BELIZE
Mathematics
Curriculum

Teacher's Guide

STANDARD 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 third year of primary education [Standard 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.

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- 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

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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.

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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

M1.10 Count up to 1000

- *start and end at any two given numbers*
- *count forward and backwards by 1's, 2's, 5's, 10's and 100's up to 1000, start and end from any two given numbers, use natural multiples*

M1.11 Place a set of consecutive and/or non-consecutive numbers in correct sequence

M1.12 Read, write and match numbers up to 1000 using numerals and words

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

M2.3 Express numbers in usual and expanded form
- *up to 3 digits*
- *use place value to name number that is 10, 100 more than or less than a given number*
- *recognize that every place value is 10x bigger than the place value to the right*

M2.4 Use place value to compare numbers
- use inequality symbols for less than and greater than

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

M3.3 Introduce situations in which students use integers to indicate size

- *real-life situations*
- *relate to measurement*

M4: Work fluently with fractions and decimals

M4.5 Use fractions to describe parts of a whole or of a set
- *match halves to make a whole*
- *use terms of numerator and denominator*
- introduce other fractions like $\frac{2}{3}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$ and tenths (fraction and decimal forms)

M5: Use numbers to show position or ranking

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M5.3 Use ordinal numbers to express rankings

- real-life situations

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

M6.5 Write and complete division and multiplication sentences

- *use to establish relationship between multiplication and division*
- *recognize division as repeated subtractions*

M6.6 Investigate factors and multiples

- *single digit factors*
- multiples not to exceed 100

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

M7.4 Add and subtract numbers

- *2-digit numerals with and without regrouping*
- *add three 2-digit numerals with and without regrouping in unit column*
- *add two 3-digit numerals with regrouping in unit column with sum also a 3-digit number*
- *subtract two 3-digit numerals with regrouping from tens to units*

M7.5 Multiply and divide numbers

- *product up to 2-digit numbers*
- *develop and use multiplication tables*
- divide 2-digit numbers by 2, 3, 4, 5, 10

M8: Make reasonable estimates and approximations

M8.3 Use rounding-off to the nearest tens to estimate solutions to computations

- answer will be close to, bigger than, smaller than

M9: Use mental math techniques creatively

M9.3 Use variety of techniques to do mental addition and subtraction

- *Eg. 43+25=60+8=68 (do not write underlined part)*
- *Eg. 55-27=(50-25)+(5-2)=25+3=28*
- *Eg. 17+49=(17+40)+9=57+9=66*
- *Eg. 245-178=(245-100)-78=(145-70)-8=75-8=67*

MP: Patterns and Relationships

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

M10.5 Recognize, describe, create and continue increasing and decreasing number patterns

- *up to 500*
- *include non-numerical patterns*

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

M11.3 Explore patterns for special number groups

- *Eg. triangular numbers, multiples, factors*
- *use words like "union" and "intersection" when comparing sets*
- *introduce concept of universal set and compliment of a set*

M12: Understand relations, functions and graphs

M12.3 Analyze graphs of linear relations (categories)

- Eg. weather trends

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

M13.1 Use symbol or letter to represent an unknown value

MM: Measurement

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

- *N/A*

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

M15.5 Estimate, measure, compare and record measurements

- *lengths in feet, yards and meters using various instruments*
- *weight in pounds and kilograms*

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- *capacity in quarts, gallons, liters*
- *time in intervals of 1 and 5 minutes, including digital clock, am and pm*
- *angles of 0, 90, 180, 360 degrees*
- *temperature using Celsius and Fahrenheit scales*

M15.6 Convert among units within the same system

- *length, weight, volume, time, temperature*

M15.7 Uses standard units to measure area of shapes in their environment

M15.8 Derives simple formulas for perimeter of common shapes

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

M16.7 Compose and decompose compound shapes

- *c*onstruct simple shapes with given dimensions *(lengths)*

M16.8 Visualize sketches and construct 3-D representations giving drawings of different views

M16.9 Construct simple figures from given nets

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

M17.7 Use the coordinate system to specify location

M17.8 Explore transformations

- slide, flip, turn

M17.9 Explore diagonal, intersecting, parallel and perpendicular lines

MD: Data Handling and Probability

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

M18.7 Organize and display data using pictographs and bar graphs with scale of many-to-one correspondence

M18.8 Collect and record data and generate appropriate graphs

- obtain data from interviews and measurements

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

M19.4 Read, interpret and answer questions based on graphs

M19.5 Describe characteristics like shape, peaks, distribution of data sets

- use dot plots

M19.6 Match data set to chart or graph and vice versa

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

M20.3 Discuss situations that involve chance: certain, impossible, equally likely events

M20.4 Use tables and graphs to investigate probability

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 use numbers to describe actual quantities of physical things in their everyday life. Through everyday tasks, students use a variety of strategies to carry out suggested actions, match groups or to make requested portions.

Students 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.

Many opportunities to strengthen counting and number operations concepts and skills 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.

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M1: Count and sequence numbers, reading and writing numbers in a variety of ways
[M1.10 – M1.12]

Comments: Care should be taken that students use the repeating pattern as they continue to count even larger numbers.

Sample Lesson Objectives:

- Students will count from a given start number to a given end number.
- Given a list of ten numbers, students will place them in order from smallest to largest.

Sample Assessment:

Other

- read and write numbers in a variety of situations

Specific Content: N/A

Sample Activities [student]:

- oral counting: individual or in groups

Teacher Support:

- use of flash cards

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.kindergarten-lessons.com/
http://www.teachingideas.co.uk/maths/

Linkages [Math]: All areas.

Linkages [content areas]: All areas.

Textbook Resources:

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M2: Use place value to understand our number system and other systems
[M2.3 – M2.4]

Comments: Strengthen understanding of place value and number system by applying different forms of expressing numbers and when comparing numbers.

Sample Lesson Objectives:

- Students will write a given 3-digit number in expanded form clearly indicating the number of hundreds, tens and ones.
- Given two numbers, students will use the appropriate inequality symbol to indicate relative relationship.

Sample Assessment:

Written

- use place value words to write numbers

Oral

- use place value to compare numbers

Specific Content:

In our number system, each number to the left of another has a relative value that is ten times greater. The tens place value is ten times the units place value, the hundreds place value is ten times greater than the tens place value, and so on.

Sample Activities [student]:

- Too many tens: use groups of tens to form 10 groups of tens
- Three other ways: represent numbers with hundreds, tens and ones and three other ways
- Digit change: use calculator to form new number by changing one digit by adding or subtracting a specific amount. Discuss results in relation to place value of digit(s) that change.
- Missing numbers: students replace missing values/cards in incomplete hundreds chart.

