BELIZE
Mathematics
Curriculum

Teacher's Guide

STANDARD IV

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 sixth year of primary education [Standard IV] 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

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

M1.16 Read and write numbers up to 1,000,000

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

M2.9 Use place value to recognize difference between two numbers
- *Eg. 8,537 is 400 less than 8,937 because the hundreds place values differ by 4*

M2.10 Use place value to recognize the advantage of a positional number system over a character based system
- *historical comparison of relevant number systems*

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

M3.6 Use number line to sequence directed numbers

- *integers in ascending and descending order*

M3.7 Use objects / pictorials to represent and solve problems involving small negative integers

M4: Work fluently with fractions and decimals

M4.11 Compare and sequence mixed numbers, decimals and percents
- *fractions with like and unlike denominators*
- *decimals up to thousandths*

M4.12 Write equivalent forms of given fraction
- *introduce use of LCM / LCD*
- *write mixed numbers as improper fractions and vice versa*
- *reduce fractions to simplest form*

M4.13 Use percent to represent common everyday situations

M5: Use numbers to show position or ranking

- *N/A*

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

M6.9 Express repeated division as roots

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

M7.10 Add and subtract

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- *develop formal algorithms for working with integers, especially negative values*
- *add and subtract fractions with unlike denominators*
- *add and subtract decimals (positive and negative)*
- *expand powers with same base to add or subtract*

M7.11 Multiply and divide integers, fractions and decimals

M7.12 Use ratio to compare quantities

M8: Make reasonable estimates and approximations

M8.6 Round-off decimals to the nearest tenth

M9: Use mental math techniques creatively

M9.6 Use variety of techniques for adding a series of small numbers

- *re-arrange*
- *use benchmark sums (Eg. numbers that sum to multiples of 10)*
- *use rounding-off (Eg. 547+98=(547+100)-2=647-2=645)*

MP: Patterns and Relationships

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

M10.8 Use pattern rules to predict subsequent element(s) in a series or sequence of numbers

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

M11.8 Explore divisibility rules for division by single digits

M11.9 Investigate patterns with fractions

- *especially sevenths, ninths, elevenths*

M11.10 Investigate growing, shrinking and repeating patterns involving translations

M12: Understand relations, functions and graphs

M12.7 Use graphs and charts to show variation or change over time

- *include Venn diagrams for 2 sets*

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

M13.5 Solve equations in one variable

- *understand role of variable in equation*
- *whole number coefficient and solution*

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

M15.19 Measure lengths, weights, volumes, time, temperature with metric and customary units and convert among them

- *select appropriate unit and instrument*

M15.20 Solve problems involving the relationship between a 12-hour clock and a 24-hour clock

M15.21 Calculate surface area of common regular objects using metric and customary units

- *identifying the appropriate units for the object in question*

M15.22 Derive simple formulas for determining volume 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

M16.18 Draw faces of 3-dimensional figures

M16.19 Sketch spheres and cones

M16.20 Construct pyramids

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

M17.14 Use rectangular grid and ordered pairs to plot simple shapes and investigate vertical and horizontal distance and area

M17.15 Investigate tessellations of geometrical shapes

MD: Data Handling and Probability

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

M18.13 Represent data using a variety of graphical forms

M18.14 Understand precision, accuracy and error in measurement

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

M19.11 Interpret frequency tables, charts, and graphs

M19.12 Compute mean, median, mode, range for a set of data

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

M20.9 Use lists, tree diagrams, and tables to determine the possible combinations from two disjoint sets when choosing one item from each set

M20.10 Probability of complementary events

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 and number operations and the relationships amongst them.

Development of an understanding of patterns and relationships is critical for long-term continuity without formal exposure with every individual number and its related operations. Concentration on procedural fluency is of vital importance with in depth understanding of the methods and procedures utilized. Mental mathematics is a critical factor that enhances procedural fluency and develops independence from calculating devices.

Number operations become an integral part of problem solving in all other areas of mathematics and finds links in other subject areas. Without concentrating too strongly on obtaining the correct final answer, teachers must remain vigilant that students understand the what, how and why of each stage in the computation procedure and method utilized.

Standard IV

M1: Count and sequence numbers, reading and writing numbers in a variety of ways
[M1.16]

Comments: Concentrate on repeating pattern rather than memorization of individual numbers and number names.

Sample Lesson Objectives:

Given a number in words, student will be able to write the number using numerals.

