MATHEMATICS POLICY AND NUMERACY GUIDELINES: PRIMARY SCHOOL

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1. MISSION STATEMENTS

1.1 JOHN WOLLASTON ANGLICAN COMMUNITY SCHOOL: MISSION STATEMENT

We enable our students to discover their passion and direction in life and make a positive contribution in the world.

1.2 INTERNATIONAL BACCALAUREATE MISSION STATEMENT

The International Baccalaureate aims to develop inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through intercultural understanding and respect.

To this end the organization works with schools, governments and international organizations to develop challenging programmes of international education and rigorous assessment.

These programmes encourage students across the world to become active, compassionate and lifelong learners who understand that other people, with their differences, can also be right.

2. BACKGROUND

The Primary School at John Wollaston Anglican Community School (the School) is authorised as a World School of the International Baccalaureate (IB) for the Primary Years Programme (PYP). The PYP is a curriculum framework based on a constructivist approach to learning. As a school in Western Australia these guidelines are reflective of International (IB), National and State requirements. Each is explained in this document to inform our Mathematics education practices.

This policy aligns closely with the *Inclusive Education Policy* and *Assessment and Reporting Policy and Guidelines Primary School*. It addresses our approach to the teaching and learning of Mathematics within an IB context, as well as meeting the criteria of the Western Australian School Curriculum and Standards Authority (SCSA) and the Western Australian Curriculum.

3. IB LEARNER PROFILE

As IB Learners we strive to be:

Inquirers	We nurture our curiosity, developing skills for inquiry and research. We know how to learn independently and with others. We learn with enthusiasm and sustain our love of learning throughout life.
Knowledgeable	We develop and use conceptual understanding, exploring knowledge across a range of disciplines. We engage with issues and ideas that have local and global significance.
Thinkers	We use critical and creative thinking skills to analyse and take responsible action on complex problems. We exercise initiative in making reasoned, ethical decisions.
Communicators	We express ourselves confidently and creatively in more than one language and in many ways. We collaborate effectively, listening carefully to the perspectives of other individuals and groups.
Principled	We act with integrity and honesty, with a strong sense of fairness and justice, and with respect for dignity and rights of people everywhere. We take responsibility for our actions and their consequences.

Open-minded	We critically appreciate our own cultures and personal histories, as well as the values and traditions of others. We seek and evaluate a range of points of view, and we are willing to grow from the experience.
Caring	We show empathy, compassion and respect. We have a commitment to service, and we act to make a positive difference in the lives of others and in the world around us.
Risk-takers	We approach uncertainty with forethought and determination; we work independently and cooperatively to explore new ideas and innovative strategies. We are resourceful and resilient in the face of challenge and change.
Balanced	We understand the importance of balancing different aspects of our lives – intellectual, physical and emotional – to achieve well-being for ourselves and others. We recognize our interdependence with other people and with the world in which we live.
Reflective	We thoughtfully consider the world and our own ideas and experience. We work to understand our strengths and weaknesses in order to support our learning and personal development.

The IB Learner Profile, along with the five essential elements of the programme – knowledge, concepts, skills, attitudes and action – directs planning, teaching and assessing in Mathematics.

4. MATHEMATICS LEARNING AT JOHN WOLLASTON

4.1 OUR BELIEFS ABOUT LEARNING MATHEMATICS

Mathematics is a vehicle to support inquiry, providing a global language through which we make sense of the world around us. By becoming competent users of the language of Mathematics, students begin to use it to shape their thinking, rather than simply memorizing facts and processes. When Mathematics is used to describe and analyze the world around us it becomes an effective tool for solving problems.

The School's Mathematics program will provide opportunities for students to see themselves as 'mathematicians', where they enjoy exploring, and are enthusiastic when learning about, Mathematics. Learners will acquire mathematical understanding by constructing their own meaning, beginning with their own personal experiences and real-life situations. As Mathematics is to be used in real life, it needs to be taught in a relevant, realistic context, rather than by attempting to impart a fixed body of knowledge directly to students. The transdisciplinary units of inquiry provide an authentic context for exploring mathematical concepts. Regardless of whether Mathematics is being taught inside or outside the programme of inquiry, it is important to nurture the spirit of inquiry and enable students to explore their wonderings, hypothesise and test theories.

4.2 OUR AIMS

Our aims for the teaching of Mathematics are as follows:

- To develop sound mathematicians who can confidently approach and solve real-life problems across the variety of mathematical areas
- To develop conceptual understanding of Mathematics through structured, purposeful inquiry
- To provide real-life contexts for learning Mathematics, and where possible, enable students to apply their learning within the context of units of inquiry
- To provide learning opportunities that enhance engagement, exploration and enjoyment of Mathematics
- To build on students' prior knowledge and understandings
- To use assessment and data to inform learning
- To differentiate the curriculum to provide all students with opportunities to succeed

4.3 ASSOCIATED PEDAGOGY

4.3.1 Opportunity to Learn

Learning experiences should enable students to observe and practise the actual processes, products, skills and values that are expected of them.

