are:



Assessment Standards



Grade



Learning Outcome

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CHAPTER 1

INTRODUCTION

INTRODUCING THE NATIONAL CURRICULUM STATEMENT

The Constitution of the Republic of South Africa (Act 108 of 1996) provides the basis for curriculum transformation and development in South Africa. The Preamble to the Constitution states that the aims of the Constitution are to:

- heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights;
- improve the quality of life of all citizens and free the potential of each person;
- lay the foundations for a democratic and open society in which government is based on the will of the people and every citizen is equally protected by law; and
- build a united and democratic South Africa able to take its rightful place as a sovereign state in the family of nations.

Education and the curriculum have an important role to play in realising these aims. The curriculum aims to develop the full potential of each learner as a citizen of a democratic South Africa.

Outcomes-based Education

Outcomes-based education forms the foundation of the curriculum in South Africa. It strives to enable all learners to achieve to their maximum ability. This it does by setting the outcomes to be achieved at the end of the process. The outcomes encourage a learner-centred and activity-based approach to education. The Revised National Curriculum Statement builds its Learning Outcomes for the General Education and Training Band for Grades R-9 (for schools) on the critical and developmental outcomes that were inspired by the Constitution and developed in a democratic process.

The critical outcomes envisage learners who are able to:

- identify and solve problems and make decisions using critical and creative thinking;
- work effectively with others as members of a team, group, organisation and community;
- organise and manage themselves and their activities responsibly and effectively;
- collect, analyse, organise and critically evaluate information;
- communicate effectively using visual, symbolic and/or language skills in various modes;
- use science and technology effectively and critically, showing responsibility towards the environment and the health of others; and
- demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.

The developmental outcomes envisage learners who are also able to:

- reflect on and explore a variety of strategies to learn more effectively;
- participate as responsible citizens in the life of local, national, and global communities;

- be culturally and aesthetically sensitive across a range of social contexts;
- explore education and career opportunities; and
- develop entrepreneurial opportunities.

Issues such as poverty, inequality, race, gender, age, disability and challenges such as HIV/AIDS all influence the degree and way in which learners can participate in schooling. The Revised National Curriculum Statement Grades R-9 (Schools) adopts an inclusive approach by specifying the minimum requirements for all learners. All the Learning Area Statements try to create an awareness of the relationship between social justice, human rights, a healthy environment and inclusivity. Learners are also encouraged to develop knowledge and understanding of the rich diversity of this country, including the cultural, religious and ethnic components of this diversity.

Revised National Curriculum Statement: Learning Area Statements

The Revised National Curriculum Statement Grades R-9 (Schools) consists of an Overview and eight Learning Area Statements for:

- Languages;
- Mathematics;
- Natural Sciences;
- Social Sciences;
- Arts and Culture;
- Life Orientation;
- Economic and Management Sciences; and
- Technology.

Each Learning Area Statement identifies the main Learning Outcomes to be achieved by the end of Grade 9. Each Learning Area Statement also specifies the Assessment Standards that will enable the Learning Outcomes to be achieved. Assessment Standards are defined for each grade and describe the depth and breadth of what learners should know and be able to do. Each Learning Area Statement's Assessment Standards show how conceptual and skill development can take place over time. Assessment Standards can be integrated within grades as well as across grades. The achievement of an optimal relationship between integration across Learning Areas (where necessary and educationally sound), and conceptual progression from grade to grade, are central to this curriculum.

Revised National Curriculum Statement: Learning Programmes

The Revised National Curriculum Statement is aimed at promoting commitment as well as competence among teachers, who will be responsible for the development of their own Learning Programmes. In order to support this process, the Department of Education will provide policy guidelines based on each Learning Area Statement. Provinces will develop further guidelines where necessary in order to accommodate diversity.

The underlying principles and values of the Revised National Curriculum Statement Learning Area Statements underpin the Learning Programmes. Whereas the Learning Areas stipulate the concepts, skills and values to be achieved on a grade by grade basis, Learning Programmes specify the scope of learning and assessment activities for each phase. Learning Programmes also contain work schedules that provide the pace and sequence of

these activities each year, as well as exemplars of lesson plans to be implemented in any given period.

In the Foundation Phase, there are three Learning Programmes: Literacy, Numeracy and Life Skills. In the Intermediate Phase, Languages and Mathematics are distinct Learning Programmes. Learning Programmes must ensure that the prescribed outcomes for each learning area are covered effectively and comprehensively. Schools may decide on the number and nature of other Learning Programmes in the Intermediate Phase based on the organisational imperatives of the school, provided that the national priorities and developmental needs of learners in a phase are taken into account. In the Senior Phase, there are eight Learning Programmes based on the Learning Area Statements. Time allocations for each Learning Area are prescribed for all Grades and Phases.

Time Allocations

In terms of Section 4 of the Employment of Educators Act, (1998), the formal school day for teachers will be seven hours. In terms of the National Education Policy Act, (1996), the formal teaching time per school week is 35 hours. This is set out in:

- (i) Overview Document ISBN 1-919917-08-X, pages 17 & 18.
- (ii) Government Gazette No. 23406, Vol. 443, May 2002, pages 26 & 27

Assessment

Each Learning Area Statement includes a detailed section on assessment. An outcomes-based framework uses assessment methods that are able to accommodate divergent contextual factors. Assessment should provide indications of learner achievement in the most effective and efficient manner, and ensure that learners integrate and apply skills. Assessment should also help students to make judgments about their own performance, set goals for progress and provoke further learning.

The Kind of Teacher that is Envisaged

All teachers and other educators are key contributors to the transformation of education in South Africa. This Revised National Curriculum Statement Grades R-9 (Schools) envisions teachers who are qualified, competent, dedicated and caring. They will be able to fulfil the various roles outlined in the Norms and Standards for Educators. These include being mediators of learning, interpreters and designers of Learning Programmes and materials, leaders, administrators and managers, scholars, researchers and lifelong learners, community members, citizens and pastors, assessors and Learning Area or Phase specialists.

The Kind of Learner that is Envisaged

The promotion of values is important not only for the sake of personal development, but also to ensure that a national South African identity is built on values very different from those that underpinned apartheid education. The kind of learner that is envisaged is one who will be inspired by these values, and who will act in the interests of a society based on respect for democracy, equality, human dignity, life and social justice. The curriculum seeks to create a lifelong learner who is confident and independent, literate, numerate, multi-skilled, compassionate, with a respect for the environment and the ability to participate in society as a critical and active citizen.

INTRODUCING THE MATHEMATICS LEARNING AREA

Definition

Mathematics is a human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves. Through this process, new mathematical ideas and insights are developed.

Mathematics uses its own specialised language that involves symbols and notations for describing numerical, geometric and graphical relationships. Mathematical ideas and concepts build on one another to create a coherent structure.

Mathematics is a product of investigation by different cultures – a purposeful activity in the context of social, political and economic goals and constraints.

The Mathematics Learning Area includes interrelated knowledge and skills:

- Knowledge:
 - numbers, operations and relationships;
 - patterns, functions and algebra;
 - space and shape (geometry);
 - measurement; and
 - data handling.
- Skills:
 - representation and interpretation;
 - estimation and calculation;
 - reasoning and communication;
 - problem posing;
 - problem solving and investigation; and
 - describing and analysing.

Purpose

Being mathematically literate enables persons to contribute to and participate with confidence in society. Access to Mathematics is, therefore, a human right in itself.

The teaching and learning of Mathematics aims to develop the following in the learner:

- a critical awareness of how mathematical relationships are used in social, environmental, cultural and economic relations;
- the necessary confidence and competence to deal with any mathematical situation without being hindered by a fear of Mathematics;
- an appreciation for the beauty and elegance of Mathematics;
- a spirit of curiosity; and
- a love for Mathematics.

In addition, the teaching and learning of Mathematics can enable the learner to:

- develop an awareness of the diverse historical, cultural and social practices of Mathematics;
- recognise that Mathematics is a creative part of human activity;
- develop deep conceptual understandings in order to make sense of Mathematics; and
- acquire the specific knowledge and skills necessary for:
 - the application of Mathematics to physical, social and mathematical problems,
 - the study of related subject matter (e.g. other Learning Areas), and
 - further study in Mathematics.

Unique Features and Scope

The unique features of learning and teaching Mathematics include:

- *working with numbers, data, space and shape*: visualising, measuring, ordering, calculating, estimating, interpreting, making informed choices, comparing and contrasting, classifying and representing with confidence and accuracy.
- *problem solving*: making sense of the problem, analysing and synthesising, and determining and executing solution strategies, as well as validating and interpreting the solutions appropriate to the context.
- *investigating patterns and relationships*: describing, conjecturing, inferring, deducing, reflecting, generalising, predicting, refuting, explaining, specialising, defining, modelling, justifying and representing.

The Mathematics Learning Area develops:

- a critical awareness of how mathematical relationships can be used responsibly in addressing human rights issues such as social, political and economic relations and environmental problems and risks;
- an appreciation for the diverse historical, cultural and social practices of Mathematics;
- pleasure in mathematical experiences;
- an ability to engage in the process of inquiry and investigation;
- an ability to use manipulatives as well as electronic and other technology effectively; and
- working effectively, independently and as a member of a team.

Mathematical knowledge, skills and values will enable the learner to:

- participate equitably and meaningfully (with an awareness of rights) in political, social, environmental and economic activities by being mathematically literate;
- contribute responsibly to the reconstruction and development of society by using mathematical tools to expose inequality and assess environmental problems and risks;
- display critical and insightful reasoning and interpretative and communicative skills when dealing with mathematical and contextualised problems;
- describe suitable situations using mathematical notation and language;
- apply Mathematics in a variety of contexts;
- transfer mathematical knowledge and skills between Learning Areas and within Mathematics; and
- display mental, algorithmic and technological confidence and accuracy in:
 - working with numbers, data, space and shape,
 - investigating patterns and relationships,
 - problem solving, and

- constructing new insights and meaning.

Mathematics Learning Outcomes

The unique features and scope of the Mathematics Learning Area are consolidated into five Learning Outcomes:



Learning Outcome 1: Numbers, Operations and Relationships

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Learning Outcome 2: Patterns, Functions and Algebra

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.



Learning Outcome 3: Space and Shape (Geometry)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.



Learning Outcome 4: Measurement

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.



Learning Outcome 5: Data Handling

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.

These Learning Outcomes and their Assessment Standards are cognitively dependent and supportive of each other. For example, important Number Development (Learning Outcome 1) can happen in the context of Measurement (Learning Outcome 4) or Data Handling (Learning Outcome 5). These cognitive links are reflected in Assessment Standards that sometimes stay the same across one or more grades. Progression in these Assessment Standards should be interpreted in terms of increased knowledge and skills developed between grades in other Learning Outcomes/Assessment Standards. Assessment should take place in the increasingly sophisticated contexts in which learners can work as they progress from one grade to the next.

CHAPTER 2

FOUNDATION PHASE

(Grades R-3)

INTRODUCTION

The Foundation Phase section of the Learning Area Statement starts with an overview of the five Mathematics Learning Outcomes. The importance of each outcome is explained for both the learner of Mathematics and the learner in general. Also included is a discussion on the teaching and learning focus of each Learning Outcome within this phase.

The minimum Assessment Standards for each Learning Outcome in Grades R, 1, 2 and 3 are listed. The Assessment Standards for each grade show progression of knowledge, skills and values within the phase.

These Assessment Standards are closely related to each other. Whenever possible, learning activities should address:

- more than one related Assessment Standard within a Learning Outcome; and
- related Assessment Standards across Learning Outcomes within the grade.

LEARNING OUTCOMES



Learning Outcome 1: Numbers, Operations and Relationships

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.

Learning Outcome focus

Learning Outcome 1 builds the learner's number sense, which is the foundation of further study in Mathematics. It also develops the learner's understanding of:

- what different kinds of numbers mean;
- how different kinds of numbers relate to one another;
- the relative size of different numbers;
- how different numbers can be thought about and represented in various ways; and
- the effect of operating with numbers.

Essential to the development of number sense is knowledge of basic number facts, the use of efficient and accurate methods for calculation and measurement, and a range of strategies for estimating and checking results.

Learning Outcome 1 also provides opportunities for the learner to use appropriate technology and to engage with the historical and cultural developments of numerical counting and writing systems. Learners with a good sense of number and operations have the mathematical confidence to make sense of problems and results in various contexts.

Contexts should be selected in which the learner has to count, estimate and calculate in a way that builds awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- compare counting in different African languages and relate this to the geographical locations of the language groups;
- count animals in the environment with an awareness of animals at risk of becoming extinct;
- compare national health statistics with an awareness of how learners' own regions are affected;
- calculate and compare the ratios of elements in a chemical compound;
- interpret climatic conditions (e.g. read temperature and rainfall information); and
- calculate within financial contexts found in the Economic and Management Sciences Learning Area.

Foundation Phase focus

The range of numbers developed by the end of Grade 3 includes whole numbers to at least 1 000, and unitary and non-unitary common fractions.

In this phase, the number concept of the learner is developed through working with physical objects in order to count collections of objects, partition and combine quantities, skip count in various ways, solve contextual (word) problems, and build up and break down numbers.

Therefore, the teacher should:

- give the learner opportunities to work with number cards, number charts and number lines to recognise, read, write, count and order numbers;
- encourage the learner to say number names out aloud and to write numbers in words and symbols;
- give the learner opportunities to practise mental calculations;
- structure activities with an awareness that the learner can count by rote and recognise and say number names and symbols for larger numbers than the learner is able to use for calculation and solving problems;
- encourage the learner to appreciate and learn number names and symbols in the mother tongue (if not the language of instruction) and at least one other local language; and
- encourage the learner to judge the reasonableness of answers.

Fraction concepts should be developed through problems involving the sharing of physical quantities and by using drawings. Problems should include solutions that result in whole number remainders or fractions. Sharing should involve not only finding parts of wholes, but also finding parts of collections of objects. In this phase, the learner is not expected to read or write fraction symbols.



Learning Outcome 2: Patterns, Functions and Algebra

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.

Learning Outcome focus

Algebra is the language for investigating and communicating most of Mathematics. Algebra can be seen as generalised arithmetic, and can be extended to the study of functions and other relationships between variables. A central part of this outcome is for the learner to achieve efficient manipulative skills in the use of algebra.

Learning Outcome 2 focuses on:

- describing patterns and relationships through the use of symbolic expressions, graphs and tables; and
- identifying and analysing regularities and change in patterns and relationships that enable learners to make predictions and solve problems.

Investigating patterns and relationships allows the learner to develop an appreciation of the aesthetic and creative qualities of Mathematics. These investigations develop mathematical thinking skills such as generalising, explaining, describing, observing, inferring, specialising, creating, justifying, representing, refuting and predicting.

Mathematical skills are developed over time. The learner should be given opportunities at every grade level to develop these skills to greater levels of sophistication so that they can be used with greater competence and confidence.

Contexts should be selected in which the learner can use algebraic language and skills to describe patterns and relationships in a way that builds awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- investigate geometric patterns in art and architecture;
- study symmetrical patterns that occur in nature;
- understand formulae used to calculate pensions and medical aid rates;
- understand and use formulae for calculating quantities encountered in Natural Sciences (e.g. air pressure, resistance, voltage);
- consider how graphs in the media can be manipulated to misrepresent trends and patterns; and
- use mathematical models to represent relationships within an ecosystem.

Foundation Phase focus

In this phase, the focus of this Learning Outcome is to lay the foundation for developing algebra in the Intermediate and Senior Phases.

This foundation can be established by helping the learner to use physical objects and drawings to copy, extend, create and describe:

- geometric patterns (e.g. pictures); and
- numeric patterns (e.g. skip counting).



Learning Outcome 3: Space and Shape (Geometry)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.

Learning Outcome focus

The study of space and shape improves understanding and appreciation of the pattern, precision, achievement and beauty in natural and cultural forms. It focuses on the properties, relationships, orientations, positions and transformations of two-dimensional shapes and three-dimensional objects.

The study of space and shape enables the learner to:

- develop the ability to visualise, interpret, calculate relevant values, reason and justify; and
- interpret, understand, classify, appreciate and describe the world through two-dimensional shapes and three-dimensional objects, their location, movement and relationships.