Teacher Support:

- Model proper thinking patterns using place value.
- Help students represent numbers in different ways that apply the concept of place value.

- More or less on the hundreds chart
- Compatible pairs: in a sheet with several numbers, students match two that form a given total (say 100, 500 or 1000).

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.kindergarten-lessons.com/

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

Linkages [Math]:

All areas.

Linkages [content areas]:

All areas.

Textbook Resources:

M3: Use and work with integers to show both size and direction
[M3.3]

Comments: By this level students should be counting-on rather than recounting when combining two groups and needing to count their combined total.

Sample Lesson Objectives:

- Student can identify a number, used in the local news, that indicates size.
- After inserting more items into a previously counted group, students will use “counting-on” to find the new combined total.

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Sample Assessment:

Problem Solving

- identify integers that indicate size in real-life situations: data collection and newspapers can be used

Specific Content:

Counting-on: start from a previously counted amount and continue counting newly added items to find a new combined total.

Re-counting: when finding a combined total, start counting from one although a part of the total had already been counted.

Sample Activities [student]:

- data collection
- research from local news sources
- relate to other areas like measurement

Teacher Support:

- help students identify the use of numbers in everyday situations

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.kindergarten-lessons.com/

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

Linkages [Math]:

All areas.

Linkages [content areas]:

All areas.

Textbook Resources:

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M4: Work fluently with fractions and decimals

[M4.5]

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Comments: Allow students enough time and activities to develop good fraction concepts. Being able to name and identify a numerator and a denominator does not necessarily indicate full understanding of fractions and the meaning of each part of the fraction.

Sample Lesson Objectives:

- Given a fraction, students will correctly identify the numerator and denominator. [M4.6]
- Students will divide a given strip of paper to show tenths and color a given fractional part. [M4.9]

Sample Assessment:

Problem Solving

- use fraction in real-life situations
- share amounts into given fractions

Written

- writes fraction with correct numerator and denominator

Oral

- reads fractions correctly

Other

- identifies and uses fractions outside of the math classroom

Specific Content:

- Numerator
- Denominator

Sample Activities [student]:

- Who is winning: play red light-green light and express distance traveled using fractions. Students determine who is winning.
- Class fractions: use groups of students to identify "what fraction of our friends are wearing tennis shoes, have brown hair etc".
- Correct shares: show examples and non-examples of fractional parts for students to identify the wholes that are correctly divided.
- Finding fair shares: use dot paper for students to find fractional parts using shapes that are different

Teacher Support:

- Use a variety of activities that support understanding of role of numerator and denominator in a fraction

Print Resources:

Van de Walle, J. A., Karp, K. S., Bay-Williams, J. M. (2010). Elementary and middle school

Technology Resources:

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

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.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]:	Linkages [content areas]:	Textbook Resources:
All areas.	All areas.	S1T1: 20-21 S1T2: 19-20, 23 S1T3: 27-28

M5: Use numbers to show position or ranking
[M5.3]

Comments: Can be covered in a variety of situations outside of the regular math class.

Sample Lesson Objectives:

- Use a given set of data (like local sports results) to place values in correct ranking order.

Sample Assessment:

Problem Solving

- real-life situations like sports

Specific Content: N/A

Sample Activities [student]:	Teacher Support:
• use local data like sports results for local teams, school competition etc.	• support use of real life data

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]:	Linkages [content areas]:	Textbook Resources:
All areas.	All areas.	S1T1: 2-3 S1T3: 3

M6: Understand meanings of number operations and how they relate to one another [M6.5 – M6.6]
Comments: Although students are counting, reading and writing larger numbers, it is best that they develop the concept of number operations with smaller numbers they can physically manipulate. The use of language assists in the development of the concept and relations between number operations.
Sample Lesson Objectives: • List single digit factors of a given number. • Show, with the use of numbers, the relation between addition and subtraction.
Sample Assessment: Problem Solving • identify use of addition, subtraction, multiplication and division in real-life situations • apply concept of factors and multiples to real-life situations

Standard I

Other

- use relationships among operations to simplify computations

Specific Content:

Addition and subtraction are inverses of each other.

Sample Activities [student]:

- Use computation sentences to establish relationships among the operations
- Write complete multiplication and division sentences for word stories and vice versa

Teacher Support:

- Use stories to complete number sentences
- Allow choice of own manipulative to assist counting

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.kindergarten-lessons.com/

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

Linkages [Math]: All areas.

Linkages [content areas]: All areas.

Textbook Resources:

M7: Compute fluently with basic operations using integers, fractions and decimals
[M7.4 – M7.5]

Comments: Problem based learning provides for better understanding of concepts. However, students are

expected to be able to carry out basic computations quickly and accurately.

Sample Lesson Objectives:

- Add three 2-digit numbers.
- Orally and without counting, call out the two times table from x1 to x12.

Sample Assessment:

Problem Solving

- use operations to solve real-life problems

Written

- use algorithm to carry out computations
- writes and explains process for obtaining each step in procedure

Other

- identifies appropriate operation for given situation

Specific Content:

Procedures for individual operations with mathematically sound explanation for why each step.

Sample Activities [student]:

- use student-invented strategies to develop common algorithm
- link computation to solving real-life problems
- ensure a variety of problems to include regrouping at various levels

Teacher Support:

- include explanation of procedures and not only correctness of answer

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.kindergarten-lessons.com/ http://www.teachingideas.co.uk/maths/
Linkages [Math]: All areas.	Linkages [content areas]: All areas.	Textbook Resources: S1T1: 12-18, 40 S1T2: 10-18, 21-22 S1T3: 7, 12-26

M8: Make reasonable estimates and approximations **[M8.3]**		
Comments: Use estimates and approximations consistently, even outside the math lesson.		
Sample Lesson Objectives: • Before doing a computation, student will estimate answer in relation to a given base number (ex. Will the answer be close to, smaller than or larger than 100?). • Express answer to a given problem as a value rounded-off to the nearest ten.		
Sample Assessment: Problem Solving • applied to real-life situations		
Specific Content: N/A		
Sample Activities [student]: • estimate answers before all computations and discuss in relation to results obtained • use real-life problems in which it makes sense to round-off answer to nearest ten • range game: use calculator for students to estimate solutions to given operation within a specified range		Teacher Support: • integrate skill in other content areas
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]:	Linkages [content areas]:	Textbook Resources:
All areas.	All areas.	S1T1: 26

M9: Use mental math techniques creatively **[M9.3]**	
Comments: Devote a few minutes every day for mental math. This may not necessarily have to be part of the formal math lesson. Allow for student invented strategies that are logically and mathematically sound.	
Sample Lesson Objectives: • Combine different numbers to carry out calculations rather than by using the common algorithm. • Use valid student-invented strategies to mentally carry out sums and differences.	
Sample Assessment: Other • use mental math techniques to simplify calculations	
Specific Content: N/A	
Sample Activities [student]:	Teacher Support:

Standard I

• mental activities using flash cards • who computes faster: discover how to improve speed	• support use of student invented strategies

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.kindergarten-lessons.com/ http://www.teachingideas.co.uk/maths/

Linkages [Math]: All areas.	Linkages [content areas]: All areas.	

