BELIZE
Mathematics
Curriculum

Teacher's Guide

Infant I

August 2012

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GOALS FOR EDUCATION

The national goals of education outline four main philosophical pillars on which the new curriculum is built. These are described as “learning to know, learning to be, learning to do, and learning to live together”. These main themes highlight an important shift in education in Belize. Significant importance is now being placed on the holistic dimension of ‘learning’. Past emphasis on simply ‘knowing’ is shifting to ‘learning to know’ and greater emphasis is on ‘learning to do’ and ‘learning to be’. Global shifts require the need for 'learning to live together' with a growing tendency towards 'learning to transform oneself and society'.

Changes in society, in schools and in technology highlight the growing importance of mathematics to both societal and individual development and success. Students need to be mathematically proficient in order to operate efficiently as citizens and be prepared for a future that is ever changing and ever more reliant on mathematics. The needs of society are continuously changing. Students today require strong mathematical knowledge and skills. If Belize is to participate in the global economy, schools will have to ensure that students have an opportunity to be competitive in the technological oriented workforce. Changes in mathematics education and changes in the role of technology in teaching and learning are required.

PURPOSE OF THIS DOCUMENT

This document communicates high expectations for students in their mathematics program during the first year of primary education [Infant I] in Belize. It outlines the philosophy and rational on which the mathematics program is based and outlines the specific learning outcomes. It is intended to guide teachers in their planning of the teaching, learning and assessment of mathematics.

RATIONALE AND PHILOSOPHY

Introduction:

Students' performance in mathematics is a concern not only of Belizean educators but also of educators worldwide. Over the last decade research has provided information on how students learn mathematics. This information can inform changes to our mathematics program to improve the learning, teaching and assessment of mathematics. The first year of formal schooling is of great importance as it sets the stage and basis for a quality Mathematics program.

What is Mathematics?

Mathematics is a useful, exciting and creative area of study. The main purpose of learning mathematics in schools is to help students to understand and interpret their world and solve problems. As an organized and formal field of study, mathematics can be defined or viewed from different perspectives:

- As a human endeavor, mathematics affects and is applied to many aspects of everyday life and human development in our modern society.

- As a discipline, mathematics is a broad and deep academic discipline that continues to grow in breadth and depth.
- As an interdisciplinary tool, mathematics, its language and tools, is an important component of learning in other fields and as such is considered an important and basic content area in our formal system of education.

As a subject in the primary school curriculum, math is mainly treated as defined in the third bullet above; however, an attempt is made to bring together all three of the above definitions. At this level, instruction and assessment tend to focus on the basic skills, concepts and processes, and on solving problems requiring the application of these basic skills and concepts.

Problem solving, taken as a means for learning math and also as an end product of learning, involves several components:

- problem posing, the presentation of problematic situations that are not clearly defined;
- mathematical modeling to help clarify the problem to make it solvable;
- use of computational or algorithmic procedures to solve a problem;
- and applying the mathematical solution to the real-world problematic situation to determine if the problem has been solved.

Mathematics is important, not only for its own intrinsic value, but also as an aid to represent and solve problems in all other disciplines. The use of calculators and technology have both a place and a time in the primary curriculum. Teachers must ensure a balance between lower-order knowledge and skills obtained through problem practice, and higher-order problem solving and conceptual understanding. The integration of these components and views of mathematics help students develop and strengthen their self-confidence in doing and learning mathematics. This positive attitude translates to better performance by all learners.

What does it mean to be mathematically literate?

Mathematically literate students have the capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet their needs. Mathematics literacy includes:

o Conceptual understanding – the ability to understand mathematical concepts, operations and relations

o Procedural fluency – the skill to carry out procedures flexibly, accurately, efficiently and appropriately

o Strategic competence – the ability to formulate, represent and solve mathematical problems

o Adaptive reasoning – the capacity for logical thought, reflection, explanation and justification

o Productive disposition – habitual inclination to see mathematics as sensible, useful and worthwhile, combined with a belief in diligence and one's own efficiency

Beliefs about Mathematics and Learning:

All children can learn mathematics. Students are curious, active learners with individual interests, abilities and needs. They come to classrooms with varying knowledge, life experiences and backgrounds. A key component in successfully developing numeracy is making connections to these backgrounds and experiences. Students with a positive attitude towards mathematics see it both as useful and worthwhile. They believe that they are capable of learning, understanding and doing mathematics. They are prepared to take risks and become involved in authentic problem solving and learn from others.

Knowledge of mathematics can help to develop desirable personal traits such as independence and discipline; it promotes logical thinking and can help to free one from dependence on remembered procedures; can be used in the pursuit of other subject areas and as a tool to solve problems in everyday situations. Students explore and record results, analyze observations, make and test generalizations from patterns and reach new conclusions by building from what is already known or assumed to be true.

To become mathematically literate, there are certain fundamental principles that should guide teaching and learning:

A) The curriculum provides a framework for the development of concepts, the interrelationships and connections among topics, and the application of mathematics to the solution of real life problems.

B) The planning for mathematical learning begins with the child and his/her level of understanding. Instructional decisions are based on students' progress.

C) Students need to construct their own meaning of mathematics through active engagement that ensures that the mathematics they learn makes sense.

D) Mathematics understanding is best developed when learners encounter mathematical experiences that proceed from the simple to the complex and from the concrete to the abstract.

E) A range of formal and informal assessment practices help make student thinking visible. Both formal and informal assessments support student learning – they monitor student learning, diagnose learning issues and determine what they need to do next to further learning.

F) The mathematics program develops mathematical thinking and reasoning skills. Students use their reasoning skills to make, test, and evaluate statements and to justify steps in mathematical procedures.

G) Learning through problem solving is the focus of mathematics learning and teaching. Problem solving is a powerful teaching tool that fosters multiple, creative and innovative solutions.

H) A child-centered, responsive and math focused environment with high, yet realistic expectations, helps students develop confidence, competencies and mathematical identities.

I) The language of mathematics is used to describe mathematical ideas. This requires the learning of signs, symbols and mathematical terms.

J) Mathematical conversations and reflections are essential components of learning mathematics.

Building a Supportive Environment:

Environments, that create a sense of belonging, encourage risk taking and provide opportunities for success, develop and maintain positive attitudes and self-confidence amongst students. A positive learning environment respects, is sensitive to, is responsive and values the diversity of student experiences, cultural heritages and ways of thinking. Caring and trusting classroom communities emphasize a strong math focus with high, yet realistic, expectations.

Teachers assist students in making connections to their lived experiences and the mathematical experiences in the classroom. Students are comfortable in taking intellectual risks, asking questions and posing conjectures. Teachers need to listen carefully to students and to guide them in the development of ideas. Probing, questioning and talking through an idea helps students to develop confidence in seeking solutions to problems. Creating an environment where students openly look for and engage in finding a variety of strategies for solving problems empowers students to explore alternatives and develop into confident, cognitive mathematical risk takers.

The thoughtful use of physical materials is needed to foster the learning of abstract ideas. Classrooms need to have a variety of physical materials: stoppers, counters, geometric shapes - regular and irregular; measuring tools; fraction pieces etc. to motivate students in meaningful learning and to construct conceptual understanding. Physical models of complex ideas assist students to visualize and make sense of abstract concepts. New technologies provide dynamic graphical, numerical and visual applications. These provide new opportunities to explore and represent math concepts and makes math more accessible and relevant to students.

Emphasis should be on varied pedagogical approaches: problem-solving; cooperative learning groups; thematic; discussion and inquiry; and interdisciplinary approach- field trips, integrated projects, environmental studies. Developmentally appropriate, highly math focused activities that provide the opportunity to discuss, listen, read, and write will help students to clarify their thinking and deepen their understanding of what is being studied. This means that more time will be devoted to the development of student understanding and there will be decreased emphasis on rote learning and memorization of rules and procedures and on teaching by telling.

Learning:

Developmentally appropriate math activities that challenge students in active learning allow opportunities for independent and collaborative work as students participate in problem solving and making sense of ideas. Students are provided the opportunity to think and work quietly while active participation in whole class discussions provides the opportunity to clarify their understanding and exposes them to broader interpretations of the ideas and different perspectives of the topics covered. Working in pairs or small groups help students share and clarify their ideas as well as learn from and with others. These opportunities also provide emotional and practical support that enhance engagement, facilitate the exchange and testing of ideas, encourage higher levels of thinking, help students make conjectures and as they engage in mathematical argumentation and validation of ideas and concepts.

Classroom math experiences are built upon existing proficiencies, interests and previous experiences. As students engage in mathematical tasks, they develop ideas about the nature of mathematics and discover that they have the capacity to make sense of it. As they become proficient doers and learners of math, open-ended

tasks allow for original thinking about important mathematical concepts and relationships. Students make and test conjectures, pose problems, look for patterns and explore alternative solutions.

Students are provided with opportunities to practice for them to improve in computational fluency, problem solving skills and conceptual understanding. Involvement in games that incorporate skill development builds fluency and automacity in computation. Modeling exercises allow students to visualize complex abstract concepts and build conceptual understanding. Multiple representations provide connections to existing understanding and build conceptual understanding and computational flexibility.

Questions posed by teachers provide a powerful means for students to explore responses in depth. As teachers listen to student responses, paying close attention to mathematical thinking and not only if the answer is correct, further questions press for explanations and understanding. Feedback given to students is a critical step in the teaching-learning process. Feedback should focus on the mathematical task, should explain what is right or wrong and why, and describe what the student needs to do next or suggest strategies for improvement.

Effective teachers support students in creating connections between different mathematical topics, different ways of solving a problem, between math representations and math topics, between math and other subjects and between math and everyday experiences. Applying math in everyday contexts allows students to see math as part of their own histories and lives, its contributions to other areas of knowledge and its value to society. In planning units of study and lessons, teachers must not see Math as a collection of fragmented topics but rather as a collection of inter-related strands, standards and learning outcomes.

Conceptual understanding is developed through the use of manipulatives that model the mathematics and allow students to construct a visual understanding of the concept. This visual manifestation of the concept is transfered to a picture representation that starts to evolve into a deeper mental understanding of the absract mathematical concept. Teachers plan and deliver lesson activities that aid in the movement from the concrete, to the picutre to the abstract.