This will be evident at the School when there is provision for:

- Appropriate time and opportunities to explore and investigate concepts
- Access to concrete materials and using different learning styles
- Making connections through real-life examples and connecting to other learning areas

4.3.2 Connection and Challenge

Learning should connect with students' existing knowledge, skills and values while extending and challenging their current ways of thinking and acting.

This will be evident at the School when there is provision for:

- Building on activities to scaffold learning
- Differentiating the curriculum to cater for all abilities
- Using diagnostic tasks for prior knowledge before starting a new concept
- Open-ended and challenging tasks to cater for high level thinking
- Linking to real-life situations and connecting to other areas of learning

4.3.3 Action and Reflection

Learning experiences should be meaningful and encourage both action and reflection on the part of the learner.

This will be evident at the School when:

- Students are encouraged to set realistic goals within the Mathematics learning area and reflect on the achievement of these goals
- A range of reflection tools is used
- Different styles of learning are considered when planning for meaningful learning experiences

4.3.4 Motivation and Purpose

Learning experiences should be motivating and their purpose clear to students.

This will be evident at the School when:

- Explicit criteria and expectations are communicated to students
- Learning tasks provide a real audience and purpose for students' work
- Students are given an opportunity to practise and apply skills in a meaningful context

4.3.5 Inclusivity and Difference

Learning experiences should respect and accommodate differences between learners.

This will be evident at the School when:

- Teachers take into consideration the needs of all students when planning for the Mathematics learning area including gender, cultural background, English as an Additional Language or Dialect (EAL/D), Students at Educational Risk (SAER), gifted and talented students and children with disabilities
- Teachers consider learning styles of students when planning learning experiences

4.3.6 Independence and Collaboration

Learning experiences should encourage children to learn both independently and with others.

This will be evident at the School when:

- Learning takes place in a variety of contexts i.e. independent, pair, group and whole class
- Collaborative learning skills are explicitly taught and students are given an opportunity to practise these skills

- Children are taught the skills of reflection and given the opportunity to reflect on their own achievements and the achievements of others within a supportive framework.
- Students are given regular opportunities to share their learning journey with others

4.3.7 Supportive Environment

The school and classroom setting should be safe and conducive to effective learning.

This will be evident at the School when:

- Students are encouraged to take risks in their Mathematics learning and they are supported in this risk taking
- Students are supported to undertake more challenging tasks and encouraged to persist in their problem-solving efforts
- Students' efforts are valued and their achievements celebrated

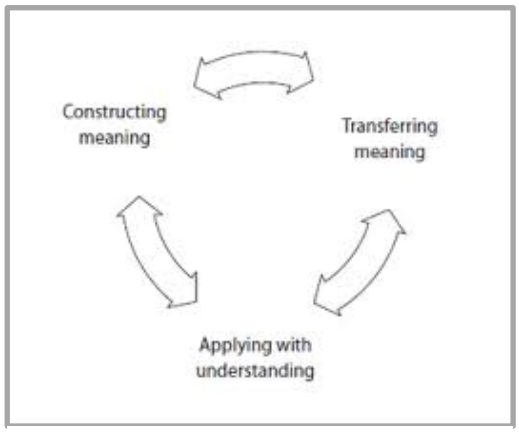
5. OUR APPROACH

The John Wollaston Scope and Sequence documents for Mathematics provide for a developmental and conceptual approach to the teaching of Mathematics. The Scope and Sequence documents present as a continuum of learning for each of the content strands of the Western Australian Curriculum.

- Number and Algebra
- Measurement and Geometry
- Statistics and Probability

For each strand the content has been organized as follows:

- There are four phases of development, with the conceptual understandings to be developed at each stage.
- Within the phases, Western Australian Curriculum content descriptors have been integrated with PYP learning outcomes for each year level.
- Learning outcomes reflect the stages a learner goes through in developing conceptual understanding. These provide a structure for teachers to follow in planning for conceptual understanding.



How Children Learn Mathematics
PYP Mathematics Scope and Sequence, Updated December 2018

5.2 CONSTRUCTING MEANING ABOUT MATHEMATICS

Learners construct meaning based on their previous experiences and understanding, and by reflecting upon their interactions with objects and ideas. Therefore, involving learners in an active learning process, where they are provided with possibilities to interact with manipulatives and to engage in conversations with others, is paramount to this stage of learning Mathematics. When making sense of new ideas all learners will interpret these ideas to conform to their present understanding or they generate a new understanding that accounts for what they perceive to be occurring. This construct will continue to evolve as learners experience new situations and ideas, have an opportunity to reflect on their understandings and make connections about their learning.

5.3 TRANSFERRING MEANING INTO SYMBOLS

Only when learners have constructed their ideas about a mathematical concept should they attempt to transfer this understanding into symbols. Symbolic notation can take the form of pictures, diagrams, modeling with concrete objects and mathematical notation. Learners should be given the opportunity to describe their understanding using their own method of symbolic notation, then learning to transfer it into conventional mathematical notation.

