Mathematics

Syllabus

Grades 6, 7 & 8

Standards Based

Papua New Guinea
Department of Education

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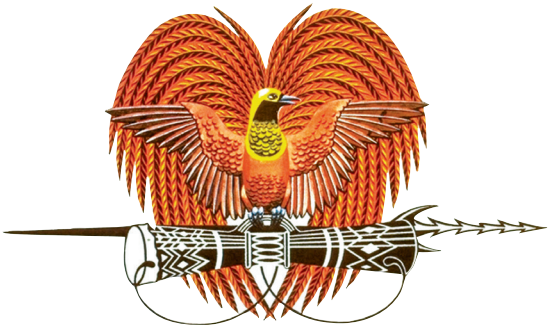

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Department of Education

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Acknowledgements

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Education Board of Studies (BEBoS) committee members are also acknowledged for their recommendation and endorsement of this syllabus.

Contents

Acronyms

AAL	Assessment *As* Learning
AFL	Assessment *For* Learning
AOL	Assessment *Of* Learning
BEBos	Basic Educations Board of Studies
CDD	Curriculum Development Division
CP	Curriculum Panel
DMR	Data and Mathematical Relations
GMT	Geometry, Measurement and Transformation
F	Functions
GF	Geometrical Figures
IHD	Integral Human Development
MUD	Making Use of Data
NA	Number and Algebra
NDoE	National Department of Education
NO	Numbers and Operation
NOC	Number, Operation and Computation
OBC	Outcomes Based Curriculum
OBE	Outcomes Based Education
PAA	Patterns and Algebra
QM	Quantities and Measurement
SAC	Syllabus Advisory Committee
SAP	Statistics and Probability
SBC	Standards Based Curriculum
SBE	Standards Based Education
SCG	Subject Curriculum Group
STEAM	Science, Technology, Arts and Mathematics

Secretary's Message

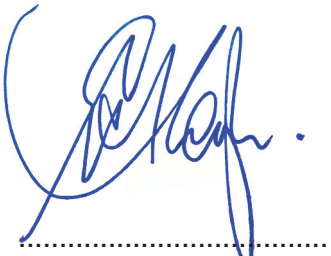
The development of Grades 6, 7 and 8 Mathematics Syllabus is a direct response to the Governments directive through the Outcomes-Based Education (OBE) exit report, (Czuba 2013) to phase out Outcomes Based Curriculum and realign the curriculum using the Standards Based approach.

The realignment of mathematics curriculum from Outcome Based Curriculum (OBC) to Standards Based Curriculum (SBC) is aimed at improving the organisation of content and context of what the students will be studying at that level. It is envisaged that by the end of grade 8, the students will acquire the necessary basic mathematics knowledge, skills, attitude and values to help prepare them to progress to the next level of learning while at the same time aiming to strive and compete against 21st century competencies and demands locally and globally.

It is therefore important for Mathematics Teachers to be creative, innovative and motivated when teaching mathematics. The realigned mathematics curriculum is focused to develop student's numeracy skills, utilizing the mathematical processes that will inspire the mind to think logically, abstractly, critically and creatively whilst nurturing the love for and of mathematics to support every learner to reach their full potential. Mathematics literacy is critically important for Papua New Guinea to participate productively in an increasingly competitive knowledge and technological based society.

Teachers are encouraged to use the syllabus in conjunction with teacher guides and other relevant resources to generate creative teaching and learning activities to deliver the mathematics content.

I commend and approve this Standards Based Mathematics Syllabus for grades 6, 7 and 8 to be used in all Schools throughout Papua New Guinea.



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DR. UKE W. KOMBRA, PhD
Secretary for Education

Introduction

The introduction of Standards Based Education in Papua New Guinea is an important Government directive to raise performance competencies in all aspects of education; curriculum development, teacher training, student and teacher performance, monitoring, school management and leadership. The designing of courses in the curriculum have been done to raise standards in teaching and learning at all levels of schooling through reviewing, aligning, realigning and repositioning of the existing content in order to cater for the shift in the pedagogy.

The Mathematics curriculum is focused on helping students to acquire basic Mathematical understanding, knowledge, processes and manipulative skills in order for the learners to progressively improve their arithmetic skills over time thus improving the level of numeracy in Papua New Guinea.

The grades 6, 7 and 8 Mathematics Syllabus makes explicit the mental knowledge, skills, attitudes and values that all students are expected to progressively learn and master before leaving each grade. These are described in the Content Standards and benchmarks. They provide a reference point that will enable students to meet the expectation of the PNG national curriculum.

Aims and Goals

Ultimate Aim

Integral human development is the ultimate aim of education in Papua New Guinea.

- *integral* in the sense that all aspects of a person are important;
- *human* in the sense that social relationships are basic; and
- *development* in the sense that every individual has the potential to grow in the knowledge, wisdom, understanding, skill and goodness.

Goals

1) Every person will be dynamically involved in the process of freeing himself or herself from every form of domination and oppression so that each individual will have the opportunity to develop as an integrated person in relationship with others. This means that the national curriculum must integrate and maximise socialisation, participation, liberation and equality;

2) Awareness of human potential and the willingness to develop this potential so that each individual can solve his or her own problems, contribute to the common good of society and maintain, promote and improve learning and living; and

3) Awareness of the goodness and the dignity of every person. It calls for the promotion of self and mutual respect, a sense of self-worth and self-discipline and a sense of responsibility for one self and others.

The process of integral human development calls for a national curriculum, which helps individuals to:

- identify their basic human needs;
- analyse situations in terms of these needs;
- see these needs in the contexts of spiritual and social values of the community; and take responsible action in co-operation with others.

Overarching Curriculum Principles

Curriculum principles identify, describe and focus attention on the important concerns that must be addressed when developing the curriculum at all levels of schooling. They are based on significant cultural, social and educational values and beliefs.

Relevance

The national curriculum should be relevant to the social, spiritual and resource development needs of a community. This can be achieved by integrating teaching and learning situations that reflect the knowledge, skills, attitudes and spiritual values needed for integral human development. A relevant national curriculum will prepare students for productive community living; integrate academic and practical education; and will provide ways to paid and unpaid employment.

Most people in Papua New Guinea work in the informal economy. Students who leave at the end of grade 8, 10 or 12 will need to find work in the informal economy. These students, however, will not only need to be skilled to work in the informal economy, but they will also need to be prepared to work in the formal economy and undertake formal education if there are opportunities. All students will need applied and academic skills and knowledge. All students will need to know how to adapt new technologies and knowledge appropriately to their environment.

The national curriculum will enable teachers to support students learning by encouraging teaching in real-life contexts. This means relating the skills and knowledge of subjects to real life situations. For example, mathematics can be used to study how to run a business, or appropriate technology can be applied to improve water supplies. People from the community could also be brought into the classroom to help teach a topic and support students undertaking useful projects in the community.