The learner should gain these skills from experiences with concrete objects, through drawing and construction, and in the abstract justification of spatial relationships. It is important that the study of two-dimensional shapes and three-dimensional objects be contextualised to include the study of natural and cultural forms and artefacts.

Contexts should be selected in which the learner can study space and shape in a way that can be used to build awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- use national flags to demonstrate transformations and symmetry in designs;
- investigate and recognise the geometrical properties and patterns existing in traditional and modern architecture;
- use maps in Geography as specific forms of grids; and
- investigate geometric patterns in art.

Foundation Phase focus

The study of space and shape in the Foundation Phase is very practical and hands-on. The learner begins by recognising and describing objects and shapes in the environment that resemble mathematical objects and shapes. The learner should handle these objects and shapes, cut out and draw sketches, and describe them with appropriate and expanding vocabulary.

The learner should be given opportunities to follow and give directions as well as to describe his or her own position and the positions of objects in space using appropriate vocabulary.



Learning Outcome 4: Measurement

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.

Learning Outcome focus

The ability to measure appropriately has been developed by humans over time and through various cultures. Measurement focuses on the selection and use of appropriate units, instruments and formulae to quantify characteristics of events, shapes, objects and the environment.

Measuring relates directly to the scientific, technological and economic worlds of the learner, enabling the learner to:

- make sensible estimates; and
- be alert to the reasonableness of measurements and results.

Contexts should be selected in which the learner can measure in a way that builds awareness of other Learning Areas, as well as human rights, social, political, economic, cultural and environmental issues. For example, the learner should be able to:

- measure and compare distances and times taken by learners from home to school;
- compare the capacity of dams and the volume of water available through taps in a particular community;
- measure working hours and their relation to income earned;
- compare the distribution and allocation of land areas to population size; and
- use measuring units from Technology, Natural Sciences and Social Sciences.

Foundation Phase focus

In this phase the learner's concept of measurement is developed by working practically with different concrete objects and shapes. These investigations should happen through making direct comparisons and using non-standardised measuring units (e.g. body parts, containers, pacing on foot). The learner should develop appropriate vocabulary to describe these comparisons (e.g. 'shorter than', 'longer than').

Activities relating to time should be structured with the awareness that the learner's understanding of the passing of time should take place before he or she reads time.



Learning Outcome 5: Data Handling

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.

Learning Outcome focus

Data – meaning information in statements, graphs and tables – bombard our senses through television, newspapers and other media. For example, crime rates, rainfall, sports results, election polls, government spending, population and economic growth are all reported in graphical or summarised form as statistics.

Through the study of data handling, the learner develops the skills to collect, organise, display, analyse and interpret this information. This enables the learner to participate meaningfully in political, social and economic activities.

Making sense of data involves collecting, organising, analysing, summarising and interpreting it, as well as drawing conclusions and making predictions.

Through the study of chance, the learner will also develop skills and techniques for making informed choices, and coping with randomness and uncertainty.

In this Learning Outcome, the learner will develop a sense of how Mathematics can be used to manipulate data to represent or misrepresent trends and patterns. The learner will also develop a sense of how Mathematics can provide solutions that sustain or destroy the environment, and promote or harm the health of others. The learner is thereby able to use Mathematics effectively and critically, showing responsibility towards the environment and health of others. For example, the learner should be able to understand:

- the distribution of resources according to class, race or gender; and
- economic trends and patterns between developing countries and developed countries.

Foundation Phase focus

The focus in the teaching and learning of data handling in the Foundation Phase is on sorting objects and data in different ways, based on the different features of the objects or data.

The learner should be able to represent data in different forms that involve a one-to-one correspondence between items in the data set and their representation. The learner should develop an awareness that the selection of attributes used for sorting data will influence:

- how the data is represented; and
- how conclusions and predictions are made.

ASSESSMENT STANDARDS

In the next sections, the Assessment Standards for each Learning Outcome will be given for each grade.

Teachers need to remember that not all learners will have attended Grade R. Concepts, skills and strategies for Grade R need to be taught and consolidated in Grade 1.

Grade R



Learning Outcome 1

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Counts to at least 10 everyday objects reliably.
- Says and uses number names in familiar contexts.
- Knows the number names and symbols for 1 to 10.
- Orders and compares collections of objects using the words 'more', 'less' and 'equal'.
- Solves and explains solutions to practical problems that involve equal sharing and grouping with whole numbers of at least 10 and with solutions that include remainders.
- Solves verbally-stated additions and subtraction problems with single-digit numbers and with solutions to at least 10.
- Uses the following techniques:
 - building up and breaking down numbers to at least 10;
 - doubling and halving to at least 10;
 - using concrete apparatus (e.g. counters).
- Explains own solutions to problems.

Grade R



Learning Outcome 2

PATTERNS, FUNCTIONS AND ALGEBRA

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.



Assessment Standards

We know this when the learner:

- Copies and extends simple patterns using physical objects and drawings (e.g. using colours and shapes).
- Creates own patterns.

Grade R



Learning Outcome 3

SPACE AND SHAPE (GEOMETRY)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.



Assessment Standards

We know this when the learner:

- Recognises, identifies and names three-dimensional objects in the classroom and in pictures, including:
 - boxes (prisms);
 - balls (spheres).
- Describes, sorts and compares physical three-dimensional objects according to:
 - size;
 - objects that roll;
 - objects that slide.
- Builds three-dimensional objects using concrete materials (e.g. building blocks).
- Recognises symmetry in self and own environment (with focus on front and back).
- Describes one three-dimensional object in relation to another (e.g. 'in front of' or 'behind').
- Follows directions (alone and/or as a member of a group or team) to move or place self within the classroom (e.g. 'at the front' or 'at the back').

Grade R



Learning Outcome 4

MEASUREMENT

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.



Assessment Standards

We know this when the learner:

- Describes the time of day in terms of day or night.
- Orders recurring events in own daily life.
- Sequences events within one day.
- Works concretely comparing and ordering objects using appropriate vocabulary to describe:
 - mass (e.g. light, heavy, heavier);
 - capacity (e.g. empty, full, less than, more than);
 - length (e.g. longer, shorter, wider, tall, short).

Grade R



Learning Outcome 5

DATA HANDLING

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.



Assessment Standards

We know this when the learner:

- Collects physical objects (alone and/or as a member of a group or team) in the environment according to stated features (e.g. collects 10 dead flowers).
- Sorts physical objects according to one attribute (property) (e.g. red shapes).
- Draws a picture as a record of collected objects.
- Answers questions (e.g. 'Which has the most...?') based on own picture or own sorted objects.



Grade 1



Learning Outcome 1

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Counts to at least 34 everyday objects reliably.
- Counts forwards and backwards in:
 - ones from any number between 0 and 100;
 - tens from any multiple of 10 between 0 and 100.
- Knows and reads number symbols from 1 to at least 100 and writes number names from 1 to at least 34.
- Orders, describes and compares whole numbers to at least 2-digit numbers.
- Solves money problems involving totals and change in rands and cents.
- Solves and explains solutions to practical problems that involve equal sharing and grouping with whole numbers to at least 34 and with solutions that include remainders.

Grade 2



Assessment Standards

We know this when the learner:

- Counts to at least 100 everyday objects reliably.
- Counts forwards and backwards in:
 - ones from any number between 0 and 200;
 - tens from any multiple of 10 between 0 and 200;
 - fives from any multiple of 5 between 0 and 200;
 - twos from any multiple of 2 between 0 and 200.
- Knows and reads number symbols from 1 to at least 200 and writes number names from 1 to at least 100.
- Orders, describes and compares the following numbers:
 - whole numbers to at least 2-digit numbers;
 - common fractions including halves and quarters.
- Recognises the place value of digits in whole numbers to at least 2-digit numbers.
- Solves money problems involving totals and change in rands and cents.
- Solves and explains solutions to practical problems that involve equal sharing and grouping and that lead to solutions that also include unitary fractions (e.g. $\frac{1}{4}$).

Grade 3



Assessment Standards

We know this when the learner:

- Counts forwards and backwards in:
 - the intervals specified in Grade 2 with increased number ranges;
 - twenties, twenty-fives, fifties and hundreds between 0 and at least 1 000.
- Knows number names from 1 to at least 10 in the mother tongue (if not the language of learning and teaching) and one other local language.
- Knows, reads and writes number symbols and names from 1 to at least 1 000.
- Orders, describes and compares the following numbers:
 - whole numbers to at least 3-digit numbers;
 - common fractions including halves, quarters and thirds.
- Recognises the place value of digits in whole numbers to at least 3-digit numbers.
- Solves money problems involving totals and change in rands and cents, including converting between rands and cents.
- Solves and explains solutions to practical problems that involve equal sharing and grouping and that lead to solutions that also include unitary and non-unitary fractions (e.g. $\frac{1}{4}$, $\frac{3}{4}$).

Grade 1



Learning Outcome 1 Continued

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Can perform calculations, using appropriate symbols, to solve problems involving:
 - addition and subtraction with whole numbers and solutions to at least 34;
 - repeated addition with whole numbers and with solutions to at least 34;
 - estimation.
- Performs mental calculations involving addition and subtraction for numbers to at least 10.
- Uses the following techniques:
 - building up and breaking down numbers;
 - doubling and halving;
 - using concrete apparatus (e.g. counters);
 - number-lines.
- Explains own solutions to problems.
- Checks the solution given to problems by peers.

Grade 2



Assessment Standards

We know this when the learner:

- Can perform calculations, using appropriate symbols, to solve problems involving:
 - addition and subtraction of whole numbers with at least 2 digits;
 - multiplication of whole 1-digit by 1-digit numbers with solutions to at least 50;
 - estimation.
- Performs mental calculations involving:
 - addition and subtraction for numbers to at least 20;
 - multiplication of whole numbers with solutions to at least 20.
- Uses the following techniques:
 - building up and breaking down numbers;
 - doubling and halving;
 - using concrete apparatus (e.g. counters);
 - number-lines.
- Explains own solutions to problems.
- Checks the solution given to problems by peers.

Grade 3



Assessment Standards

We know this when the learner:

- Can perform calculations, using appropriate symbols, to solve problems involving:
 - addition and subtraction of whole numbers with at least 3 digits;
 - multiplication of at least whole 2-digit by 1-digit numbers;
 - division of at least whole 2-digit by 1-digit numbers;
 - estimation.
- Performs mental calculations involving:
 - addition and subtraction for numbers to at least 50;
 - multiplication of whole numbers with solutions to at least 50.
- Uses the following techniques:
 - building up and breaking down numbers;
 - doubling and halving;
 - number-lines;
 - rounding off in tens.
- Explains own solutions to problems.
- Checks the solution given to problems by peers.

Grade 1



Learning Outcome 2

PATTERNS, FUNCTIONS AND ALGEBRA

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.



Assessment Standards

We know this when the learner:

- Copies and extends simple patterns using physical objects and drawings (e.g. using colours and shapes).
- Copies and extends simple number sequences to at least 100.
- Creates own patterns.
- Describes observed patterns.
- Identifies, describes and copies geometric patterns in natural and cultural artefacts of different cultures and times.

Grade 2



Assessment Standards

We know this when the learner:

- Copies and extends simple patterns using physical objects and drawings.
- Copies and extends simple number sequences to at least 200.
- Creates own patterns.
- Describes observed patterns.
- Identifies, describes and copies geometric patterns in natural and cultural artefacts of different cultures and times.

Grade 3



Assessment Standards

We know this when the learner:

- Copies and extends simple patterns using physical objects and drawings.
- Copies and extends simple number sequences to at least 1 000.
- Creates own patterns.
- Describes observed patterns.
- Identifies, describes and copies geometric patterns in natural and cultural artefacts of different cultures and times.

Grade 1



Learning Outcome 3

SPACE AND SHAPE (GEOMETRY)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.



Assessment Standards

We know this when the learner:

- Recognises, identifies and names two-dimensional shapes and three-dimensional objects in the classroom and in pictures, including:
 - boxes (prisms) and balls (spheres);
 - triangles and rectangles;
 - circles.
- Describes, sorts and compares physical two-dimensional shapes and three-dimensional objects according to:
 - size;
 - objects that roll or slide;
 - shapes that have straight or round edges.
- Observes and builds given three-dimensional objects using concrete materials (e.g. building blocks and construction sets).
- Recognises symmetry in self and own environment (with focus on 'left', 'right', 'front' and 'back').
- Describes one three-dimensional object in relation to another (e.g. 'in front of' or 'behind').
- Follows directions (alone and/or as a member of a group or team) to move or place self within the classroom or three-dimensional objects in relation to each other.

Grade 2



Assessment Standards

We know this when the learner:

- Recognises, identifies and names two-dimensional shapes and three-dimensional objects in the school environment and in pictures, including:
 - boxes (prisms), balls (spheres) and cylinders;
 - triangles, squares and rectangles;
 - circles.
- Describes, sorts and compares two-dimensional shapes and three-dimensional objects in pictures and the environment according to:
 - size;
 - objects that roll or slide;
 - shapes that have straight or round edges.
- Observes and creates given two-dimensional shapes and three-dimensional objects using concrete materials (e.g. building blocks, construction sets and cut-out two-dimensional shapes).
- Recognises symmetry in two-dimensional shapes and three-dimensional objects.
- Recognises three-dimensional objects from different positions.
- Positions self within the classroom or three-dimensional objects in relation to each other.
- Describes positional relationships (alone and/or as a member of a group or team) between three-dimensional objects or self and a peer.

Grade 3



Assessment Standards

We know this when the learner:

- Recognises, identifies and names two-dimensional shapes and three-dimensional objects in the environment and in pictures, including:
 - boxes (prisms), balls (spheres) and cylinders;
 - triangles, squares and rectangles;
 - circles;
 - cones and pyramids.
- Describes, sorts and compares two-dimensional shapes and three-dimensional objects in pictures and the environment, including:
 - two-dimensional shapes in or on the faces of three-dimensional objects;
 - flat/straight and curved/round surfaces and edges.
- Observes and creates given and described two-dimensional shapes and three-dimensional objects using concrete materials (e.g. building blocks, construction sets, cut-out two-dimensional shapes, clay, drinking straws).
- Determines lines of symmetry in two-dimensional shapes using paper folding and reflection.
- Recognises and describes three-dimensional objects from different positions.
- Reads, interprets and draws informal maps of the school environment or of an arrangement of three-dimensional objects and locates objects on the map.
- Describes positional relationships (alone and/or as a member of a group or team) between three-dimensional objects or self and a peer.

Grade 1



Learning Outcome 4

MEASUREMENT

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.



Assessment Standards

We know this when the learner:

- Describes the time of day using vocabulary such as 'early', 'late morning', 'afternoon' and 'night'.
- Compares events in terms of the length of time they take (longer, shorter, faster, slower).
- Sequences events using language such as 'yesterday', 'today' and 'tomorrow'.
- Places birthdays on a calendar.
- Estimates, measures, compares and orders three-dimensional objects using non-standard measures:
 - mass (e.g. bricks, sand bags);
 - capacity (e.g. spoons, cups);
 - length (e.g. hand spans, footsteps)

Grade 2



Assessment Standards

We know this when the learner:

- Reads analogue and digital clock time in hours and minutes.
- Names in order the days of the week and the months of the year.
- Calculates elapsed time in:
 - hours and minutes using clocks;
 - days, weeks and months using calendars.
- Sequences events according to days, weeks, months and years.
- Identifies important dates on calendars including dates of:
 - religious festivals;
 - historical events.
- Estimates, measures, compares and orders three-dimensional objects using non-standard measures:
 - mass (e.g. bricks, sand bags);
 - capacity (e.g. spoons, cups);
 - length (e.g. hand spans, footsteps).

Grade 3



Assessment Standards

We know this when the learner:

- Reads and writes analogue and digital clock time in terms of hours, half-hours, quarters of an hour and minutes.
- Solves problems involving calculations with and conversions between:
 - minutes $\leftrightarrow$ hours;
 - hours $\leftrightarrow$ days;
 - days $\leftrightarrow$ months.
- Identifies important dates on calendars including dates of:
 - religious festivals;
 - historical events.
- Recognises and describes different calendars used in different cultures.
- Estimates, measures, compares and orders three-dimensional objects using non-standard and standard measures:
 - mass (e.g. packets, kilograms);
 - capacity (e.g. bottles, litres);
 - length (e.g. desk lengths, metres).
- Investigates (alone and/or as a member of a group or team) and approximates:
 - distance around two-dimensional shapes using string;
 - area of two-dimensional shapes using tiling.