5.4 APPLYING WITH UNDERSTANDING

Applying with understanding can be viewed as the learners demonstrating and acting on their understanding. Through authentic activities, learners should independently select and use appropriate symbolic notation to process and record their thinking. These authentic activities should include a range of practical hands-on problem-solving activities and realistic situations that provide the opportunity to demonstrate mathematical thinking through presented or recorded formats. In this way, learners are able to apply their understanding of mathematical concepts as well as utilize mathematical skills and knowledge.

PYP Mathematics Scope and Sequence, Updated December 2018

5.5 KEY CONCEPTS IN THE PYP: WHAT DO WE WANT STUDENTS TO UNDERSTAND ABOUT MATHEMATICS?

Central to the philosophy of the PYP is the principle that guided inquiry is a powerful vehicle for learning that promotes meaning and understanding, and challenges students to engage with significant ideas. Hence in the PYP there is also a commitment to a **concept-driven curriculum** as a means of supporting that inquiry. There are clusters of ideas that can usefully be grouped under a set of overarching concepts, each of which has major significance within and across subjects, regardless of time or place. These key concepts are one of the essential elements of the PYP framework. It is accepted that these are not, in any sense, the only concepts worth exploring. Taken together they form a powerful curriculum component that drives the teacher- and/or student-constructed inquiries that lie at the heart of the PYP curriculum.

When viewed as a set of questions, the concepts form a research tool that is manageable, open-ended and more readily accessible to students. It is these questions, used flexibly by teachers and students when planning an inquiry-based unit, that shape that unit, giving it direction and purpose.

The following table explains each concept from both the generic perspective and the mathematics perspective.

Concept	Generic perspective	Mathematics perspective
Form What is it like?	Everything has a form with recognizable features that can be observed, identified, described and categorized.	The recognition, categorization and description of patterns throughout the curriculum.
Function How does it work?	Everything has a purpose, a role or a way of behaving that can be investigated.	The examination of systems, relationships, mechanics, components and patterns.
Causation Why is it like it is?	Things do not just happen. There are causal relationships at work, and actions have consequences.	An examination of the mathematical concepts and processes that influence the way things are.
Change How is it changing?	Change is the process of movement from one state to another. It is universal and inevitable.	Looking for evidence of change, analysing the evidence, drawing conclusions and making predictions.
Connection How is it connected to other things?	We live in a world of interacting systems in which the actions of any individual element affect others.	The examination of systems and strategies to identify different kinds and levels of relationships, within and between different strands of mathematics and beyond to other subjects.
	perspectives lead to different interpretations, understandings and findings. Perspectives may be individual, group, cultural or disciplinary.	use mathematics to solve problems. Developing respect for varied interpretations, explanations, strategies and solutions.
Responsibility What is our responsibility?	People make choices based on their understandings, and the actions they take as a result do make a difference.	Understanding the importance of communicating accurately and appreciating the obligation to apply mathematics with honesty.

5.5.1 Examples of questions that illustrate the key concepts

The following table provides sample teacher/student questions that illustrate the key concepts, and that may help to structure or frame an inquiry. These examples demonstrate broad, open-ended questioning—requiring investigation, discussion, and a full and considered response—that is essential in an inquiry-led programme.

Concept	Sample teacher/student questions
Form What is it like?	• What is a pattern? • How can we describe these shapes? • What is a fraction? • How can we describe time?
Function How does it work?	• How does the scale on a graph work? • What happens if we keep adding? • What is each shape being used for? • How can we record time?
Causation Why is it like it is?	• Why is a block the best shape for building a tower? • Why do these calculations produce patterns? • What prompted people to develop a place value system? • Why was the data displayed in this form?
Change How is it changing?	• How can we convert from the 12-hour clock to the 24-hour clock? • How can you change one quadrilateral into another? • What do all patterns have in common? • What would happen to the area of something if … ?
Connection How is it connected to other things?	• How can you use fractions to explain musical notation? • How are 4 + 3 and 3 + 4 connected? • What do you already know that helps you to read and interpret this display of data? • How is area connected to perimeter?
Perspective What are the points of view?	• Are there some different ways of explaining this? • Who might be interested in, or be able to use, the results of our survey? • How do people calculate in different cultures? • What would make this game fair to all players?
Responsibility What is our responsibility?	• What makes your answer reasonable? • Why does the measurement need to be accurate? • How have you collected all the relevant data?

5.6 VIEWING A UNIT OF INQUIRY THROUGH THE LENS OF MATHEMATICS

The following diagram shows a sample process for viewing a unit of inquiry through the lens of mathematics. This has been developed as an example of how teachers can identify the mathematical concepts, skills and knowledge required to successfully engage in the units of inquiry.