Standard I

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, place value, multiplication, functions, and many other mathematical topics and 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."

Standard I

M10: Understand and work with patterns (repeating, increasing, decreasing, and numerical)
[M10.5]

Comments: In infant 2, numeric patterns were introduced, where simple increasing patterns are explored. 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. At this level, children will continue exploring number patterns to include those with factors and multiples. Perfect numbers are also introduced as a special type of numeric pattern. When working with growing patterns, have student try to determine how each step in the pattern differs from the proceeding step. Each new step can be built by adding on to the previous step.

When exploring numbers and patterns the opportunity is used to introduce set concepts for comparing sorted sets and pattern sets.

Sorting by two attributes - 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. Sorting is the physical act of grouping objects according to shared characteristics. Students need frequent practice with sorting and not necessarily only in their early years. Sorting can be done with everyday materials, or materials created specific for that purpose. Children need to identify the attributes by which the sorting is being done.

Sample Lesson Objectives:

- Given the set of numbers (>500), students will be able create/reproduce a number pattern given the core set.
- Given a set of shapes found in the classroom, students will be able to define two attributes for sorting them and produce a sorted table accordingly.

Sample Assessment:

Understanding Patterns is NOT finite

- As students work on the number patterns and other related activities try not to think about the activities in terms of mastery. It is not reasonable at any grade level to say "students have mastered number patterns." Instead, look for how individual students are able to reason with the patterns as they explore. Many times when students are struggling with patterns it might be more from other related math concepts. E.g. Having difficulty with skip counts beyond 20, adding or subtracting, or with place value concepts. For students whose number concepts are still developing, encourage them to use a hundreds chart or number line to keep track of patterns.

What to look for

- When working with number patters check to see if students can build successive steps of an increasing pattern. Then see if the student can explain in words how it is growing. Remember that when the next step can be built on the previous core, it will be easier for students to see the increment or change and then extend.

Standard I

***Note: Pattern skills and sorting skills at the Standard 1 level are continuously developing; teacher should use both observation and checking for mastery using rubrics for tracking the developing skills.

Common errors:

- Differentiating a repeating from an increasing pattern
- Misinterpretation of the pattern rule
- Believing that starting with a core string there will only be one rule that can be applied to expand it
- Difficulty in describing patterns that changes by compound rules . E.g. a counting sequence interspersed with 5s.

Specific Content:

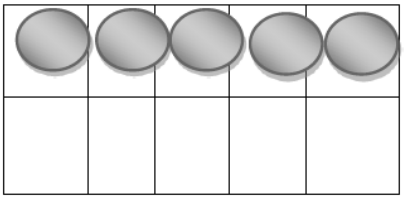
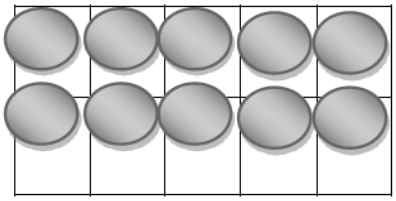
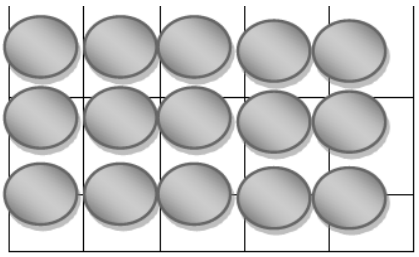
Numeric Patterns

Our number system is a pattern and it allows for generating and describing many other different patterns. Here is a short list of patterns, some easy enough for very young children.

1, 2, 1, 2, 1, 2,	. a simple alternating scheme
1, 2, 2, 3, 3, 3,	. each digit repeats according to its value
5, 1, 5, 2, 5, 3,	. the counting sequence interspersed with 5s
2, 4, 6, 8, 10,	. even numbers-skip counting by 2
1, 2, 4, 5, 7, 8, 10, ...	. two counts, then skip one
1, 2, 4, 8, 16,	. double the previous number
2,5, 11,23,	. double the previous number and add 1
1,2,4, 7, 11, 16,	. successively increase the skip count
1, 4, 9, 16, 25,	. squares: 1^2, 2^2, 3^2, ..
0, 1, 5, 14, 30,	. add the next square number
2, 2, 4, 6, 10, 16,	. add the preceding two numbers

Students are encouraged to look for patterns on the hundreds chart, primarily because the structure found in the chart can aid in learning to count and eventually develop ten structured thinking

Use of the 10-frame allows for students to work with pattern by coloring or placing a counter to demonstrate numeric patterns. E.g 5, 10, 15, ...

|

Patterns with Operations

Interesting and useful patterns can be found in the operations on numbers (+,-,x,/). That is, students are asked to explore a situation using an operation and see what they can find out about that situation. What is alike? What is different? How do things change? Again here, the 100 chart can be used to operate with a set of the numbers

Sorting

Any object has many attributes (sometimes confused with characteristics). An attribute is a way to compare objects (colour) whilst a characteristic describes how the attribute is reflected in a particular object (red, blue etc.). Sorting occurs by selecting all objects having the characteristic of the attribute described in the sorting rule. All other objects would be in the “NOT” group. To facilitate sorting, separate containers are provided to physically separate. For two or more attributes tables and Venn diagrams are good tools to use.

Set Notation

A set, informally, is a collection of things. The "things" in the set are called the "elements", and are listed inside curly braces. Union os two sets are all the elements in the sets combined and “intersection” are those elements common to the two sets. The universal set is the set of all the elements within that greater set. The compliment of a set is those elements not belonging to that set, but elements of the universal set.