Multiculturalism

Papua New Guinea is blessed and fortunate to have so many languages and cultures. The diversity of our cultures is the source of our knowledge, skills, attitudes and values. As a multicultural society, we must protect, promote and respect our many cultures and languages. There are many people from our own ethnic groupings and from other countries with their own cultures, living and working together in Papua New Guinea. This is the most multicultural country in the world. Therefore, we must ensure that we promote and share our cultures with the rest of the world.

Ethics, Morals, and Values

Papua New Guinea is striving to create a society in line with democratic liberal traditions. The citizens of Papua New Guinea should recognise appropriate social relationships based on sound human and religious ethics, morals and values. These are required for interaction with families, villages, and other economic groups and people from other provinces and nations. The process of socialisation requires a belief in the ethics, morals and values of the Melanesian extended family, dialogue with and respect for others and a willingness to conserve and promote those aspects of our traditions, which are consistent with integral human development. Socialisation also requires an awareness of the interdependence of individuals, societies and nations in the modern world. It requires involvement with family, school, church, community and the world beyond.

The Right to Healthy Living

The health status of Papua New Guinea is very low. All citizens have a right to a healthy life such as clean water, a nutritious diet, improved sanitation, appropriate and better local health services. Students need to learn attitudes, skills and knowledge that will help them become productive, healthy and contented citizens of Papua New Guinea. They need to be given a set of skills that will enable them to improve their own and their community's health in order to improve the health status of Papua New Guinea. The national curriculum will ensure that students have the opportunity to learn about healthy living.

Nation Building and National Unity

Our nation is young and there is still a great deal of nation building to be done. Students need to be given the skills to undertake this task and participate in nationally organised events. The national curriculum should enable them to understand how Papua New Guinean societies work and how they can be a useful part of these societies. Students should learn that they have a place in Papua New Guinea and that Papua New Guinea has a place in the world as a whole. They will be able to help Papua New Guinea develop a national identity as one nation if they learn to:

- work together with tolerance;
- respect one another, their traditional ways and resolve problems peacefully;
- respect and act in the spirit of the National Constitution;
- recognise their capabilities and develop their own talents;
- participate in the development of the national community; and
- protect and safeguard the national wealth and resources and consider how they will contribute to national revenues.

Education for Sustainable Development

PNG National curriculum focuses on Education for Sustainable Development (ESD) as an integral part of learning in the 21st century, ensuring learners are equipped to participate in and contribute to their own society and the wider world. Education for Sustainable Development (ESD) is much more than teaching content related knowledge and skills; it is also about teaching new ways of thinking about and perceiving the realities of our world and the possibilities for change. It is an approach to teaching and learning based on the ideals and principles that support sustainability of human rights, sustainable livelihoods, peace, environmental protection, health, biological and landscape diversity, climate change, gender equality, and protection of indigenous cultures.

Education for Sustainable Development (ESD) prepares students to be actively involved in creating a sustainable future by engaging them in solutions-based design and action that integrate knowledge across different disciplines and that considers diverse social, economic, and cultural perspectives. These skills and approaches also position students to perform more successfully across the school curriculum and prepare them for careers, higher education, and citizenship.

Gender Equity and Social Inclusion

Gender is what it means to be a woman or a man. Gender refers to those behaviours and attitudes that are culturally accepted as ways of being a woman (femininity) and of being a man (masculinity). Addressing gender issues goes well beyond ensuring that females have the same opportunities as males to receive an education. A person's experiences determine the way he or she understand and make sense of the world. Gender is also culturally determined. In Papua New Guinea, there is a need for sensitivity to local cultural practices and values, with respect to traditional roles for males and females. The National Curriculum will provide students with subjects, resources, activities and experiences that value the needs of girls and boys.

Females are generally a disadvantaged group in Papua New Guinea. Papua New Guinea does not have in place a good record about gender equity for females. Violence against women is widely acknowledged as a serious problem. A number of health and other indicators of human development show that females have a lower quality of life than males. Females have lower literacy rates and lower income levels than males. Males hold nearly all positions of leadership, authority and decision making. For example, in 2001 there were only two women in the National Parliament. Men hold most senior positions in government departments and the community. It is a similar situation in the Department of Education, provincial education divisions and schools. The National Curriculum will provide students with opportunities to consider these problems and ways of addressing gender issues.

Inclusive Curriculum

The national curriculum is inclusive and designed to meet the needs of all students irrespective of their abilities, gender, geographic locations, cultural and language backgrounds, or their socioeconomic backgrounds. The national curriculum must be implemented by teachers in ways that are inclusive of all students at all levels of schooling. Much more can be achieved if parents, community leaders, churches, and schools co-operate and communicate with each other.

Students learn in different ways. It is best to use a variety of methods to teach them. No one method is best. It is true that students are very different and even the same students learn best from different methods at different times. By using a range of teaching methods, it is more likely that the needs of all students will be met. In order to be inclusive of all students, teachers need to cater for a range of physical, social, cultural, emotional and intellectual needs of their students. This can be achieved through using appropriately and carefully planned learning activities, a range of teaching methods and strategies and thoughtful use of a teacher's language of communication.

In addition teachers will need to ensure that all girls and boys have the same opportunity to participate. Teaching practices, including classroom organisation and management, should ensure that girls and boys are able to participate fully in all learning activities. Participation allows individuals to be motivated to achieve the goal of socialisation fully where they are encouraged to develop a sense of obligation for the opportunity to contribute. Through participation, individual creativity can be recognised and encouraged as contributing to social and national development, without losing sight of the principle of communal sharing. Participation is the key to social interaction and can lead to social mobility. It can also help to conserve and generate knowledge and cultural values for future generations.

Student-Centred Learning

Student-centred learning recognises the fact that no two classes are alike and no two children are the same with respect to their needs. A teacher who uses a student-centred approach will endeavour to create a classroom environment that will motivate students to discover new skills and knowledge. In such an environment, the teacher might focus on teaching students how to learn and help them discover relevant information. It is essential to teach students how to learn while at the same time teaching them important content. A student-centred classroom will usually involve students working together in small groups using activity centres set up in the classroom while the teacher works more closely with one or two students.

The national curriculum describes the learning outcomes for all subjects. A student-centred approach allows teachers to be more flexible in determining the most effective ways to help all students achieve these learning outcomes.

Lifelong Learning

School is an important part of a student's education but learning continues throughout life. The initial experience that students have with the school curriculum is critical in encouraging them to continue learning throughout their lives. Going to school should be an enjoyable and satisfying experience for the students and should prepare them for life after school. Students will discover and learn many things when they go to school. They will also learn many things outside of school and continue to learn after they leave school. The national curriculum should build on what students already know. Teachers should make use of this knowledge and skills. When students are learning new, unfamiliar things, teachers should relate the new things to what students already understand. This important learning will continue throughout life as students willingly take responsibility for their own learning. Increasingly, students who leave school will look for opportunities to continue their education and to return to school or some other educational or training institutions in order to improve their qualifications.