Note: It is important that the integrity of a central idea and ensuing inquiry is not jeopardized by a subject specific focus too early in the collaborative planning process. Once an inquiry has been planned through to identification of learning experiences, it would be appropriate to consider the following process.

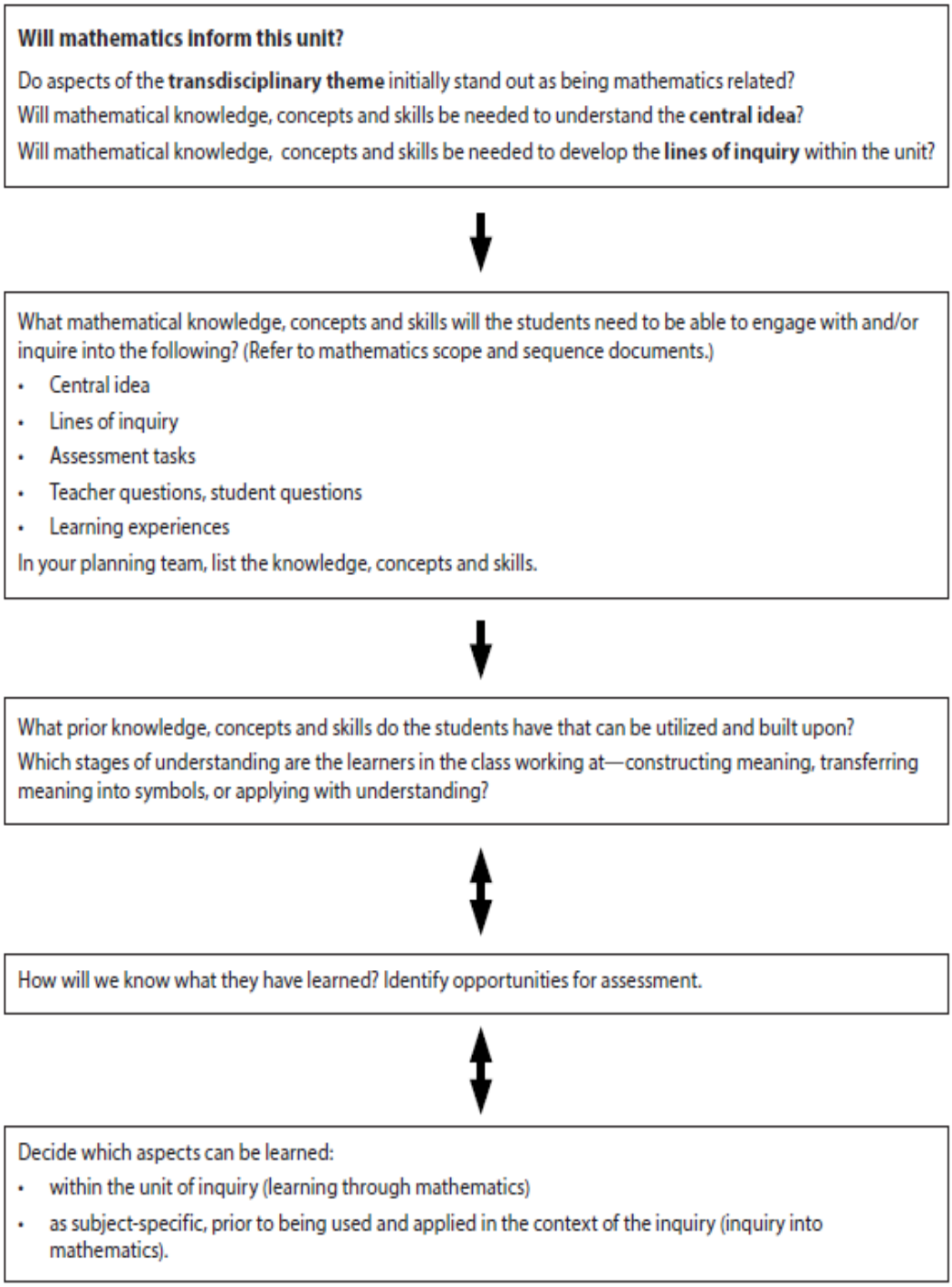


Figure 2

Sample processes for viewing a unit of inquiry through the lens of mathematics

PYP Mathematics Scope and Sequence, Updated December 2018

5.7 THE WESTERN AUSTRALIAN PROFICIENCY STRANDS

The proficiency strands support the phases of learning by describing the actions students are taking when engaged in learning. The statements in the Scope and Sequence documents provide teachers with an indication of how students are engaging with the content.

5.7.1 Understanding

Teachers build understanding when they provide opportunities for students to

- connect related ideas,

- represent concepts in different ways,
- identify commonalities and differences between aspects of content,
- describe their thinking mathematically
- interpret mathematical information.

5.7.2 Fluency

Teachers build fluency when they provide opportunities for students to

- calculate answers efficiently,
- recognise robust ways of answering questions,
- choose appropriate methods and approximations,
- recall definitions and regularly use facts,
- manipulate expressions and equations to find solutions.