Sample Activities [student]:	Teacher Support:
• Start and Jump on the Hundreds Chart: Questions that students can explore from the 100 chart: How do patterns change when only the start number changes? How are the diagonal patterns alike and different for jumps of 4, 6, and 8? Which skip counts make diagonal patterns and which make column patterns? Pick any number between 1 and 100. How can you tell if your pattern will land on that number? • Fractured Chart Pieces of the 100 chart: Prepare worksheets each a collection of squares represents a portion of the hundreds chart. Where only one (some children might need more) number in a piece is provided and the remaining numbers can be filled in.	• Every skip count number pattern will make a visual pattern on the hundreds chart. Even if students are unable to articulate the interesting patterns that they observe, coloring the different patterns one pattern per chart is interesting and pleasing in itself. • Some children may benefit by having two or even three numbers filled in. • Algebra is about looking for pattern and regularity in all of mathematics, it is appropriate to encourage

Standard I

• Diagonal Sums - Have students select any four numbers in the hundreds chart that form a square. Add the two numbers on each. Have students explore other diagonal sums on the chart. Expand their search to diagonals of any rectangle. Challenge students who are able to see if they can figure out why this is so. • One Up and One Down: Multiplication - Show students that when you begin with 7 x 7 = 49 and then raise one factor and lower the other, each by one, the product is one less than the original: 8 x 6 = 48. Their task is to explore this for other numbers multiplied by themselves (squares). • Set notation –Have them represent number patterns using Venn diagrams.	algebraic thinking embedded in numeration activities and in all aspects of the mathematics curriculum. An extended activity is to have children exploring differences on the hundreds chart. The diagonal differences will always differ by some amount. How much they differ can be predicted by knowing only the top two numbers in the rectangle, regardless of the choice of the two bottom numbers. • Encourage students to explore similar situations and see what patterns they can discover. • Encourage the use of set vocabulary in their describing pattern sets.

Print Resources: Books: Anno's Mysterious Multiplying Jar (Anno, 1983) Sea Squares (Hulme, 1999) 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: Software: http://illuminations.nctm.org/LessonDetail.aspx?ID=U103 Lesson online: http://www.linkslearning.org/Kids/1_Math/2_Illustrated_Lessons/5_Patterns/index.html Worksheets: http://letsplaymath.net/2008/09/22/things-to-do-hundred-chart/ http://www2.edc.org/mathpartners/pdfs/3-5%20Patterns%20and%20Functions.pdf

Linkages [Math]: Number, counting, shapes, place value, multiplication, functions	Linkages [content areas]:	Textbook Resources:

M11: Explore number patterns to discover properties of special number groups
[M11.3]

Standard I

Comments: Students learn number groups like odd and even by exploring their properties through the use of patterns.		
Sample Lesson Objectives: • Using colored patterns on a 1-100 number chart, students will compare odd and even numbers.		
Sample Assessment: • student can use number charts to show and describe number patterns		
Specific Content:		
Sample Activities [student]: • color number charts to describe patterns • reproduce number patterns described on a number chart • investigate numerical relationships for given number patterns		Teacher Support: • allow time for students to explore • use probing and prompting questions for students to investigate a variety of number patterns
Print Resources:	Technology Resources:	
Linkages [Math]:	Linkages [content areas]:	Textbook Resources:

M12: Understand relations, functions and graphs **[M12.3]**
Comments: When students begin to extend a growing pattern, they should also make a table showing how many items are needed to make each step of the pattern. One row of the table or chart is always the number of steps, and the other is for recording how many objects are in that step. The description that tells how a pattern changes from step to step is known as a recursive relationship. If a rule or relationship can be discovered that connects the number of objects in a step to the number of the step, any table entry can be determined without building or calculating all of the intermediate entries. A rule that determines the number of elements in a step from the step number is an example of a functional relationship. Note that at this level students need not know how to determine functional relationships, but arriving at the table for the first set of steps can be done. From the table, graphing the data from the growing pattern adds another way of seeing these data. It is not the procedure for making graphs that is important but seeing the result and understanding what it represents. It is important that if students are to draw graphs, limit the relationship to a linear one. Variables and equations are powerful tools in representing mathematical ideas and the primary grades are not too early to begin using them. However, many misconceptions often develop in these early years that unfortunately stay with students into later years. It is important for teachers to have a complete and accurate

understanding of variables and equations so that we can help students construct appropriate ideas. It is useful for them to think of variables as numbers that can be operated on and manipulated like other numbers. The box that they see in an equation is not an answer space but a yet-to-be-determined number. They write a number in the box to show what the box represents.

Sample Lesson Objectives:

- Given a mathematical statement with one variable, students will be able to insert correctly what the variable represents.
- Using a growing linear pattern, students will be able to plot a graph showing the relationship.

Sample Assessment:

Problem Solving

- Check for correctness of the tables that students generate from patterns or from a mathematical statement.

Graphing a Linear pattern/relationship with 2 variable

- Check for accuracy of points plotted on the graph.

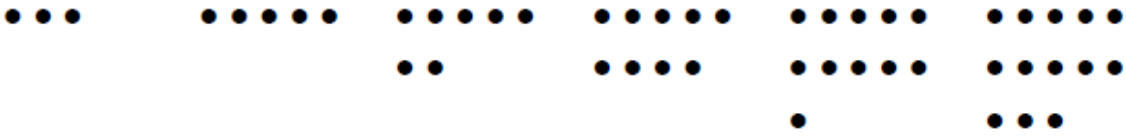
Discussion

- Have student generate a table from a graph and describe the relationship
- When the points on the graph form an approximate straight line, discuss with your students how a straight line that comes close to the dots may be a good approximation of the real situation. The line can be used to predict the outcomes of trials not yet conducted.

***Note: Make sure that at this level the focus is not the graphing exercise, but more making connections and finding relationships between the two variables. There will be many more years for the student to explore functional relationships.

Specific Content:

Odd number pattern:

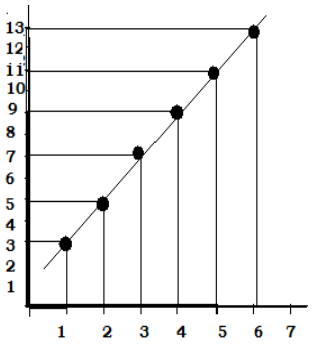


Rule: increases by 2

Standard I

Functional relationship: each step # is increased by one more than the previous, starting with 2

Steps	1	2	3	4	5	6
Relationship	+2	+3	+4	+5	+6	+7
# of dots	3	5	7	9	11	13



Charts or Tables - The charts used to keep track of the in-out numbers for the function machines are themselves a form of representation of functions. A chart can be in either vertical or horizontal form.

Open statements have a empty box to represent the variable.

A variable is a symbol that can stand for anyone of a set of numbers or other objects. At least three different uses of variables have been identified. As the use of the variable changes, the meaning of the variable changes accordingly.