Assessment:

The purpose of assessment is to guide teachers in planning appropriate learning activities. Good assessment strategies align with good teaching strategies. Assessment can occur before, during and after a lesson or unit of study. Assessments provide information on how students learn, seems to know, is able to do, what interests them, what is working and what is not working. Continuous informal assessment and observation during lessons help teachers decide what questions to ask, when to intervene and how to respond to questions students pose.

Assessment should be continuous and include more than paper and pencil tests. A variety of strategies can be used to obtain the information about student learning. These include observations (watch for; listen for), interviews, self-assessment and portfolios which can also help to provide evidence of student growth. A wide range of formal and informal assessment practices make student thinking visible and support student learning.

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Both formal and informal strategies are used to monitor the learning process, diagnose learning issues and determine what steps to take next to further learning.

Education Partnerships:

A good education system involves a variety of stakeholders including students, parents, teachers, school administrators, the Ministry of Education and the extended community the school serves. Each has a role to play in the success of the mathematics program in Belize.

Teachers have the responsibility to provide a supportive learning environment which engages students and encourages them to do their best. Teachers plan for students based on their individual needs and through continuous professional development keep informed about best practices in order to implement current and effective teaching and learning strategies. Teachers ensure safety, avoid encouraging dependency, show genuine interest in the ideas students construct and express, and model the practice of evaluating ideas. A strong positive attitude, respect and value for the math and culture students bring to the classroom is critical for students to develop a strong positive identity as math learners. Effective teachers clarify expectations, focus thinking, challenge, and use student misconceptions and errors as natural and necessary steps in conceptual development and use them as building blocks for building deeper understanding. Good teachers have a sound grasp of relevant math content, know the big ideas and know how to teach it. They can think of, model and use a variety of examples and metaphors in ways that advance student thinking. They can critically evaluate student processes, solutions, understanding and give appropriate and helpful feedback.

Students come to school ready to learn. When students are provided with opportunities to succeed, they continue to build a positive attitude towards learning. Students must also reflect upon their own learning and take initiative to ask questions, take intellectual risks and seek support when needed. Students develop the ability to think, reason, communicate, reflect upon and critique the math they encounter. A wide range of classroom opportunities enhance problem solving and social skills that contribute to the holistic development of the student for productive citizenship.

Parents play a vital role in the education of their children. This begins with a positive disposition towards mathematics and providing opportunities to involve their children in everyday mathematical tasks. Parents should see themselves as part of the school community and participate in activities that foster parent-school partnerships.

Administrators ensure that teachers have the support and resources required to implement the mathematics program. Administrators are instructional leaders and provide models of best practice. Administrators also have a responsibility to provide opportunities for parents to become active members of the school community and guide collaborative endeavors among all staff.

The Ministry of Education sets high standards for students and teachers in mathematics teaching and learning and provides support for the implementation of the program.

Organization

The mathematics curriculum is organized in five content strands from which twenty standards are derived. For each grade level, the twenty standards are further decomposed into thirty-five learning outcomes.

The five content strands:

The curriculum is organized around five content standards as described below.

- Number and number operations: Learners develop an understanding of numbers, a variety of ways of representing numbers, relationships among numbers, number systems, the meanings of operations, how they relate to one another, the ability to compute fluently and make reasonable estimates.
- Patterns and relationships: Learners develop an understanding of patterns, relations, functions, the use of symbols, use mathematical models to represent and understand quantitative relationships and analyze change in various contexts.
- Measurement: Learners develop an understanding of measurable attributes of objects and the units, systems, processes of measurement and apply appropriate techniques, tools, and formulas to determine measurements.
- Spatial relationships and shapes: Learners investigate and analyze characteristics and properties of two- and three-dimensional geometric shapes, develop mathematical arguments about geometric relationships, specify locations and describe spatial relationships using coordinates and other representational systems, apply transformations and use symmetry to analyze mathematical situations and use visualization, spatial reasoning, and geometric modeling to solve problems.
- Data handling and probability: Learners formulate questions that can be addressed with data and collect, organize, and display relevant data to answer such questions, select and use appropriate statistical methods to analyze data, develop and evaluate inferences and predictions that are based on data and understand and apply basic concepts of probability.

Processes:

Implicit in the five content strands, twenty standards and 280 learning outcomes are five process standards.

- Problem solving: Both an outcome and a process, learners build new mathematical knowledge through problem solving, they solve problems that arise in mathematics and in other contexts, apply and adapt a variety of appropriate strategies to solve problems and monitor and reflect on the process of mathematical problem solving.
- Reasoning and proof: Reasoning and proof are fundamental aspects of mathematics, learners make and investigate mathematical conjectures, develop and evaluate mathematical arguments and proofs and select and use various types of reasoning and methods of proof.
- Communication: Learners organize and consolidate their mathematical thinking through communication, they communicate their mathematical thinking coherently and clearly to peers, teachers, and others, they analyze and evaluate the mathematical thinking and strategies of others and use the language of mathematics to express mathematical ideas precisely.

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- Connections: Learners recognize and use connections among mathematical ideas, they understand how mathematical ideas interconnect and build on one another to produce a coherent whole and recognize and apply mathematics in contexts outside of mathematics.
- Representations: Learners create and use representations to organize, record, and communicate mathematical ideas, they select, apply, and translate among mathematical representations to solve problems and use representations to model and interpret physical, social, and mathematical phenomena.

Attitude and disposition:

It is imperative that we break the trend in which with every year of formal education, more and more students develop a dislike for Mathematics. Actively engaged in relevant and mathematically focused activities, students develop a positive attitude and disposition towards mathematics and its applications. They develop mathematical identities and intuition based on confidence that they can make sense of mathematics and can successfully complete the primary mathematics program. Making sense of the mathematics they learn requires that students see mathematics as useful to their everyday activities outside of the classroom.

Standards and Learning Outcomes

MN: Numbers and Number Operations

M1: Count and sequence numbers, reading and writing numbers in a variety of ways

M1.1 Counting from 0 – 10

- *count groups of objects*
- *include all six counting principles: one-to-one, stable order, cardinality, abstraction, order irrelevance, counting on*

M1.2 Compose and decompose numbers from 1 – 10

- *group items into given amounts with no remainder*
- *use number line or chart to sequence numbers*
- *identify number before, after, between*

M1.3 Recognize meaning of zero

- *zero as having nothing*

M1.4 Represent numbers from 0 to 10

- *read, write and match numerals and number names*
- *subitize*

M1.5 Rote count sets of up to 30 objects

- *counting forward and backward*
- *counting by 1's and by 2's*
- *use appropriate currency and calendar*

M2: Use place value to understand our number system and other systems

- *N/A*

M3: Use and work with integers to show both size and direction

M3.1 Recognize that the last number counted shows the amount of things in a group of objects

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- *groups of objects not exceeding 30*

M4: Work fluently with fractions and decimals

M4.1 Show whole and parts with concrete objects

M4.2 Compose and decompose region, shape or set of objects into halves

- *recognize that the fractional parts are equal*
- *match halves to make a whole*
- *express a half as* $\frac{1}{2}$

M5: Use numbers to show position or ranking

M5.1 Use ordinal numbers to express order from first to tenth

M6: Understand meanings of number operations and how they relate to one another

M6.1 Combine, rearrange and separate objects to show addition and subtraction

- *use +, - symbols*

M6.2 Share objects into groups of 2's, 5's

- *10 or less objects*

M7: Compute fluently with basic operations using integers, fractions and decimals

M7.1 Using counting to do addition and subtraction for sets of objects

- *include sum and difference of zero*
- *sums not to exceed 10*

M8: Make reasonable estimates and approximations

M8.1 Make reasonable guess of number of objects in a group

- *answer questions like "Is it closer to ___ or to ___?"*

M9: Use mental math techniques creatively

M9.1 Oral exercises to develop visual counting

- *use number families*

MP: Patterns and Relationships

M10: Understand and work with patterns (repeating, increasing, decreasing, and numerical)

M10.1 Describe, reproduce, extend, transfer and create repeating patterns

- *use shapes, letters, colors, numbers (1-10), objects, sounds, actions (real-life)*

M10.2 Sort objects and shapes (in their environment) and describe sorting rule

- *1 attribute at a time*

M11: Explore number patterns to discover properties of special number groups

M11.1 Use number patterns to identify odd and even numbers

- *use the word "set" when describing groups*

M12: Understand relations, functions and graphs

M12.1 Use a balance to describe equality and inequality

- *use the equal (=) symbol to represent equality*

M13: Apply equations and inequalities in one variable to solve problems

- *N/A*

MM: Measurement

M14: Understand concept of measurement and measurable attributes: length, mass / weight, capacity, time, angle, temperature

M14.1 Encounter the concept of measurement as a comparison of two items with similar attribute in questio

- *use concrete objects as informal units of the attribute*
- *recognize not to leave gaps between unit used*

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M14.2 Compare, describe and sort objects based on single measurement attribute

- *length, height, weight, capacity, time, temperature, turn*

M14.3 Investigate attributes of 2-D and 3-D items using informal measures

- *perimeter: how many pencils are needed to go around the top of the student-desk*
- *area: how many notepad pages will it take (without overlap) to cover the teacher's desk*
- *volume: how many match boxes can fit inside a shoe box*

M15: Apply measurement systems, techniques, tools and formulas moving fluently between related units

M15.1 Estimate and measure lengths, heights and weights using nonstandard units

- *place selected device end-to-end (no gaps, no overlaps)*
- *use an equal arm balance*

M15.2 Explore the concept of time

- *recognize a week as seven days and an year as 12 months*
- *use names of days and of months*
- *use a 12-hour clock to read time on the hour*

MS: Spatial Relationships and Shapes

M16: Discover, analyze and use characteristics and properties of two- and three-dimensional geometrical shapes to identify, describe, sketch and model

M16.1 Manipulate, explore, recognize, describe concrete shapes in the environment such as square, circle, rectangle and triangle

M16.2 Use properties to sketch simple representations of 2-D and 3-D figures

M16.3 Compose and decompose 2-D and 3-D figures

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M17: Use representational systems (Eg. coordinate system) to give location, describe spatial relationships, and explore symmetry and transformations

M17.1 Describe relative positions in the environment

- *locate and/or describe position of objects in the school yard*
- *use seating rows and column in classroom*

M17.2 Identify representations of point, line, ray, angle and plane in their environment

M17.3 Draw line segments

MD: Data Handling and Probability

M18: Collect, organize and display relevant data to answer questions related to real-life situations

M18.1 Gather data from environment

- *Eg. objects, pictures*
- *through observation, counting, sorting, grouping etc.*

M18.2 Use tally charts to record data

M18.3 Use symbols to represent objects using one-to-one correspondence

M18.4 Organize and display data using concrete materials, columns and pictorial representations

M19: Analyze, describe and summarize data using appropriate statistical methods and measures

M19.1 Interpret information presented in picture graphs and simple column graphs

M20: Investigate inferences and apply probability concepts in the solution of problems

M20.1 Describe a trend shown on a picture or column graph

Number and Number Operations

Introduction

Students commence their formal introduction to mathematics through numbers and counting and throughout their lives will be continuously engaged with numbers and number operations. It is essential that children develop a strong conceptual understanding of numbers so that they can better handle more abstract concepts involving numbers and number operations later on. The use of activities, physical actions and physical objects is crucial for in depth understanding at this level.