5.7.3 Problem Solving

Students formulate and solve problems when they are given opportunities to

- use Mathematics to represent unfamiliar or meaningful situations,
- design investigations and plan their approaches,
- apply their existing strategies to seek solutions,
- verify that their answers are reasonable.

5.7.4 Reasoning

To reason mathematically students require opportunities to

- explain their thinking,
- deduce and justify strategies used and conclusions reached,
- adapt the known to the unknown,
- transfer learning from one context to another
- prove that something is true or false and
- compare and contrast related ideas and explain their choices.

5.8 THE WESTERN AUSTRALIAN ACHIEVEMENT STANDARD

An achievement standard describes the quality of learning (the extent of knowledge, the depth of understanding and the sophistication of skills) that would indicate the student is well placed to commence the learning required in the following school year. The achievement standard describes an expected level that the majority of students are achieving or working towards by the end of that year of schooling. Some students will have progressed beyond the achievement standard; others will need additional support. The expected standard for each year is described as 'C' or Satisfactory.

5.8.1 Judging Standards Tool

Judging Standards is a tool to support teachers when reporting against the achievement standards for each year of schooling; when giving assessment feedback; and when explaining the differences between one student's achievement and another's. The Judging Standards Tool can be accessed at https://k10outline.scsa.wa.edu.au/home/assessment/judgingstandards

6. THE EARLY YEARS

The teaching and learning of Mathematics in the early years (3-5 year olds) involves educators using play as the primary vehicle to plan a range of environments, strategies and multi-modal experiences to engage children in learning.

The curriculum is guided by the John Wollaston Scope and Sequence, the outcomes of the Early Years Learning Framework for Australia and the Western Australian Kindergarten Guidelines. Teachers use the principles and practices to guide their pedagogical approach to the teaching and learning of Mathematics.

7. ASSESSMENT

Assessment is used to provide feedback on the learning process and to inform future teaching and learning. This is achieved through:

- **Pre-assessment: Assessment for learning**
  Teachers establish students' prior knowledge and experience before embarking on new learning experiences. This determines the students' entry point to any new learning and informs planning of teaching experiences to move students forward in their learning.
- **Formative assessment: Assessment as learning**
  Formative assessments should provide fine-grained information about student performance that supports teachers to plan learning that challenges students to go beyond what they already know, understand and can do in order to build new knowledge, understanding and skills.
- **Summative assessment: Assessment of learning**
  Summative assessment aims to give teachers and students a clear insight into students' understanding. It can assess several elements simultaneously, measures all proficiencies and informs student learning.
- **Reflection**
  Students are encouraged to reflect on their learning and identify areas for improvement. Teachers reflect on their own practice and student achievement and make amendments to their programming and practice accordingly.

Further Reference: *Assessment and Reporting Policy and Guidelines Primary School.*

8. DATA COLLECTION AND ANALYSIS

A range of assessments is used across the School for the purposes of compiling a profile of school and student progress and achievement in relation to age and national norms. The School has systems in place for recording this data to guide discussion and analysis.

8.1 DATA COLLECTION

Assessments used to collect data include

- **Numeracy on-entry assessment:** Pre-Primary to Year 2
- **NAPLAN:** Years 3 and 5
- **Australian Council of Educational Research (ACER):** Progressive Achievement Tests (PAT) Maths Adaptive: Years 3 to 6

The schedule for data collection is updated annually and can be accessed on the School drive at:
Staff Shared J:\Primary\Data collection**Year** *e.g. J:\Primary\Data collection\2023*

8.2 DATA ANALYSIS

Information gathered from these assessments is used to inform teaching and assess learning. Data is analysed in collaborative teams led by Primary Leadership and used to:

- Plan for differentiation and set learning goals
- Inform the necessity and type of intervention necessary
- Assess growth over time

9. RELEVANT SCHOOL POLICES

- *Assessment and Reporting Policy and Guidelines Primary School*
- *Inclusive Education Policy*

10. REFERENCES

- John Wollaston Mathematics Scope and Sequence
- PYP Mathematics Scope and Sequence

- Western Australian Mathematics Curriculum
- Western Australian Curriculum and Reporting Policy
- Early Years Learning Framework
- Western Australian Kindergarten Guidelines

11. APPENDICES

- Primary School Numeracy Guidelines
- Mental Computation Strategies: Glossary of Terms
- Pre-K to Year 6 Calculations Overview

PRIMARY SCHOOL
NUMERACY GUIDELINES 2023

1. JOHN WOLLASTON'S APPROACH TO MATHEMATICS

Please refer to 5. Our Approach in the *Mathematics Policy and Numeracy Guidelines: Primary School.*

2. ASSESSMENTS

Data collected from PAT-Maths assessments and On-entry assessments in Term 1 are used at the beginning of the academic year to assist with planning in order to better accommodate students within our classes.