- As a specific unknown
- As a pattern generalizer
- As quantities that vary in joint variation

Real-World Functions - Functions in the real world can be found in abundance. As just one example, if bananas cost .25 each, then there is a functional relationship between the number of bananas purchased and the total cost.

Sample Activities [student]:	Teacher Support:
• Number Tricks (writing statement with variables) - Have students do the following sequence of operations: Write down any number. Add to it the number that comes after it. Add 9. Divide by 2.Subtract the number you started with. Now you can magically read their minds. Everyone ends up with 5! The task is to see if students can discover how the trick works. Suggest that instead of using a specific number to begin with, they draw a shape like a box or triangle or a letter of the alphabet. The letter or shape represents a number, but even they do not need to know what the number is.	• Others: Pick a number between 1 and 9, multiply by 5, add 3, multiply by 2, add another number between 1 and 9, subtract 6. What do you see? Pick a number, multiply by 6, add 12, take half of the result, subtract 6, divide by 3. What happens? These tricks can profitably be explored with models by using a box or a block for the unknown and simple counters to represent numbers.
• Guess My Rule - Draw a simple in-out "machine" on the board, The machine "operator" knows the secret that is stored in the machine. For example, a rule might be double the input number and add 1. Students try to guess the rule	• "Guess My Rule" can be played with the whole class, or students can play in small groups, perhaps as a station activity. Provide a collection of rules

by putting numbers into the machine and observing what comes out. A list of in-out pairs are kept on the board. Students who think they have guessed the rule raise their hands. As more numbers are put into the machine, those students who think they know the rule tell what comes out. Continue until most have guessed the rule. • Predict How Many - Have students begin to extend a growing pattern you provide. They should also make a table showing how many items are needed to make each step of the pattern. The task is to predict the number of items in the tenth or fifteenth step of the pattern. Predictions should also be accompanied by an explanation. • Plotting growing patterns- Have students use squared paper to draw a growing pattern of squares made up of dots along the sides. 1st square- 4 dots, 2nd square – 8 dots, 3 rd - 12 dots etc. Have them complete the following table: 1 2 3 4 5 6 4 8 12 Have them recognize a straight line forming by drawing the extending diagonal.	on cards. The function rules have been described with words. It is important for students to begin to use variables for the rules so that they can be expressed with equations. • You will need to set up the "T" table structure for them to fill in. Important to keep the table near the extended pattern. The table should be labelled "Steps" and "# of objects" • When working with growing patterns, have student try to determine how each step in the pattern differs from the proceeding step. Each new step can be built by adding on to the previous step.

Print Resources: 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: Software: Use spreadsheet to generate line graphs from data patterns Interactive lesson online: http://maths.nayland.school.nz/Year_9/y9_Algebra/Patterns_Graphs_Home.htm Worksheets: http://maths.nayland.school.nz/OHP_wordocs/Year_9/Y9_Algebra_Patterns_Rules/patterns/Y9_algebra_patterns_web_files/frame.htm http://www2.edc.org/mathpartners/pdfs/3-5%20Patterns%20and%20Functions.pdf http://www.abcteach.com/directory/basics/math/patterns/

Linkages [Math]: Number, counting, shapes	Linkages [content areas]:	Textbook Resources:

Standard I

<table>
<tr><td colspan="3">M13: Apply equations and inequalities in one variable to solve problems
[M13.1]</td></tr>
<tr><td colspan="3">Comments: Express number sentences using symbols.</td></tr>
<tr><td colspan="3">Sample Lesson Objectives:
• Given a real life situation, students will express the given conditions using a symbolic number statement.</td></tr>
<tr><td colspan="3">Sample Assessment:
• student can identify situations as being equal, less than or greater than.</td></tr>
<tr><td colspan="3">Specific Content:
• correct symbols to express inequalities</td></tr>
<tr><td colspan="2">Sample Activities [student]:
• express real life situation into number sentences before translating them into symbolic number statements</td><td>Teacher Support:
• support students in translating spoken language to symbolic form</td></tr>
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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.

Standard I

M14; Understand concept of measurement and measureable attributes: length, mass / weight, capacity, time, angle, temperature
• *N/A*

M15: Apply measurement systems, techniques, tools and formulas moving fluently between related units **[M15.5 – M15.8]**
Comments: In Standard One, phase one measurement practices continues. Students will continue developing the concepts of identifying the attributes and distinguishing each attribute from the other. The lessons for the development of measurement concepts will be done through concrete experiences and practices. Standard One student must also develop the ability to use measuring tools and estimate with these tools. Furthermore, students will now apply measure systems techniques, tools and formulas as they estimate and compare using whole numbers, and fractions of standard units of measure.
Sample Lesson Objectives: • Estimate, measure and order objects and containers using specific standard units to measure heights and distances. • Compare, record heights and distances using specific units of measurements. • Convert units of measures for heights and distances to other specific units given.
Sample Assessment: Observe students during whole-class or group activities when they are ordering objects according to size. Note the following: How students explain their reasons for ordering objects in sequence (size, length, weight, and so on)? How students select measurement tools for a given task? 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?) 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 beans?) Provide oral and written questions related to measurement. They must cover quantity, weight, cost, length, distance, time and height. E.g. How many 20cm pieces of string would you need to make a 80cm piece of

string? (Quantity)

Use creativity to construct and design a simple standard measuring device, for example, a litre

Construct a simple usable balance scale. Write about how it works.

Use a bathroom scale to weigh each other and record weights on a graph.

Use standard and non-standard unit of measurement to find the perimeter of shapes and objects.

Solve word problems on measurement covering quantity, weight, cost, length, distance, time and height. For example,

- I walk 800m in the morning and I walk twice as far in the afternoon. How far did I walk?
- The Maya mountain is 3400m. I climb halfway and twist my ankle. How far did I get

Specific Content:

Distance: Distance is the measure of separation in space and can be measured using standard and non-standard units.

Weight: Weight is how heavy something is and can be determined using standard and non-standard units.

Time: Time is the point at which something happens: moment, hour, day, or year as indicated by a clock or calendar.

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

Perimeter: the total distance around any shape.

Circumference: the distance around a circle.