For a given number, student will be able to orally name the number that is 1000 less than the given number.

Sample Assessment:

Other; Uses numbers and their names in a variety of situations

Specific Content: N/A

Sample Activities [student]:

- integrate with solution of problems in other areas

Teacher Support:

- integrated

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.

M2: Use place value to understand our number system and other systems
[M2.9 – 2.10]

Comments: Place value is a critical aspect that students need to understand well.

Sample Lesson Objectives:

Given two numbers in only one digit is different, students will use place value to determine the difference.

Sample Assessment:

Problem Solving: Uses place value to determine difference between two numbers.

Specific Content: N/A

Sample Activities [student]:

- flash cards
- partner share

Teacher Support:

- integrate

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.

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

Linkages [Math]:

All areas.

Linkages [content areas]:

All areas.

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M3: Use and work with integers to show both size and direction
[M3.6 – 3.7]

Comments: Apply to everyday situations like temperature and altitude.

Sample Lesson Objectives:

Given two negative numbers, students will compare them with or without the use of a number line.

Correctly interprets a specified real-life situation involving negative numbers.

Sample Assessment:

Problem Solving

uses negative and positive numbers appropriately in specified real-life situations

Other

compares positive and negative numbers

Specific Content: N/A

Sample Activities [student]:

- explore real-life situations involving negative numbers

Teacher Support:

- integrate

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.

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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.

M4: Work fluently with fractions and decimals
[M4.11 – 4.13]

Comments: Students use fractions on a daily basis but not always correctly or accurately. It is easy for students to memorize procedures involving fraction without proper understanding of why or when such procedures are applicable.

Sample Lesson Objectives:

Express a given mixed number as an improper fraction.

Given a set of fractions, decimals and percentages, students will be able to identify those that are equivalent.

Sample Assessment:

Problem Solving

use percentages to express real-life situations

Other

determines the LCM for set of 2 or 3 denominators

recognizes equivalent forms for fractions, decimals and percentages

moves fluently between improper and mixed numbers

understands place value for decimals up to the thousandths place

Specific Content: Procedure with explanation for finding LCM

Sample Activities [student]:	Teacher Support:
• LCM flash cards • models for fractions • real-life worded problems and applications	• realistic percent problems

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.).	http://www.proteacher.com/100000.shtml http://www.apples4theteacher.com/math.html

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://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.

M5: Use numbers to show position or ranking
N/A

M6: Understand meanings of number operations and how they relate to one another [M6.9]
Comments: Relations are discovered and better understood when used to represent the same situation in a variety of ways.
Sample Lesson Objectives: Uses multiplication table to determine common roots. Recognizes the associative property of addition.
Sample Assessment: Problem Solving recognizes properties in non-math situations

Other

understands roots: symbol, knows common roots (reverse-multiplication)

Specific Content:

- Associative
- Commutative
- Distributive

Sample Activities [student]:

- investigations (relate to pattern search for binary operations)
- use of calculator

Teacher Support:

- Relate properties to real life 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.

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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.

M7: Compute fluently with basic operations using integers, fractions and decimals
[M7.10 – M7.12]

Comments: Conceptual understanding is important, however, students are expected to be able to compute quickly and accurately using conventional methods.

Sample Lesson Objectives:

Adds a positive and a negative decimal using the formal algorithm.

Uses a formal algorithm to divide an integer by a fraction.

Sample Assessment:

Problem Solving: uses formal algorithm to perform calculations

Other: recognizes situations involving ratios

Specific Content: Procedure with explanations.

Sample Activities [student]:

- develop formal algorithms
- calculator decimal and fraction counting
- exact sums and differences
- where does the decimal go (multiplication)
- where does the decimal go (division)

Teacher Support:

Allow students to develop formal procedures

Allow for discussion of procedures and not only correct 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.

Standard IV

M8: Make reasonable estimates and approximations
[M8.6]

Comments: Apply consistently and use examples outside the math lesson.

Sample Lesson Objectives:

Uses rounding-off to approximate solution before computing.

Sample Assessment:

Other: Uses rounding-off as a strategy to estimate answer before doing computation.

Specific Content: N/A

Sample Activities [student]:

Close 'nice' numbers: move from closest whole number to closest tenths

Teacher Support:

Integrate

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.

M9: Use mental math techniques creatively
[M9.6]

Comments: Do for a few minutes daily. Does not have to take place within the formal math lesson.