Grade 1



Learning Outcome 5

DATA HANDLING

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.



Assessment Standards

We know this when the learner:

- Collects everyday objects (alone and/or as a member of a group or team) in the classroom and school environment according to given criteria or categories.
- Sorts physical objects according to one attribute chosen for a reason (e.g. 'Sort crayons into colours.').
- Gives reasons for collections being grouped in particular ways.
- Draws a picture as a record of collected objects.
- Constructs pictographs where stickers or stamps represent individual elements in a collection of objects.
- Describes own collection of objects, explains how it was sorted, and answers questions about it.

Grade 2



Assessment Standards

We know this when the learner:

- Collects data (alone and/or as a member of a group or team) in the classroom and school environment to answer questions posed by the teacher (e.g. ‘How many learners are there in each classroom?’).
- Sorts physical objects according to one attribute chosen by the teacher.
- Gives reasons for collections being grouped in particular ways.
- Draws pictures and constructs pictographs that have a 1-1 correspondence between own data and representations.
- Describes own or a peer’s collection of objects, explains how it was sorted, and answers questions about it.

Grade 3



Assessment Standards

We know this when the learner:

- Collects data (alone and/or as a member of a group or team) in the classroom and school environment to answer questions posed by the teacher and class (e.g. ‘How many learners walk to school?’).
- Sorts, orders and organises own and supplied data by one or more attributes for a particular reason.
- Draws pictures and constructs pictographs and bar graphs that have a 1-1 correspondence between own data and representation.
- Reads, interprets and reports on information in own and a peer’s representations of data.
- Reads and interprets data presented in simple tables and lists.



CHAPTER 3

INTERMEDIATE PHASE

(Grades 4-6)

INTRODUCTION

The Intermediate Phase section of the Learning Area Statement starts with an overview of the five Mathematics Learning Outcomes. The importance of each outcome is explained for both the learner of Mathematics and the learner in general. Also included is a phase-specific discussion on the teaching and learning focus of the Learning Outcomes within this phase.

The minimum Assessment Standards for each Learning Outcome in Grades 4, 5 and 6 are listed. The Assessment Standards for each grade show progression of knowledge, skills and values within the phase.

These Assessment Standards are closely related to each other. Whenever possible, learning activities should address:

- more than one related Assessment Standard within a Learning Outcome; and
- related Assessment Standards across Learning Outcomes within the grade.

LEARNING OUTCOMES



Learning Outcome 1: Numbers, Operations and Relationships

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.

Learning Outcome focus

Learning Outcome 1 builds the learner's number sense, which is the foundation of further study in Mathematics, and develops the learner's understanding of:

- what different kinds of numbers mean;
- how different kinds of numbers relate to one another;
- the relative size of different numbers;
- how different numbers can be thought about and represented in various ways; and
- the effect of operating with numbers.

Essential to the development of number sense is knowledge of basic number facts, the use of efficient and accurate methods for calculation and measurement, and a range of strategies for estimating and checking results.

Learning Outcome 1 also provides opportunities for the learner to use appropriate technology and to engage with the historical and cultural developments of numerical counting and writing systems. The learner with a good sense of number and operations has the mathematical confidence to make sense of problems and results in various contexts.

Contexts should be selected in which the learner can count, estimate and calculate in a way that builds awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- compare counting in different African languages and relate this to the geographical locations of the language groups;
- count animals in the environment with an awareness of animals at risk of becoming extinct;
- compare national health statistics with an awareness of how the learner's own region is affected;
- calculate and compare the ratios of elements in a chemical compound;
- interpret climatic conditions (e.g. read temperature and rainfall information); and
- calculate within the financial contexts found in the Economic and Management Sciences Learning Area.

Intermediate Phase focus

The range of numbers developed by the end of Grade 6 is extended to at least 9-digit whole numbers, decimal fractions to at least 2 decimal places, common fractions and fractions written in percentage form.

In this phase, the learner is expected to move from counting reliably to calculating fluently with all four operations. The learner should be encouraged to:

- memorise multiplication fluently to at least 12×12 ;
- sharpen mental calculation skills; and
- use calculators confidently.

Since the range of numbers that the learner works with is continually expanding, much attention needs to be focused on understanding the concept of place value so that the learner develops a sense of large numbers and decimal fractions.

Fraction concepts should be expanded through the use of fraction walls and number-lines to compare and order fractions. Measurement is a useful context in which the learner can practise calculations with fractions, including decimal fractions.

Through the study of a variety of number patterns, the learner should recognise and describe properties of numbers and operations, including identity properties, factors, multiples, and commutative, associative and distributive properties. The purpose should be for the learner to recognise:

- what the properties are; and
- how they can be used to solve problems and simplify calculations.



Learning Outcome 2: Patterns, Functions and Algebra

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.

Learning Outcome focus

Algebra is the language for investigating and communicating most of Mathematics. Algebra can be seen as generalised arithmetic, and can be extended to the study of functions and other relationships between variables.

A central part of this Learning Outcome is for the learner to achieve efficient manipulative skills in the use of algebra.

Learning Outcome 2 focuses on:

- describing patterns and relationships through the use of symbolic expressions, graphs and tables; and
- identifying and analysing regularities and change in patterns and relationships that enable the learner to make predictions and solve problems.

Investigating patterns and relationships allows the learner to develop an appreciation of the aesthetic and creative qualities of Mathematics. These investigations develop mathematical thinking skills such as: generalising, explaining, describing, observing, inferring, specialising, creating, justifying, representing, refuting and predicting.

Mathematical skills are developed over time. The learner should be given opportunities at every grade level to develop these skills to greater levels of sophistication so that they can be used with greater competence and confidence.

Contexts should be selected in which the learner can use algebraic language and skills to describe patterns and relationships in a way that builds awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- investigate geometric patterns in art and architecture;
- study symmetrical patterns that occur in nature;
- understand formulae used to calculate pensions and medical aid rates;
- understand and use formulae for calculating quantities encountered in Natural Sciences (e.g. air pressure, resistance, voltage);
- consider how graphs in the media can be manipulated to misrepresent trends and patterns; and
- use mathematical models to represent relationships within an ecosystem.

Intermediate Phase focus

In the Intermediate Phase, the study of numeric and geometric patterns is extended with a special focus on the relationships:

- between terms in a sequence; and
- between the number of the term (its place in the sequence) and the term itself.

The study of numeric and geometric patterns develops the concepts of variable, relationship and function. The understanding of these relationships by the learner will allow her or him to describe the rules generating the patterns.

This phase has a particular focus on the use of different, yet equivalent, representations to describe problems or relationships by means of flow diagrams, tables, number sentences or verbally.

Graphs are not dealt with in this Learning Outcome in the Intermediate Phase. However, the learner is given opportunities to read, interpret and draw graphs within data contexts (see Learning Outcome 5).



Learning Outcome 3: Space and Shape (Geometry)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.

Learning Outcome focus

The study of space and shape improves understanding and appreciation of the pattern, precision, achievement and beauty in natural and cultural forms. It focuses on the properties, relationships, orientations, positions and transformations of two-dimensional shapes and three-dimensional objects.

The study of space and shape enables the learner to:

- develop the ability to visualise, interpret, calculate relevant values, reason and justify; and
- interpret, understand, classify, appreciate and describe the world through two-dimensional shapes and three-dimensional objects, their location, movement and relationships.

The learner should gain these skills from experiences with concrete objects, through drawing and construction, and in the abstract justification of spatial relationships. It is important that the study of two-dimensional shapes and three-dimensional objects be contextualised to include the study of natural and cultural forms and artefacts.

Contexts should be selected in which the learner can study space and shape in a way that can be used to build awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- use national flags to demonstrate transformations and symmetry in designs;
- investigate and recognise the geometrical properties and patterns existing in traditional and modern architecture;
- use maps in Geography as specific forms of grids; and
- investigate geometric patterns in art.

Intermediate Phase focus

The learner's experience of space and shape in this phase moves from recognition and simple description to classification and more detailed description of features and properties of two-dimensional shapes and three-dimensional objects.

Learners should be given opportunities to:

- draw two-dimensional shapes and make models of three-dimensional objects; and
- describe location, transformations and symmetry.



Learning Outcome 4: Measurement

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.

Learning Outcome focus

The ability to measure appropriately has been developed by humans over time and through various cultures. Measurement focuses on the selection and use of appropriate units, instruments and formulae to quantify characteristics of events, shapes, objects and the environment.

Measuring relates directly to the learner's scientific, technological and economic worlds, enabling the learner to:

- make sensible estimates;
- be alert to the reasonableness of measurements and results.

Contexts should be selected in which the learner can measure in a way that builds awareness of other Learning Areas, as well as human rights, social, political, economic, cultural and environmental issues. For example, the learner should be able to:

- measure and compare distances and times taken by learners from home to school;
- compare the capacity of dams and the volume of water available through taps in a particular community;
- measure working hours and their relation to income earned;
- compare the distribution and allocation of land areas to population size; and
- use measuring units from Technology, Natural Sciences and Social Sciences.

Intermediate Phase focus

In this phase, the learner is introduced to the use of standardised units of measurement and appropriate instruments for measuring. The learner should be able to estimate and verify results through accurate measurement.

A useful teaching and learning strategy is to expose the learner to a variety of measurement activities that will make it possible to select and convert between appropriate units of measurement. Measurement is an opportunity to use common fractions and decimals in context.

Measurement in this phase should also enable the learner to:

- informally measure angles, area, perimeter and capacity/volume; and
- discuss and describe the historical development of measuring instruments and tools.



Learning Outcome 5: Data Handling

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.

Learning Outcome focus

Data – that is, information in statements, graphs and tables – bombard our senses through television, newspapers and other media. For example, crime rates, rainfall, sports results, election polls, government spending, population and economic growth are all reported in graphical or summarised form as statistics.

Through the study of data handling, the learner develops the skills to collect, organise, display, analyse and interpret this information. This enables meaningful participation in political, social and economic activities.

Making sense of data involves collecting, organising, analysing, summarising, interpreting, drawing conclusions and making predictions.

Through the study of chance, the learner will also develop skills and techniques for making informed choices, and coping with randomness and uncertainty.

In this Learning Outcome, the learner will develop a sense of how Mathematics can be used to manipulate data, to represent or misrepresent trends and patterns. The learner will develop a sense of how Mathematics can provide solutions that sustain or destroy the environment, and promote or harm the health of others. The learner is thereby able to use Mathematics effectively and critically, showing responsibility towards the environment and health of others. For example, the learner should be able to understand:

- the distribution of resources according to class, race or gender; and
- economic trends and patterns between developing countries and developed countries.

Intermediate Phase focus

The focus in the teaching and learning of data handling in the Intermediate Phase is on gaining the skills to gather and summarise data so that they can be interpreted and predictions made from them.

The learner should become aware that:

- different questions reveal different features of a situation, and that this will affect the ability to understand the situation; and that
- different forms of representation highlight some aspects of the data while hiding others, and that this, too, has a role in limiting interpretations of the data.

The learner should begin to develop sensitivity to how the data-gathering context limits interpretation and prediction (e.g. interviewing only boys on the role of peer pressure in deciding whether or not to start smoking may give different results compared to interviewing only girls or interviewing both boys and girls).

Contexts should be selected to read, interpret and represent data that build awareness of human rights and other social, economic and environmental issues. Such contexts should focus on discrete data involving whole numbers only.

The learner should develop the capacity to analyse critically interpretations and predictions from data.

The study of chance (probability) develops awareness that:

- different situations have different probabilities of occurring; and
- for many situations there are a finite number of different possible outcomes.

In this phase, the learner is *not* expected to calculate the probability of events occurring.

ASSESSMENT STANDARDS

In the next sections, the Assessment Standards for each Learning Outcome will be given for each grade in the Intermediate Phase.

Grade 4



Learning Outcome 1

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Counts forwards and backwards in a variety of intervals (including 2s, 3s, 5s, 10s, 25s, 50s and 100s) between 0 and at least 10 000.
- Describes and illustrates various ways of counting in different cultures (including local) throughout history.
- Recognises and represents the following numbers in order to describe and compare them:
 - whole numbers to at least 4-digit numbers;
 - common fractions with different denominators including halves, thirds, quarters, fifths, sixths, sevenths and eighths;
 - common fractions in diagrammatic form;
 - decimal fractions of the form 0,5; 1,5 and 2,5 and so on, in the context of measurement;
 - odd and even numbers to at least 1 000;
 - multiples of single-digit numbers to at least 100.
- Recognises the place value of digits in whole numbers to at least 4-digit numbers.
- Recognises and uses equivalent forms of the numbers listed above, including:
 - common fractions with denominators that are multiples of each other;
 - decimal fractions of the form 0,5, 1,5 and 2,5 and so on, in the context of measurement.

Grade 5



Assessment Standards

We know this when the learner:

- Counts forwards and backwards in whole number intervals and fractions.
- Describes and illustrates various ways of writing numbers in different cultures (including local) throughout history.
- Recognises and represents the following numbers in order to describe and compare them:
 - whole numbers to at least 6-digit numbers;
 - common fractions to at least twelfths;
 - decimal fractions of the form 0,5, 1,5 and 2,5 and so on, in the context of measurement;
 - 0 in terms of additive inverses;
 - 1 in terms of multiplicative inverses;
 - multiples of single-digit numbers to at least 100;
 - factors of at least any 2-digit whole number.
- Recognises the place value of digits in whole numbers to at least 6-digit numbers.
- Recognises and uses equivalent forms of the numbers listed above, including:
 - common fractions with denominators that are multiples of each other;
 - decimal fractions of the form 0,5, 1,5 and 2,5 and so on, in the context of measurement.

Grade 6



Assessment Standards

We know this when the learner:

- Counts forwards and backwards in decimals.
- Describes and illustrates written number systems different to own.
- Recognises and represents the following numbers in order to describe and compare them:
 - whole numbers to at least 9-digit numbers;
 - decimal fractions to at least two decimal places;
 - common fractions including specifically tenths, hundreds and percentages;
 - 0 in terms of its additive property;
 - 1 in terms of its multiplicative property;
 - multiples and factors of at least any 2-digit and 3-digit whole number;
 - prime numbers to at least 100.
- Recognises the place value of digits in:
 - whole numbers to at least 9-digit numbers;
 - decimal fractions to at least 2 decimal places.
- Recognises and uses equivalent forms of the numbers listed above, including:
 - common fractions with 1-digit or 2-digit denominators;
 - decimal fractions to at least 2 decimal places;
 - percentages.

Grade 4



Learning Outcome 1 Continued

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Solves problems in context including contexts that may be used to build awareness of other Learning Areas, as well as human rights, social, economic and environmental issues such as:
 - financial (including buying and selling, and simple budgets);
 - measurements in Natural Sciences and Technology contexts.
- Solves problems that involve:
 - comparing two or more quantities of the same kind (ratio);
 - comparing two quantities of different kinds (rate, e.g. kg/R).
- Estimates and calculates by selecting and using operations appropriate to solving problems that involve:
 - rounding off to the nearest 10, 100 or 1 000;
 - addition and subtraction of whole numbers with at least 4 digits;
 - addition of common fractions in context;
 - multiplication of at least whole 2-digit by 2-digit numbers;
 - division of at least whole 3-digit by 1-digit numbers;
 - equal sharing with remainders.

Grade 5



Assessment Standards

We know this when the learner:

- Solves problems in context including contexts that may be used to build awareness of other Learning Areas, as well as human rights, social, economic and environmental issues such as:
 - financial (including buying and selling, profit and loss, and simple budgets);
 - measurements in Natural Sciences and Technology contexts.
- Solves problems that involve:
 - comparing two or more quantities of the same kind (ratio);
 - comparing two quantities of different kinds (e.g. learners/teacher).
- Estimates and calculates by selecting and using operations appropriate to solving problems that involve:
 - rounding off to the nearest 5, 10, 100 or 1 000;
 - addition and subtraction of whole numbers with at least 5 digits;
 - addition and subtraction of common fractions with the same denominator and whole numbers with common fractions (mixed numbers);
 - multiplication of at least whole 3-digit by 2-digit numbers;
 - division of at least whole 3-digit by 2-digit numbers;
 - finding fractions of whole numbers which result in whole numbers;
 - equivalent fractions.