Sample Activities [student]:	Teacher Support:
Have students rearrange objects in order by weight. Discuss how one might determine how much more one object weighed than another: How might numbers be used to describe this?	Provide many opportunities for students to order a variety of objects (e.g., baseball, book, orange, pencil) according to size.
Discuss which measurement tools (rulers, thermometers, measuring cups, scales) can be used in a particular situation?	Play some music for a set time, such as one minute. Have students listen to the music and then estimate how many times they can complete a given activity (e.g., tie and untie their shoes, hop on two feet) in that period of time. Record their estimates and ask them to test their predictions as the music is played a second time.
Collect devices used to measure capacity in metric , ½ litre, litre, millilitre	
Discuss what each unit of measure is needed to measure millilitre (small amounts) litre (large amounts such as milk)	
Students design class calendars with important events.	
Have students refer to printed time table and schedules on a	

daily basis. Shade face to face clocks with different colours to show five minutes intervals. During the morning (am) and afternoon (pm), Have students tell the time at the points of five minutes intervals from the classroom clock comparing the two types of clocks. Students name and describe devices used for measuring distances Work in pairs to measure body heights in linear or metric units Arrange heights in ascending and descending order Measure distances around shape and objects using non-standard units Collect standard measure devices e.g. teaspoon, cups, pints, grams, kilograms, quarts, litres, ½ litre, and gallons. Find distance around circular points of the body (head, arm, and legs) using non-standard units, and then use a ruler to measure length of string. Students can then create their own stories based on personal experiences Collect standard units of measurement for measuring capacity. Different shapes and sizes (bottles, cups, cans, jars, etc. explore process of filling containers marked to specific levels. Do hands-on practices to find out how many of each unit makes the other, for example, how many teaspoons will make a gram.	Hang a digital clock beside the analogue clock on the classroom wall. Stop at significant moments in the day and read the time, Draw pictures of clock faces to show important times of the day at home and at school. Display these pictures under the class clocks so children can match these times as they occur. Read a story that develops the concept of sequencing events in time. Discuss the pattern with the children.

Print Resources: Mathematics in Action – Macmillan, McGraw, Hill; Scott Foreman – Bk1; Mathematics – K-7 Integrated;	Technology Resources: http://www.mathworksheetwizard.com/grade3/grade3measurements.html http://www.lessonplanspage.com/Math23.htm http://www.hbschool.com/glossary/math2/index3.html

Linkages [Math]: Sequencing patterns, spatial relation, statistics and	Linkages [content areas]: Identify a sequence of events - Arrange ideas in sequence to convey	Textbook Resources:

probability, number relations	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. Recognize an issue or a problem. Examine information related to the problem/issue. Use creative arts/images/music.	

Standard I

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.

Standard I

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

[M16.7 – M16.9]

Comments: This content standard focuses on the children's ability to observe and describe basic two and three dimensional geometric shapes and call them by name. They will explore how to combine shapes to make new compound shapes. Children enjoy making things with their own hands, therefore the making of models of three-dimensional shapes will be appreciated immensely.

Sample Lesson Objectives:

- Children will put rectangular, triangular and square shapes together to construct compound shapes.
- Given the dimensions of squares and rectangles, children will be able to draw the figures and name them.

Sample Assessment:

- Observe and listen as children:
  - recognize, name, build, draw, compare, and sort two- and three-dimensional shapes,
  - describe attributes and parts of two- and three-dimensional shapes,
  - investigate and predict the results of putting together and taking apart two- and three-dimensional shapes
- Match shapes that are congruent

Specific Content:

Congruent Shapes: Two figures are congruent if they have the same shape and size. If one shape can become another using Turns, Flips and/or Slides, then the two shapes are congruent:

Line of symmetry

If you can reflect (or flip) a figure over a line and the figure appears unchanged, then the figure has reflection symmetry or line symmetry. The line that you reflect over is called the line of symmetry. A line of symmetry divides a figure into two mirror-image halves.

Squares and Rectangles

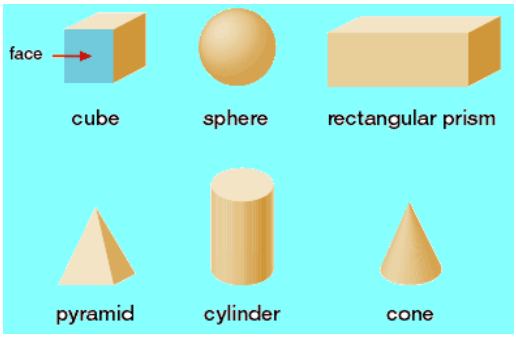
In a square, all 4 sides are of equal measure. In a rectangle that is *not* a square; the two pairs of opposite sides will be of unequal length. Note that a square is a special case of a rectangle, so care should be given in considering the difference.

Standard I

3-D Shapes

It means three-dimensional shapes. It is one part of geometry shapes. 3-d shape means that a geometry shape has three dimensions length, width and depth. 3-d shapes are cube, rectangular prism, sphere, cone, cylinder, pyramid and polyhedrons. It is also known as solid shapes. In 3-d shapes, we have two main properties: surface area and volume.

Some 3d shapes figure is shown in below diagram.



Sample Activities [student]:	Teacher Support:
• Name 2-D and 3-D shapes • Identify faces, edges, and corners • Examine shapes – write names, number of faces and shape of faces • Folding shapes to identify lines of symmetry. Using the skill learned, the students will identify shapes which contain line of symmetry	• Build understanding that figures that have the same size and shape are congruent • Explain that a figure is symmetrical if the shape is folded in two parts and one part covers the other part exactly. The fold line is called a line or axis of symmetry

Print Resources:	Technology Resources:
Caribbean Primary Mathematics Leve3	www.tutorvista.com/topic/3d-shapes-definition www.mathsisfun.com/geometry/congruent.html

Linkages [Math]:	Linkages [content areas]:	Textbook Resources:
M10	Creative Arts	

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

Standard I

[M17.7 – M17.9]

Comments: This content standard deals with children's ability to use the coordinate system to identify specific location by naming the ordered pair of coordinates.

The terms slide; flip and turn will be explored in relationship with transformations of shapes and solids.

Sample Lesson Objectives:

- Children will be able to point to and identify representations of 3 lines, and 3 angles in their classroom.
- Given a numbered pattern using points, children draw line segments connecting the numbered points in the correct sequential order.

Sample Assessment:

- 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.
- 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:

Coordinate Systems

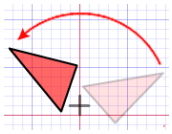
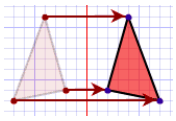
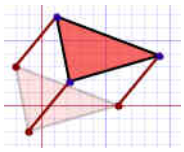
A coordinate system allows one to place points on a plane in a precise way. In other words, each point in the plane is given a precise manner of specifying their location. The most useful coordinate system is called rectangular coordinates system (also known as Cartesian coordinate system).