Sample Lesson Objectives:

Uses invented strategies to simplify computations.

Sample Assessment:

Other: Applies invented strategies when carrying out simple computations.

Specific Content: N/A

Sample Activities [student]:

- who computes faster
- explore intuitive methods for calculations
- uses invented strategies for mental computations

Teacher Support:

Support 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 IV

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.

M10: Understand and work with patterns (repeating, increasing, decreasing, and numerical)
[M10.8]

Comments: Allow students to explore a variety of numerical patterns.

Sample Lesson Objectives:

Given five numbers that form a pattern, students will be able to predict the sixth element of the pattern.

Sample Assessment:

students describe the pattern shown and can reproduce it

Specific Content:

Sample Activities [student]:	Teacher Support:
• students work in pairs – one student develops a pattern which his partner tries to describe	• allow time for students to explore a variety of number patterns

Print Resources:	Technology Resources:
Linkages [Math]:	Linkages [content areas]:

M11: Explore number patterns to discover properties of special number groups
[M11.8 – M11.10]

Comments: through exploration students can discover the properties that define different number groups

Sample Lesson Objectives:

Students will use patterns to define one property that defines a given number group.

Sample Assessment:

Student can use concrete items to model a number group pattern.

Standard IV

Specific Content:	
Sample Activities [student]: • groups compete to determin rule that governs a pattern developed by another group	Teacher Support: • allow the use of concrete items for students to visualize patterns in a variety of number groups
Print Resources:	Technology Resources:
Linkages [Math]:	Linkages [content areas]:

M12: Understand relations, functions and graphs **[M12.7]**	
Comments: Visual representations of real-life data sets allows students to better understand distributions and their properties and relationships.	
Sample Lesson Objectives: Students use visual presentation of data set to describe common properties of a data distribution.	
Sample Assessment: Use project based assessment.	
Specific Content:	
Sample Activities [student]: • allow students to design data collection and presentation projects	Teacher Support: • support students in selecting interesting project problems
Print Resources:	Technology Resources:
Linkages [Math]:	Linkages [content areas]:

M13: Apply equations and inequalities in one variable to solve problems
[M13.5]

Comments: Use real-life situations that students can model visually and then using equations and/or inequalities.

Sample Lesson Objectives:

Student selects appropriate inequality symbol to model a given real-life sutuation.

Sample Assessment:

Student can model visually and symbolically a given real-life situation.

Specific Content:

Sample Activities [student]:	Teacher Support:
• explore variety of models, visual and mathematical, for a variety of real-life situations • use number balance to model solution(s)	• model visual and symbolic representations

Print Resources:	Technology Resources:

Linkages [Math]:	Linkages [content areas]:

Measurement

Introduction

Measurements involve a comparison of an attribute of an item or situation with a unit that has the same attributes. 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.

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 **[M15.19 – M15.22]**
Comments: In Stage Three, students will learn to calculate and develop a more sophisticated understanding of measurement. The students will learn about quadrilaterals and how to calculate their actual measurement. They now begin to develop and use formulas to find measures. This level also provides opportunities for activity-oriented investigations of real-life problems. It also shows students practical applications of mathematics in daily life as well as in other school subjects, such as science and social studies.
Sample Lesson Objectives: Develop, verify, and use rules or expressions to determine the area of polygon. Develop, verify, and use rules or expressions to determine the area of irregular objects/shapes. Estimate, measure, and then calculate units to find capacity.
Sample Assessment: Observe students to determine to what extent they are measuring volume and mass appropriately and accurately. Group presentations to see if students understand their measurements. Can they identify relationships between surface area and volume or area and perimeter? Examine students' products for accurate measurement and the use of correct units Ask students to assess their activities. You may wish to provide a series of questions to guide their self-assessment: e.g. How accurate are my measures? Why are the milliliters and grams not identical? Why are some measures larger or smaller? Apply formula to solve relevant problems involving distance, time and speed

Standard IV

Convert units from larger to smaller and vice versa

Draw diagrams/polygons and apply appropriate procedure to solve for perimeter of each

Pupils work in groups to solve similar problems then work individually and apply formula to solve other problems involving distance (time & average speed)