Language Development Across the Curriculum

The national curriculum will provide opportunities for language development across the curriculum. Language development across the curriculum should be encouraged because all subject areas provide meaningful contexts for real purpose learning. Specific subjects have different language requirements such as, the vocabulary and language features of science and the written and oral genres to narrate, explain, persuade, report, and discuss the particular content of various subjects. The conventions and differences must be explicitly taught in relevant contexts across the curriculum.

Statement of Children rights

A child is any human being below the age of eighteen years, according to the United Nations Convention on the Rights of the Child. Therefore, special protection and care should be afforded in setting out the civil, political, economic, social and cultural rights of every child, regardless of their race, religion or abilities. In teaching and learning to fulfil the education of the child as his/her right and holistically.

The four core principles of the UN Convention on the Rights of the Child should be an impending role of an educator and parent or guardian;

That a child/student is;

- Not discriminated regardless of their race, religion or abilities
- Getting the best of learning out of commitment and devotion by the educator, parent or guardian according to his/her best interest.
- Having his/her right to life, survival and development holistically met.
- Gaining respect for his/her views in all aspects of oral or written literature.

When the child is given every opportunity to learn and progress, the child will develop visions and aims to achieve his/her goals of careers, higher education and citizenship in any context of lifelong learning.

Therefore teachers and educators are encouraged to plan and program content taking special care and consideration the articles 26 to 30 as stipulated in the Convention on Child Rights.

Standards Based Curriculum Principles

The principles of the Standards Based Curriculum (SBC) include the following:

- Setting of high academic standards and a careful and continuous assessment and reporting of students' performance against these standards, will motivate students to perform at a much higher level.
- Standards allow every student, every parent, and every teacher to share in common expectations of what students should know, understand, and be able to do.
- Students will learn more when more is expected of them in school and at home.
- The setting of clear, measurable, and attainable standards is the key to attaining high academic standards and hence the attainment of the desired quality of education.
- All children are capable of learning and achieving high academic standards, regardless of their backgrounds.
- Students can learn in their own ways and at their own pace.

Rationale, Aim, and Goals and Guiding Principle of Mathematics

Papua New Guinea (PNG) like any other country in the world is also making concerted efforts to boost student achievement in literacy, numeracy and Life skills. Mathematics is regarded as an important course aimed at improving mathematics education that underpins many aspects of everyday life such as making sense of natural patterns, information in various forms to make informed decisions. The impact and influence of current development and technological trend is significant as Mathematics, Information, Technology, Engineering, and Science have become driving forces for growing job markets and sustainable development agendas for nations.

The realigned Mathematics curriculum is focused on mathematics skills and fundamental mathematical processes (reasoning, communicating, connecting, and representing), utilizing the problem solving based approaches. This will inspire the students mind to become mathematically literate as they progress from one level of learning to another.

The most important goal is for students to enjoy and value mathematics as important in the current development and technological trends and help explore the natural world and human interactions while at the same time nurture them to grow and become a meaningful members of the society as stipulated under the National Education Act promoting Integral Human Development.

Ultimate Aim of Mathematics

The overall aim of mathematics is to nurture individuals to be mathematically literate in order to identify and understand mathematical related phenomena and concerns and be able to generate mathematical thinking, competence and confidence in the application of mathematics, and appreciation of the subject.

Goal of Mathematics

The overarching goal of the mathematics curriculum is to ensure that all students will achieve a level of mastery of mathematical proficiencies and knowledge that will serve them well in life, and nurture the passion for living that emphasizes scholastic ability, a rich heart and mind and the harmony of healthy body as envisioned in vision 2050.

Guiding Principles of Mathematics

Mathematics curriculum principles below identify, describe and focus attention on the important concerns that must be addressed when developing and implementing the Mathematics Curriculum.

A Coherent and Focused Curriculum

In a coherent curriculum, mathematical ideas are linked to and build upon one another so that students' understanding and knowledge are deepened and their ability to apply mathematics expand. An effective mathematics curriculum focuses on important mathematics that will prepare students to continue study and solve problems in a variety of school, home, and work settings. A well-articulated curriculum challenges students to learn increasingly more sophisticated mathematical ideas as they continue their studies.

Gender Equity and Social Inclusion

All children, regardless of their gender, ability, and other backgrounds, are expected to achieve high academic standards in mathematics. High expectations and strong support for especially female students and children living with disabilities will enable all children to be actively involved in the learning of mathematics. All students come to school with expectations to learn mathematics that meets their individual interest and needs. Mathematics standards provide a wide range of opportunities for students to acquire and apply mathematical knowledge, processes, concepts, ideas, skills, values, attitudes in real life. Every student regardless of race, colour, gender and ability should have the benefit of quality instructional materials, good libraries, and adequate technology.

Evidence - Based Teaching and Learning

Assessment should support the learning of important mathematics knowledge, processes, skills, values, and attitudes, and focused on assessing and reporting children's progress towards meeting the expected mathematics benchmarks and contentstandards. Assessment, monitoring, and reporting are integral parts of mathematics planning and instruction, they contribute significantly to students' mathematics learning when effectively carried out. Assessment should inform and guide teachers as they make instructional decisions. The tasks teacher's select for assessment convey a message to the students about what kind of mathematical knowledge, skills, values, attitudes and performance are valued. Feedback from assessment tasks helps students' in setting goals, assuming responsibility for their own learning, and becoming more independent learners.

Teaching and Learning Mathematics using Technology

Technology is essential in the teaching and learning of mathematics. It influences the way mathematics is taught and contributes to enhancing students' learning of mathematics. Technology can enhance the teaching and learning of mathematics if used appropriately. The use of technological tools such as measuring instruments, base ten blocks, fraction chart and pieces, calculators, and computers can help students learn and master essential mathematical concepts, ideas, and processes. These tools can contribute to a rich learning environment for developing and applying mathematical concepts.

Content Overview

The content overview is the description of what students will learn in each grade prescribed in the syllabus content.

The grades 6, 7 and 8 syllabi are organised by strands. Strands are broad frameworks that define and describe the subject matter to be taught and learned. They incorporate cross-curriculum learning as well. Each strand has a rationale that justifies its inclusion in the mathematics curriculum.

Each strand embeds a particular aspect of Mathematics and articulates the subject matter to be learned. Strands are broken down into teachable units to allow content standards and benchmarks to be effectively taught and learned. Units are aligned and connected to each other and to the strand.

The mathematics strands for Grade 6 are as follows:

(1) Number and Operation (NO),
(2) Quantities and Measurement (QM),
(3) Geometrical Figures (GF) and,
(4) Data and Mathematical Relations (DMR).

Strands for Grades 7 and 8 are as follows:

(1) Number, Operation and Computation (NOC),
(2) Geometry, Measurement and Transformation(GMT),
(3) Patterns and Algebra (PAA) and,
(4) Statistics and Probability (SAP).

Table of Strands and Units

The strands and units of content standards explain the progression from Grade 6 to Grade 8, linking to high school mathematics content. The order and linkage of units signifies what the students will achieve from one grade to next.