In rectangular coordinates, two lines are used, called axes. One horizontal and one vertical. (The two axes are perpendicular to each other.) Their intersection is called the origin. The horizontal axis is called the x-axis, and the vertical one called the y-axis. Each axis is a number line. A number line is a line marked with numbers in regular intervals as in a ruler. On the x-axis, points to the right are positive, and to the left are negative. For the y-axis, points above the origin is positive, below are negative

Transformations

The three main Transformations are:

Standard I

Rotation		**Turn!**
Reflection		**Flip!**
Translation		**Slide!**

After any of those transformations (turn, flip or slide), the shape still has **the same size**, **area**, **angles** and **line lengths.**

Sample Activities [student]:	Teacher Support:
• Have students plot and connect sets of coordinates that create shapes and images • Have students find and identify examples of points, lines, parallel lines, and intersecting segments using photographs from magazines.	• Showing pictures where some of the items are upside-down and some are right-side-up, have students identify the proper orientation of each item

Print Resources:	Technology Resources:
Caribbean Primary Mathematics Leve3	xahlee.org/...dir/CoordinateSystem.../coordinateSystem.html www.mathsisfun.com/geometry/transformations.html

Linkages [Math]:	Linkages [content areas]:	Teacher Resources:
M10	Creative Arts	

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 analysing data from a variety of sources such as reference books, newspapers, magazines, computer databases, graphs, charts, radio and TV.

We live in an uncertain world and probability offers a means of measuring uncertainty. It provides the foundation for much statistical work. 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 [M18.7 – M18.8]

Comments: Students will be guided through the skill of collecting data, organizing it, creating graphs to show the data and answer questions based on graphs. Students will begin to decide which type of graph will be adequate for the type of information gathered, whether bar graph or pictograph. As with other cases, topics should be of interest to students. They must first formulate the question of what information they want to get before they attempt to start collecting data.

Sample Lesson Objectives:

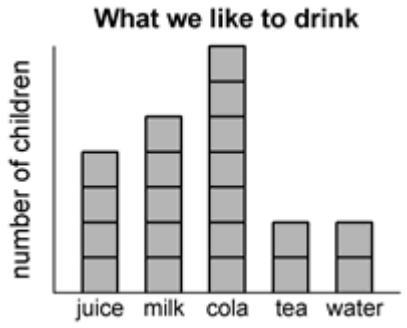
- Children will use a pictograph to display information collected on the colors of cars seen passing by their home over a one hour period.
- Children will collect information on the month when classmates celebrate their birthday and present it on a bar graph.

Sample Assessment:

- Assess children in their observation and findings as they demonstrate their knowledge of graph by plotting a bar graph using the data from the tally chart.
- Show graphing skills by making a bar chart to show the amount of male and female members in the family.
- Using a table or data gathered on the time children take from home to school, a class discussion will evaluate reasons for the difference and similarities in time.

Specific Content:

Many-to-one correspondence: A function between two sets where each element in one set (domain) corresponds to exactly one element in the other set (range); however, an element in the range may be mapped onto by more than one element in the domain. For example, each student, in a class of twenty, is asked what liquid they like to drink. The graph shows that each liquid is preferred by different number of children.



Sample Activities [student]:	Teacher Support:
• Collection of data through observation and recording	• Guide students in various activities.

(e.g.) color of cars, types of cars. Use measurement to gather data, (e.g.) weight, height, length of arm and record on bar graph. This activity can be done individually. • Form groups and have them collect data on different topics of interest,(e.g.) birth months, height of classmates, daily maximum temperature for a week, etc.. Cooperative groups work together to produce graphs which show the information relevant to their collection of data.	Direct children how to make data collecting forms, (i.e.) what data they want to collect • Supervise groups as they work. Conduct one-to-one interviews eliciting from them why they do what they are doing. Make corrections of wrong concepts aloud so as to benefit other groups which may have encounter the same misconceptions.

Print Resources:	Technology Resources: www.teach-nology.com › ... › Lesson Plans › Math http://www.allentownsd.org/EETT/secondgrade.htm

Linkages [Math]: M1-9, M10-13, M14-\15	Linkages [content areas]: All other subject areas.	Textbook Resources:

M19: Analyse, describe and summarize data using appropriate statistical methods and measures [M19.4 – M19.6]
Comments: This content standard deals with the concepts of studying graphs to find out how information is distributed. Children will be introduced to dotplots. They will spend more time interpreting information, not creating dotplots. Dotplots display features such as shape, peak and distribution of data set so it is important that children understand what it is. Students will be guided in how to extract relevant information shown on the graphs. Some introduction can be made to creating graphs so that data can be matched to them.
Sample Lesson Objectives: • Given a bar graph on the population of six classes in the school, children will be able to answer six questions correctly based on the graph. • Given a set of data, children will be able to match it to a graph and explain what information is seen on the graph.
Sample Assessment: • Answer oral word problems involving reading of graphs

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- Answer written word problems involving reading of graphs. Teacher will check answers for correctness.
- Connect dots on graphs to make line segment graphs Teacher will check answers for correctness.
- Use data collected to make graphs. Check for accuracy of data.

Specific Content:

Dot plot

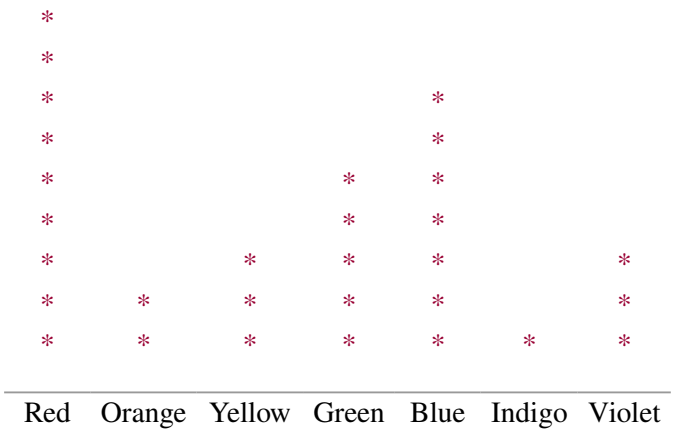
A dotplot is a type of graphic display used to compare frequency counts within categories or groups.

A dotplot is made up of dots plotted on a graph. Here is how to interpret a dotplot.

a) Each dot can represent a single observation from a set of data, or a specified number of observations from a set of data.

b) The dots are stacked in a column over a category, so that the height of the column represents the relative or absolute frequency of observations in the category.