At the start of formal training, students bring a wide range of previous knowledge related to writing number symbols and saying number names (for small numbers). However, the concept of numbers is not fully developed and much less is that of number operations.

Initially, children reason about small amounts of physical items, learning to distinguish small groups by size. They can also recognize when such groups increase and decrease. They recognize and repeat number words used around them and also to recognize their symbols. Words like “bigger”, “smaller” and “the same” are used to describe differences between small groups of similar items and easily compared quantities. They learn to immediately recognize and attach number names to small collections of objects (especially if arranged in a particular pattern). They recognize that numbers can be used to signify quantity.

Students then start to use numbers to describe actual quantities of physical things. Through everyday tasks, students use one-to-one relations to directly carry out suggested actions, match groups or to make requested portions. The one-to-one correspondence is used share and count out.

Students then start to reason about numerical quantities and come to recognize that if nothing is added or removed, even if rearranged, the quantity remains the same. They start to see numbers as the composition of other numbers. Students start to think of addition and subtraction in relation to the whole and the two parts and what is missing. Students recognize that they can divide a whole into portions and that portions must be equal regardless of how they look. Students use part-part-whole relations for numerical quantities.

Teachers at this level must take every opportunity to count with their students. Practice is key when learning to count. A variety of items, objects and actions can be used as opportunities to practice. Many opportunities arise in the other subject areas. The use of manipulative allows for children to reason with the concepts through everyday problematic situations and questions. Opportunity should be given for students to move from reasoning using physical items, to visualization, as they develop their ability to work abstractly with numbers and simple operations with them. Teachers understand that this standard plays a vital role in successful completion of the other standards and further work in the field of mathematics.

M1: Count and sequence numbers, reading and writing numbers in a variety of ways
[M1.1 – M1.5]

Comments: A good grasp of counting concepts goes beyond the singing of number names in correct sequential order. Students must connect number names with the quantities represented as well as understand that where one starts is not important as long as each item counted is included only once. An important concept related to counting is that the last number counted gives the total number of items in the group. Teachers must ensure that students get a strong principle-based foundation to counting with emphasis on the use of manipulative objects. Flash or dot cards and counters (different objects, colors, shapes, sizes) are useful.

Sample Lesson Objectives:

- Given numbers and number names, students will be able to match each number to its name and vice versa.
- Given any number from 1-9, students will be able to orally name the number that comes before the given number.

Sample Assessment:

Problem Solving
- interprets real-life situations by applying counting
- recognizes “more than” and “less than” situations
- apply numbers, including zero, to real-life situations

Written
- students can clearly write numbers and number names

Oral
- count and properly say numbers
- fluently count backwards and forward including skip counting

Specific Content:

- The stable-order rule. Counting words must be said only once, and in a consistent order. A child counts, "one, two, three, four, five, six, eight, seven..." each time he counts. he isn't completely correct, but he is consistent.
- The one-to-one rule. Each counting word must be paired with one, and only one, object. Many 4-year-olds will make such mistakes as skipping an object, but will catch similar mistakes when others make them.
- The cardinal rule. The last counting word indicates "how many" of the collection. If you ask a child who is just learning to count how many items she just counted, she may recount! But with counting practice, children learn to abstract this rule, and they find that the last number word is not an attribute of the last object counted, but an attribute of the entire collection as a whole.

- The order-irrelevance rule. Objects can be counted in any order. As in the train-engine example, a child can label objects with different numbers and the count will remain the same.
- The abstraction rule. Any kind of object can be collected and counted. Children can count jumps, the number of dog barks, or the missing eggs from an egg carton. As the name of the rule indicates, counting is an abstract, principled activity!
- The counting-on rule. When a child has counted a group of items and other items are to be added to the group, the child recognizes that s/he does not have to start counting from "one" but can continue from the previous total and count the newly added items.
- Subitize. It is important that students start to recognize numbers based on patterns used to represent them.

Sample Activities [student]:

- Find the same amount: given a collection of cards with sets on them (dot cards), students pick up a card and find another card that has the same amount. Can be extended to include values "less than" and values "greater than".
- Make sets of more/less/same: give students a set of objects and a number. Students form three sets showing less, more and the same.
- Count on: use counters for students to identify a start point and then count on from there.
- Make a two-more-than set: give students a dot card and they use counters to make a set that is two more than the number shown on the dot card. A calculator may also be used for this activity.
- Ten-frame flash: flash ten-frame cards and see how fast students can tell how many dots are shown. Variations include saying the number of blank spaces, one more than the number of dots shown or two less than and can also include saying the "10 fact" like "six and four make ten".
- Use five frames when developing counting from 0 – 5.
- Use ten frames when developing counting up to ten and double ten frames for 10 – 20.

Teacher Support:

- Model counting, speaking and writing numbers for students.
- Use a variety of objects when counting.
- Provide a variety of item types for students to practice counting regularly and as often as possible.
- When it comes to counting, practice, and more practice, is key.

Print Resources:	Technology Resources:

Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7 th ed.). Boston: Allyn and Bacon. Van de Walle, J. A., Lovin, L. H. (2006). *Teaching student-centered mathematics: Grades K-3* (vol. 1). Boston: Allyn and Bacon. Suffolk, J. (2004). *Teaching primary mathematics*. Oxford: Macmillan Teaching Handbooks.	http://www.proteacher.com/100000.shtml http://www.apples4theteacher.com/math.html http://s22318.tsbvi.edu/mathproject/ http://www.mathwire.com/standards/numbop.html http://www.internet4classrooms.com/ http://illuminations.nctm.org/ http://free.ed.gov/subjects.cfm?subject_id=33 http://www.kindergarten-lessons.com/ http://www.teachingideas.co.uk/maths/

Linkages [Math]: All areas	Linkages [content areas]: All areas	Textbook Resources: Y1T1: 6 – 20, 25 – 27, 34 – 36 Y1T2: 12, 13, 18 – 24, 32 – 37 Y1T3: 2- 4

M2: Use place value to understand our number system and other systems
N/A

M3: Use and work with integers to show both size and direction **[M3.1]**
Comments: Use real-life situations to establish the concept of a number showing size or how many.
Sample Lesson Objectives: • Given a set of objects (not to exceed 10), students will orally tell how many objects are in the set.
Sample Assessment: Problem Solving • count number of a specific object in their surroundings, like how many windows the classroom has Written • write numeral and number name obtained from counting how many

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Oral

- give number obtained from counting how many

Other

- observe students counting and using number to identify "how many" outside of the regular math lesson

Specific Content:

Directed numbers give both size and direction like in altitude and temperature.

Sample Activities [student]:	Teacher Support:
• identify an object found in the surroundings (inside the classroom, outside or even at home) and ask students to identify, by counting, how many	• sets of counters and flash cards can be used as stated above

Print Resources:	Technology Resources:
Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7 th ed.). Boston: Allyn and Bacon. Van de Walle, J. A., Lovin, L. H. (2006). *Teaching student-centered mathematics: Grades K-3* (vol. 1). Boston: Allyn and Bacon. Suffolk, J. (2004). *Teaching primary mathematics*. Oxford: Macmillan Teaching Handbooks.	http://www.proteacher.com/100000.shtml http://www.apples4theteacher.com/math.html http://s22318.tsbvi.edu/mathproject/ http://www.mathwire.com/standards/numbop.html http://www.internet4classrooms.com/ http://illuminations.nctm.org/ http://free.ed.gov/subjects.cfm?subject_id=33 http://www.teachingideas.co.uk/maths/

Linkages [Math]: All areas.	Linkages [content areas]: All areas.	Textbook Resources: Y1T1: 19 – 21 Y1T2: 24 Y1T3: 2

M4: Work fluently with fractions and decimals
[M4.1 – M4.2]

Comments: Students may have an idea of half and other fractions or parts/pieces but the concept may not be

fully developed.

Sample Lesson Objectives:

- Given the border of a shape on grid paper, students will color half the squares.
- Given several cut-out shapes, students will match corresponding halves.

Sample Assessment:

Problem Solving

- identify in their surroundings objects that are divided into halves
- share a set of things so that each of two persons, get the same amount

Other

- divide a sheet of paper to show half
- draw/colour to show division into half
- match shapes to form whole from cut-out halves

Specific Content:

Regardless of shape, ensure both halves are equal. Paper folding may be a useful tool.

Sample Activities [student]:

- use paper folding to show half
- colour on grid paper
- use a variety of ways to identify how a set of items or a shape could be divided into half
- match cut-out shapes or dot-cards to show half

Teacher Support:

- ensure students understand that half does not only mean two parts but two 'equal' parts

Print Resources:

Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7 th ed.). Boston: Allyn and Bacon.

Van de Walle, J. A., Lovin, L. H. (2006). *Teaching student-centered mathematics: Grades K-3* (vol. 1). Boston: Allyn and Bacon.