Grade	Strands	Units
Grade 6	**Number and Operation**	Relationship Between Fractions, Decimals, and Percentages
		Multiplication and Division of Fractions
		Calculation of Fraction and Decimal Numbers
	Quantities and Measurement	Calculating Area of Various Shapes
		Speed
		System of Matric Units
		Volume of Prisms and Cylinders
	Geometric Figures	Symmetry
		Reduce and Enlarge Figures
	Data and Mathematical Relations	Ratio
		Proportional Relationship
		Mathematical Letter and Expression
		How to Explore Data
		Order and Combination
Grade 7	**Numbers, Operation and Computation**	Positive and Negative Numbers
	Geometrical, Measurement and Transformation	Plane Figures
		Spatial Figures
	Patterns and Algebra	Algebraic Expression
		Linear Equation with One Unknown
		Proportional Function
	Statistics and Probability	Distribution of Data and Representative Values
		Reduce and Enlarge Figures
Grade 8	**Number, Operation and Computation**	Operation of Algebraic Expressions Reduce and Enlarge Figures
	Geometry, Measurement, and Transformation	Properties of Parallel Lines and Angles
		Congruent Triangles
	Patterns and Algebra	Simultaneous Linear Equations
		Linear Functions
	Statistics and Probability	Probability

Content Standards, Benchmarks and Evidence Outcomes

Content standards, benchmarks, and evidence outcomes are all curriculum standards. However, they have specific curriculum purposes. Despite this, these curriculum standards are interconnected and enable the intended learning outcomes to be attained.

Content Standards

Content Standards are broadly stated expectations of what students should know, understand, and be able to do in particular subjects, grade level, or school level. *For example,* Pupils will be able to interact and convey simple messages using comprehensive language.

Benchmarks

Benchmarks are specifications of content standards or more detailed descriptions of a specific level of performance expected of students at particular ages, grades, or levels of development. For example, grade 6 students will meet the above standard when they ask and answer questions about routine matters using comprehensive language.

Benchmarks focus on the essential knowledge, skills, values and attitudes that all students are expected to learn, master and demonstrate competency using various representations in real life situations.

Evidence Outcomes

Evidence outcomes are indicators that show students' progress towards meeting an expectation at the mastery level. They measure students' mastery and application of knowledge, skills, values, and attitudes at grade and cluster levels.

Content Standards and Benchmarks Coding

The following is the coding system used to code the content standards and benchmarks to not only make it easier to interpret and understand the relationship between these two standards but also to help with lesson planning, and assessment and reporting of students' performance in relation to a content standard.

Grade:	Grade is indicated by the first number (*for example,* **6**)
Strand:	Strand is indicated by the second number (*for example,* **6.1**).
Content Standard:	Content Standard is indicated by the third number (*for example,* **6.1.1**)
Benchmark:	Benchmark is indicated by the fourth number (*for example,* **6.1.1.1**)

Thus, the code will read as **6.1.1.1.**

Grade 6 Strands and Units

Strand 1: Number and Operation

Rationale

In grade 6 the strand "Numbers and Operations," multiplication and division of fractions are taught. By the end of learning the four arithmetic operations of decimal numbers and fractions, teaching should be done in the way that solidifies students' calculation skills with these types of numbers and enhances their ability to apply these skills.

The knowledge, skills, values, and attitudes learned at the junior primary school level are expanded and reinforced in senior primary school. Grade 6 students are expected to master the Number and Operation knowledge, skills, values, and attitudes described in the content standards and grade-level benchmarks.

Evidence Outcomes

At the end of grade 6, all students can:

- solve problems involving fraction, decimal and percentages accurately
- calculate decimal numbers and fractions using the four arithmetic operations confidently
- multiply and divide fractions with multipliers and divisors as fractions confidently.

Unit 1: Relationship among Fractions, Decimals and Percentages

Content Standard	Benchmarks
6.1.1. Students will be able to explain the relationship between fractions, decimals, and percentages, and convert and appreciate their usage in daily life	**6.1.1.1.** Describe the relationship between fractions, decimals and percentages. **6.1.1.2.** Convert between fractions, decimals, and percentages. **6.1.1.3.** Use percentage, decimal notation, fraction or ratio interchangeably to suit given mathematical problems.

Unit 2 : Multiplication and Division of Fractions

Content Standard	Benchmarks
6.1.2. Students will be able to extend the multiplication and division to fractions with multipliers and divisors as fraction and do multiplication and division, and appreciate the simplicity of rules.	**6.1.2.1.** Distinguish the fractional situation for multiplication and division in the expression. **6.1.2.2.** Calculate fraction x fraction. **6.1.2.3.** Calculate fraction ÷ fraction and find the inverse number. **6.1.2.4.** Examine commutative, associative and distributive properties and division with fractions.

Unit 3 : Calculation of Fraction and Decimal Number

Content Standard	Benchmarks
6.1.3. Students will be able to demonstrate the proficiency in calculation of four arithmetic operations with fractions and decimals, and be confident in using them.	**6.1.3.1.** Calculate decimal numbers using the four arithmetic operations. **6.1.3.2.** Calculate fractions using the four arithmetic operations. **6.1.3.3.** Use the four arithmetic operations to solve mathematical problems with fractions and decimals.

Strand 2 : Quantities and Measurement

Rationale

In Quantities and Measurement, students are taught how to approximate shapes and areas, how to determine the area of a circle and how to determine the volume of prisms and cylinders and ways of determining speed and the system of the metric units.

Grade 6 students are expected to master the Quantities and Measurement knowledge, skills,values and attitudes described in the content standards and grade-level benchmarks.

Evidence Outcomes

All students are expected to learn and master the following essential quantities and measurement knowledge, skills, values and attitudes at the end of grade 6.

At the end of grade 6, all students can:

- calculate areas of various shapes confidently using the other perimeters and formulas.
- calculate speed, time and distance from given mathematical problems and graphs correctly.
- measure various quantities of measurements using the metric units, and appreciate their usefulness in daily life.
- calculate the volume of prisms and cylinders accurately using other perimeters and formulae.

Unit 1 : Calculating Area of Various Shapes

Content Standard	Benchmarks
6.2.1. Students will be able to explore the area of various shapes such as a circle and measure their area, and attain expected level of proficiency and appreciation power of the formula.	**6.2.1.1.** Use familiar area formula of figures to estimate and measure area of various shapes. **6.2.1.2.** Identify ways to determine the formula of area of circles. **6.2.1.3.** the usefulness formula of circle and sector to calculate.

Unit 2 : Speed

Content Standard	Benchmarks
6.2.2. Students will be able to comprehend speed as a ratio of time and distance, and use its situation to calculate and appreciate their relationship.	**6.2.2.1.** Determine ways using the formula to express speed in relation to distance and time. **6.2.2.2.** Represent the relationship between time and distance and explain the features.