Refer to the *Assessment and Reporting Policy and Guidelines Primary School* for the Assessment Schedule

3. DIFFERENTIATION

The On-entry reports provide strategies for teachers and parents to use according to student performance on the assessment. These strategies are used to inform differentiated approaches to teaching and learning in Mathematics.

In Years 3 to 6, plans for differentiation are developed from the PAT Band Descriptions. These indicate to teachers potential gaps in learning, the extent to which some students require extension and the students who require significant support.

4. CURRICULUM MODIFICATIONS

Students who score significantly high or significantly low on the assessments have modifications made to the curriculum in accordance with their needs.

4.1 CURRICULUM ADJUSTMENT PLANS

From Year 4, a Curriculum Adjustment Plan is drawn up for students who score above the 90th percentile on PAT Maths to ensure these students continue to be challenged and extended in Mathematics. These plans are drawn up by class teachers in consultation with Years 3-6 Coordinator and / or Primary Inclusive Education Coordinator.

4.2 MODIFIED GOALS

Students who are on existing modified goals and/or IEPS are assessed at their cognitive year level, or the level assessed in the previous schooling year. Students who are not expected to achieve a 'C' Grade in Mathematics are placed on modified goals. Modified goals are drawn up by class teachers in consultation with the Primary Inclusive Education Coordinator. Students who score significantly low on assessments may be referred to the Primary Inclusive Education Coordinator for further assessment.

5. TEACHING AND LEARNING OF MATHEMATICS

Mathematics learning within the PYP is purposeful and driven by a spirit of inquiry. The approach to teaching is broad and inclusive and accommodates a wide variety of teaching strategies and styles. Whilst teachers' prior experiences of teaching Mathematics are acknowledged and valued, the following table can be used as a tool for reflection and a guide to improving teaching and learning in Mathematics.

PYP

How are mathematics practices changing?	
Increased emphasis on:	**Decreased emphasis on:**
connecting mathematical concepts and applications to learning	treating mathematics as isolated concepts and facts
manipulatives, to make mathematics understandable to students	rote learning, memorization and symbol manipulation
real-life problem solving using mathematics	word problems as problem solving
instruction built on what students know, what they want to know, and how they best might find out	instruction focused on what students do not know
a variety of strategies for possible multiple solutions—emphasis on process	one answer, one method, emphasis on answer
students being encouraged to speculate and pursue hunches	the teacher as the sole authority for right answers
a broad range of topics regardless of computational skills	computational mastery before moving on to other topics
mathematics as a means to an end	teaching mathematics disconnected from other learning
the use of calculators and computers for appropriate purposes	a primary emphasis on pencil and paper computations
programme of inquiry as the context for learning	the textbook as the context for learning
students investigating, questioning, discussing, justifying and journalling their mathematics	the use of worksheets
students and teachers engaged in mathematical discourse.	teacher telling about mathematics.

Mathematics Scope and Sequence, Updated December 2018

Play-based learning in the Early Years

Educators utilise the classroom as the third teacher, carefully planning and structuring the environment for play by providing appropriate concrete materials and resources, space and time to support the exploration of the envisioned mathematical outcomes. The environment provides children with a social context where they can work with others to test ideas, co-construct and challenge each other's thinking. Educators play an active role in scaffolding the learning in the context of play by observing, questioning and encouraging children to explain their thinking and challenging ideas. It is important for educators to model curiosity, creative thinking, playfulness and the use of mathematics in play situations. Intentional teaching of concepts through whole class and small group experiences, transitions and routines enables educators to make links to play-based and real-life experiences in order to move students forward in their thinking and their construction and understanding of mathematical concepts.

Mental Mathematics

The Mental Mathematics approach at the School promotes the development of:

- Opportunities to practise learned concepts
- A range of flexible and efficient strategies
- A deep understanding of number, patterns, operations and the connections between them

- Speed and recall towards a more automatic response
- A sense of reasonableness of answer
- The use of specific mathematical vocabulary
- Use and application of Mathematics in real-life contexts

We achieve this through making Mental Mathematics:

- A regular routine as part of our daily Mathematics lessons
- Fun and fast-paced using a variety of formal and informal activities and tasks
- Have an explicit focus and reflection on the Mathematics in games, tasks and activities
- Include a variety of mental, paper, manipulative and calculator tools and strategies
- Applicable to participation through individual, pairs, small group and whole class activities

The tools used in Mental Mathematics include:

- Number lines
- Playing Cards
- Dice
- Counting sticks
- Number charts and sequences
- ICT Software (MacBooks, Manipulatives, Mathletics)
- Mini-Whiteboards
- Paper tasks
- Number fans
- Flash cards
- Ten Frames
- Calculators

Lesson Planning

To ensure a consistent approach to the teaching of Mathematics, lesson planning is guided by the structure laid out in the *Oxford Mathematics Primary Years Programme Teacher's Guide*. This resource aligns PYP approaches to teaching with the content of the Australian Curriculum. The process of learning outlined for each learning focus includes:

- **Tuning-in** through daily practice activities
- **Pre-tests** to assess prior knowledge
- **Constructing meaning** through whole class topic introduction
- **Transferring meaning:** differentiated approaches for different levels of understanding
- **Applying meaning:** real-life applications and opportunities to apply Mathematics within the unit of inquiry
- **Post-tests** to establish the extent of learning.