Suffolk, J. (2004). *Teaching primary*

Technology Resources:

http://www.proteacher.com/100000.shtml

http://www.apples4theteacher.com/math.html

http://s22318.tsbvi.edu/mathproject/

http://www.mathwire.com/standards/numbop.html

http://www.internet4classrooms.com/

http://illuminations.nctm.org/

mathematics. Oxford: Macmillan Teaching Handbooks.	http://free.ed.gov/subjects.cfm?subject_id=33 http://www.teachingideas.co.uk/maths/	
Linkages [Math]: All areas.	Linkages [content areas]: All areas.	Textbook Resources: Y1T2: 14 – 17 Y1T3: 30 – 32

M5: Use numbers to show position or ranking **[M5.1]**	
Comments: Students may be aware of first and second but may not know how to use the other numbers to show position or ranking.	
Sample Lesson Objectives: • Placed on a line, students will identify who is second on the line from a given start point. [M5.1] • Given an ordered list of items, students will write the position or ranking of a named item. [M5.1]	
Sample Assessment: Problem Solving • use real-life situations for students to identify and name different positions or ranking Written • writes ordinal number from first to tenth using numerals and names Oral • tells correct position	
Specific Content: First, second, third, fourth, fifth, sixth, seventh, eighth, ninth, tenth are ordinal numbers that indicate position or ranking.	
Sample Activities [student]: • use seating order to identify position • have students identify which person or object is in a particular position	Teacher Support: • use a variety of situations outside math lesson for practice
Print Resources: Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7 th ed.). Boston: Allyn and Bacon.	Technology Resources: http://www.proteacher.com/100000.shtml http://www.apples4theteacher.com/math.html

Van de Walle, J. A., Lovin, L. H. (2006). *Teaching student-centered mathematics: Grades K-3* (vol. 1). Boston: Allyn and Bacon. Suffolk, J. (2004). *Teaching primary mathematics*. Oxford: Macmillan Teaching Handbooks.	http://s22318.tsbvi.edu/mathproject/ http://www.mathwire.com/standards/numbop.html http://www.internet4classrooms.com/ http://illuminations.nctm.org/ http://free.ed.gov/subjects.cfm?subject_id=33 http://www.teachingideas.co.uk/maths/	
Linkages [Math]: All areas.	Linkages [content areas]: All areas.	Textbook Resources: Y1T3: 8 – 10

M6: Understand meanings of number operations and how they relate to one another **[M6.1 – M6.2]**	
Comments: Students may bring some knowledge of making more or making less but may not necessarily call this addition and subtraction or know the mathematical symbol for each.	
Sample Lesson Objectives: • Given two small sets of counters, students will identify the amount gotten when the two sets are combined. • Students will use the correct symbol to indicate what they did like when combining two small sets. (ex. 2 + 3 when joining two sets to get a set of five)	
Sample Assessment: Problem Solving • use real-life situations that require students to combine sets or break apart sets Written • writes statements (2+3, 4-1) using correct symbol Other • identifies amount gotten when combining two smaller sets of items	
Specific Content: • Addition (+) • Subtraction (-)	
Sample Activities [student]: • Two out of three: make list of three numbers, two of which	Teacher Support: • Social studies: 3 children + 2

total the whole focused on (for five use 2-3-4, 4-3-1 etc). Students identify which two numbers make five and write the statement 2+3=5. • Do activity similar to the above with subtraction • Build in parts: use connecting cubes or Legos for students to build columns that combine two colors to make the whole • Use 3-part dot-cards for students to identify missing part	parents = 5 family members

Print Resources: Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7 th ed.). Boston: Allyn and Bacon. Van de Walle, J. A., Lovin, L. H. (2006). *Teaching student-centered mathematics: Grades K-3* (vol. 1). Boston: Allyn and Bacon. Suffolk, J. (2004). *Teaching primary mathematics*. Oxford: Macmillan Teaching Handbooks.	Technology Resources: http://www.proteacher.com/100000.shtml http://www.apples4theteacher.com/math.html http://s22318.tsbvi.edu/mathproject/ http://www.mathwire.com/standards/numbop.html http://www.internet4classrooms.com/ http://illuminations.nctm.org/ http://free.ed.gov/subjects.cfm?subject_id=33 http://www.teachingideas.co.uk/maths/

Linkages [Math]: All areas.	Linkages [content areas]: All areas.	Textbook Resources: Y1T1: 25 – 27 Y1T2: 3 – 8

M7: Compute fluently with basic operations using integers, fractions and decimals **[M7.1]**
Comments: Operations with numbers are introduced as a practical exercise rather than theoretical.
Sample Lesson Objectives: • Use given counters to illustrate a given addition sentence. • With the use of manipulative, finds the sum of two given numbers.
Sample Assessment: Problem Solving

- use real-life situations
- recognizes situations outside the classroom as addition / subtraction

Written

- uses correct symbols when writing addition and subtraction sentences

Oral

- determines the total gotten from an addition or subtraction – mental math

Other

- shows addition statements and subtraction sentences using objects or counters

Specific Content: N/A

Sample Activities [student]:

- I wish I have: identify a number and ask students to identify another number and then determine the whole obtained.
- I wish I had: above activity modified to identifying how many are needed to make a given amount.
- After doing an activity, write statements as "four and two make six" as (4+2=6).
- Double war: each student picks two cards, the winner is the one with the largest total.
- Number sandwiches: find combination of two cards that make a given total.

Teacher Support:

- zero is abstract and good understanding of "something that represents nothing" is critical for further success and deeper understanding, including place value

Print Resources:

Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7 th ed.). Boston: Allyn and Bacon.

Van de Walle, J. A., Lovin, L. H. (2006). *Teaching student-centered mathematics: Grades K-3* (vol. 1). Boston: Allyn and Bacon.

Suffolk, J. (2004). *Teaching primary mathematics*. Oxford: Macmillan Teaching Handbooks.

Technology Resources:

http://www.proteacher.com/100000.shtml

http://www.apples4theteacher.com/math.html

http://s22318.tsbvi.edu/mathproject/

http://www.mathwire.com/standards/numbop.html

http://www.internet4classrooms.com/

http://illuminations.nctm.org/

http://free.ed.gov/subjects.cfm?subject_id=33

http://www.teachingideas.co.uk/maths/

Linkages [Math]: All areas.

Linkages [content areas]: All areas.

Textbook Resources:
Y1T2: 3 – 8, 25, 42 – 47
Y1T3: 5 – 7, 15 – 19

M8: Make reasonable estimates and approximations
[M8.1]

Comments: Infuse throughout units.

Sample Lesson Objectives:

- For a given set of items, students will (before counting) approximate if the amount is closer to ten or to five.

Sample Assessment:

Oral

- can identify if a given set (before counting) closer to ten or five

Specific Content:

Proximity (absolute value – distance) on number line can be determined using a counting-on / counting-back strategy.

Sample Activities [student]:

- Ask regularly when doing other activities in this unit. Can be used as a starter to real-life problems.
- Use estimate or approximation to discuss and compare 'closeness' of results.

Teacher Support:

- Often taken for granted that students estimate or approximate before counting or computing. Use initial estimate or approximation to check 'reasonableness' of answer obtained.

Print Resources:

Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7 th ed.). Boston: Allyn and Bacon.

Van de Walle, J. A., Lovin, L. H. (2006). *Teaching student-centered mathematics: Grades K-3* (vol. 1). Boston: Allyn and Bacon.

Suffolk, J. (2004). *Teaching primary mathematics*. Oxford: Macmillan Teaching Handbooks.

Technology Resources:

http://www.proteacher.com/100000.shtml

http://www.apples4theteacher.com/math.html

http://s22318.tsbvi.edu/mathproject/

http://www.mathwire.com/standards/numbop.html

http://www.internet4classrooms.com/

http://illuminations.nctm.org/

http://free.ed.gov/subjects.cfm?subject_id=33

http://www.teachingideas.co.uk/maths/

Linkages [Math]: All areas.

Linkages [content areas]: All areas.

Textbook Resources: N/A

M9: Use mental math techniques creatively
[M9.1]

Comments: Use every opportunity to strengthen counting.

Sample Lesson Objectives:

- Students will visually count an identified amount of items or objects.

Sample Assessment:

Oral

- can count an amount without use of manipulative

Specific Content:

Certain numbers can make specific recognizable geometric arrangements or patterns.

Sample Activities [student]:

- use flash cards with dots for students to visually count
- use objects around the room for visual counting

Teacher Support:

- Short practice can be scheduled for a few minutes at various times throughout the day.

Print Resources:

Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7 th ed.). Boston: Allyn and Bacon.

Van de Walle, J. A., Lovin, L. H. (2006). *Teaching student-centered mathematics: Grades K-3* (vol. 1). Boston: Allyn and Bacon.

Suffolk, J. (2004). *Teaching primary mathematics*. Oxford: Macmillan Teaching Handbooks.

Technology Resources:

http://www.proteacher.com/100000.shtml

http://www.apples4theteacher.com/math.html

http://s22318.tsbvi.edu/mathproject/

http://www.mathwire.com/standards/numbop.html

http://www.internet4classrooms.com/

http://illuminations.nctm.org/

http://free.ed.gov/subjects.cfm?subject_id=33

http://www.teachingideas.co.uk/maths/

Linkages [Math]: All areas.

Linkages [content areas]: All areas.

Textbook Resources: N/A

Patterns and Relationships

Introduction

Working with Patterns and forming Relationships are fundamental skills in mathematics and in everyday life- focusing on the type of thinking and reasoning that prepares students to think mathematically across the curriculum. This section, patterns and relationships builds the foundation for the use of various representations symbolic, numeric, and graphic to help make sense of all sorts of mathematical situations. As students become comfortable with these ideas and methods of representation, they will begin to utilize them in nearly all of mathematics, not just in a study of algebraic ideas.

It is common today to hear or read about algebraic reasoning or algebraic thinking. This involves the way a student uses the content of algebra patterns, representations, and functions in generalizing and formalizing regularity in all aspects of mathematics. Activities aimed at the goal of algebraic thinking should begin in preschool and continue to develop across the years, and not just in algebra lessons but to some extent in all of the other strands of mathematics.

BIG IDEAS

1. Logical patterns exist and are a regular occurrence in mathematics. They can be recognized, extended, and generalized with both words and symbols. The same pattern can be found in many different forms. Patterns are found in physical and geometric situations as well as in numbers.
2. A variety of representations such as diagrams, number lines, charts, and graphs can be used to illustrate mathematical situations and relationships. These representations help in conceptualizing ideas and in solving problems.
3. Symbolism, especially that involving equations and variables, is used to express generalizations of patterns and relationships.
4. Variables are symbols that take the place of numbers or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown values, or placeholders in a generalized expression or formula.
5. Equations and inequalities are used to express relationships between two quantities. Symbolism on either side of an equation or inequality represents a quantity. Thus, 3 + 8 and 5n + 2 are both expressions for numbers, not something "to do."
6. Functions are a special type of relationship or rule that uniquely associate members of one set with members of another set. For example, one-more-than is a functional relationship on the set of all numbers. It associates the number 3 with 4 and the number 2386 with 2387. Another example of a function is the rule that associates any polygon with the number of vertices of that polygon.