Unit 3 : System of Metric Units

Content Standard	Benchmarks
6.2.3. Students will be able to explain the metric unit system and measure various quantities of measurements using it, and appreciate its usefulness in real life.	**6.2.3.1.** Determine units of quantities used in everyday life and ways to represent them. **6.2.3.2.** Identify how systems of metric units relate to measurements. **6.2.3.3.** Use metric units effectively in measuring quantities.

Unit 4 : Volume of Prisms and Cylinders

Content Standard	Benchmarks
6.2.4. Students will be able to investigate the process of calculating the volume of prisms and cylinders using other perimeters, and find the volume and have confidence using the formula.	**6.2.4.1.** Identify the base area of prisms and cylinders using perimeters measurements. **6.2.4.2.** Use volume formulae to calculate the base area and height of prisms and cylinders.

Strand 3 : Geometrical Figures

Rationale

The strand focuses on the concept formation of geometrical figures and the understanding of their properties in relation to the concepts and properties of basic geometrical figures, the mastering of the ability to draw and construct geometrical figures accurately and to extend the ability of using knowledge and skills related to geometrical figures. In "Geometrical Figures," students are taught about reduced and enlarged figures and symmetric figures.

The knowledge, skills, values and attitudes learned at the junior primary school level are expanded and reinforced in senior primary school. Senior primary school students are expected to master the following knowledge, skills, values and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of Grade 6, all students will master the following knowledge, skills, values and attitudes to prepare them for the next grade:

- identify line and point geometrical properties correctly
- construct enlarged and reduced drawings using the geometrical properties.

Unit 1 : Symmetry

Content Standard	Benchmarks
6.3.1. Students will be able to examine symmetrical figures, and find out about their properties, and enjoy constructing symmetrical figures.	**6.3.1.1.** Explain the properties of symmetrical figures. **6.3.1.2.** With an awareness of their properties, identify line symmetrical figures and point symmetry.

Unit 2 : Reduce and Enlarge Figures

Content Standard	Benchmarks
6.3.2. Students will be able to expand the plane figures by enlargement and reduction, and explore the properties for expansion.	**6.3.2.1.** Identify the properties of enlargement and reduction of figures. **6.3.2.2.** Explain how to draw enlarged and reduced figures using their properties.

Strand 4 : Data and Mathematical Relations

Rationale

The main content of "Data and Mathematical Relations" include some ideas of functions such as change and correspondences, representation by algebraic expressions, and tables and graphs and involves ways of thinking and methods that can be commonly used in handling quantities and geometrical figures. Students are taught about ratios, direct and inverse proportional relationships, and algebraic expressions with letters. In data handling, mean, frequency distribution, and analysis of all possible outcomes for actual events are taught in this grade.

Grade 6 students are expected to master the following data and mathematical relations, knowledge, skills, values and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of grade 6, all students can:

- recognise and solve problems involving simple ratios confidently.
- investigate proportional relationship between two numbers or quantities as they vary simultaneously and solve problems using proportional relationship approaches with skills of analysis.
- use mathematical letters to solve problem expression and be able to interpret the letter representation confidently.
- analyse and represent data statistically and appreciate its usefulness in daily life
- investigate possible outcomes and be able to sort and organize in order using tables and graphs and interpret with confidently.

Unit 1 : Ratio

Content Standard	Benchmarks
6.4.1. Students will be able to define ratio, and use it in various situations, and appreciate its usefulness in daily life.	**6.4.1.1.** Explain ratio and show how to represent it in various situations. **6.4.1.2.** Examine various situations in which ratio is used in daily life.

Unit 2 : Proportional Relationship

Content Standard	Benchmarks
6.4.2. Students will be able to appraise the proportional relationship between two numbers or quantities in various simultaneous expression approaches, and appreciate their usefulness in daily life.	**6.4.2.1.** Explain proportion and identify using tables, graphs and expression. **6.4.2.2.** Apply proportional relationships in daily life. **6.4.2.3.** Use proportional properties to explain inverse proportion.

Unit 3 : Mathematical Letter and Expression

Content Standard	Benchmarks
6.4.3. Students will be able to use mathematical letter in expressions to represent place values and interpret them.	**6.4.3.1.** Represent relationships in expressions by using mathematical letter. **6.4.3.2.** Find the answer for the mathematical letter by using inverse operation.

Unit 4 : How to Explore Data

Content Standard	Benchmarks
6.4.4. Students will be able to examine data and analyse and represent it statistically, and appreciate its usefulness in daily life.	**6.4.4.1.** Find the average data of various situations. **6.4.4.2.** Draw and represent data in tables and graphs, and interpret them meaningfully.

Unit 5 : Order and Combination

Content Standard	Benchmarks
6.4.5. Students will be able to critique possible outcomes from appropriate viewpoints, and be able to figure out, sort and organize viewpoints systematically with confidence.	**6.4.5.1.** Evaluate possible outcomes of events. **6.4.5.2.** Organise and order systematically actual events and represent them using diagrams and tables.

Grade 7 Strands and Units

Strand 1 : Number, Operation and Computation

Rationale

The unit on Numbers is the basis of all mathematics. Number is used for order and size in calculations. We calculate by adding, subtracting, multiplying and dividing numbers, either mentally, written or by using technology. We also build patterns using numbers in written or symbolic forms to represent mathematical ideas. We need numbers to count, compare, and measure. In everyday life, we use numbers for almost everything. Our age, weight and height, time, money, and work are measured using numbers. Numbers have meaning and are represented in many different forms. This strand covers whole numbers, decimal, fractions, percentages, integers, scientific notation, exponential numbers and logarithmic numbers under the Real Numbers System. Complex numbers are introduced in the latter part to prepare students especially for higher education.

The mathematics concepts, ideas, processes and reasoning skills studied at the elementary and junior primary school levels are reinforced at the senior primary school level but at an increased level of complexity and abstraction. Students at this level are expected to represent, compare, order and use numbers in a variety of forms, including integer, fraction, decimal, percentage and exponents, in mathematical problem-solving situations.

Evidence Outcomes

At the end of grade 7, all students can:

- recognise the usefulness of positive and negative numbers in real life.
- understand the necessity and meaning of positive and negative numbers.
- perform the four operations using positive and negative numbers confidently.

Unit 1 : Positive and Negative Numbers

Content Standard	Benchmarks
7.1.1. Students will be able to make sense of positive and negative numbers, and perform the four operations, by utilising positive and negative numbers confidently.	**7.1.1.1.** Reflect on the significance of positive and negative numbers in various situations. **7.1.1.2.** Explain the process of operations on positive and negative numbers using absolute values. **7.1.1.3.** Use various representations and models to calculate negative and positive numbers.

Strand 2 : Geometrical, Measurement and Transformation

Rationale

Topics of geometry, measurement, and transformation remain important components of the mathematics curriculum at all levels. This body of knowledge helps in making informed decisions on some necessities in life. We think geometrically when we choose shapes and solids, we want precision so we take measurements seriously, and we like to be creative so we transform what is common to something new. When questioned we justify our choices, for clarity we explain the processes required to arrive at solutions. These knowledge, skills, and techniques are integrated in the teaching of these topics.