Here is an example to show what a dot plot looks like and how to interpret it. Suppose 30 first graders are asked to pick their favorite color. Their choices can be summarized in a dot plot, as shown below.



Each dot represents one student, and the number of dots in a column represents the number of first graders who selected the color associated with that column. For example, Red was the most popular color (selected by 9 students), followed by Blue (selected by 7 students). Selected by only 1 student, Indigo was the least popular color.

Peaks are the highest frequency shown on the graph

Shape refers to how the data is distributed on either side of the highest peak on the graph. If the data is distributed evenly on both side the shape of the graph is referred to as bell-shaped.

Sample Activities [student]:	Teacher Support:
Group sharing – interpreting graphs to arrive at answers Collect data , make graphs, and make questions about graphs –	Guide children through the steps in plotting points on a graph

Standard I

group work	Collect and display different types of charts or graphs and hold discussion on the data found in each

Print Resources:	Technology Resources: mathforum.org/teachers/elem/3-5/lessons-individual.html www.teach-nology.com › ... › Lesson Plans › Math

Linkages [Math]:	Linkages [content areas]:	Textbook Resources:

M20: Investigate inferences and apply probability concepts in the solution of problems
[M20.3 – M20.4]

Comments: Students will conduct experiments after they have made predictions on the outcomes of certain actions. They will state what the probability of certain actions will be after they have explored and understand the concepts of certain, impossible, and equally likely.

Sample Lesson Objectives:

- Students will be able to:
  - describe probability as likely, unlikely, impossible, or certain
  - use a fraction to express probability
- Students will be able to create a double bar graph to show data collected from a coin-
  - tossing experiment.

Sample Assessment:

- Have a checklist for each student reflecting their understanding of the language (do their statements fit into the right column)-Take notes to keep track of students' abilities, difficulties and progress.
- Listen for a reasonable prediction as well as an explanation of why or why not their prediction was a reasonable one

Specific Content:

A certain event is an event which must happen as a result of the experiment without fail.

An impossible event is called an empty subset of a space of elementary events. That is, an impossible event

cannot happen as a result of the experiment.

If several events can happen as a result of an experiment, and each of them isn't more possible than others according to objective conditions, then such events are called equally likely events.

Sample Activities [student]:	Teacher Support:
• Game of Roll to Empty the bowl: - working in groups taking turn throwing die to record how many toss it takes to empty a bowl of colored items. • Use bag of colored seeds, buttons, disks or items of choice and have children use the data to create a bar graph. Ask students to determine the ratio of each color. With this information, the students can predict the probability of selecting one color at random from a large bag. How many of each color would be likely to be found in a handful of 10, of 20? Try it. Discuss the results.	• Supply enough material so that each group will have equal amount of manipulative. Help children along with appropriate questions. • By prompting children with pre-determined questions, they can be guided into self-discovery of how probability functions work.

Print Resources:	Technology Resources:
	www.lessonplanspage.com/Math23.htm www.lessonplanspage.com/Math45.htm

Linkages [Math]:	Linkages [content areas]:	Textbook Resources:
Patterns, relations, functions, graphs	Social Studies – weather and climate	

List of resources and manipulatives

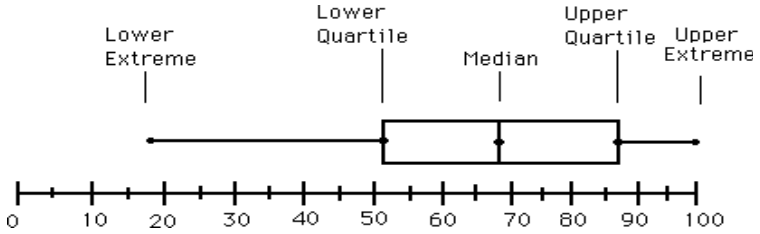
10-frameses
3-D models
5-frames
algebra tiles
aluminum foil
aluminum pans
ball large (beach ball)
balloons
base-10 blocks
baseball
basketball
bottle caps
bottles empty
bowls
brass paper fastener
bristol board
brown paper bags
bucket plastic
building blocks
cardboard(poster board)
clay / play doh
construction 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

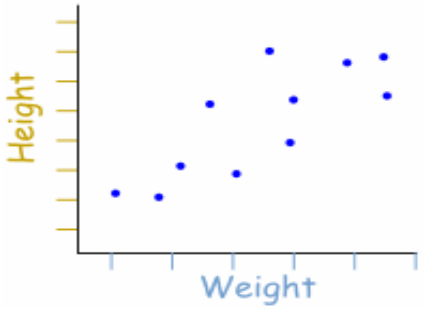
relative position – a point defined with reference to another position; the distance from an identified reference point

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

Standard I

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

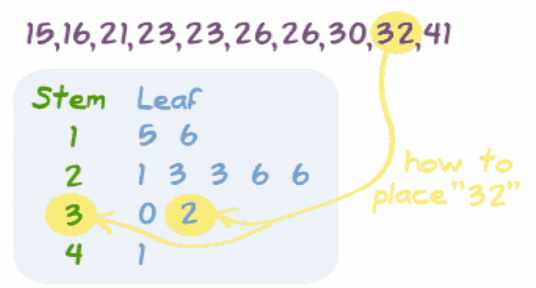
similarity – having the same shape but of different size

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)



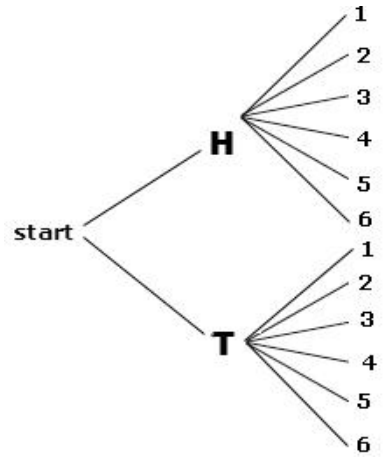
subitize – to perceive at a glance the number of the items presented based on their arrangement and without counting the maximum number

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

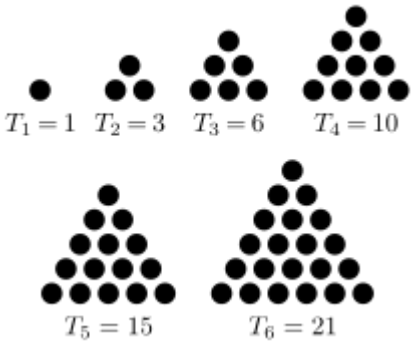
theoretical probability - the probability that a certain outcome will occur, as determined through reasoning or calculation

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

Standard 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/]