Grade 6



Assessment Standards

We know this when the learner:

- Solves problems in context including contexts that may be used to build awareness of other Learning Areas, as well as human rights, social, economic and environmental issues such as:
 - financial (including buying and selling, profit and loss, simple budgets, reading and interpreting accounts, and discount);
 - measurements in Natural Sciences and Technology contexts.
- Solves problems that involve:
 - comparing two or more quantities of the same kind (ratio);
 - comparing two quantities of different kinds (rate, e.g. wages/day).
- Estimates and calculates by selecting and using operations appropriate to solving problems that involve:
 - rounding off to the nearest 5, 10, 100 or 1 000;
 - addition and subtraction of whole numbers;
 - addition and subtraction of common fractions with denominators which are multiples of each other and whole numbers with common fractions (mixed numbers);
 - multiplication of at least whole 4-digit by 3-digit numbers;
 - division of at least whole 4-digit by 3-digit numbers;
 - finding fractions of whole numbers;
 - equivalent fractions;
 - addition and subtraction of positive decimals with at least 2 decimal places;
 - finding percentages of whole numbers;
 - multiple operations on whole numbers with or without brackets.

Grade 4



Learning Outcome 1 Continued

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Performs mental calculations involving:
 - addition and subtraction;
 - multiplication of whole numbers to at least 10×10 .
- Uses a range of techniques to perform written and mental calculations with whole numbers including:
 - building up and breaking down numbers;
 - rounding off and compensating;
 - doubling and halving;
 - using a number-line;
 - using a calculator.
- Uses a range of strategies to check solutions and judges the reasonableness of solutions.
- Recognises, describes and uses:
 - the reciprocal relationship between multiplication and division (e.g. if $5 \times 3 = 15$ then $15 \div 3 = 5$ and $15 \div 5 = 3$);
 - the equivalence of division and fractions (e.g. $1 \div 8 = \frac{1}{8}$);
 - the commutative, associative and distributive properties with whole numbers (the expectation is that learners should be able to use the properties and not necessarily know the names).

Grade 5



Assessment Standards

We know this when the learner:

- Performs mental calculations involving:
 - addition and subtraction;
 - multiplication of whole numbers to at least 10×10 .
- Uses a range of techniques to perform written and mental calculations with whole numbers including:
 - adding and subtracting in columns;
 - building up and breaking down numbers;
 - rounding off and compensating;
 - doubling and halving;
 - using a calculator.
- Uses a range of strategies to check solutions and judge the reasonableness of solutions.
- Recognises, describes and uses:
 - the reciprocal relationship between multiplication and division (e.g. if $5 \times 3 = 15$ then $15 \div 3 = 5$ and $15 \div 5 = 3$);
 - the equivalence of division and fractions (e.g. $1 \div 8 = \frac{1}{8}$);
 - the commutative, associative and distributive properties with whole numbers (the expectation is that learners should be able to use the properties and not necessarily know the names).

Grade 6



Assessment Standards

We know this when the learner:

- Performs mental calculations involving:
 - addition and subtraction;
 - multiplication of whole numbers to at least 12×12 .
- Uses a range of techniques to perform written and mental calculations with whole numbers including:
 - adding, subtracting and multiplying in columns;
 - long division;
 - building up and breaking down numbers;
 - rounding off and compensating;
 - using a calculator.
- Uses a range of strategies to check solutions and judge the reasonableness of solutions.
- Recognises, describes and uses:
 - divisibility rules for 2, 5, 10, 100 and 1 000;
 - the commutative, associative and distributive properties with whole numbers (the expectation is that learners should be able to use the properties and not necessarily know the names).

Grade 4



Learning Outcome 2

PATTERNS, FUNCTIONS AND ALGEBRA

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.



Assessment Standards

We know this when the learner:

- Investigates and extends numeric and geometric patterns looking for a relationship or rules, including patterns:
 - represented in physical or diagrammatic form;
 - not limited to sequences involving constant difference or ratio;
 - found in natural and cultural contexts;
 - of the learner's own creation.
- Describes observed relationships or rules in own words.
- Determines output values for given input values using:
 - verbal descriptions;
 - flow diagrams.
- Writes number sentences to describe a problem situation, including problems within contexts that may be used to build awareness of human rights, social, economic, cultural and environmental issues.
- Solves or completes number sentences by inspection or by trial-and-improvement, checking the solutions by substitution (e.g. $\square \div 4 = 12$).
- Determines, through discussion and comparison, the equivalence of different descriptions of the same relationship or rule presented:
 - verbally;
 - in flow diagrams;
 - by number sentences.

Grade 5



Assessment Standards

We know this when the learner:

- Investigates and extends numeric and geometric patterns looking for a relationship or rules, including patterns:
 - represented in physical or diagrammatic form;
 - not limited to sequences involving constant difference or ratio;
 - found in natural and cultural contexts;
 - of the learner's own creation.
- Describes observed relationships or rules in own words.
- Determines output values for given input values using:
 - verbal descriptions;
 - flow diagrams.
- Writes number sentences to describe a problem situation, including problems within contexts that may be used to build awareness of human rights, social, economic, cultural and environmental issues.
- Solves or completes number sentences by inspection or by trial-and-improvement, checking the solutions by substitution (e.g. $\square \div 4 = 12$).
- Determines, through discussion and comparison, the equivalence of different descriptions of the same relationship or rule presented:
 - verbally;
 - in flow diagrams;
 - by number sentences.

Grade 6



Assessment Standards

We know this when the learner:

- Investigates and extends numeric and geometric patterns looking for a relationship or rules, including patterns:
 - represented in physical or diagrammatic form;
 - not limited to sequences involving constant difference or ratio;
 - found in natural and cultural contexts;
 - of the learner's own creation;
 - represented in tables.
- Describes observed relationships or rules in own words.
- Determines output values for given input values, or input values for given output values, using:
 - verbal descriptions;
 - flow diagrams;
 - tables.
- Writes number sentences to describe a problem situation, including problems within contexts that may be used to build awareness of human rights, social, economic, cultural and environmental issues.
- Solves or completes number sentences by inspection or by trial-and-improvement, checking the solutions by substitution (e.g. $2 \times \square - 8 = 0$).
- Determines, through discussion and comparison, the equivalence of different descriptions of the same relationship or rule presented:
 - verbally;
 - in flow diagrams;
 - by number sentences;
 - in tables.

Grade 4



Learning Outcome 3

SPACE AND SHAPE (GEOMETRY)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.



Assessment Standards

We know this when the learner:

- Recognises, visualises and names two-dimensional shapes and three-dimensional objects in the environment including:
 - rectangular prisms, spheres, cylinders, and other objects;
 - prisms and pyramids;
 - circles and rectangles;
 - polygons in terms of the number of sides up to 8-sided figures.
- Describes, sorts and compares two-dimensional shapes and three-dimensional objects from the environment according to geometrical properties including:
 - shapes of faces,
 - number of sides;
 - flat and curved surfaces, straight and curved sides.
- Investigates and compares (alone and/or as a member of a group or team) two-dimensional shapes and three-dimensional objects studied in this grade according to properties listed above by:
 - making three-dimensional models using cut-out polygons (supplied);
 - drawing shapes on grid paper.
- Recognises and describes lines of symmetry in two-dimensional shapes, including those in nature and its cultural art forms.

Grade 5



Assessment Standards

We know this when the learner:

- Recognises, visualises and names two-dimensional shapes and three-dimensional objects in natural and cultural forms and geometric settings including those previously dealt with and focusing on:
 - similarities and differences between cubes and rectangular prisms;
 - similarities and differences between squares and rectangles.
- Describes, sorts and compares two-dimensional shapes and three-dimensional objects from the environment and from drawings or pictures according to properties including:
 - number and/or shape of faces;
 - number and/or length of sides.
- Investigates and compares (alone and/or as a member of a group or team) two-dimensional shapes and three-dimensional objects studied in this grade according to properties listed above by:
 - making models of geometric objects using polygons they have cut out;
 - cutting open models of geometric objects (e.g. boxes) to trace their nets;
 - drawing shapes on grid paper.
- Recognises, describes and performs rotations (turns), reflections (flips) and translations (slides) using geometric figures and solids.

Grade 6



Assessment Standards

We know this when the learner:

- Recognises, visualises and names two-dimensional shapes and three-dimensional objects in natural and cultural forms and geometric settings including those previously dealt with and focusing on:
 - similarities and differences between tetrahedrons and other pyramids;
 - similarities and differences between rectangles and parallelograms.
- Describes and classifies two-dimensional shapes and three-dimensional objects in terms of properties including:
 - faces, vertices and edges;
 - length of sides;
 - angle size of corners.
- Investigates and compares (alone and/or as a member of a group or team) two-dimensional shapes and three-dimensional objects studied in this grade according to properties listed above by:
 - making three-dimensional models using:
 - ▶ drinking straws to make a skeleton,
 - ▶ nets provided by the teacher;
 - drawing shapes on grid paper;
 - using a pair of compasses to draw circles, patterns in circles, and patterns with circles.
- Uses the vocabulary and properties of rotations, reflections and translations to describe the relationships between distinct two-dimensional shapes and three-dimensional objects within patterns (including transformations and symmetry).

Grade 4



Learning Outcome 3 Continued

SPACE AND SHAPE (GEOMETRY)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.



Assessment Standards

We know this when the learner:

- Makes two-dimensional shapes, three-dimensional objects and patterns from geometric objects and shapes (e.g. tangrams) with a focus on tiling (tessellation) and line symmetry.
- Recognises and describes natural and cultural two-dimensional shapes, three-dimensional objects and patterns in terms of geometric properties.
- Describes changes in the view of an object held in different positions.
- Locates position on a coded (labelled) grid including:
 - maps from given instructions;
 - column and row.

Grade 5



Assessment Standards

We know this when the learner:

- Makes two-dimensional shapes, three-dimensional objects and patterns from geometric shapes and describes these in terms of:
 - tessellations;
 - line and rotational symmetry;
 - movement including rotations, reflections and translations.
- Recognises and describes natural and cultural two-dimensional shapes, three-dimensional objects and patterns in terms of geometric properties.
- Describes and sketches views of a simple three-dimensional object in different positions.
- Locates position on a coded (labelled) grid including maps and traces a path between positions following verbal and written instructions.

Grade 6



Assessment Standards

We know this when the learner:

- Draws enlargements and reductions of two-dimensional shapes (at least quadrilaterals and triangles) using grid paper to compare their size and shape.
- Recognises and describes natural and cultural two-dimensional shapes, three-dimensional objects and patterns in terms of geometric properties.
- Draws and interprets sketches of simple three-dimensional objects from different positions (perspectives).
- Locates positions on a coded grid, describes how to move between positions on the grid, and recognises maps as grids.

Grade 4



Learning Outcome 4

MEASUREMENT

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.



Assessment Standards

We know this when the learner:

- Reads, tells and writes analogue, digital and 24-hour time to at least the nearest minute and second.
- Solves problems involving calculation and conversion between appropriate time units including seconds, minutes, hours, days, weeks, months and years.
- Uses time-measuring instruments to appropriate levels of precision, including watches and clocks.
- Describes and illustrates ways of measuring and representing time in different cultures throughout history.
- Estimates, measures, records, compares and orders two-dimensional shapes and three-dimensional objects using S.I. units with appropriate precision for:
 - mass using grams (g) and kilograms (kg);
 - capacity using millilitres (ml) and litres (l);
 - length using millimetres (mm), centimetres (cm), metres (m) and kilometres (km).
- Solves problems involving selecting, calculating with and converting between appropriate S.I. units listed above, integrating appropriate contexts for Technology and Natural Sciences.

Grade 5



Assessment Standards

We know this when the learner:

- Reads, tells and writes analogue, digital and 24-hour time to at least the nearest minute and second.
- Solves problems involving calculation and conversion between appropriate time units including decades, centuries and millennia.
- Uses time-measuring instruments to appropriate levels of precision including watches and stopwatches.
- Describes and illustrates ways of representing time in different cultures throughout history.
- Estimates, measures, records, compares and orders two-dimensional shapes and three-dimensional objects using S.I. units with appropriate precision for:
 - mass using grams (g) and kilograms (kg);
 - capacity using millilitres (ml) and litres (l);
 - length using millimetres (mm), centimetres (cm), metres (m) and kilometres (km);
 - temperature using degree Celsius scale.
- Solves problems involving selecting, calculating with and converting between appropriate S.I. units listed above, integrating appropriate contexts for Technology and Natural Sciences.

Grade 6



Assessment Standards

We know this when the learner:

- Reads, tells and writes analogue, digital and 24-hour time to at least the nearest minute and second.
- Solves problems involving calculations and conversion between appropriate time units including time zones and differences.
- Describes and illustrates ways of representing time in different cultures throughout history.
- Estimates, measures, records, compares and orders two-dimensional shapes and three-dimensional objects using S.I. units with appropriate precision for:
 - mass using grams (g) and kilograms (kg);
 - capacity using millilitres (ml) and litres (l);
 - length using millimetres (mm), centimetres (cm), metres (m) and kilometres (km);
 - temperature using degree Celsius scale.
- Solves problems involving selecting, calculating with and converting between appropriate S.I. units listed above, integrating with appropriate Technology and Natural Sciences contexts.

Grade 4



Learning Outcome 4 Continued

MEASUREMENT

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.



Assessment Standards

We know this when the learner:

- Uses appropriate measuring instruments (with understanding of their limitations) to appropriate levels of precision including:
 - bathroom scales, kitchen scales and balances to measure mass;
 - measuring jugs to measure capacity;
 - rulers, metre sticks, tape measures and trundle wheels to measure length.

- Investigates and approximates (alone and/or as a member of a group or team):
 - perimeter using rulers or measuring tapes;
 - area of polygons (using square grids and tiling) in order to develop an understanding of square units;
 - volume/capacity of three-dimensional objects (by packing or filling them) in order to develop an understanding of cubic units.

Grade 5



Assessment Standards

We know this when the learner:

- Uses appropriate measuring instruments (with understanding of their limitations) to appropriate levels of precision including:
 - bathroom scales, kitchen scales and balances to measure mass;
 - measuring jugs to measure capacity;
 - rulers, metre sticks, tape measures and trundle wheels to measure length;
 - thermometers to measure temperature.

- Investigates and approximates (alone and/or as a member of a group or team):
 - perimeter using rulers or measuring tapes;
 - area of polygons (using square grids and tiling) in order to develop an understanding of square units;
 - volume/capacity of objects (by packing or filling them) in order to develop an understanding of cubic units.

- Recognises and describes right angles in two-dimensional shapes, three-dimensional objects and the environment.

Grade 6



Assessment Standards

We know this when the learner:

- Uses appropriate measuring instruments (with understanding of their limitations) to appropriate levels of precision including:
 - bathroom scales, kitchen scales and balances to measure mass;
 - measuring jugs to measure capacity;
 - rulers, metre sticks, tape measures and trundle wheels to measure length;
 - thermometers to measure temperature.

- Describes and illustrates ways of measuring in different cultures throughout history, including informal measuring systems.

- Investigates and approximates (alone and/or as a member of a group or team):
 - perimeter using rulers or measuring tapes;
 - area of polygons (using square grids) in order to develop rules for calculating the area of squares and rectangles;
 - volume/capacity of objects (by packing or filling them) in order to develop rules for calculating volume of rectangular prisms.

- Investigates relationships between the perimeter and area of rectangles and squares.

- Investigates relationships between surface area, volume and the dimensions of rectangular prisms.

- Recognises and describes angles in two-dimensional shapes, three-dimensional objects and the environment in terms of:
 - right angles;
 - angles smaller than right angles;
 - angles greater than right angles.

Grade 4



Learning Outcome 5

DATA HANDLING

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.