In the PNG context, building a house is almost every family's dream. Shape, measurement and transformation come at a cost. A sound mathematical knowledge will ensure satisfaction at an acceptable cost.

Grade 7 students are expected to master the following Geometry, Measurement and Transformation knowledge, skills, values and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of grade 7, all students can:

- recognise the basic methods of constructing plane figures such as a bisector of an angle, the perpendicular bisector of a line segment and perpendicular lines, and verify them using their properties carefully.
- describe symmetry, reflections and translations with appropriate notation reasonably.
- identify and measure various spatial figures in relation to plane figures confidently.
- describe the characteristics of various solids confidently.
- explain the positional relationship between planes and lines by observing the faces and edges of solids with reason.
- find volume and surface area of various solids through calculation accurately.

Unit 1 : Plane Figures

Content Standard	Benchmarks
7.2.1. Students will be able to investigate plane figures by constructing them with the application of the properties of plane figures and appreciate representing them logically.	**7.2.1.1.** Identify the basic methods for constructing figures like the bisector of an angle, the perpendicular bisector of a line segment and perpendicular lines, and make use of them in concrete situations. **7.2.1.2.** Explain parallel translation, symmetric and rotational transformation and discuss their relationships.

Unit 2 : Spatial Figures

Content Standard	Benchmarks
7.2.2. Students will be able to probe spatial figures in relation to plane figures and measure various figures.	**7.2.2.1.** Explain the positional relationship between lines and planes in space. **7.2.2.2.** Construct spatial figures by moving or projecting lines and plane figures, and nets. **7.2.2.3.** Find the length and area of a sector, surface area, and volume of cylinders, pyramids and spheres.

Strand 3 : Patterns and Algebra

Rationale

Algebra is the language of generalization. If something is done once you probably don't need algebra. But if the process is to be done repeatedly, algebra provides a very simple language for describing what is being done. Algebra is the language through which we describe patterns. Many areas of mathematics integrate algebra specifically for problem solving.

When we add, subtract, multiply and divide we follow patterns. Algebra develops patterns into equations and formulas that come handy in life. You may want to buy a piece of land and want to know the formula for area, or sew clothes and want to know the amount of material needed or perimeter for amount of fencing you might need, etc. Income tax, discounts, sales tax and virtually every money matter involve applying some formula.

Grade 7 students are expected to master the following patterns and algebra knowledge, skills, values, and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of Grade 7, all students can:

- recognise algebraic expressions and represent the relationships and rules of expression, and calculate confidently.
- solve linear equations with one unknown using and confidently verify their solutions.
- explain the changes and correspondence of the relationships of proportion confidently.
- express propositional relationships and inversely proportional relationship using tables, expressions and graphs carefully.
- express the position of points on a plane figure confidently.
- use propositional relationships and inversely proportional relationship to solve real life problems confidently.
- expressing proportional relationship $y = ax$, and inversely proportional relationship $y = \frac{a}{x}$ on a graph.

Unit 1 : Algebraic Expression

Content Standard	Benchmarks
7.3.1. Students will be able to interpret the algebraic expressions and represent the relationships and rules of expression and calculate confidently**.**	**7.3. 1. 1.** Explain the significance of using letters and represent the relationships and rules of expression. **7.3. 1. 2.** Express algebraic expressions of multiplication and division. **7.3. 1.3.** Simplify addition and subtraction of letters in linear expressions. **7.3.1.4.** Use equality and inequality to represent situations.

Unit 2 : Linear Equation with One Unknown

Content Standard	Benchmarks
7.3. 2. Students will be able to examine equations, and be able to solve linear equations with one unknown and enjoy problem solving.	**7.3.2.1.** Explain the significance of linear equations. **7.3.2.2.** Solve linear equations based on the properties of equalities. **7.3.2.3.** Explain equal ratios with proportional expressions and solve.

Unit 3 : Proportional Function

Content Standard	Benchmarks
7.3. 3. Students will be able to investigate the changes and correspondence of functional relationships of proportion, and represent the functions confidently.	**7.3.3.1** Explain functional relationships in one to one correspondence. **7.3.3.2** Extend proportion to positive and negative numbers in a situation with domain, range and variables. **7.3.3.3** Use proportion and inverse proportion to explain phenomena. **7.3.3.4** Represent proportion and inverse proportion into tables, algebraic expressions, graphs and to examine their characteristics. **7.3.3.5** Explain coordinates and represent quantitative relationships in graphs**.**

Strand 4: Statistics and Probabilities

Rationale

In the study of social science, students might encounter data. In a science laboratory experience, students might collect data. In a mathematics classroom, students would be expected to know how to calculate the mean of a set of numbers. Statistics has become more important, its connections with everyday literacy, science, health, and the social sciences suggest statistics must be taught across the curriculum as topic in mathematics. Moves are underway to introduce probability into elementary and secondary curricula for a variety of reasons. It is required for reading newspapers, being an informed citizen, it helps one to understand and evaluate information in the world around us, and it is a prerequisite knowledge for other fields of study. In the current curriculum design, students may encounter probability topics, by themselves or in connection with descriptive statistics, as early as elementary level, or as late as upper secondary school.

Grade 7 students are expected to master the following statistics and probabilities knowledge, skills, values and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of Grade 7, all students can:

- collect and organise data according to a specific purpose and use data to identify trends and characteristics.
- recognise values that express dispersion and central tendency.
- express data collected through measurement and other means.

Unit 1 : Distribution of Data and Representative Values

Content Standard	Benchmarks
7.4.1. Student will be able to comprehend how to collect data according to purpose, and explain the tendencies in data with confidence.	**7.4.1.1.** Explain the significance of histogram and representative values for analysing data. **7.4.1.2.** Show the tendency of data by representing it using histogram and frequency tables. **7.4.1.3.** Express dispersion and representative values, and approximate values through calculations.

Grade 8 Strands and Units

Strand 1. Number, Operation and Computation

Rationale

Algebra is the language of generalization. If something is done once you probably don't need algebra. But if the process is to be done repeatedly, algebra provides a very simple language for describing what is being done. Algebra is the language through which we describe patterns. Many areas of mathematics integrate algebra specifically for problem solving.

When we add, subtract, multiply, and divide we follow patterns. Algebra develops patterns into equations and formulas that come handy in life. You may want to buy a piece of land and want to know the formula for area, or sew clothes and want to know the amount of material needed or perimeter for amount of fencing you might need, etc. Income tax, discounts, sales tax and virtually every money matter involve applying some formula.

Grade 8 students are expected to master the following Number,Operation and Computation knowledge, skills, values and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of Grade 8, all students can:

- add and subtract expressions with two letters.
- identify different ways to calculate linear expressions.
- multiply and divide algebraic expression.