Infant I

M10: Understand and work with patterns (repeating, increasing, decreasing, and numerical)
[M10.1 – M10.2]

Comments: Wherever possible, patterning activities should involve some form of physical materials. This is especially true of repeating patterns in Infant 1 to Standard 2. When patterns are built with materials, children are able to test the extension of a pattern and make changes without fear of being wrong. If a mistake is made, materials allow a trial-and-error approach to be used. Most children enjoy using materials such as colored blocks, buttons, and connecting cubes, stringing beads to extend their patterns well beyond what can be done on a single page. Children are frequently observed continuing a pattern with materials halfway across the classroom floor.

The third learning outcome focuses on sorting by one attribute. This skill is simultaneously being developed when students are being asked to work with patterns. So that it is important that children understands this concept initially.

Sample Lesson Objectives:

- Given objects of different colors/patterns, students will be able create/reproduce a pattern that was initially describes from letters.
- Given a set of simple geometric shapes, students will be able to define an attribute for sorting them and sort the shapes accordingly.

Sample Assessment:

Observation (patterns)

- Observe level of mastery while students are involved using manipulatives. A checklist with increasing difficulty using descriptors like 'needs more work', 'adequate' and 'mastered' can assist the observation process, for each of the following repeating pattern skills:
- Describe, Reproduce, Extend, Create
- Observation (sorting)
- Observe correct sorting of objects as defined by the attribute. Record mastery of skill.

Problem Solving

- Children can explore patterns with all sorts of materials letters of the alphabet, blocks and so on. It is especially useful to integrate pattern activities with other activities in your school day. As children work with materials sorting them by one attribute is required.

Act out patterns

- rhythm clapping, children in line (patterns are created using position of hands), describe, reproduce, extend, create and find the missing element from the patterns. Observe correctness of these skills.

Infant I

Create patterns

- use as many different materials and actions for children to create their own patterns (have them describe the pattern). Assess the correctness of the description/illustration.
- Have students make a pattern with one set of materials given a pattern sequence shown by a different (material) set. Check for the correct reproduction.

***Note: Pattern skills and sorting skills at the Infant I level is to be done using materials that are readily available, hence teacher observe and assess skills when children are manipulating.

Common errors:

- Differentiating a repeating from a growing pattern
- Misinterpretation of the core i.e. the pattern rule
- When asked to create a AAB pattern, they form an AB pattern
- Difficulty in describing patterns that changes by multiple attributes. E.g. change by color then by shape

Specific Content:

The concepts of repeating patterns and how a pattern is extended and translated are critical for children to do mathematics and thinking algebraically. The core of a repeating pattern is the shortest string of elements that repeats. Note for any pattern the core is always fully repeated and never partially shown. Recognizing and describing the core for a pattern is the first skill for children to develop proficiency in. This is then followed by them creating their own patterns. Then have them reproduce the same elements within a pattern and then translating the pattern to another set.

Sample Patterns

Singing: do, mi, mi, do, mi, ...

Standing/sitting: boy, girl, girl, boy, girl, ..

Geometry shapes:

A B B A B pattern

Smiley Faces:

A B B . . . pattern

A B C C . . . pattern

Infant I

Sample Activities [student]:	Teacher Support:
• To introduce patterns: draw simple shape patterns on the board and extend them in a class discussion. Oral patterns can be joined in by all children. For example, "do, mi, mi, do, mi, mi, ... " is a simple singing pattern. Up, down, and sideways arm positions provide three elements with which to make patterns: up, side, side, down, up, side, side, down, .. Sing songs with actions strings. Have students recognize what happens when the pattern is confused or repeated correctly. • Group working: For each set of materials, draw two or three complete repetitions of a pattern. The students' task is to use actual materials, copy the pattern shown, and extend it as far as they wish. • Transferring a repeated pattern: Using some form of symbolism (the alphabet - A, B, C method of reading a pattern) to represent the structure of a pattern (This is the beginning of algebraic reasoning). • Pattern Match: Using the chalkboard, show six or seven patterns with different materials or pictures. Teach students to use an A, B, C method of reading a pattern. Half of the class can close their eyes while the other half uses the A, B, C scheme to read a pattern that you point to. After hearing the pattern, the students who had their eyes closed examine the patterns and try to decide which pattern was read. If two of the patterns in the list have the same structure, the discussion can be very interesting • Sort by 1 attribute: Use surrounding for students to find things possessing that attribute. Change roles so that children can name and describe their sorting attribute. Use simple shapes for students to sort.	• This topic allows for children to have fun and learn. Allow the students to explore with a variety of materials. • Use sets of non-patterns at times to check for understanding • Drawings and worksheets of patterns are the next logical step after engaging them with objects. • Caution: repeating patterns and not growing patterns. Don't introduce at this time numeric growing increasing patterns (unless the #s 1-10, are used as symbols and not for their value) • Introduce ABC of reading patterns only after all children can recognize, repeat and extend patterns • This pattern match can be turned into a game that can be played in small groups. • As noted earlier, children will bevusing sorting skills for them to work with patterns.

Print Resources:	Technology Resources:
Books: Pattern Fish, and Pattern Bugs (Harris, 2001) Nature's Paintbrush: The Patterns and Colors Around You (Stockdale, 1999) Text: Bright Sparks, Macmillan, Bk 1	Software: Teachers or students can use word processor (Insert Shapes and copy) that can be resized or colored to show patterns. KidPix software allows students to stamp patterns. You Tube: DONALD IN MATHMAGIC LAND – Walt

Teacher: Van de Walle, J. A., Lovin, L. H. (2006). Teaching student-centered mathematics: Grades K-3 (vol. 1). Boston: Allyn and Bacon.	Disney Interactive lesson online: http://www.linkslearning.org/Kids/1_Math/2_Illustrated_Lessons/5_Patterns/index.html Worksheets: http://www.kidzone.ws/prek_wrksht/math-readiness/patterns.htm http://www.mathworksheets4kids.com/patterns.html http://www.abcteach.com/directory/basics/math/patterns/	
Linkages [Math]: Number, counting, geometric shapes	Linkages [content areas]: Language Arts: letter patterns in words Music; sound patterns PE: movement patterns	Textbook Resources: N/A

M11: Explore number patterns to discover properties of special number groups **[M11.1]**
Comments: The patterns discussed so far, repeating and translating patterns are far from the only patterns in mathematics. Our number system is full of wonderful patterns. Numbers not only offer children an opportunity to explore patterns but also to learn to expect, see, and use patterns in all of mathematics. The simplest form of a number pattern is a string of numbers that follows some rule for determining how the string continues. For example: the set of real numbers, the set of odd and even numbers. At infant 1 it is important to limit numeric patterns to increasing (growing) and decreasing (shrinking)#s 1-10.
Sample Lesson Objectives: • Given numbers as increasing patterns, students will be able to make and describe the set of whole, even, and odd numbers.
Sample Assessment: Observation (even and odd sets of patterns) • Observe level of mastery while students are involved using pattern sets. A checklist with increasing difficulty using descriptors like 'needs more work', 'adequate' and 'mastered' can assist the observation process, for each of the following repeating pattern skills:

Infant I

- Describe set
- Reproduce set

Problem Solving

- Answer simple oral/worded problems involving set of odd and even numbers. Similarities and differences

Written

- Write set of even/odd numbers using symbols (1-10).

Reading

- Read number set by skip counting.

***Note: Skip counting skills at the Infants I level is to be done orally and assessed from that prespective.

Common errors:

- Differentiating an increasing from a repeating pattern

Specific Content:

Simple growing and shrinking number patterns are quite familiar to students. For example:

1,2,3,4,5,6 whole numbers – start with 1 and increment by 1

2, 4, 6, 8, 10, even numbers- start at 2 and skip counting by 2

1,3,5,7,9, odd numbers-start at 1 and skip counting by 2

Special names are given to them: set of whole numbers, set of even and set of odd numbers.

Growing means the number increases in size and shrinking means they decrease in size.

Sample Activities [student]:	Teacher Support:

• What's Next and Why:
  • Have students recognize the set of numbers (1-10) as an increasing pattern, different from regular patterns (color or other attribute) incrementing by 1
  • Show students a few numbers from a number pattern. The task for students is to extend the pattern for several more numbers and to explain the rule for generating the pattern.
  • 1,2,3,4,5,6 start at 1 and increment by 1
  • 2, 4, 6, 8, 10, start at 2 and skip counting by 2
	• Skip counting can be an excellent source of patterns and can help students begin to do some serious reasoning about numbers.
	• Classroom discussion on work done in groups is an essential activity to complete students understanding. New ideas are identified and gaps are filled in the process

• 1,3,5,7,9, start at 1 and skip counting by 2 • Group sharing: Identify whether children can describe the set, and give them their special names.	
Print Resources: Books: Even Steven And Odd Todd (level 3) (Hello Reader, Math) by Cristaldi Odd and Even Socks (Rookie Read-About Math) by Melanie Chrismer Text: Bright Sparks, Macmillan, Bk 1 Teacher: Van de Walle, J. A., Lovin, L. H. (2006). Teaching student-centered mathematics: Grades K-3 (vol. 1). Boston: Allyn and Bacon.	Technology Resources: Interactive lesson online: http://www.brainpopjr.com/math/numbersense/evenandodd/preview.weml You Tube: Monsters Number Song: "Even and Odd" Worksheets: http://www.superteacherworksheets.com/odd-even.html http://www.primaryresources.co.uk/maths/mathsB2.htm

Linkages [Math]:	Linkages [content areas]:	Textbook Resources: N/A
Number Theory- even and odd, counting, recursive patterns		

M12: Understand relations, functions and graphs **[M12.1]**
Comments: This is the first step in developing student's skills in stating relationships between two things. The use of the balance beam allows for establishing when two things are equal in mass or not. The concept of equality is defined from the balance being established or not balance (Not the same) for inequality. The concept is established but the terminology used remains age appropriate. Simple balance beams can be constructed from wood, string and suspended containers, or balancing a ruler in the middle. It would be preferred that the fulcrum is fixed for young children and the entire beam stays together when being used). Investigating equality is great opportunity to extend student's understanding of numbers and has connections to addition and subtraction. If equality has not been well explored in previous years, grade 3 teachers will likely have to move back to concrete explorations. Without these previous rich experiences, students will usually misunderstand the equals sign. They see it as "what you put before the answer", rather than an indication that the left and right sides of the equals sign are

balanced or have the same amount.