Assessment Standards

We know this when the learner:

- Poses simple questions about own school and family environment, and identifies appropriate data sources in order to address human rights, social, political, cultural, environmental and economic issues in that environment.
- Collects data (alone and/or as a member of a group or team) in the classroom and school environment to answer questions posed by the teacher and the class.
- Organises and records data using tallies and tables.
- Draws a variety of graphs to display and interpret data (ungrouped) including:
 - pictographs with a one-to-one correspondence between data and representation (e.g. one picture = one person);
 - bar graphs.

Grade 5



Assessment Standards

We know this when the learner:

- Poses simple questions about own school and family environment, and identifies appropriate data sources in order to address human rights, social, political, cultural, environmental and economic issues in that environment.
- Makes and uses simple data collection sheets that involve counting objects in order to collect data (alone and/or as a member of a group or team) to answer questions posed by the teacher and the class.
- Organises and records data using tallies and tables.
- Examines ungrouped numerical data to determine the most frequently occurring score (mode) of the data set in order to describe central tendencies.
- Draws a variety of graphs to display and interpret data (ungrouped) including:
 - pictographs with a many-one correspondence and appropriate keys (e.g. one picture = ten persons);
 - bar graphs.

Grade 6



Assessment Standards

We know this when the learner:

- Poses simple questions about own school and family environment, and identifies appropriate data sources in order to address human rights, social, political, cultural, environmental and economic issues in that environment.
- Uses simple data collection sheets (requiring tallies) and simple questionnaires (with yes/no type responses) in order to collect data (alone and/or as a member of a group or team) to answer questions posed by the teacher, class and self.
- Distinguishes between samples and populations.
- Organises and records data using tallies and tables.
- Examines ungrouped numerical data to determine the most frequently occurring score (mode) and the midpoint (median) of the data set in order to describe central tendencies.
- Draws a variety of graphs by hand/technology to display and interpret data (grouped and ungrouped) including:
 - pictographs with a many-one correspondence and appropriate keys;
 - bar graphs and double bar graphs.

Grade 4



Learning Outcome 5 Continued

DATA HANDLING

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.



Assessment Standards

We know this when the learner:

- Critically reads and interprets data presented in a variety of ways (including own representations and representations in the media – both words and graphs) to draw conclusions and make predictions sensitive to the role of:
 - context (e.g. rural or urban);
 - other human rights issues.

- Compares and classifies events from daily life as:
 - certain that they will happen; or
 - certain that they will not happen; or
 - uncertain.

- Counts the number of possible outcomes for simple trials.

Grade 5



Assessment Standards

We know this when the learner:

- Critically reads and interprets data presented in a variety of ways (including own representations, representations in the media – both words and graphs) to draw conclusions and make predictions sensitive to the role of:
 - context (e.g. rural or urban);
 - categories within the data (e.g. gender and race);
 - other human rights issues.
- Compares, classifies and orders events from daily life on a scale from ‘certain that they will happen’ to ‘certain that they will not happen’.
- Lists possible outcomes for simple experiments (including tossing a coin, rolling a die, and spinning a spinner).
- Counts the frequency of actual outcomes for a series of trials.

Grade 6



Assessment Standards

We know this when the learner:

- Critically reads and interprets data presented in a variety of ways (including own representations, representations in the media – words, graphs, pie graphs) to draw conclusions and make predictions sensitive to the role of:
 - context (e.g. rural or urban, national or provincial);
 - categories within the data (e.g. age, gender, race);
 - other human rights issues.
- Predicts the likelihood of events in daily life based on observation, and places them on a scale from ‘impossible’ to ‘certain’.
- Lists possible outcomes for simple experiments (including tossing a coin, rolling a die, and spinning a spinner).
- Counts the frequency of actual outcomes for a series of trials.



CHAPTER 4

SENIOR PHASE

(Grades 7-9)

INTRODUCTION

The Senior Phase section of the Learning Area Statement starts with an overview of the five Mathematics Learning Outcomes. The importance of each outcome is explained for both the learner of Mathematics and the learner in general. Also included is a phase-specific discussion on the teaching and learning focus of the Learning Outcomes within this phase.

The minimum Assessment Standards for each Learning Outcome in Grades 7, 8 and 9 are listed. The Assessment Standards for each grade show progression of knowledge, skills and values within the phase.

These Assessment Standards are closely related to each other. Whenever possible, learning activities should address:

- more than one related Assessment Standard within a Learning Outcome; and
- related Assessment Standards across Learning Outcomes within the grade.

LEARNING OUTCOMES



Learning Outcome 1: Numbers, Operations and Relationships

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.

Learning Outcome focus

Learning Outcome 1 builds the learner's number sense, which is the foundation of further study in Mathematics, and develops the learner's understanding of:

- what different kinds of numbers mean;
- how different kinds of numbers relate to one another;
- the relative size of different numbers;
- how different numbers can be thought about and represented in various ways; and
- the effect of operating with numbers.

Essential to the development of number sense is knowledge of basic number facts, the use of efficient and accurate methods for calculation and measurement, and a range of strategies for estimating and checking results.

Learning Outcome 1 also provides opportunities for the learner to use appropriate technology and to engage with the historical and cultural developments of numerical counting and writing systems. Learners with a good sense of number and operations have the mathematical confidence to make sense of problems and results in various contexts.

Contexts should be selected in which the learner has to count, estimate and calculate in a way that builds awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- compare counting in different African languages and relate this to the geographical locations of the language groups;
- count animals in the environment with an awareness of animals at risk of becoming extinct;
- compare national health statistics with an awareness of how the learner's own region is affected;
- calculate and compare the ratios of elements in a chemical compound;
- interpret climatic conditions (e.g. read temperature and rainfall information); and
- calculate within the financial contexts found in the Economic and Management Sciences Learning Area.

Senior Phase focus

The range of numbers developed by the end of Grade 9 is the set of rational numbers. In this phase, the learner should:

- expand the capacity to represent numbers in a variety of ways and move flexibly between representations;
- be given ample opportunity to solve a variety of problems, using an increased range of numbers and the ability to perform multiple operations correctly and fluently;
- be able to recognise irrational numbers such as π and the square roots of non-perfect squares that arise in the context of measurement; and
- be able to use rational approximations (determined by calculator) of p, square and cube roots.

Contexts for solving problems should be expanded to contexts involving negative numbers and percentages (e.g. calculate simple and compound interest).

The learner should be encouraged to:

- sharpen the ability to estimate and judge the reasonableness of solutions, using a variety of strategies (including mental calculations, calculators and proportional reasoning); and
- use number knowledge to develop algebraic skills.



Learning Outcome 2: Patterns, Functions and Algebra

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.

Learning Outcome focus

Algebra is the language for investigating and communicating most of Mathematics. Algebra can be seen as generalised arithmetic, and can be extended to the study of functions and other relationships between variables. A central part of this outcome is for the learner to achieve efficient manipulative skills in the use of algebra.

Learning Outcome 2 focuses on:

- describing patterns and relationships through the use of symbolic expressions, graphs and tables; and
- identifying and analysing regularities and change in patterns and relationships that enable learners to make predictions and solve problems.

Investigating patterns and relationships allows the learner to develop an appreciation of the aesthetic and creative qualities of Mathematics. These investigations develop mathematical thinking skills such as generalising, explaining, describing, observing, inferring, specialising, creating, justifying, representing, refuting and predicting.

Mathematical skills are developed over time. The learner should be given opportunities at every grade level to develop these skills to greater levels of sophistication so that they can be used with greater competence and confidence.

Contexts should be selected in which the learner can use algebraic language and skills to describe patterns and relationships in a way that builds awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- investigate geometric patterns in art and architecture;
- study symmetrical patterns that occur in nature;
- understand formulae used to calculate pensions and medical aid rates;
- understand and use formulae for calculating quantities encountered in Natural Sciences (e.g. air pressure, resistance, voltage);
- consider how graphs in the media can be manipulated to misrepresent trends and patterns; and
- use mathematical models to represent relationships within an ecosystem.

Senior Phase focus

In the Senior Phase the focus of Learning Outcome 2 is to formalise the rules generating patterns. The learner should continue to:

- investigate numerical and geometric patterns to establish the relationships between variables; and
- express rules governing patterns in algebraic language or symbols.

The learner continues to analyse situations in a variety of contexts in order to make sense of them, with added ability to represent and describe them in algebraic language, formulae, expressions and graphs. The learner should be exposed to a variety of functions and graphs to compare their global features, rather than to focus on the behaviour or the features of particular functions or graphs.

The learner should also study properties of algebraic expressions by manipulating them with sufficient practice to form simpler equivalent expressions for calculating and solving problems. The learner should develop an appreciation of how algebraic manipulation is useful for solving problems (and not engage in algebraic manipulation for its own sake).



Learning Outcome 3: Space and Shape (Geometry)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.

Learning Outcome focus

The study of space and shape improves understanding and appreciation of the pattern, precision, achievement and beauty in natural and cultural forms. It focuses on the properties, relationships, orientations, positions and transformations of two-dimensional shapes and three-dimensional objects.

The study of space and shape enables the learner to:

- develop the ability to visualise, interpret, calculate relevant values, reason and justify; and
- interpret, understand, classify, appreciate and describe the world through two-dimensional shapes and three-dimensional objects, their location, movement and relationships.

The learner should gain these skills from experiences with concrete objects, through drawing and construction, and in the abstract justification of spatial relationships. It is important that the study of two-dimensional shapes and three-dimensional objects be contextualised to include the study of natural and cultural forms and artefacts.

Contexts should be selected which enable the learner to study space and shape in a way that can be used to build awareness of other Learning Areas, as well as human rights, social, economic, cultural, political and environmental issues. For example, the learner should be able to:

- use national flags to demonstrate transformations and symmetry in designs;
- investigate and recognise the geometrical properties and patterns existing in traditional and modern architecture;
- use maps in geography as specific forms of grids; and
- investigate geometric patterns in art.

Senior Phase focus

In the Senior Phase two-dimensional shapes and three-dimensional objects are referred to as geometric figures and solids. In this phase the learner draws and constructs a wide range of geometric figures and solids using appropriate geometric instruments. The learner should develop an appreciation for the use of constructions to investigate the properties of geometric figures and solids.

Classification and description of geometric figures and solids should be extended to include similarity and congruence. The learner should develop the ability to reason effectively and justify appropriately when required.



Learning Outcome 4: Measurement

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.

Learning Outcome focus

The ability to measure appropriately has been developed by humans over time and through various cultures. Measurement focuses on the selection and use of appropriate units, instruments and formulae to quantify characteristics of events, shapes, objects and the environment.

Measuring relates directly to the learner's scientific, technological and economic worlds, enabling the learner to:

- make sensible estimates; and
- be alert to the reasonableness of measurements and results.

Contexts should be selected in which the learner can measure in a way that builds awareness of other Learning Areas, as well as human rights, social, political, economic, cultural and environmental issues. For example, the learner should be able to:

- measure and compare distances and times taken by learners from home to school;
- compare the capacity of dams and the volume of water available through taps in a particular community;
- measure working hours and their relation to income earned;
- compare the distribution and allocation of land areas to population size; and
- use measuring units from Technology, Natural Sciences and Social Sciences.

Senior Phase focus

In this phase the learner should:

- expand knowledge of measurement through investigative activities; and
- derive rules for calculating measurements relating to geometric figures and solids.

The learner should be able to solve problems in a variety of measurement contexts, through selection of appropriate formulae. Answers should be given with appropriate accuracy and precision, including the use of rational approximations for irrational numbers where necessary.

The Senior Phase learner is expected to:

- use measuring skills in the context of space and shape (Learning Outcome 3); and
- compare and evaluate measuring instruments and tools throughout history.



Learning Outcome 5: Data Handling

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.

Learning Outcome focus

Data – meaning information in statements, graphs and tables – bombard our senses through television, newspapers and other media. For example, crime rates, rainfall, sports results, election polls, government spending, population and economic growth are all reported in graphical or summarised form as statistics.

Through the study of data handling, the learner develops the skills to collect, organise, display, analyse and interpret this information. This enables the learner to participate meaningfully in political, social and economic activities.

Making sense of data involves collecting, organising, analysing, summarising, interpreting, drawing conclusions and making predictions.

Through the study of chance, the learner will also develop skills and techniques for making informed choices, and coping with randomness and uncertainty.

In this Learning Outcome, the learner will develop a sense of how Mathematics can be used to manipulate data, to represent or misrepresent trends and patterns. The learner will develop a sense of how Mathematics can provide solutions that sustain or destroy the environment, and/or promote or harm the health of others. The learner is thereby able to use Mathematics effectively and critically, showing responsibility towards the environment and health of others. For example, the learner should be able to understand:

- the distribution of resources according to class, race or gender; and
- economic trends and patterns between developing countries and developed countries.

Senior Phase focus

The focus of teaching and learning data handling in the Senior Phase is on the application of techniques already learned in order to investigate and solve problems. The learner is expected to deal with data in significant social, political, economic and environmental contexts with opportunities to explore relevant issues (e.g. HIV/AIDS, crime, abuse, environmental issues). In analysis and interpretation of data, the learner should be critical and aware of the use, and especially abuse, of data representation and statistics.

The learner in this phase should be expected to pose questions for investigation, and to gather, summarise and represent data in order to interpret and make predictions about situations. Data dealt with in this phase should include both discrete and continuous data.

In this phase the study of chance (probability) should include both single and compound events. Through experimentation and the analysis of situations, the learner should recognise the difference between the probability of outcomes and their relative frequency in simple experiments.

Understanding of probability in this phase should enable the learner to engage with expressions of chance and probability in life (e.g. ‘The HIV test is 85% reliable.’), and not merely to rely on formulae.

ASSESSMENT STANDARDS

The Assessment Standards for Grades 7-9 are presented in the following pages.

Grade 7



Learning Outcome 1

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Counts forwards and backwards in the following ways:
 - in decimal intervals;
 - in integers for any intervals.
- Describes and illustrates the historical and cultural development of numbers (e.g. integers, common fractions).
- Recognises, classifies and represents the following numbers in order to describe and compare them:
 - integers;
 - decimals (to at least three decimal places), fractions and percentages;
 - factors including prime factors of 3-digit whole numbers;
 - numbers in exponential form including squares of natural numbers to at least 12^2 , cubes of natural numbers to at least 5^3 , and their square and cube roots.
- Recognises and uses equivalent forms of the rational numbers listed above, including:
 - common fractions;
 - decimals;
 - percentages.

Grade 8



Assessment Standards

We know this when the learner:

- Describes and illustrates the historical and cultural development of numbers (e.g. irrational numbers).
- Recognises, classifies and represents the following numbers in order to describe and compare them:
 - integers;
 - decimals, fractions and percentages;
 - numbers written in exponential form including squares and cubes of natural numbers and their square and cube roots;
 - large numbers in scientific notation;
 - additive and multiplicative inverses;
 - multiples and factors;
 - irrational numbers in the context of measurement (e.g. π and square and cube roots of non-perfect squares and cubes).
- Recognises and uses equivalent forms of the rational numbers listed above.

Grade 9



Assessment Standards

We know this when the learner:

- Describes and illustrates the historical development of number systems in a variety of historical and cultural contexts (including local).
- Recognises, uses and represents rational numbers (including very small numbers written in scientific notation), moving flexibly between equivalent forms in appropriate contexts.

Grade 7



Learning Outcome 1 Continued

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Solves problems in context including contexts that may be used to build awareness of other Learning Areas, as well as human rights, social, economic and environmental issues such as:
 - financial (including profit and loss, budgets, accounts, loans, simple interest, hire purchase, exchange rates);
 - measurements in Natural Sciences and Technology contexts.

- Solves problems that involve ratio and rate.

- Estimates and calculates by selecting and using operations appropriate to solving problems that involve:
 - rounding off numbers to at least one decimal place;
 - multiple operations with integers;
 - addition, subtraction and multiplication of common fractions;
 - addition, subtraction and multiplication of positive decimals to at least 2 decimal places;
 - division of positive decimals with at least 3 decimal places by whole numbers;
 - finding percentages;
 - exponents.

- Performs mental calculations involving squares of natural numbers to at least 10^2 and cubes of natural numbers to at least 5^3 .