Unit 1: Operation of Algebraic Expressions

Content Standard	Benchmarks
8.1.1. Students will be able to use the algebraic expression with more than one variable for representing various situations and operations to find the answer, and interpret with confidence.	**8.1.1.1.** Simplify addition and subtraction with polynomials, multiplication, and division with monomials. **8.1.1.2.** Explain number and quantity relationships using algebraic expressions. **8.1.1.3.** Rearrange algebraic expressions according to like and unlike terms, and operate to find the answer. **8.1.1.4.** Utilize algebraic expressions to explain problem situations.

Strand 2: Geometry, Measurement and Transformation

Rationale

Topics of geometry, measurement, and transformation remain important components of the mathematics curriculum at all levels. This body of knowledge helps in making informed decisions on some necessities in life. We think geometrically when we choose shapes and solids, we want precision so we take measurements seriously, and we like to be creative so we transform what is common to something new. When questioned we justify our choices, for clarity we explain the processes required to arrive at solutions. These knowledge, skills, and techniques are integrated in the teaching of these topics. In the PNG context, building a house is almost every family's dream. Shape, measurement, and transformation come at a cost. A sound mathematical knowledge will ensure satisfaction at an acceptable cost.

The knowledge, skills, values, and attitudes learned at the junior primary school level are expanded and reinforced in senior primary school. Senior primary school students are expected to master the following knowledge, skills, values, and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of Grade 8, all students can:

- recognise the angles that are formed by intersection lines.
- describe the properties of angles in triangles and other polygons.
- describe the properties of angles in triangles and other polygons.
- apply logical reasoning including the use of congruence and similarity and the numerical properties of plane figures.
- formulate proofs to congruent triangles and angle properties.

Unit 1: Properties of Parallel Lines and Angles

Content Standard	Benchmarks
8.2.1. Students will be able to investigate the properties of parallel lines and angles and find angles using properties, and appreciate the properties for verifying the reasoning.	**8.2.1.1.** Explain the properties of parallel lines and angles. **8.2.1.2.** Use the properties of parallel lines and angles to explain the angles produced. **8.2.1.3.** Identify and examine the angles of polygons based on the properties of parallel lines and angles of triangle.

Unit 2 : Congruent Triangles

Content Standard	Benchmarks
8.2.2. Students will be able to investigate congruent triangles using conditions of the properties of congruent figures and to proof with confidence.	**8.2.2.1.** Use the properties of congruent triangles to explain congruence. **8.2.2.2.** Identify and explain the significance of proof. **8.2.2.3.** Show how to proof using the conditions for congruence.

Strand 3. Patterns and Algebra

Rationale

Algebra is the language of generalization. If something is done once you probably don't need algebra. But if the process is to be done repeatedly, algebra provides a very simple language for describing what is being done. Algebra is the language through which we describe patterns. Many areas of mathematics integrate algebra specifically for problem solving.

When we add, subtract, multiply, and divide we follow patterns. Algebra develops patterns into equations and formulas that come handy in life. You may want to buy a piece of land and want to know the formula for area, or sew clothes and want to know the amount of material needed or perimeter for amount of fencing you might need, etc. Income tax, discounts, sales tax, and virtually every money matter involve applying some formula.

Grade 8 students are expected to master the following Patterns and Algebra knowledge, skills, values, and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of Grade 8, all students can:

- use algebraic expressions to solve problems.
- recognize equations with two unknowns and find their solutions.
- solve simultaneous equations with confidence.
- use simultaneous equations to solve real life problems.
- recognise linear functions using algebraic expressions, tables, and graphs with appreciation.
- use the graph to find the expression of linear functions.
- graph solution to understand the relationship between the intersection of two lines and solutions to simultaneous equations.
- apply linear functions to solve real life problems.

Unit 1 : Simultaneous Linear Equations

Content Standard	Benchmarks
8.3.1 Students will be able to grasp simultaneous linear equations with two variables and solve simultaneous equations with confidence**.**	**8.3.1.1** Explain the significance of linear equations with two variables and their solutions. **8.3.1.2** Solve simultaneous linear equations and use in various situations. **8.3.1.3** Set simultaneous linear equations and solve.

Unit 2 : Linear Functions

Content Standard	Benchmarks
8.3.2. Students will be able to investigate the changes and correspondence of two quantities, examine linear functions using algebraic expressions, tables, and graphs with appreciation.	**8.3.2.1.** Identify the linear functions in concrete phenomena and express the rate of change for two corresponding values. **8.3.2.2.** Express the rate of change for two corresponding values on algebraic expressions, tables, and graphs. **8.3.2.3.** Represent linear equations with two unknowns as algebraic expression functions. **8.3.2.4.** Represent simultaneous equations on the graphs and explain the meaning of the solution.

Strand 4. Statistics and Probabilities

Rationale

In the study of social science, students might encounter data. In a science laboratory experience, students might collect data. In a mathematics classroom, students would be expected to know how to calculate the mean of a set of numbers. Statistics has become more important, its connections with everyday literacy, science, health, and the social sciences suggest statistics must be taught across the curriculum as topic in mathematics. Moves are underway to introduce probability into elementary and secondary curricula for a variety of reasons. It is required for reading newspapers, being an informed citizen, it helps one to understand and evaluate information in the world around us, and it is a prerequisite knowledge for other fields of study. In the current curriculum design, students may encounter probability topics, by themselves or in connection with descriptive statistics, as early as elementary level, or as late as upper secondary school.

The knowledge, skills, values and attitudes learned at the junior primary school level are expanded and reinforced in senior primary school. Senior primary school students are expected to master the following knowledge, skills, values and attitudes to prepare them for next grade.

Evidence Outcomes

At the end of Grade 7, all students can:

- use fractions and percentage to express the likely hood of an event.
- identify various ways an event to occur in order to find the probability.
- find the probabilities of various events.

Unit 1 : Probability

Content Standard	Benchmarks
8.4.1. Students will be able to comprehend the probabilities of uncertain phenomena and find the probability of uncertainty events.	**8.4.1.1.** Explain the probabilities of uncertainty phenomena with law of large number and probability, equally likely. **8.4.1.2.** Identify the probability of uncertain event of simple cases by considering all cases, equally likely. **8.4.1.3.** Explain uncertain phenomena by using diagrams, which represent all equally likely cases.

Assessment, Monitoring and Reporting

The relationship between the assessment standards, the content standards, and the teaching standards assessment is an integral part of good instruction. The most effective teaching aligns the content standards with teaching and learning instruction and assessment.

What is Assessment?

The term "assessment" is generally used to refer to all activities teachers use to help students learn and to monitor and measure students' progress. Assessment is an on-going process of identifying, gathering and interpreting information about student's progress towards achievement of the content standards described in the subject syllabuses.

What is Standards Based Assessment?

In a standards based curriculum, assessment is a tool for unpacking performance standard for formative assessment and measuring content standard on summative assessment. It is viewed not only as a final product (summative), but more importantly as a continual process (formative) that provides pupil performance data to teachers and students regarding their progress towards achieving the intended standards. Assessment refers to all activities undertaken by teachers and by students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged.