Sample Lesson Objectives:

- Using the balance beam and a set of assorted objects(mass), students will be able to describe which two sets are equal or not equal. [M12.1]
- Using the equal sign, students will be able to describe things (real life) that are equal. [M12.2]

Sample Assessment:

Observation

- Observe for each student their understanding of balance as being equal, unbalanced as being unequal.
- Use a checklist to record more difficult understanding of using the balance beam:
    - Side to remove or add object to achieve equality
    - Predict equality or inequality for a proposed action done to the balance beam.
- Note: (make sure the concept is understood before expecting the use of the symbol"=") If these things are to be representative of students' ideas, students must have those ideas before a representation will have any meaning for them. Meanings do not come from the representations. You cannot represent an idea you have not yet formed

Problem Solving

- Answer simple oral/worded problems involving adding or removing objects from the beam in balance or not balanced. (Make sure they use the balance beam to establish the understanding, and afterwards the answers can be provided without the beam.

Written

- Record number of objects placed on beam to achieve balance.
- Transfer understanding of equal and unequal to situations beyond the beam, to real life situations.
- Use the symbol "=" to describe when two things (set of) are equal.

***Note: Equality and inequality is a critical math concepts that must be mastered by children. Solicit this from each and make sure that their explanation eventually is removed from the balance beam. This is a good example of where the manipulative (beam) helps in developing the math understanding, and is not the math concept itself.

Specific Content: N/A

Sample Activities [student]:	Teacher Support:

Infant I

• Show: demonstrate the use of the balance beam for weighing objects, solicit reasoning when it tilts and when balanced • Group activity: In small groups have children use the balance beam for a varied number of situations. • Discussion: From activities have students share their thoughts and occurrences. • Predictions games: have groups predict balance or not; equal or not. Before conducting the test on the beam. • Stories: use real life scenarios to pose problems in story form to reinforce the understanding of equality. (Sharing of things have a profound impact on children when not equal)	• provide enough time for students to explore

Print Resources:	Technology Resources:	
Linkages [Math]: Counting: before and after numbers	Linkages [content areas]:	Textbook Resources:

M13: Apply equations and inequalities in one variable to solve problems
N/A

Measurement

Introduction

Measurements involve a comparison of an attribute of an item or situation with a unit that has the same attribute. Lengths are compared to units of length, areas to units of areas, time to units of time, and so on. Before anything can be measured meaningfully, it is necessary to understand the attribute to be measured.

Meaningful measurement and estimation of measurements depend on a personal familiarity with the unit of measure being used.

Estimation of measures and the development of personal benchmarks for frequently used units of measure help students increase their familiarity with units, prevent errors in measurement, and aid in the meaningful use of measurement.

Measurement instruments are devices that replace the need for actual measurement units. It is important to understand how measurement instruments work so that they can be used correctly and meaningfully.

Measurement is the identification and quantification of attributes of objects so that they can be compared and ordered. There are three (3) broad phases for teaching about each of the measurement attributes for objects (such as length, area, volume, capacity, mass, angle, temperature) and for events (such as time). These three phases are: (1) Identifying the attribute (2) Learning to measure (3) Learning to calculate

In phase one, which is developed in the Infants division, the purpose of teaching measurement is to develop the concept of identifying the attribute and to distinguish each from the other attribute. The students at Infant One are expected to develop each attribute by identifying the attribute and making comparison of objects, through the exploration of informal units.

Infant I

M14: Understand concept of measurement and measureable attributes: length, mass / weight, capacity, time, angle, temperature

[M14.1 - M14.2]

Comments: In phase one, which is developed in the Infants division, the purpose of teaching measurement is to develop the concept of identifying the attribute and to distinguish each from the other attribute. The students at Infant One are expected to develop each attribute by identifying the attribute and making comparison of objects, through the exploration of informal units.

Sample Lesson Objectives:

- Classify, describe, and arrange objects using comparative language to compare length, size, area, weight, and volume.
- Use comparative terms to describe time and temperature.
- Compare the relative sizes of non-standard units by measuring the same object using different units of measurement, and recognize that different objects may have the same mass.

Sample Assessment:

a) Observe students during whole-class or partner activities when they are ordering objects according to size. Note the following: Have students do ordering of objects and explain. (size, length, weight, and so on)? Have do students select measurement tools for a given task?

b) Have students look at a class weather chart to identify "the coolest/hottest day this week." Have them record the date and temperature, and describe that day with words or pictures on the classroom calendar or in the journal. Note which students are able to compare numbers, which students make the connection between lower numbers and colder temperatures, and how students use comparative language in talking about weather.

c) Observe students as they trace their hands and cut out shapes. How do they cover the area of the selected surface? (E.g. Does the spacing of their hands cover the whole area or only part of the area?)

d) Examine the record sheets that students complete as they compare, estimate, and measure size in various situations. Do their estimations improve over time? To what extent do different materials affect their estimates? (e.g., Can the container hold more rice or popcorn?)

e) Identify the objects/ measurement tools and conform their related attributes to their appropriate uses in particular situations.

f) Read stories that develop the concept of length, area, volume and capacity, mass and sequencing events in time, e.g. The Big Turnip. Discuss the pattern with the children. Students can then create their own stories based on personal experience.

g) Answer simple worded problems involving comparing and estimating each of the measurement attributes, e.g. Which flower vase is taller?

Infant I

Specific Content:

Size: Some objects are small and some are big.

Distance: Distance can be long, short, or near.

Height: People, animals and things can be tall or short.

Weight: Weight/mass is how heavy something is.

Time: Time is the point at which something happens and can be measured.

Capacity/Quantity: Containers are used to hold quantity and can be sub-divided into units so that quantity can be measured.

Ruler: A ruler is used to measure distance/length.

Sample Activities [student]:	Teacher Support:
a) Order or group a variety of objects (e.g. ball, book, and orange,) according to size, shape, length, height. b) Rearrange the objects in order by weight. c) Compare weights using hands, balance board and comparative language (light, heavy). d) Name and describe containers used for measuring capacity. e) Trace straight and curvy paths; step out distances, sort pencils by length. f) Students can compare to find out - which snake is longer, who is taller, which house is further away, sort pencils by length... g) Comparing similar or different attributes to find out - This box is longer, but that box is bigger; he is taller, but I am older. h) Trace around one hand on a piece of paper and cut it out. Working with a partner, they can then estimate how many hands would cover different objects in the room and try it to find out the correct answer. Record the information using a grid. Repeat the activity using other, non-standard units. e.g. i) In finding length, students can do the activity to find out - It is 5 giant steps to the window, this table is 12 books long …	a) Question students: - how one might determine how much more one object weighed than another: b) How might numbers be used to describe this? c) Which measurement tools (rulers, thermometers, measuring cups, and scales) can be used in a particular situation? d) Refine and expand students' language to describe time and temperature, length, height, etc. For example, a thermometer placed outside the window could be checked daily for temperature readings. The class discussion would include terms such as colder, coolest, hotter, and warm. Discuss how far, how long, tall, short, wide some things are.

Print Resources:	Technology Resources:

Infant I

Mathematics in Action – Macmillan, McGraw Hill Scott Foreman – Bk1 Mathematics – K-7 Integrated	http://www.ixl.com/math/grade/first/ http://www.ixl.com/ http://www.teachervision.fen.com/tv/printables/scottforesman/Math_1_PS_11-12.pdf http://www.instructorweb.com/basicskills/measurement.asp http://vdc.engr.scu.edu/KnowItAll/FirstGrade/firstMath/1stGradeMeasureLessons.html http://www.linkslearning.org/Kids/1_Math/2_Illustrated_Lessons/2_Estimation_of_Length/index.html

Linkages [Math]:	Linkages [content areas]:	Textbook Resources:
Sequencing patterns Spatial relation Statistics and Probability Number relations	Identify a sequence of events Arrange ideas in sequence to convey information and express feelings Use descriptive language to portray image, events and feelings Ask questions and give information Time periods in relation to their own growth and development Test simple devices to see if they meet a need or solve a problem Practice skills using various materials.	

M15: Apply measurement systems, techniques, tools and formulas moving fluently between related units [M15.2 – M15.2]
Comments: In phase one, which is developed in the Infants division, the purpose of teaching measurement is to develop the concept of identifying the attribute and to distinguish each from the other attribute. The students at Infant One are expected to develop each attribute by identifying the attribute and making comparison of objects, through the exploration of informal units.
Sample Lesson Objectives: • Using a 12-hour clock, students will read time to the hour.
Sample Assessment:

<table>
<tr><td colspan="3">

- does student pay attention to accuracy
- can student identify appropriate attribute

</td></tr>
<tr><td colspan="3">Specific Content:

Measurement as a concept involves comparing, with respect to a specified attribute, one item with an item that has been identified as the unit.</td></tr>
<tr><td colspan="2">Sample Activities [student]:

• Who is the winner?
  ○ Provide a competitive situation that will require exploration of measurement using a variety of informal techniques</td><td>Teacher Support:

• allow students to develop their own strategies and experiment with different attributes and informal units</td></tr>
<tr><td colspan="2">Print Resources:</td><td>Technology Resources:</td></tr>
<tr><td>Linkages [Math]:</td><td>Linkages [content areas]:</td><td>Textbook Resources:</td></tr>
</table>

Spatial Relationships and Shapes

Introduction

Younger students identify and name shapes on an intuitive level, “They just know it” - A ball (sphere) or a box (rectangular-based prism) or a square or a triangle. As students further develop their geometry sense, they are increasingly able to identify and name shapes by examining its properties and using reasoning. It is important to note that children ability to conceptualize shape develops through different stages which are fostered through the child’s experience (van Hiele). Here at the initial level, students focus on what individual shapes looks like and starts to transition to conceiving shapes as part of a group of similar shapes and begin to take note of the properties of shapes and sketching them. Drawing on their environment is critical for children to experience the shapes in the world they live.

M16: Discover, analyse and use characteristics and properties of two- and three-dimensional geometrical shapes to identify, describe, sketch and model

[M16.1 – M16.3]

Comments:

Students can name and recognize shapes by their appearance, but cannot specifically identify properties of shapes. Although they may be able to recognize characteristics, they do not use them for recognition and sorting.

Geometry taught in the elementary school should be informal. Such informal geometry activities should be exploratory and hands-on, in order to provide children with the opportunity to investigate, to build and take apart, to create and make drawings, and to make observations about shapes in the world around them. This provides the basis for more formal activities at higher levels.