Grade 8



Assessment Standards

We know this when the learner:

- Solves problems in context including contexts that may be used to build awareness of other Learning Areas, as well as human rights, social, economic and environmental issues such as:
 - financial (including profit and loss, budgets, accounts, loans, simple interest, hire purchase, exchange rates);
 - measurements in Natural Sciences and Technology contexts.
- Solves problems that involve ratio and rate.
- Estimates and calculates by selecting and using operations appropriate to solving problems that involve:
 - rounding off;
 - multiple operations with rational numbers (including division with fractions and decimals);
 - exponents.

Grade 9



Assessment Standards

We know this when the learner:

- Solves problems in context including contexts that may be used to build awareness of other Learning Areas, as well as human rights, social, economic and environmental issues such as:
 - financial (including profit and loss, budgets, accounts, loans, simple and compound interest, hire purchase, exchange rates, commission, rentals and banking);
 - measurements in Natural Sciences and Technology contexts.
- Solves problems that involve ratio, rate and proportion (direct and indirect).
- Estimates and calculates by selecting and using operations appropriate to solving problems and judging the reasonableness of results (including measurement problems that involve rational approximations of irrational numbers).

Grade 7



Learning Outcome 1 Continued

NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.



Assessment Standards

We know this when the learner:

- Uses a range of techniques to perform calculations including:
 - using the commutative, associative and distributive properties with positive rational numbers and zero;
 - using a calculator.

- Uses a range of strategies to check solutions and judges the reasonableness of solutions.

- Recognises, describes and uses:
 - algorithms for finding equivalent fractions;
 - the commutative, associative and distributive properties with positive rational numbers and zero (the expectation is that learners should be able to use these properties and not necessarily to know the names of the properties).

Grade 8



Assessment Standards

We know this when the learner:

- Uses a range of techniques to perform calculations including:
 - using the commutative, associative and distributive properties with rational numbers;
 - using a calculator.
- Uses a range of strategies to check solutions and judges the reasonableness of solutions.
- Recognises, describes and uses:
 - algorithms for finding equivalent fractions;
 - the commutative, associative and distributive properties with rational numbers (the expectation is that learners should be able to use these properties and not necessarily to know the names of the properties).

Grade 9



Assessment Standards

We know this when the learner:

- Uses a range of techniques and tools (including technology) to perform calculations efficiently and to the required degree of accuracy, including the following laws and meanings of exponents (the expectation being that learners should be able to use these laws and meanings in calculations only):
 - $x^n \times x^m = x^{n+m}$
 - $x^n \div x^m = x^{n-m}$
 - $x^0 = 1$
 - $x^{-n} = \frac{1}{x^n}$
- Recognises, describes and uses the properties of rational numbers.

Grade 7



Learning Outcome 2

PATTERNS, FUNCTIONS AND ALGEBRA

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.



Assessment Standards

We know this when the learner:

- Investigates and extends numeric and geometric patterns looking for a relationship or rules, including patterns:
 - represented in physical or diagrammatic form;
 - not limited to sequences involving constant difference or ratio;
 - found in natural and cultural contexts;
 - of the learner's own creation;
 - represented in tables.
- Describes, explains and justifies observed relationships or rules in own words.
- Represents and uses relationships between variables in order to determine input and/or output values in a variety of ways using:
 - verbal descriptions;
 - flow diagrams;
 - tables.
- Constructs mathematical models that represent, describe and provide solutions to problem situations, showing responsibility toward the environment and the health of others (including problems within human rights, social, economic, cultural and environmental contexts).
- Solves or completes number sentences by inspection or by trial-and-improvement, checking the solutions by substitution (e.g. $2 \times \square - 8 = 4$).

Grade 8



Assessment Standards

We know this when the learner:

- Investigates and extends numeric and geometric patterns looking for a relationship or rules, including patterns:
 - represented in physical or diagrammatic form;
 - not limited to sequences involving constant difference or ratio;
 - found in natural and cultural contexts;
 - of the learner's own creation;
 - represented in tables;
 - represented algebraically.
- Describes, explains and justifies observed relationships or rules in own words or in algebra.
- Represents and uses relationships between variables in order to determine input and/or output values in a variety of ways using:
 - verbal descriptions;
 - flow diagrams;
 - tables;
 - formulae and equations.
- Constructs mathematical models that represent, describe and provide solutions to problem situations, showing responsibility toward the environment and the health of others (including problems within human rights, social, economic, cultural and environmental contexts).
- Solves equations by inspection, trial-and-improvement or algebraic processes (additive and multiplicative inverses), checking the solution by substitution.

Grade 9



Assessment Standards

We know this when the learner:

- Investigates, in different ways, a variety of numeric and geometric patterns and relationships by representing and generalising them, and by explaining and justifying the rules that generate them (including patterns found in natural and cultural forms and patterns of the learner's own creation).
- Represents and uses relationships between variables in order to determine input and/or output values in a variety of ways using:
 - verbal descriptions;
 - flow diagrams;
 - tables;
 - formulae and equations.
- Constructs mathematical models that represent, describe and provide solutions to problem situations, showing responsibility toward the environment and the health of others (including problems within human rights, social, economic, cultural and environmental contexts).
- Solves equations by inspection, trial-and-improvement or algebraic processes (additive and multiplicative inverses, and factorisation), checking the solution by substitution.

Grade 7



Learning Outcome 2 Continued

PATTERNS, FUNCTIONS AND ALGEBRA

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.



Assessment Standards

We know this when the learner:

- Describes a situation by interpreting a graph of the situation, or draws a graph from a description of a situation (e.g. height of a roller-coaster car over time; the speed of a racing car going around a track).

- Determines, analyses and interprets the equivalence of different descriptions of the same relationship or rule presented:
 - verbally;
 - in flow diagrams;
 - in tables;
 - by equations or expressionsin order to select the most useful representation for a given situation.

Grade 8



Assessment Standards

We know this when the learner:

- Describes a situation by interpreting a graph of the situation, or draws a graph from a description of a situation, with special focus on trends and features such as:
 - linear or non-linear;
 - increasing or decreasing;
 - maximum/minimum;
 - discrete or continuous.
- Determines, analyses and interprets the equivalence of different descriptions of the same relationship or rule presented:
 - verbally;
 - in flow diagrams;
 - in tables;
 - by equations or expressions
 in order to select the most useful representation for a given situation.

Grade 9



Assessment Standards

We know this when the learner:

- Draws graphs on the Cartesian plane for given equations (in two variables), or determines equations or formulae from given graphs using tables where necessary.
- Determines, analyses and interprets the equivalence of different descriptions of the same relationship or rule presented:
 - verbally;
 - in flow diagrams;
 - in tables;
 - by equations or expressions;
 - by graphs on the Cartesian plane
 in order to select the most useful representation for a given situation.

Grade 7



Learning Outcome 2 Continued

PATTERNS, FUNCTIONS AND ALGEBRA

The learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.



Assessment Standards

(There are no further Assessment Standards for this Learning Outcome in Grade 7.)

Grade 8



Assessment Standards

We know this when the learner:

- Uses conventions of algebraic notation and the commutative, associative and distributive laws to:
 - classify terms as like or unlike, and to justify the classification;
 - collect like terms;
 - multiply or divide an algebraic expression with one, two or three terms by a monomial;
 - simplify algebraic expressions given in bracket notation, involving one or two sets of brackets and two kinds of operations;
 - compare different representations of algebraic expressions involving one or more operations, selecting those which are equivalent, and justifying own choice;
 - write algebraic expressions, formulae or equations in simpler or more useful equivalent forms in context.
- Interprets and uses the following basic algebraic vocabulary in context: term, expression, coefficient, exponent (or index), base, constant, variable, equation, formula (or rule).

Grade 9



Assessment Standards

We know this when the learner:

- Uses the distributive law and manipulative skills developed in Grade 8 to:
 - find the product of two binomials;
 - factorise algebraic expressions (limited to common factors and difference of squares).
- Uses the laws of exponents to simplify expressions and solve equations.
- Uses factorisation to simplify algebraic expressions and solve equations.

Grade 7



Learning Outcome 3

SPACE AND SHAPE (GEOMETRY)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.



Assessment Standards

We know this when the learner:

- Recognises, visualises and names geometric figures and solids in natural and cultural forms and geometric settings, including those previously dealt with as well as focusing on:
 - similarities and differences between different polyhedra;
 - similarities and differences between all quadrilaterals including kites and trapeziums.
- In contexts that include those that may be used to build awareness of social, cultural and environmental issues, describes and classifies geometric figures and solids in terms of properties, including:
 - faces, vertices and edges;
 - sides and angles of polygons (with focus on, but not limited to, triangles and quadrilaterals);
 - parallel and perpendicular sides.
- Uses a pair of compasses, ruler and protractor to accurately construct geometric figures for investigation of own property and design of nets.
- Designs and uses nets to make models of geometric solids studied up to and including this grade.

Grade 8



Assessment Standards

We know this when the learner:

- Recognises, visualises and names geometric figures and solids in natural and cultural forms and geometric settings, including:
 - those previously dealt with;
 - the platonic solids (tetrahedron, cube, octahedron, dodecahedron, icosahedron).
- In contexts that include those that may be used to build awareness of social, cultural and environmental issues, describes and classifies geometric figures and solids in terms of properties, including:
 - sides, angles and diagonals and their interrelationships, with focus on triangles and quadrilaterals (e.g. types of triangles and quadrilaterals).
- Uses vocabulary to describe parallel lines cut by a transversal, perpendicular lines, intersecting lines and triangles in terms of angle relationships (e.g. vertically opposite, corresponding).
- Uses a pair of compasses, ruler and protractor to accurately construct geometric figures for investigation of own property and design of nets.
- Designs and uses nets to make a model of geometric solids studied up to and including this grade.

Grade 9



Assessment Standards

We know this when the learner:

- Recognises, visualises and names geometric figures and solids in natural and cultural forms and geometric settings, including:
 - regular and irregular polygons and polyhedra;
 - spheres;
 - cylinders.
- In contexts that include those that may be used to build awareness of social, cultural and environmental issues, describes the interrelationships of the properties of geometric figures and solids with justification, including:
 - congruence and straight line geometry;
 - transformations.
- Uses geometry of straight lines and triangles to solve problems and to justify relationships in geometric figures.
- Draws and/or constructs geometric figures and makes models of solids in order to investigate and compare their properties and model situations in the environment.

Grade 7



Learning Outcome 3 Continued

SPACE AND SHAPE (GEOMETRY)

The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.



Assessment Standards

We know this when the learner:

- Uses transformations (rotations, reflections and translations) and symmetry to investigate (alone and/or as a member of a group or team) properties of geometric figures.
- Recognises and describes the properties of similar and congruent figures and the difference between them.
- Draws and interprets sketches of solids from different perspectives.
- Locates positions on co-ordinate systems (ordered grids) and maps using:
 - horizontal and vertical change;
 - compass directions.

Grade 8



Assessment Standards

We know this when the learner:

- Uses transformations (rotations, reflections and translations) and symmetry to investigate (alone and/or as a member of a group or team) properties of geometric figures.
- Uses proportion to describe the effect of enlargement and reduction on properties of geometric figures.
- Draws and interprets sketches of geometric solids from different perspectives with attention to the preservation of properties.
- Locates positions on co-ordinate systems (ordered grids), Cartesian plane (first quadrant) and maps, and describes how to move between positions using:
 - horizontal and vertical change;
 - ordered pairs;
 - compass directions.

Grade 9



Assessment Standards

We know this when the learner:

- Uses transformations, congruence and similarity to investigate, describe and justify (alone and/or as a member of a group or team) properties of geometric figures and solids, including tests for similarity and congruence of triangles.
- Recognises and describes geometric solids in terms of perspective, including simple perspective drawing.
- Uses various representational systems to describe position and movement between positions, including:
 - ordered grids;
 - Cartesian plane (4 quadrants);
 - compass directions in degrees;
 - angles of elevation and depression.

Grade 7



Learning Outcome 4

MEASUREMENT

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.



Assessment Standards

We know this when the learner:

- Solves problems involving time, including relating time, distance and speed.
- Solves problems involving:
 - length;
 - perimeter and area of polygons;
 - volume and surface area of rectangular prisms.
- Solves problems using a range of strategies including:
 - estimating;
 - calculating to at least 2 decimal places;
 - using and converting between appropriate S.I. units.
- Describes and illustrates ways of measuring in different cultures throughout history, including metric and other formal measuring systems.
- Calculates, by selecting and using appropriate formulae:
 - perimeter of polygons;
 - area of triangles, rectangles and squares;
 - volume of triangular and rectangular based prisms.
- Describes interrelationships between perimeter and area of geometric figures.

Grade 8



Assessment Standards

We know this when the learner:

- Solves more complex problems involving time, including relating time, distance and speed.
- Solves problems involving:
 - length;
 - perimeter and area of polygons and circles;
 - volume and surface area of rectangular prisms and cylinders.
- Solves problems using a range of strategies including:
 - estimating;
 - calculating to at least 2 decimal places;
 - using and converting between appropriate S.I. units.
- Describes the meaning of and uses π in calculations involving circles and discusses its historical development in measurement.
- Calculates, by selecting and using appropriate formulae:
 - perimeter of polygons and circles;
 - area of triangles, rectangles, circles and polygons by decomposition into triangles and rectangles;
 - volume of triangular and rectangular-based prisms and cylinders.
- Converts between:
 - $\text{mm}^2 \leftrightarrow \text{cm}^2 \leftrightarrow \text{m}^2 \leftrightarrow \text{km}^2$
 - $\text{mm}^3 \leftrightarrow \text{cm}^3 \leftrightarrow \text{m}^3$
 - $\text{ml (cm}^3) \leftrightarrow \text{l} \leftrightarrow \text{kl}$

Grade 9



Assessment Standards

We know this when the learner:

- Solves ratio and rate problems involving time, distance and speed.
- Solves problems – including problems in contexts that may be used to develop awareness of human rights, social, economic, cultural and environmental issues – involving known geometric figures and solids in a range of measurement contexts by:
 - measuring precisely and selecting measuring instruments appropriate to the problem;
 - estimating and calculating with precision;
 - selecting and using appropriate formulae and measurements.
- Describes and illustrates the development of measuring instruments and conventions in different cultures throughout history.

Grade 7



Learning Outcome 4 Continued

MEASUREMENT

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.



Assessment Standards

We know this when the learner:

- Describes interrelationships between surface area and volume of geometric solids.
- Classifies angles into acute, right, obtuse, straight, reflex or revolution.
- Estimates, compares, measures and draws angles accurate to one degree using protractors

Grade 8



Assessment Standards

We know this when the learner:

- Estimates, compares, measures and draws angles accurate to one degree using protractors.
- Investigates (alone and/or as a member of a group or team) the relationship between the sides of a right-angled triangle to develop the Theorem of Pythagoras.
- Uses the Theorem of Pythagoras to calculate a missing length in a right-angled triangle leaving irrational answers in surd form ($\sqrt{\quad}$).
- Describes and illustrates ways of measuring in different cultures throughout history (e.g. determining right angles using knotted string, leading to the Theorem of Pythagoras).

Grade 9



Assessment Standards

We know this when the learner:

- Uses the Theorem of Pythagoras to solve problems involving missing lengths in known geometric figures and solids.

Grade 7



Learning Outcome 5

DATA HANDLING

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.



Assessment Standards

We know this when the learner:

- Poses questions relating to human rights, social, economic, environmental and political issues in own environment.
- Selects appropriate sources for the collection of data (including peers, family, newspapers, books, magazines).
- Uses simple questionnaires (with a variety of possible responses) and designs and uses questionnaires (with yes/no type responses) in order to collect data (alone and/or as a member of a group or team) to answer questions.
- Distinguishes between samples and populations, and suggests appropriate samples for investigation (including random samples).
- Organises (including grouping where appropriate) and records data using tallies, tables and stem-and-leaf displays.
- Summarises ungrouped numerical data by determining mean, median and mode as measures of central tendency and distinguishes between them.
- Identifies the largest and smallest scores in a data set and determines the difference between them in order to determine the spread of the data (range).