Compute problems relating to metric measure of length, using the four operations

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, working in groups, use centimeter cubes, beakers, and scales. Have them drop a specific number of centimeter cubes into a beaker filled with a set amount of water. For example they should measure the rise in milliliters of water. Then, using a scale, they should compare the weight of the displaced water in grams with the volume of the water displaced. Have them build a table to show several measures and discuss relationships. As a project, students could integrate mathematics with science by first estimating and then measuring the volume and mass of rocks or other objects.	Guide students to use beakers and other instruments appropriately and safely.
Have students do group projects that involve finding the surface area of cardboard boxes.	Provide questions to guide students as they explore e.g. Have them explore how the surface area of the boxes relates to the volume inside. What shape provides the smallest surface area for any given volume?
Have students work in groups and use a length of string to create angles of various sizes. Discuss the types of angles.	Guide students to classify groups of angles. Ask: Is this more than 90° or less? How many degrees might this be?
Have students cut out pictures from magazines then trace and extend lines that make angles within the pictures. Then have students measure and label examples of each type of angle using these pictures.	Integrate computer artwork with mathematics by challenging students to draw their own pictures. Then have them label and measure the angles within their drawings.
	Discuss computing customary measures using the four operations and times

Standard IV

Have children create models of the 24 hour clock and use them to show various times in a.m. and p.m. Children make time-line to show events, e.g. constitutional development (link with Social studies).	when converting units are useful. Present data/chart and discuss to have pupils recall or identify operation to use when converting, metric units from one to another.

Print Resources: Mathematics Today; School Mathematics; Progress in Mathematics; Caribbean Primary	Technology Resources: http://www.mathworksheetwizard.com/grade4/grade4measurements.html

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

Spatial Relationships and Shapes

Introduction

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

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

[M16.18 – M16.20]

Comments: Students will continue to build on prior knowledge acquired in previous classes when they were introduced to 2-D figures. This standard takes them one step more where they will learn about and work with 3-D figures. When teaching this standard, a measure of accuracy in construction is expected as children produce figures, however, keep figures as least complicated as possible.

Sample Lesson Objectives:

Given four 3- dimensional figures children will be able to identify, draw the faces and make nets of each correctly.

Children will be able to draw the net of a rectangular pyramid, cut out the pattern and construct the pyramid neatly.

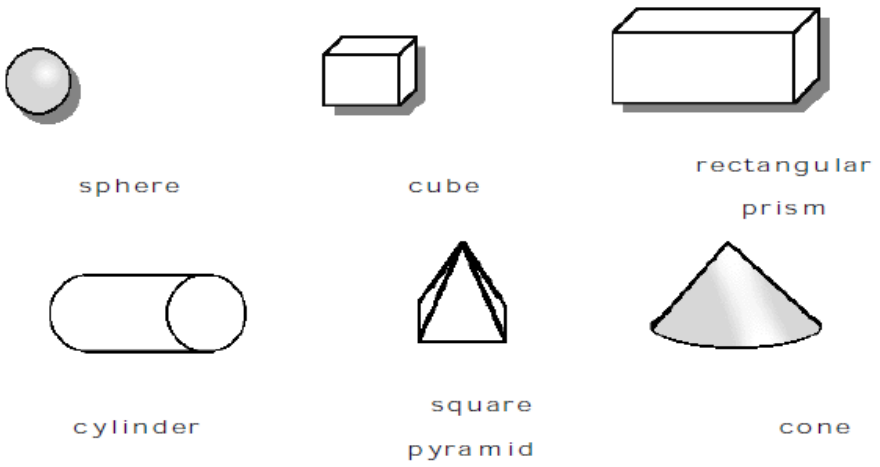
Sample Assessment:

Most practical activities require pair work or group work. The students will often have to share their answers with the rest of the class. This provides an opportunity for assessment of problem solving skills and presentation skills. If necessary, re-teach concepts.

Group work gives an opportunity to assess each student's social and communication skills. More confident students will often dominate the group; make sure that questions are aimed at the shyer members of the group in order to assess their contributions too.

Specific Content:

3-dimensional figures



Sample Activities [student]:	Teacher Support:
Examine and classify figures that are polehedrons (e.g.) triangular prism, pentagonal prism, triangular pyramid, rectangular pyramid, hexagonal pyramid Make and display models of 3-d figures using nets.	Review 3-dimensional figures. Have children draw and write properties for 3-d figures and share information in groups. The 3-d's are cube, sphere, rectangular prism, cone, cylinder, pyramid.