Purpose of Assessment

The primary purpose of assessment is to improve students' learning and teachers' teaching as both respond to fulfilling the following:

- inform and improve students' progress and achievements in learning.
- provide valuable information that enable teachers, schools and Department of Education to make decisions about how to improve the quality of teaching and learning in the education system.
- inform teachers of the progress of students learning in order to adjust teaching and planning to improve student learning.
- inform parents and guardians, about their children's progress and achievements.
- schools and systems, about teaching strategies, resource allocations and curriculum; and other educational institutions, employers and the community, about the achievements of students in general or of particular students.

Whatever its purpose, assessment is seen as an integral part of the learning and teaching program rather than a separate process.

Types of Assessment

Papua New Guinea Standards based curriculum has adopted the following types of assessments to monitor and assess the achievement of content standards.

- Assessment ***As*** learning
- Assessment ***For*** learning
- Assessment ***Of*** learning

Assessment *For* Learning

Assessment *For* learning, also known as classroom assessment, is different. It is an ongoing process that arises out of the interaction between teaching and learning. It is not used to evaluate learning but to help learners learn better. It does so by helping both students and teachers to see the learning goals and criteria, where each learner is in relation to the goals, where they need to go next and ways to get there. Assessment *For* learning is also known as *Formative Assessment.*

Assessment *Of* Learning

Assessment *of* learning is the use of a task or an activity to measure, record and report on a student's level of achievement in regards to specific learning expectations. Assessment *of* learning is also known as *Summative Assessment.*

Assessment *As* Learning

Assessment *as* learning is the use of a task or an activity to allow students the opportunity to use assessment to further their own learning. Self and peer assessments allow students to reflect on their own learning and identify areas of strength and weakness. These tasks offer students the chance to set their own personal goals and advocate for their own learning. Assessment As learning is also known as *Formative Assessment.*

Diagnostic Assessment

Apart from these three main types of assessments teachers are expected to do the diagnostic test/assessment to identify strengths and weaknesses in students. This can be done before any teaching and learning of a new content and for new entry levels for students.

Reporting

Reporting is communicating clearly to students, parents, guardians, teachers and others, the information gained from assessing students' learning. Students' reports should be based on assessment information collected from ongoing assessments. Schools will decide on how reports will be presented to best suit the needs of their communities. Methods will include interviews and written reports. Written reports should include:

- a written record of content standards achieved by students since the previous report,
- a written record of the content standards the student is now working towards.
- information about students' attitudes, values and other additional information that is specific to individual students.

Monitoring and Evaluation

All stakeholders have a role to play in using assessment information to make judgments about student's achievements. Analysis of assessment data must be used to inform decision makers about:

- the effectiveness of teaching, learning and assessment programs
- suitability of available resources
- the degree of community participation in schools
- trend in students' achievement at local and national levels
- the contribution of the education systems to the future development of the nation

Evaluation is part of the process of continuously raising standards of student achievement in PNG. Assessment information used for evaluation purposes should be used in ethical and constructive ways.

Monitoring

The teachers are encouraged to practice general supervision over the teaching and learning content of Mathematics instructions in primary classes within the school. Teachers also advise school officials, school boards, and other teachers in the development and improvement of Mathematics programs, and identify strategies to improve Mathematics education.

The assessment coordinators in the schools should develop and use the monitoring tools to check on the progress of teaching and learning of Mathematics content.

Evaluation

Teachers will use assessment information to evaluate the effectiveness of their teaching, learning to make improvements to their teaching practice in order to improve student learning. Evaluation tools such as written records, questionnaires, logs and diaries, submissions or records of meetings and discussion with general staff members, teaching staff, parents and other community members.

Glossary

Word	Definition
Algebraic equation	An equation containing algebraic expressions.
Algebraic expression	A statement that expressed in letters of the alphabet.
Approximate value	An approximate is not an exact value, but a substitution for it. Measured value is an approximate value.
Benchmark	A benchmark is a required standard or yardstick in which something is assessed or measured against. In the national curriculum, it is set to evaluate and validate the standard of curriculum as well as the effectiveness of teaching and learning.
Bisect	To divide or cut something into exactly 2 equal parts.
Bisector	A straight line which bisect or divides a given angle or line into two equal parts.
Congruent	When two plane figures are congruent, they are identical in every respect. Their corresponding sides and angles are equal.
Content Standard	Content Standards are broad statements that describe the essential; knowledge, skills, values, and attitudes that all students are expected to learn and master.
Deductive reasoning	A method of reasoning logically.
Direct proportion	When the relationship of two variables remains constant.
Distributive law	Multiplication of numbers; all the terms of one factor are multiplied by all the terms of other factor.
Enlarge figures	When a figure is made larger by a certain ratio in proportion to the figure
Equation	An equation is a sentence in which two phrases are connected by an equality sign (=).
Estimation	Guessing, predicting or assuming an approximate value.
Expression	An expression is a mathematical sentence or phrase with symbols for numbers and letters, which is combined by the mathematical operations, or relational symbols.
Indirect proportion	When one variable is multiplied by a number and the other variable is divided by the same number.
Inductive reasoning	Being able to reason things out based on particular given facts or examples. Observed through inductive reasoning, one discovers general laws.
Inequality symbols	Symbols used to compare numbers or quantities: $<, >, \neq, \leq$ and $\geq$ are all inequality symbols.
Intersection	A common point at which two or more lines or curves pass through.
Line Symmetry	A figure when it can be folded along a straight line and the two halves of the shapes fit exactly on top of each other.
Linear function	Equation of the straight line or equation of the first degree, when the highest power of x is 1.
National Benchmarks	National set of Standards to evaluate and validate the effectiveness of the curriculum by which all students should achieve in a particular grade or grade level in order to proceed to the next level of their education.
Negative number	A number less than 0. The negative numbers lie to the left direction of zero on the x- axis infinitively get lesser
Performance Standards	Performance standards make content standards operational. They transform inert (passive) statements of content into active expectations for performance.

Point Symmetry	A figure when it is rotated 180° with respect to a point and the shape exactly matches the original.
Polynomial	Is an expression which consists of a sum of monomials, $5x^2$, $-4x$, etc.
Positive number	A number greater than 0. The positive numbers lie to the right direction of zero on the x - axis infinitively get larger.
Probability	The change or likelihood of something happening. An event, which is sure to happen, has a probability of 1, while an event, which cannot possibly happen, has a probability of 0. Most probabilities values lie between 0 and 1.
Proportion	A proportion expresses the number of times when quantity A is compared with quantity B; where A and B are two similar types of quantity.
Pythagoras theorem	A theory of Pythagoras which states that for any right angled triangle, the square on the hypotenuse, c, is equal to the sum of the squares on the other sides, a and b.
Reduce figures	When a figure is made smaller by a certain ratio in proportion to the original figure.
Simultaneous equation	Two or more equations with variables to be solved together at the same time using various approaches.
Speed	A ratio of distance covered compared to the time it takes to cover that distance.
Transformation	Mapping of a figure onto another shape or on itself.

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