Grade 8



Assessment Standards

We know this when the learner:

- Poses questions relating to human rights, social, economic, environmental and political issues in own environment.
- Selects appropriate sources for the collection of data (including peers, family, newspapers, books, magazines, the Internet).
- Designs and uses questionnaires with a variety of possible responses in order to collect data (alone and/or as a member of a group or team) to answer questions.
- Performs simple experiments using random number generators, coins, spinners, dice and cards in order to collect data.
- Organises (including grouping where appropriate) and records data using tallies, tables and stem-and-leaf displays.
- Summarises grouped and ungrouped numerical data by determining mean, median and mode as measures of central tendency, and distinguishes between them.
- Determines measures of dispersion, including range and extremes.

Grade 9



Assessment Standards

We know this when the learner:

- Poses questions relating to human rights, social, economic, environmental and political issues in South Africa.
- Selects, justifies and uses appropriate methods for collecting data (alone and/or as a member of a group or team) which include questionnaires and interviews, experiments, and sources such as books, magazines and the Internet in order to answer questions and thereby draw conclusions and make predictions about the environment.
- Organises numerical data in different ways in order to summarise by determining:
 - measures of central tendency;
 - measures of dispersion.

Grade 7



Learning Outcome 5 Continued

DATA HANDLING

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.



Assessment Standards

We know this when the learner:

- Draws a variety of graphs by hand/technology to display and interpret data (grouped and ungrouped) including:
 - bar graphs and double bar graphs;
 - histograms with given intervals;
 - pie charts;
 - line and broken-line graphs.

- Critically reads and interprets data presented in a variety of ways to draw conclusions and make predictions sensitive to the role of:
 - context (e.g. rural or urban, national or provincial);
 - categories within the data (e.g. age, gender, race);
 - scales used in graphs as a source of error and bias;
 - choice of summary statistics (mean, median or mode);
 - any other human rights and inclusivity issues.

- Performs simple experiments where the possible outcomes are equally likely and:
 - lists the possible outcomes based on the conditions of the activity;
 - determines the frequency of actual outcomes for a series of trials;
 - determines the relative frequency using the definition of relative frequency (see Mathematics Learning Area Glossary).

Grade 8



Assessment Standards

We know this when the learner:

- Draws a variety of graphs by hand/technology to display and interpret data including:
 - bar graphs and double bar graphs;
 - histograms with given and own intervals;
 - pie charts;
 - line and broken-line graphs;
 - scatter plots.
- Critically reads and interprets data presented in a variety of ways in order to draw conclusions and make predictions sensitive to the role of:
 - context (e.g. rural or urban, national or provincial);
 - categories within the data (e.g. age, gender, race);
 - data manipulation (e.g. grouping, scale, choice of summary statistics) for different purposes;
 - the role of outliers on data distribution;
 - any other human rights and inclusivity issues.
- Considers a simple situation (with equally likely outcomes) that can be described using probability and:
 - lists all the possible outcomes;
 - determines the probability of each possible outcome using the definition of probability (see Mathematics Learning Area Glossary);
 - finds the relative frequency of actual outcomes for a series of trials;
 - compares relative frequency with probability and explains possible differences;
 - predicts with reasons the relative frequency of the possible outcomes for a series of trials based on probability.

Grade 9



Assessment Standards

We know this when the learner:

- Draws a variety of graphs by hand/technology to display and interpret data including:
 - bar graphs and double bar graphs;
 - histograms with given and own intervals;
 - pie charts;
 - line and broken-line graphs;
 - scatter plots.
- Critically reads and interprets data with awareness of sources of error and manipulation to draw conclusions and make predictions about:
 - social, environmental and political issues (e.g. crime, national expenditure, conservation, HIV/AIDS);
 - characteristics of target groups (e.g. age, gender, race, socio-economic groups);
 - attitudes or opinions of people on issues (e.g. smoking, tourism, sport);
 - any other human rights and inclusivity issues.
- Considers situations with equally probable outcomes, and:
 - determines probabilities for compound events using two-way tables and tree diagrams;
 - determines the probabilities for outcomes of events and predicts their relative frequency in simple experiments;
 - discusses the differences between the probability of outcomes and their relative frequency.



CHAPTER 5

LEARNER ASSESSMENT

INTRODUCTION

The assessment framework of the Revised National Curriculum Statement Grades R-9 (Schools) is based on the principles of outcomes-based education. Assessment should provide indications of learner achievement in the most effective and efficient manner, and ensure that learners integrate and apply knowledge and skills. Assessment should also help students to make judgements about their own performance, set goals for progress and provoke further learning.

To assist in the process of learner assessment, this Revised National Curriculum Statement:

- outlines the Learning Outcomes and their associated Assessment Standards in each Learning Area and for each grade in the General Education and Training Band (Grades R-9);
- contextualises the Critical and Developmental Outcomes within the Learning Outcomes and Assessment Standards; and
- places Assessment Standards at the heart of the assessment process in every grade. Assessment Standards describe the level at which learners should demonstrate their achievement of the Learning Outcome(s) and the ways (depth and breadth) of demonstrating their achievement.

The following diagram illustrates the interaction between the design elements of this Revised National Curriculum Statement:



ASSESSMENT PRINCIPLES USED IN OUTCOMES-BASED EDUCATION

Definition

Assessment in the Revised National Curriculum Statement Grades R-9 (Schools) is a continuous, planned process of gathering information about the performance of learners measured against the Assessment Standards of the Learning Outcomes. It requires clearly-defined criteria and a variety of appropriate strategies to enable teachers to give constructive feedback to learners and to report to parents and other interested people.

Key Elements

Outcomes-based education is a way of teaching and learning which makes it clear what learners are expected to achieve. The principle by which it works is that the teacher states beforehand what the learners are expected to achieve. The teacher's task is to teach in order to help learners to satisfy the requirements of the Assessment Standards in the curriculum; the learners' task is to learn or do what the Assessment Standards expect. Assessment is essential to outcomes-based education because it must be possible to assess when a learner has achieved what is required in each grade.

To help learners to reach their full potential, assessment should be:

- transparent and clearly focused;
- integrated with teaching and learning;
- based on predetermined criteria or standards;
- varied in terms of methods and contexts; and
- valid, reliable, fair, learner-paced, and flexible enough to allow for expanded opportunities.

Purposes of Assessment

The main purpose of assessing learners should be to enhance individual growth and development, to monitor the progress of learners and to facilitate their learning. Other uses of assessment include:

- *baseline assessment of prior learning*
Baseline assessment usually takes place at the beginning of a grade or phase to establish what learners already know. It assists teachers to plan learning programmes and learning activities.
- *diagnostic assessment*
Diagnostic assessment is used to find out about the nature and cause of barriers to learning experienced by specific learners. It is followed by guidance, appropriate support and intervention strategies.
- *formative assessment*
Formative assessment monitors and supports the process of learning and teaching, and is used to inform learners and teachers about learners' progress so as to improve learning. Constructive feedback is given to enable learners to grow.
- *summative assessment*
Summative assessment gives an overall picture of learners' progress at a given time, for example, at the end of a term or year, or on transfer to another school.
- *systemic assessment*
Systemic assessment is a way of monitoring the performance of the education system. One component of this is the assessment of learner performance in relation to national indicators. Systemic assessment is conducted at the end of each phase of the General Education and Training Band. A representative sample of schools and learners is selected provincially or nationally for systemic assessment.

CONTINUOUS ASSESSMENT

Characteristics of Continuous Assessment

Continuous assessment is the chief method by which assessment takes place in the Revised National Curriculum Statement. It covers all the outcomes-based education assessment principles and ensures that assessment:

- *takes place over a period of time and is ongoing:* Learning is assessed regularly and the records of learners' progress are updated throughout the year.
- *supports the growth and development of learners:* Learners become active participants in learning and assessment, understand the criteria that are used for assessment activities, are involved in self-evaluation, set individual targets for themselves, reflect on their learning, and thereby experience raised self-esteem.
- *provides feedback from learning and teaching:* Feedback is a crucial element in formative assessment. Methods of feedback include appropriate questioning, focusing the teacher's oral and written comments on what was intended to be achieved by an assessment activity, and encouragement to a learner.
- *allows for the integrated assessment:* This may include assessing a number of related Learning Outcomes within a single activity, and combining a number of different assessment methods. Competence in particular Learning Outcomes can be demonstrated in many different ways, and thus a variety of assessment methods and opportunities must be provided through which learners can demonstrate their ability.
- *uses strategies that cater for a variety of learner needs (language, physical, psychological, emotional and cultural):* Continuous assessment allows teachers to be sensitive to learners with special education needs and to overcome barriers to learning through flexible approaches. In any group of learners, there are different rates and styles of learning. All learners do not need to be assessed at the same time and in the same way.
- *allows for summative assessment:* The accumulation of the results of continuous assessment activities provides an overall picture of a learner's progress at a given time. Summative assessment needs to be planned carefully from the beginning of the year, to include a variety of assessment strategies - for example, exercises, tasks, projects, school and class tests - which will provide learners with a range of opportunities to show what they have learned.

Assessment Strategies

The choice of what assessment strategies to use is a subjective one, unique to each teacher, grade and school, and dependent on the teacher's professional judgement. The availability of space and resources influences this decision, but even when resources are similar, teachers differ in the way that they make their choices.

The methods chosen for assessment activities must be appropriate to the Assessment Standards to be assessed, and the purpose of the assessment must be clearly understood by all the learners and teachers involved. Competence can be demonstrated in a number of ways. Thus a variety of methods is needed to demonstrate their abilities more fully.

Common Tasks for Assessment

The purpose of Common Tasks for Assessment is to:

- ensure consistency in teacher judgements;
- promote common standard setting;
- strengthen the capacity for school-based continuous assessment;
- increase the accuracy of the assessment process and tools;
- ensure that the school-based assessment tasks properly assess competencies and achievements; and
- ensure expanded opportunities for learners.

Common Tasks for Assessment may be set at national, provincial, district or cluster level, are conducted at school level, and are moderated externally

MANAGING ASSESSMENT

People Involved in Assessment

The school and the teachers have overall responsibility for the assessment of learners. Teachers are expected to create a valid, reliable and credible assessment process. Provincial policies should ensure the involvement of learners, school assessment teams, district support teams, support services, and parents, as appropriate.

School Assessment Programme

Each school must develop an assessment programme based on provincial and national assessment guidelines. It needs to have a School Assessment Plan and a team to facilitate the implementation of this programme. The team should have representatives from each Phase and Learning Area.

To ensure a professional approach to assessment, the school assessment programme must outline clearly:

- the way continuous assessment is planned and implemented;
- how record books are to be kept, their accessibility and security;
- the assessment codes determined by the province;
- internal verification of assessment;
- how moderation takes place in the school;
- the frequency and method of reporting;
- the monitoring of all assessment processes; and
- the training of staff in areas of assessment.

Areas where in-school training needs to take place include:

- how to use criteria/rubrics to assess;
- finding agreement between teachers in the same grade about what is considered necessary to satisfy the Learning Outcomes;
- how to write comments for assessment results and reports; and
- achieving a common understanding of the school's assessment programme.

KEEPING RECORDS

Record Books

Good record keeping is essential in all assessment, particularly in continuous assessment. A record book or file must be kept up to date by each teacher. It should contain:

- learners' names;
- dates of assessment;
- name and description of the assessment activity;
- the results of assessment activities, according to Learning Areas or Learning Programmes; and
- comments for support purposes.

All records must be accessible, easy to interpret, securely kept, confidential and helpful in the teaching and reporting process.

The school assessment programme determines the details of how record books must be completed. The assessment codes are used to express how the learner is performing against the Learning Outcomes. Codes used must be clear and understood by learners and parents.

Codes to Use for Assessment

There are many ways in which feedback from assessment can be provided to learners and recorded by teachers. Choosing the best way to do so for an assessment activity will depend on a number of factors, such as:

- the number of learners in the class and the amount of time available to the teacher;
- the complexity and the length of the assessment activity;
- the learning content or skills being assessed (e.g. Mathematics or writing);
- how quickly feedback is given;
- how individualised the feedback is;
- the criteria (or rubrics) used by the teacher to describe learners' performance; and
- whether learners' performance is to be compared to peers, to previous performance, and/or the requirements of the Assessment Standards and Learning Outcomes.

Some assessment codes are better for some purposes than for others. For example, comments can be detailed, individual and provide suggestions for improvement. Comments are also useful for reporting on learner performance against Assessment Standards. However, comments take long to write and are not very easy to record. Codes such as 'Excellent', 'Very Good', 'Good', 'Competent', and 'Insufficient' are much quicker to write and allow assessment of progress against previous work and against Assessment Standards. However, they do not provide the detail made possible by comments. Marks, on the other hand, are quickly recorded and can be added together, multiplied and divided. They are useful for assessing learners' performance in relation to others in the class, and to other grades or schools. However, they provide little information on learners' performance against the Assessment Standards.

Examples, among many others, of further assessment codes are:

- not yet achieved, almost there, achieved;
- satisfactory performance, needs support;
- A, B, C; and
- phrases (or rubrics) designed especially for the assessment activity or report.

Whatever assessment code is used, feedback is more effective when combined with comments. There is more likely to be an improvement in achievement when learners are given written feedback rather than marks only. Although marks and percentages are very useful for recording purposes, as it is easy to write marks into a record book, they are often not useful for feedback and reporting. Other problems presented by marks are that they can be aggregated and manipulated and that they hide much about learners' achievement and progress. If learners have completed more than one assessment activity there is a temptation to use the marks arithmetically, to add and to average. When this is done, marks lose their usefulness to feed back information. An average or aggregate mark hides the fact that a learner might have achieved the intended learning well in one aspect but not in another.

Marks give an overall impression of achievement but hide the reasons for the assessment of the achievement (or lack of achievement) from the learner, and prevent a focus on learning something from the assessment. They also do not describe learner progress in the curriculum well. In many cases maintaining the same mark (provided it is a satisfactory one) is regarded as an indication of good progress. A mark of 70 against the Grade 5 Assessment Standards and a mark of 70 against the Grade 6 Assessment Standards disguises completely the progress a learner might have made during the year, which is best described in a statement, code, or comment(s).

National Codes

In recording or reporting on learner achievement in the Learning Outcomes specific to a grade, the following codes are to be used:

- 4 = Learner's performance **has exceeded** the requirements of the Learning Outcome for the grade.
- 3 = Learner's performance **has satisfied** the requirements of the Learning Outcome for the grade.
- 2 = Learner's performance **has partially satisfied** the requirements of the Learning Outcome for the grade.
- 1 = Learner's performance **has not satisfied** the requirements of the Learning Outcome for the grade.

Progression Schedules

At the end of each year, a progression schedule must be completed, and signed by the principal and a departmental official. The progression schedule is a record with summary information about the progress of all learners in the grade in the school.

The progression schedule should include the following information:

- name of the school and school stamp;
- list of learners in each grade;
- codes for progress in each Learning Area (National Coding System);
- codes for progress in each grade (progress to the next grade or stay in the same grade);

- comments on strengths and areas for support in each Learning Area; and
- date and signature of principal, teacher or other educator, and departmental official.

Learner Profiles

A learner profile is a continuous record of information that gives an all-round impression of a learner's progress, including the holistic development of values, attitudes and social development. It assists the teacher in the next grade or school to understand the learner better, and therefore to respond appropriately to the learner. The profile must be safeguarded for every learner and should accompany learners throughout their school careers.

The following kinds of information should be included in a learner profile:

- personal information;
- physical condition and medical history;
- schools attended and record of attendance;
- participation and achievements in extra-curricular activities;
- emotional and social behaviour;
- parental involvement;
- areas needing additional support;
- summative end-of-year overall report; and
- progression summary records of the schooling years.

Notes:

- The learner profile replaces all previous continuous record documents that have been used by schools, such as record cards, tutor cards and Edlab cards. The central purpose of a learner profile is to assist the learner by having access to the variety of information it includes.
- Personal information in a profile should never be used to discriminate unfairly against a learner.
- Learner profiles should not be confused with portfolios. A portfolio is a method of assessment that gives the learner and teacher together an opportunity to consider work done for a number of assessment activities. The work is placed in a folder, file or box. The learner profile, on the other hand, is a record containing information about a learner.

REPORTS

Information to be Included in Reports

Teachers need to be accountable to learners, parents, the education system and the broader community in assessing their learners. This takes place through reporting. In addition to written reports, oral or practical presentations, displays of learners' work and exhibitions might be used.