Sample Lesson Objectives:

- Given pictures of objects, students will be able to identify basic shapes.
- Using play dough, students will be able to create basic shapes.

Sample Assessment:

Many of the skills and concepts being developed are best addressed through observation of students working directly with physical materials. In this way it is possible to see students applying the skills and concepts.

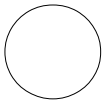
- How students match shapes to sides of 3D objects or objects in the environment
- How students trace, draw or cut out similar shapes

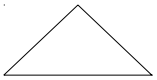
Specific Content:

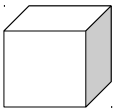
What is a:

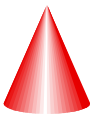
(a) square: 

(b) rectangle 

(c) circle 

(d) triangle 

(e) cube 

(f) cone 

(g) cylinder 

(h) sphere 

Sample Activities [student]:	Teacher Support:
a) Sorting shapes: use sets of shapes for students to put them in similar sets b) Jingles & rhymes c) Group sharing	a) Stories: use real life scenarios to pose problems in story form b) Orally points out a shape as seen on an object: teacher guided

Print Resources:	Technology Resources:
Text book: So many Circles, so many squares (Hoban, 1998)	www.helpingwithmath.com › By Subject › Geometry http://42explore.com/geomet.htm

Linkages [Math]:	Linkages [content areas]:	Textbook Resources:
Patterns and Relationship	Creative Arts Language Arts: 3.1; 4.1: 6.2	

M17: Use representational systems (e.g. coordinate system) to give location, describe spatial relationships, and explore symmetry and transformations

Comments: The simplest example of a coordinate system is the identification of points on a line with real numbers using the number line. In this system, point O (the origin) is chosen on a given line. The coordinate of a point P is defined as the signed distance from O to P. Each point is given a unique coordinate and each real number is the coordinate of a unique point.

Symmetry is when one shape becomes exactly like another if you flip, slide or turn it. The simplest type of Symmetry is "Reflection" (or "Mirror").

Sample Lesson Objectives:

a) Children will be able to point to and identify representations of 3 lines, and 3 angles in their classroom.

b) Given a numbered pattern using points, children draw line segments connecting the numbered points in the correct sequential order.

Sample Assessment:

a) Listen as children describe how objects are arranged in their classroom. They will use terms such as in front, behind, next to, above, below, etc.

b) Observe as children construct line segment as they work on chalkboard or on paper. Line segments may form shapes of buildings or pictures. Listen as they point out special lines and name them, i.e. point, line, ray, angle, etc.

Specific Content:

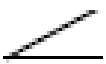
Locate and/or describe position of objects in the school yard

Use seating rows and column in the classroom

A point: •

Line: 

Ray: 

Angle: 

Plane: 

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Sample Activities [student]:	Teacher Support:
a) Games: Children locate hidden objects by listening to directive clues of their location. Children can take turn giving the directions. b) Challenge children to create shapes using the different types of representations such as rays (clock dial), angles (kite) and the other types of lines.	a) Direct games with simple rules which children can understand and follow easily b) Discuss with children pictures of their environment – playground, neighbourhood – and have them point out and identify the different types of lines, segments, or angles seen.

Print Resources:	Technology Resources:
Text book: So many Circles, so many squares (Hoban, 1998)	www.teach-nology.com › ... › Lesson Plans Center › Math www.superteacherworksheets.com/full-index.html

Linkages [Math]:	Linkages [content areas]:	Textbook Resources:
M1 – Numbers and Number Operations – count and sequence numbers M10 – Understand and work with patterns M14 – Understand concepts of measurement M15 – apply measurement techniques	Creative Arts Language Arts: 3.1; 4.1: 6.2	

Data Handling and Probability

Introduction

Data handling is to do with statistics and probability. Children are growing up in a media environment rich in statistics: statistics that describe (How many people died in the flood?), statistics that inform (How many people are unemployed?), and statistics that try to persuade (How much has the price gone up?). Children's statistical judgment will develop through practical experience of collecting and analyzing data from a variety of sources such as reference books, newspapers, magazines, computer databases, graphs, charts, radio and TV.

We use probability to work out how likely or unlikely an event is. The primary purpose of this Module is to introduce some of the simplest notions of probability through a wide variety of experiments in which the students take an active part. The focus here is on ideas and experiments rather than computational skills.

In teaching this module, the main goal should be to introduce the students to probability by means of a wide variety of probability experiments. It is essential that sufficient material be available so that several pairs of students can work on the same experiment at the same time.

When we work with data, sometimes it is useful to think of all the possible results of an experiment so that we can work out which results are more likely than others.

M18: Collect, organize and display relevant data to answer questions related to real-life situations [M18.2 – M18.4]

Comments: Data are raw facts that describe a particular object or a topic. Data may be collected through observation, sorting, grouping, measuring of objects. The information gathered can be represented by the use of pictorial representations such as charts and graphs and symbols to represent a one – to – one correspondence. Children will learn the process of gathering data, processing it and displaying it with the use of pictorials and graphs.

Sample Lesson Objectives:

- Children will use a table to summarize data.
- Children will use tally to gather data.

Sample Assessment:

- Observe and assess children in discussions of their observations and findings on field trips/nature walks
- Children can make questions in groups according to similar objects collected
- Interpret information gathered on tally sheet
- Create bar graphs using information gathered
- Interpret information displayed on graphs

Specific Content:

Tally Charts: A method of counting frequencies, according to some classification, in a set of data. The data set is then worked through, and each item is represented by a vertical stroke on the corresponding line. For ease of counting, every fifth observation is represented by a diagonal line crossing the previous four to make a five-barred gate. Tally charts are often used with grouped observations.

Duration (completed minutes)	Tally
1	||
2	|
3	|||
4	𝍸 ||

One-to-one correspondence is the process of touching one object for each number that is counted aloud.

Sample Activities [student]:	Teacher Support:
• Collect objects such as seeds, stoppers, buttons, from nature walks, on the way to school, in the classroom and sort objects under different categories • Observe and discuss collections • Grouping – arranging objects according to size,	• Show and explain samples of what are to be collected and how to sort collectives. • Lead discussion with appropriate questions. • Supply adequate amount of manipulative

color, shapes and talk about	to so children will have a variety to work with.

Print Resources:	Technology Resources: www.answers.com/topic/tally-chart www.suite101.com/.../counting-and-onetoone-correspondence-a66847

Linkages [Math]: M1, M8, M9, M10	Linkages [content areas]: Creative Arts Language Arts Social Studies	Textbook Resources:

M19: Analyse, describe and summarize data using appropriate statistical methods and measures [M19.1]

Comments: Graphs and Pictographs are the principal means of representing data. There are various types of graphs and the learner will learn to interpret them for data which can be used to answer questions. They will understand that whatever type of graph used, picture graphs, column graphs, bar graphs or pictographs, information remain the same.

As children progress into higher classes, they should be able to begin to match data to graphs, make their own graphs or pictographs and interpret others.

Sample Lesson Objectives:

- Students will use a given picture graph to determine the total number of objects represented.

Sample Assessment:

- Use various types of graphs to extract information to answer questions orally or written
- Identify and name type of graph used
- Supply tables and/or graphs in order for children to compare and interpret in order to answer questions

Specific Content:

A picture [http://www.beaconlearningcenter.com/weblessons/kindsofgraphs/default.htm#page7] graph uses pictures or symbols to show data. One picture often stands for more than one vote so a key is necessary to understand the symbols.
Column Graph: **Another name for Bar Graph**

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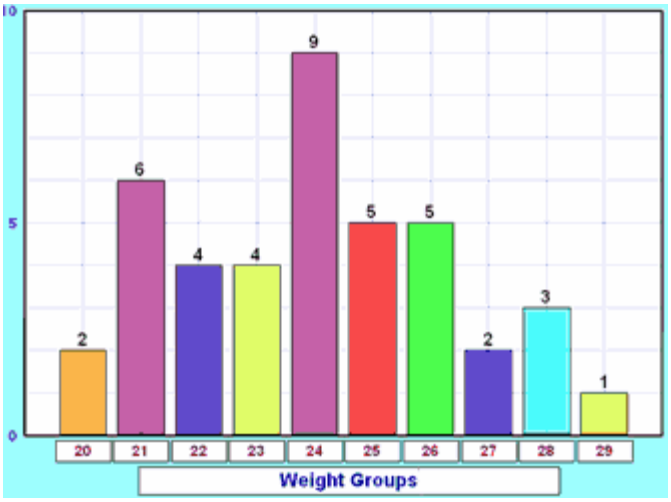


Sample Activities [student]:	Teacher Support:
• Oral discussion and comparing • Construct pictographs to depict various types of data of items in their environment • Use colored wood blocks and sticks to construct graphs	• Display various pictographs showing the same information and discuss them with the children, pointing out the fact that any picture can be used to tell the same thing • Display prepared graph so children can see and handle. This will give them a good idea what they are expected to do. • Sit with groups and guide them through the process of graph construction.

Print Resources: N/A	Technology Resources: www.mcwdn.org/Graphs/ColGraph.html

Linkages [Math]:	Linkages [content areas]:	Textbook Resources:
M10, M12	Social Studies	

M20: Investigate inferences and apply probability concepts in the solution of problems
[M20.1]

Comments: We use probability to work out how likely or unlikely an event is. The primary purpose of this Module is to introduce some of the simplest notions of probability through a wide variety of experiments in which the students take an active part. The focus here is on ideas and experiments rather than computational

skills.

In teaching this module, the main goal should be to introduce the students to probability by means of a wide variety of probability experiments. It is essential that sufficient material be available so that several pairs of students can work on the same experiment at the same time.

When we work with data, sometimes it is useful to think of all the possible results of an experiment so that we can work out which results are more likely than others.

Sample Lesson Objectives:

- Given a column graph, students will be able to look at the trend and say what will be the next item in sequence.
- Children will be able to complete a set of shapes by filling in the missing shapes.

Sample Assessment:

- Answer simple oral questions involving what would be next in a series of pictures
- (Frequency) Which colour comes next? Red-green-blue-red-green
- Complete the shape

Specific Content:

The "Trend" shown on a picture or column graph will depict whether the information given will remain constant, will increase or will decrease.

Sample Activities [student]:	Teacher Support:
• Connect the dots (forecast a trend) • Body limbs to form patterns e.g. all left arms on hips. • Game (e.g.) Tick Tack Toe	• Solicit desired answers by guided questioning. • Challenge children to identify body parts before modelling pattern on chart or chalkboard. • Provide home-made white board and markers to pair of children so they can play the game after explanation.