Teachers are encouraged to replace activities incorporated in the textbooks with opportunities for students to use manipulatives and to question, investigate, discuss and justify their thinking.

English as an Additional Language/Dialect (EAL/D)

Children from diverse language or cultural backgrounds may experience challenges when engaging in Mathematics. The EAL/D Mathematics Guide available in the WA Mathematics Curriculum Resources has been developed to:

- advise teachers about areas of the curriculum that EAL/D students may find challenging and why
- assist classroom teachers to identify where their EAL/D students are broadly positioned on a progression of English language learning
- help teachers understand students' cultural and linguistic diversity, and the ways this understanding can be used in the classroom
- provide examples of teaching strategies supportive of EAL/D students
- direct teachers to additional relevant and useful support for teaching EAL/D students.

Further information can be found at
https://k10outline.scsa.wa.edu.au/__data/assets/pdf_file/0007/186784/EALD-Mathematics-Pre-primary-to-Year-10.pdf

MENTAL COMPUTATION STRATEGIES: GLOSSARY OF TERMS

SUBITISING

Subitising develops before counting and underpins it. It is the ability to look at the collection as a whole and recognise one, two or more things without counting and to see a collection in parts. (Just knowing)
Example: Looking at the dots on a die and saying there are 4 without having to count them. Seeing the four as being made up of 2 + 2 or 3 + 1.

PRINCIPLES OF COUNTING

The five principles of counting need to be in place before children will 'trust the count'. These are:

- Each object to be counted must be touched or 'included' exactly once as the numbers are said.
- The numbers must be said once and always in the conventional order.
- The objects can be touched in any order, and the starting point and order in which the objects are counted does not affect how many there are.
- The arrangement of the objects does not affect how many there are.
- The last number said tells 'how many' in the whole collection. It does not describe the last object touched.

NUMBER BONDS

Any two numbers that add together to make another number.
Example: Number Bonds to 10 are 0 + 10, 1 + 9, 2 + 8, 3 + 7 etc. (Friends to 10)
Number Bonds to 8 are 0 + 8, 1 + 7, 2 + 6, 3 + 5 etc.

COUNT ON/BACK

Put the biggest number in your head then count on or back.
Example: 24 + 5. Put 24 in your head then count on 5 more.

PART-PART-WHOLE

- It is easier to see how many there are when collections are in special arrangements.
- Any collection can be separated into parts and each part can be represented by a number; thinking 'part-part-whole' can help us to see 'how many' there are.
- The same number can be thought of in parts in different ways.
- A number can also be thought of in more than two parts.

CONNECTIONS AND RELATIONSHIPS (commutative and inverse properties)

- Adding: the order doesn't matter. **4 + 27** is 27 + 4, so 28, 29, 30, 31.
- Multiplying: the order doesn't matter. **24** twos is **2** twenty-fours, so 48.
- Subtracting: thinking of an addition might help. **13 – 8**, think 'eight add what is 13?'
- Dividing: thinking of a multiplication might help. **63 ÷ 9**, think 'how many nines make 63?'

COMPENSATE (partition and rearrange)

- Add: take some from one number to give to the other. **8 + 7** is 10 + 5; **68 + 37** is 70 + 35.
- Multiply: take out a factor from one to give to the other. **15 x 6** is 15 times 2 times 3, so 30 times 3, so 90.
- Subtract: change the numbers by adding or subtracting the same amount. **62 – 37** is 65 – 40.
- Divide: change the numbers by multiplying or dividing by the same amount. **29 ÷ 5** is 58 ÷ 10.

COMPATIBLE NUMBERS AND BRIDGE

- Making change: **100 – 68**. I am thinking 100, what fits with 68? OR It cost 68 cents, what's the change from $1?
- Rearrange the order: **8 + 7 + 2** is 8 and 2 is 10 plus another 7 is 17; **68 + 27 + 12** is 68 and 12 is 80 plus 20 is 100 plus seven, so 107.
- Bridging: **9 + 4** is 9 + 1 + 3 = 10 + 3 = 13; **68 + 47** is 68 and 32 will make 100 and 15 left, so 115.

DOUBLING

a) Doubles and Near Doubles
Example: if 7 + 7 = 14 then 7 + 6 means the same as one less than 7 + 7, so 13.

b) Doubling and Halving
Double one number and halve the other to make calculations easier.
Example: 16 x 25 can also be 8 x 50 (or 4 x 100 if you double and halve again)

STANDARD PARTITIONING

Use standard place values to split a number into parts.
Example 482 can be 400 + 80 + 2

NON-STANDARD PARTITIONING

Use non-standard place values to split numbers into parts.
Example: 482 can be 48 tens and 2 ones, 482 ones, 40 tens and 82 ones, etc.