Every report on a learner's overall progress should include information on:

- the learning achieved;
- the learner's competencies;
- support needed; and

- constructive feedback, which should contain comments about the learner's performance in relation to peers and the learner's previous performance in relation to the requirements of the Learning Areas.

Reporting to parents should be done on a regular basis to encourage their involvement and participation. Teachers must report at the end of each term using formal report cards.

It will usually not be possible to give information on achievement in each Learning Outcome. However, reports should give information on achievement in each of the Learning Areas or Learning Programmes (in the case of the Foundation Phase).

Report Cards

The minimum requirements for a report card are:

1) *Basic information*

- name of school;
- name of learner;
- grade of learner;
- date of birth of learner;
- year and term;
- date and signature of parent or guardian;
- date and signature of teacher;
- date and signature of principal;
- dates of closing and opening of school;
- school stamp;
- school attendance profile; and
- the explanation of the codes of the national coding system.

2) *Strengths and needs*

- Give a description of the strengths, developmental needs, or areas of support required by the learner in each Learning Area or Learning Programme.
- Use the national coding system to evaluate performance against the Assessment Standards and the Learning Outcomes covered thus far - it is not necessary to give a code for each Learning Outcome. In an end of year report, the overall performance of the learner in the Learning Areas must be shown.

3) *Comments on each Learning Area or Learning Programme*

- Give comments on each Learning Area or Learning Programme, with special emphasis on students who have exceeded the requirements or need further support. Comments on specific strengths and areas of support should be linked to the Assessment Standards. These comments will allow parents, learners and other educators to gain an understanding of what support the learner needs.

REFERENCE LISTS

CURRICULUM AND ASSESSMENT GLOSSARY

This is an alphabetical list of key terms used in designing the Revised National Curriculum Statement Grades R-9 (Schools) and its learner assessment principles.

assessment – a continuous planned process of gathering information on learner performance, measured against the Assessment Standards

Assessment Standards – the knowledge, skills and values that learners need to show to achieve the Learning Outcomes in each grade

baseline assessment – initial assessment used to find out what learners already know

continuous assessment – assessment model that encourages integration of assessment into teaching and the development of learners through ongoing feedback

critical outcomes – together with the Developmental Outcomes, key outcomes of Revised National Curriculum Statement Grades R-9 (Schools), that are inspired by the Constitution; they include core life skills for learners, such as communication, critical thinking, activity and information management, group and community work, and evaluation skills

Curriculum 2005 – the first version of the post-apartheid National Curriculum Statement. That 1997 education policy document gives a framework for Early Childhood Development, General Education and Training, Further Education and Training, and Adult Basic Education and Training. This Revised National Curriculum Statement Grades R-9 (Schools) aims to strengthen Curriculum 2005.

developmental outcomes – together with the Critical Outcomes, key outcomes of the Revised National Curriculum Statement Grades R-9 (Schools) that are inspired by the Constitution; they include enabling learners to learn effectively and to become responsible, sensitive and productive citizens

exit-level – when learners complete Grade 9 and are awarded the General Education and Training Certificate

formative assessment – a form of assessment that assesses learner progress during the learning process in order to provide feedback that will strengthen learning

Foundation Phase – the first phase of the General Education and Training Band: Grades R, 1, 2 and 3

General Education and Training Band – the ten compulsory schooling years, made up of the Foundation, Intermediate and Senior Phases

General Education and Training Certificate – the certificate obtained on successful completion of the General Education and Training Band

integration – a key design principle of the Revised National Curriculum Statement Grades R-9 (Schools), that requires learners to use their knowledge and skills from other Learning Areas, or from different parts of the same Learning Area, to carry out tasks and activities

Intermediate Phase – the second phase of the General Education and Training Band: Grades 4, 5 and 6

language of learning and teaching – the language that is most used in a particular learning and teaching environment; some learners experience learning and teaching in an additional language (not their home language).

learning areas – the eight fields of knowledge in the Revised National Curriculum Statement Grades R-9 (Schools): Languages, Mathematics, Natural Sciences, Technology, Social Sciences, Arts and Culture, Life Orientation, and Economic and Management Sciences

learning area statements – the statement for each Learning Area that sets out its Learning Outcomes and Assessment Standards

learner profile – an all-round record of a learner's progress, including personal information, social development, support needs, samples of work and annual reports

learning programmes – programmes of learning activities, including content and teaching methods; these are guided by the Revised National Curriculum Statement Grades R-9 (Schools) but developed by provinces, schools and teachers

national coding system – a standard national system of performance codes used to report on a learner's progress

outcomes – the results at the end of the learning process in outcomes-based education; these outcomes help shape the learning process

outcomes-based education – a process and achievement-oriented, activity-based and learner-centred education process; in following this approach, Curriculum 2005 and the Revised National Curriculum Statement Grades R-9 (Schools) aim to encourage lifelong learning

portfolio – individual file or folder of each learner's work

progression – a key design principle of the Revised National Curriculum Statement Grades R-9 (Schools) that enables the learner to gradually develop more complex, deeper and broader knowledge, skills and understanding in each grade

progression schedules – end-of-year tool for recording the progress of all learners in a grade, including codes for progress in each Learning Area and grade, and comments on support needed

summative assessment – different from formative assessment, as it is about regular reports of a learner's progress, usually at the end of the term or year

MATHEMATICS LEARNING AREA GLOSSARY

2-D – two-dimensional; a flat surface having or appearing to have length and breadth

3-D – three-dimensional; an object or solid having or appearing to have length, breadth and thickness

acute angle – an angle measuring less than 90°

additive inverse – When a number is added to its additive inverse the answer is zero [e.g. $(-8) + (+8) = 0$, so +8 is the additive inverse of -8 and vice versa].

analogue clock time – time read from a clock with a face and hands

angle – amount of rotation or turning measured in degrees

angle of depression – the angle between the horizontal and the line of sight when looking down at an object

angle of elevation – the angle between the horizontal and the line of sight when looking up at an object

algebraic expression – an expression made up of any number of terms separated from each other by + or - signs (e.g. $3x - 2$, $5x^2 + 3$)

area – the amount of surface covered by a two-dimensional shape, measured in square units

associative property –

- (i) for addition of three or more numbers: $(a + b) + c = a + (b + c)$, for all numbers a , b and c
e.g. $(12 + 2) + 8 = 12 + (2 + 8)$;
- (ii) for multiplication of three or more numbers: $(a \times b) \times c = a \times (b \times c)$, for all numbers a , b and c e.g. $(12 \times 2) \times 8 = 12 \times (2 \times 8)$

bar graph – uses vertical or horizontal bars to represent information

base –

- (i) a side of a polygon: Any side can be the base as long as the height used is perpendicular to the base. In an isosceles triangle, the unequal side is the base.
- (ii) the flat surface on which a solid is standing at the time
- (iii) If 32 is written in the form 2^5 , 2 is the base and 5 is the exponent or index. 2^5 means $2 \times 2 \times 2 \times 2 \times 2$

binomial – an algebraic expression with two terms

broken-line graph – a graph where plotted points are joined by line segments

capacity – the amount of space inside a container measured in millilitres, litres or kilolitres; it is used mostly for liquids (see also **volume**)

Cartesian plane – plane formed by a horizontal number-line and a vertical number-line, intersecting at 0, which is used to locate the position of any point in the plane using two co-ordinates

coefficient – the number which stands in front of the variables in an algebraic term (e.g. -3 is the coefficient of $-3xy^2$); if there is no number in front of the variable, the coefficient is 1.

commutative property –

- (i) for addition of two numbers: $a + b = b + a$, for all numbers a and b (e.g. $5 + 4 = 4 + 5$);
- (ii) for multiplication of two numbers: $a \times b = b \times a$, for all numbers a and b (e.g. $5 \times 4 = 4 \times 5$)

compass directions – directions in terms of cardinal points North, South, East and West

compound events – two or more events analysed together to find outcomes and probabilities (e.g. rolling a dice and tossing a coin or tossing three coins)

cone – a three-dimensional object or solid with a circular base tapering to a point, called the vertex or apex

congruent figures – figures that are equal in every respect

constant – stays the same

continuous –

- (i) a variable is continuous if it can assume any value between two given values (e.g. measurements such as height and mass are continuous variables)
- (ii) a graph is continuous if every point between the points plotted has a meaning

co-ordinate system – a system used to give the position of points by their co-ordinates with respect to fixed reference lines or axes

cube – a polyhedron with six square faces

cubic unit – unit used to measure volume

cylinder – a three-dimensional object or solid with a curved wall standing at right angles to its circular base, making the top and base identical

data – information

decreasing – getting smaller

diagonal – line joining one vertex of a polygon to an opposite vertex

digital clock time – time read from a clock that has a continually changing digit display rather than a clock face

dimensions – measurements of an object or shape (e.g. length, breadth, height, radius, circumference)

direct proportion – a relationship between two sets of quantities whose ratio is constant

discrete variables – things that can be counted (e.g. the number of goals scored in a series of soccer matches)

distributive property – for multiplication over addition: $a \times (b + c) = (a \times b) + (a \times c)$, for all numbers a , b and c
[e.g. $5(3 + 4) = (5 \times 3) + (5 \times 4)$]

dodecahedron – a polyhedron with twelve faces

edge – where two faces of a solid object meet

enlargement – a transformation which changes the size of an object without changing its shape

equation – a mathematical statement that includes an “=” sign

exponent (index) – if 32 is written in the form 2^5 , 5 is the exponent or index on the base 2 (see **base**)

extremes – on the outside limits of given data

face – a flat surface of an object or solid

factorise – to write a number or algebraic expression as the product of its factors

flow diagram – a diagram which shows the steps to be followed in solving a problem

formula (or rule) – a mathematical or scientific rule, written in symbols

frequency – the number of times a particular item appears in a set of data

grid paper – paper printed with vertical and horizontal lines making equal squares

grouped data – data grouped into classes of the same size

histogram – a graph which shows the frequencies of grouped data

horizontal – a horizontal line is drawn across the page

icosahedron – a polyhedron with twenty faces

increasing – getting bigger

index (pl. indices) – see **exponent**

indirect proportion – a relationship between two sets of quantities such that one increases as the other decreases

intersecting – cutting through a common point (e.g. when two lines cross, they intersect at one point)

irrational number – a number that cannot be written as a fraction or ratio of two integers

kite – a quadrilateral with two pairs of adjacent sides equal in length, but not all four sides the same length

maximum – greatest

mean – one of the measures of central tendency, calculated by dividing the sum of all the given data by the number of data

measures of central tendency – average measures like mean, median and mode, which can be used to summarise a set of data

measures of dispersion – the degree to which numerical data is spread about an average value (e.g. range)

median – one of the measures of central tendency; if the given data is written in order from smallest to largest, the median is either the middle number or the mean of the two middle numbers

metre stick – a measuring stick one metre long

minimum – smallest

mode – one of the measures of central tendency; the number or item that appears most frequently in a set of data

monomial – an algebraic expression with only one term

multiplicative inverse – when a number is multiplied by its multiplicative inverse the answer is 1

net – a flat diagram from which a model of a polyhedron can be made

number sequences – a set of numbers written in order and obtained according to some rule

obtuse angle – an angle measuring more than 90° and less than 180°

octahedron – a polyhedron with eight faces

ordered pair – a pair of numbers used to give the position of a point on the Cartesian plane

outcome – the result of a statistical experiment

outlier – a point on a scatter plot which is widely separated from the other points or a result differing greatly from others in the same sample

pair of compasses – an instrument used to draw circles

parallel lines – lines that are always the same distance apart

parallelogram – a quadrilateral with both pairs of opposite sides parallel

perimeter – the total distance around a two-dimensional shape

perpendicular – at right angles to

perspective – the relative distance, size and proportion of objects viewed from a particular point

perspective drawing – giving a three-dimensional effect to a two-dimensional drawing

pictograph – a graph which makes use of pictures (e.g. people, cars) to represent data

pie graph – a graph using sectors of a circle to show information

platonic solids – the five regular polyhedra with all faces regular polygons and the same number of edges meeting at each vertex: the cube, the regular tetrahedron, the regular octahedron, the regular dodecahedron, the regular icosahedron

polygon – a two-dimensional figure with three or more straight sides

polyhedron – a solid which has four or more flat faces

population – the focus group under consideration in a statistical investigation or survey

prism – a polyhedron in which all cross-sections taken parallel to a base are identical to the base

probability – the number of favourable outcomes divided by the number of possible equally likely outcomes

protractor – an instrument for measuring the size of an angle in degrees or for drawing angles accurately

pyramid – a polyhedron with a polygonal base and triangular faces

quadrilateral – a polygon with four straight sides

random sample – a sample chosen from a population in such a way that each member of the population has an equal chance of being chosen

range – a measure of dispersion; the difference in value between the highest and the lowest numbers in a set of statistical data

rate – a comparison of two quantities of different kinds by division (e.g. km/hr)

ratio – a comparison of two quantities of the same kind by division (e.g. the ratio of 2,5 m to 1,5 m = 5 : 3 or $\frac{5}{3}$)

rational number – a number which can be written as a fraction $\frac{a}{b}$, where a and b are integers and b is not 0

real numbers – numbers made up of the set of rational and the set of irrational numbers

rectangle – a polygon with opposite sides the same length and four right angles; a parallelogram with right angles

rectangular prism – a polyhedron in which all cross-sections taken parallel to the base are rectangles identical to the base

reflection (flip) – a transformation which produces a mirror image of the same shape and size as the original, but reversed

reflex angle – an angle measuring more than 180° and less than 360°

regular polygon – all sides are the same length and all angles are the same size

regular polyhedron – all the edges are the same length, and all the inside angles of the faces are the same size; all the faces are regular polygons

relative frequency – the number of times an event happens in a statistical experiment divided by the number of trials conducted

revolution – a complete turn; an angle of 360°

right angle – an angle of 90°

rotation (turn) – a transformation under which a shape or object is rotated (turned) around a fixed point (called the centre of rotation) into a new position

S.I. units – *Système International (d’Unités)*: the universally-used system of scientific units

sample – a group chosen to represent the whole population under investigation in a statistical survey

scatter plot – a graph used to look for a relationship between two sets of data; it shows the strength of the relationship (correlation) between the variables

similar figures – figures that have the same shape but not necessarily the same size; similar polygons are equiangular and have their corresponding sides in proportion

solid – a three-dimensional object

sphere – a three-dimensional ball-shaped object

square –

- (i) a polygon with four equal sides and four right angles; a rectangle with four equal sides
- (ii) to multiply a number by itself

square unit – a unit used to measure area

stem-and-leaf display – a statistical method for organising and displaying a set of numerical data to make it easier to order the numbers

straight angle – an angle of 180° ; half a revolution

surd – the root of any number which cannot be expressed as an exact decimal; it is an irrational number (e.g. $\sqrt{2}$)

symmetry – exists if a two-dimensional shape or three-dimensional object can be divided into two identical parts

tally – a way of recording the number of items per category in a set of data by making a mark for each item

tangram – a Chinese puzzle made up of seven pieces that form a square

term – a part of an algebraic expression (e.g. $3x^4$ is a term of the expression $3x^4 - x^2 + 6$)

tessellation – formed by fitting shapes together to cover a plane without overlapping or leaving gaps

tetrahedron – a polyhedron with four faces

three dimensional (3-D) – an object or solid having or appearing to have length, breadth and thickness

total surface area – the sum of the areas of all the faces of a solid figure, measured in square units

translation (slide) – a transformation under which a shape or object is moved by sliding into a new position

trapezium – a quadrilateral with only one pair of opposite sides parallel

tree diagram – a diagram used to represent possible outcomes and/or probabilities when two or more events are combined in a statistical analysis

trial – experiment

triangle – a polygon with three sides

two dimensional (2-D) – a flat surface having or appearing to have length and breadth

two-way table – used to represent possible outcomes when two events are combined in a statistical analysis

ungrouped data – raw data which have not been grouped into classes or categories

variable – a letter used in an algebraic expression or a formula which can stand for any number

vertical – a vertical line is drawn up and down the page

vertex (pl. vertices) –

- (i) the point where the arms of an angle meet
- (ii) the point where edges of a polyhedron meet
- (iii) the apex of a cone

volume – the amount of space occupied by an object, or the amount of space inside a container, measured in cubic units (see also **capacity**)