Print Resources:	Technology Resources:

Linkages [Math]:	Linkages [content areas]:	Textbook Resources:
M12	Social Studies, HFLE	

List of resources and manipulatives

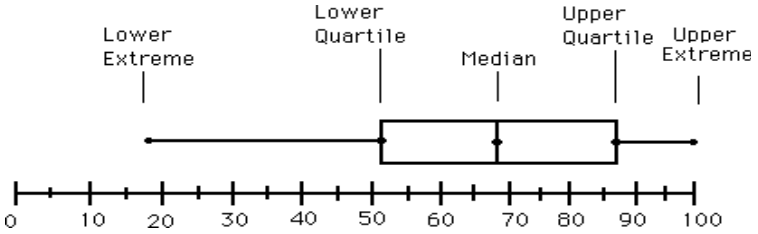
10-frameses
3-D models
5-frames
algebra tiles
aluminum foil
aluminum pans
ball large (beach ball)
balloons
base-10 blocks
baseball
basketball
bottle caps
bottles empty
bowls
brass paper fastener
bristol board
brown paper bags
bucket plastic
building blocks
cardboard(poster board)
clay / play doh
construction paper
cotton balls
cotton cloth
counters
crayons
cubes, snap-on
cuisenaire rods
cups paper
cups plastic
dice
dominoes
double sided tape
drinking straws
elastic rubber bands (diff sizes)
feather
food coloring (4 colors pack)
fraction tower / circles / strip
geoboards
glitter
hammer
knife
magnifying glass
marbles (different sizes)
markers
measuring cup
measuring spoon
measuring tapes
medicine dropper
mirrors (small)
nails (different lengths)
newspapers (old)
number balance
nylon string /fishing line
paper clips
paper plates, towels
pattern blocks
ping pong balls
piper cleaners
plastic wrap
playing cards
playing cards
popsicle sticks
rope
ruler (12”) (yrd stick) (meter rule)
scissors
soccer ball
scotch tape
shells
skewers
spinners
spoons
stones (small)
string / yarn
styrofoam / paper cups
Styrofoam balls
tangrams
tape
tennis balls
thread
timer (second)
toilet paper
toothpicks
toy person small
typing sheet
ziplock bags

Mathematics Glossary

absolute value - the absolute value of a number is the distance the number is from zero

benchmark number - a number that helps one understand the size or amount of a different number

box plot or box-and-whisker diagram or plot - graphic representation of a distribution by a rectangle, the ends of which mark the maximum and minimum values, and in which the median and first and third quartiles are marked by lines parallel to the ends; eg.



Cartesian coordinates – also referred as just coordinates refers to the (x, y) values from the Cartesian Coordinate System also referred to as just coordinate grid or rectangular grid

common decimals – decimals students would regularly work with; eg. 0.1, 0.25, 0.5

common fractions – fractions students would regularly work with; eg. $\frac{1}{2}, \frac{1}{4}, \frac{2}{5}$

common shapes – basic shapes students would regularly work with; eg. triangle, square, rectangle, circle

compose – used with numbers, shapes and figures refers to putting two or more parts together to make a whole

composite shapes – a shape made by putting together, without overlap, two or more basic shapes

congruent shapes – two shapes that are equal in size and shape; can also refer to line segments and angles

counting principles

- abstraction – all counting principles can be applied to any collection of objects, whether tangible or not
- cardinality - the number name allocated to the final object in a collection represents the number of items in that collection
- counting on - to count items by starting from a previously known amount
- one-to-one - assigning of one, and only one, distinct counting word to each of the items to be counted
- order irrelevance - the order in which items are counted is irrelevant
- stable order - means knowing that the list of words used must be in a repeatable order

customary units – for Belize, the Imperial or English system of measures

decompose – applied to numbers, shapes or figures, means to break down into parts

directed numbers – see Integers

disjoint sets – two sets that have no elements in common

equivalent form – applied to fractions, decimals or percents, two numbers that have the same value;

eg. $\frac{1}{2}=\frac{5}{10}=0.5=50\%$

expanded form - a way to write a number that shows the sum of values of each digit of a number

experimental probability - the ratio of the number of times an event occurs to the total number of trials or times the activity is performed

figures – 3-D objects; eg. cube, pyramid, sphere, cone, right prism, cylinder

formal algorithm – the widely accepted method or series of steps used in carrying out a computation

formal units – widely accepted system of measurement; Imperial system or metric system

informal measures – measurements obtained by using invented or everyday items as the base unit

integers – a number with no fractional parts including the counting numbers, zero and the negative of the counting numbers; {…, -3, -2, -1, 0, 1, 2, 3, ...}

irregular shape – a polygon that does not have all side equal and all angles equal

multiplication facts – the set of multiplication problems created by single digit numbers; 1×1 to 9×9

net - a two-dimensional pattern of a three-dimensional figure that can be folded to form the figure

number families – applied to addition / subtraction or multiplication / division, are three numbers that form a number sentence

number sentence - an equation or inequality expressed using numbers and common symbols; eg. 3 + 7 = 10

numeration principle – refers to a positional place value system

regular shape – a polygon that has all sides equal and all angles equal

relative position – a point defined with reference to another position; the distance from an identified reference point

right prism – a solid with two congruent parallel faces, called the base, where any cross section parallel to those faces is congruent to them and the lateral faces, that are rectangles, are perpendicular to either base

scatter plot - a graph of plotted points, on the Cartesian grid, that show the relationship between two

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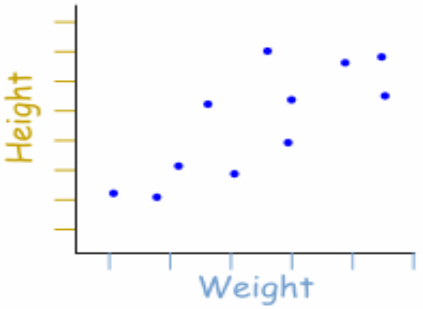
sets of data; eg.



scientific notation - a method of writing or displaying numbers in terms of a decimal number between 1 and 10 multiplied by a power of 10; the scientific notation of 10,492, for example, is 1.0492×10^4 ; also called standard form or exponential notation

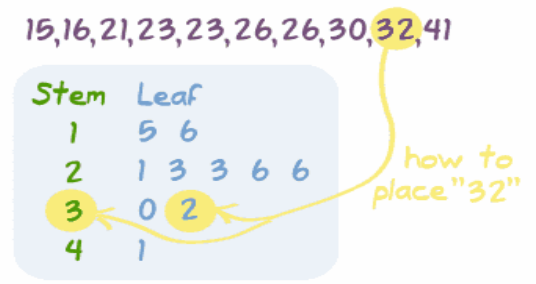
similarity – having the same shape but of different size

simple random sample – a subset of a population in which each member has an equal probability of being chosen; meant to be an unbiased representation of a group

standard form – see scientific notation

standard units – units commonly used for a particular quantity

stem and leaf plot - a plot or graphical representation of quantitative data where each data value is split into a "leaf" (usually the last digit) and a "stem" (the other digits); eg. "32" would be split into "3" (stem) and "2" (leaf)



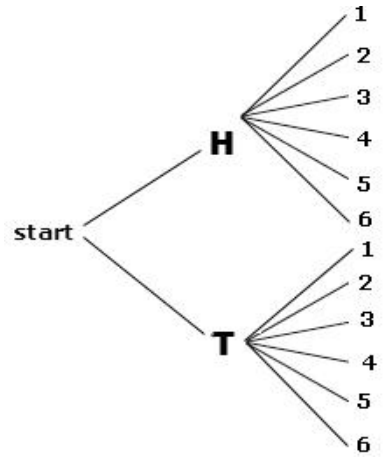
subitize – to perceive at a glance the number of the items presented based on their arrangement and without counting the maximum number

tessellations – a pattern made of identical shapes (could be more than one); the shapes must fit together without any gaps and the shapes should not overlap

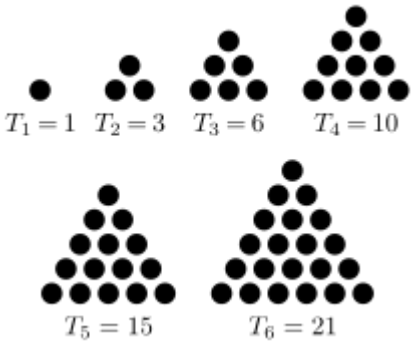
theoretical probability - the probability that a certain outcome will occur, as determined through reasoning or calculation

tree diagram – a graphical representation with branches that shows all the possible outcomes in probability; eg.

Infant I



triangular number - number of objects that can form an equilateral triangle, eg.



usual form – refers to writing numbers as a numeral using a base-10 numeration system; eg. 10,473

Useful Websites

- A+ Math Site [http://www.aplusmath.com/]
- All Math Web Site [http://www.allmath.com/]
- Center for Innovation in Mathematics Teaching [http://www.cimt.plymouth.ac.uk/]
- Free Online Math Games [http://www.math-play.com/index.html]
- Illuminations resources for teaching math [http://illuminations.nctm.org/]
- Interactive Math Site [http://www.coolmath.com/]
- Khan Academy [http://www.khanacademy.org/]
- Math explanations, problems and games [http://www.aaamath.com/]
- Math Playground [http://www.mathplayground.com/]
- Math Professional Development Wiki [http://mathprofessionaldevelopment.wikispaces.com/]
- MathSphere free printable resources [http://www.mathsphere.co.uk/resources/]
- National Library of Virtual Manipulatives [http://nlvm.usu.edu/en/nav/vlibrary.html]
- NCTM Calculation Nation [http://calculationnation.nctm.org/]
- NCTM Math site for families [http://www.figurethis.org/index.html]
- Number games online for kids [http://www.funbrain.com/numbers.html]
- Numeracy from BBC [http://www.bbc.co.uk/schools/websites/4_11/site/numeracy.shtml]
- Online Games, activities and teacher resources [http://www.gamequarium.org/]
- Teaching and learning resources [http://www.teachingandlearningresources.co.uk/]
- Teaching Ideas [http://www.teachingideas.co.uk/maths/contents.htm#]
- The Math Forum [http://mathforum.org/]
- The World of Math Online [http://www.math.com/]
- Visual Math Learning [http://www.visualmathlearning.com/]