USING A KNOWN FACT

Using a basic fact that is already known and extending it to find or work out an unknown fact.
Example: If 12 + 6 = 18 then 22 + 6 = 28 and 32 + 6 =38 etc.

FRONT LOAD (start with the biggest place value)

- Bring on the tens and then the ones: **28 + 37** is 38, 48, 58 and 7 more, so 60, 65.
- Do both tens and then both ones: **68 + 37** is 90 + 15, so 100 and 5 more, so 105.

IMAGINE A NUMBER LINE

- Jump along or back: **364 – 198**: starting at 198, it takes 2 to get to 200 and another 164 to get to 364, so 166; OR starting at 364 go back 64 to 300, 100 more to 200 (so that's 164) and back 2 more to 198, so 166.

MULTIPLY IN PARTS (partition and multiply the parts)

- Round a number and adjust: **7 x 9** is 7 tens take 7 ones, so 70 – 7, so 63; **99 x 6** is 600 take six.
- Use place value partitions: **6 x 25** is 6 x 20 add 6 x 5, so 120 add 30.

USE FACTORS

- Double, double, double: **4 x 14** is double double 14, so double 28, so 56.
- Change to a multiplication you know: **3 x 18** is 3 times 3 times 6, so 9 times 6, so 54.
- Multiply by five—**5 x 8** is 8 fives, which is 4 lots of 2 fives, 4 tens so 40.
- Multiply by fifty: **50 x 72**; 50 is half of a hundred, so half of 72 hundred, so 36 hundred or 3600.
- Multiply by twenty-five: **36 x 25**; I saw the 25 and looked for 4 to make 100, so 9 x 4 x 25 or 900.
- Doubling and halving: **45 x 14** is the same as 90 x 7, so 630

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APPENDIX 3

PRE-KINDERGARTEN TO YEAR 6 CALCULATIONS OVERVIEW

YEAR LEVEL	ORAL COUNTING	BASIC FACTS	STRATEGIES
Pre-K	Oral counting forwards and backwards to 5	Subitising up to 5	• Number rhymes and songs • Use concrete materials to show total number Acting out/role-playing
K	Oral counting forwards and backwards to 10	• Subitising Principles of counting	• Number rhymes and songs • Use concrete materials to show total number • Acting out/role-playing
P	• Oral counting of numbers to 20 and beyond from any starting point	• Counting - establish 5 principles of counting • Subitising- part / part-whole number relationships	• Solve simple number stories involving number bonds up to 10 • Use concrete materials to show total number • Drawing pictures • Classifying/sorting • Acting out/role-playing
1	• Number sequences by 1s, to and from 100 + from any starting point • Skip count by 2s, 5s 10s	• + facts to 10, 20 • x facts for 0, 1, 2, 10	• Number Bonds (all numbers up to 10) • Count on/back • Recognition of dot patterns and arrays • Compensate and Rearrange (part, part, whole) • Solve x ÷ problems using materials and diagrams • Repeated addition • Skip counting
2	• Count in 1s, 2s, 3s, 5s, 10s from any starting point	• + and – facts drawing on basic facts to 10, 20 • x facts in 0, 1, 2, 3, 5, 10	• +1 / -1 of numbers to 10, 20 • Doubles / near doubles • Count on/ back • Standard partitioning • Inverse operation - & + • Bridging 10s • Doubling strategy

APPENDIX 3

PRE-KINDERGARTEN TO YEAR 6 CALCULATIONS OVERVIEW

YEAR LEVEL	ORAL COUNTING	BASIC FACTS	STRATEGIES
3	• Count forward and back by 0, 1, 2, 3, 5, 10 from any start number	• + and – facts to 100 drawing on basic facts to 10, 20. • Recall x facts for 0, 1, 2, 3, 4, 5, 6, 10 and the related division facts	• Using known facts to derive unknown facts • Doubling and halving • Front Load • Compensation and adjustment • Standard and non-standard partitioning • Commutative and associative properties • Part-part-whole strategies
4	• Count forward and backwards in all multiples • Up to 10 x 10 from any starting point	• Recall + facts up to 10 + 10 and the related – facts • Recall x facts up to 10 x 10 and related division facts	• Use patterns in x tables • Make links between the tables • Rearrange order to use Compatible Numbers • Change numbers by + or – to each • Take from one and give to other • Compensate and bridge to the 100s • Round and adjust • Use factors (including primes)
5	• Maintain counting sequences to 10 x 10 forwards and back from any starting number • Add counting by fractions and decimals	• Maintain and extend speed and recall of known facts	• Maintain strategies taught in Years 1 to 4
6	• Maintain counting sequences to 10 x 10 forwards and back from any starting number • Extend counting by fractions and decimals	• Maintain and extend speed and recall of known facts	• Maintain strategies taught in Years 1 to 4