	Provide templates of nets for 3-D figures so children can copy and construct their own.
Print Resources: Teaching Student-Centered Mathematics Grades 5-8 Addison-Wesley Mathematics Bk. 6	Technology Resources: www.beaconlearningcenter.com/weblessons/.../default.htm en.wikipedia.org/wiki/Pyramid_(geometry)
Linkages [Math]: M15.69	Linkages [content areas]: Creative Arts Language Arts

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

[M17.14 – M17.15]

Comments: Using known geometric properties such as symmetry and congruence, standard four math students solve real-world and mathematical problems. They observe, explain, and make conjectures about geometric properties and relationships among angles, triangles, squares, rectangles, and parallelograms. On a coordinate plane standard four math students learn to identify x and y axes, identifying coordinates of a given point in the first quadrant. They plot specific points in the first quadrant of the Cartesian coordinate system.

Tessellations are created when the same shape polygons are repeated and cover an area with no gaps. Students learn about tessellations in order to recognize the beauty of the symmetry created, to measure angles and to develop observation skills for lines, shapes and colors. Tessellations have been used for centuries by architects and artists. Buildings, mosaics, woodwork, quilts, floors and gardens all utilize tessellations in designs.

Sample Lesson Objectives:

Given a set of ordered pair, children will plot on grid paper the points, connect them and name the shape formed.

Given a geometric region, the students will determine if the region will tessellate the plane.

Sample Assessment:

As teachers move around the classroom, collect and record data based on observation of student behaviour and performance that relates to student learning.

Use an objective checklist to quickly assess the strengths and weaknesses of each student in relation

to the intended learning objectives.

Specific Content:

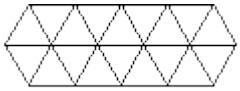
Tessellation

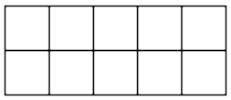
A tessellation is created when a shape is repeated over and over again covering a plane without any gaps or overlaps.

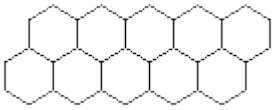
Another word for a tessellation is a **tiling**.

A regular polygon has 3 or 4 or 5 or more sides and angles, all equal. A **regular tessellation** means a tessellation made up of congruent regular polygons. [Remember: *Regular* means that the sides and angles of the polygon are all equivalent (i.e., the polygon is both equiangular and equilateral). *Congruent* means that the polygons that you put together are all the same size and shape.]

Only three regular polygons tessellate in the Euclidean plane: triangles, squares or hexagons. We can't show the entire plane, but imagine that these are pieces taken from planes that have been tiled. Here are examples of

a tessellation of triangles 

a tessellation of squares 

a tessellation of hexagons 

When you look at these three samples you can easily notice that the squares are lined up with each other while the triangles and hexagons are not. Also, if you look at 6 triangles at a time, they form a hexagon, so the tiling of triangles and the tiling of hexagons are similar and they cannot be formed by directly lining shapes up under each other - a slide (or a glide!) is involved.

Sample Activities [student]:

Games:

a) Pair children and instruct them to draw simple geometric shapes on grid paper. They take turn in calling out the ordered pair while the partner plots them on his/her paper. The partner tries to guess the name of the shape being called. The child that guesses the most out of a set of five wins the round. This activity can be repeated as often as needed.

Group Competition

b) Students first explore making patterns with a variety of shapes. They next engage in making tile designs using only one shape by rotating that shape around a point. Create a contest for creating the best design for a floor using these geometric shapes. Students are placed into groups and will use only shapes

with equal sides (triangle, square, and hexagon) to create a pattern tile design. Each group makes a tile design using combinations of these regular polygons. Students view the designs and vote for the design they like best.	
Print Resources: Teaching Student-Centered Mathematics Grades 5-8 Addison-Wesley Mathematics Bk. 6	Technology Resources: mathforum.org/sum95/suzanne/whattess.html http://www.ehow.com/geometric-shapes/
Linkages [Math]: M11.12	Linkages [content areas]: 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.

Standard IV

M18: Collect, organize and display relevant data to answer questions related to real-life situations [M18.13 – M18.14]

Comments: Learners, at this level, will formulate questions, design studies, and collect data select, create, and use appropriate graphical representations of data, including histograms, and bar graphs. Students will experiment and discover what final results will be in regards to precision, accuracy, and error in measurement of data collection.

Sample Lesson Objectives:

Given a set of data, children will be able to display the information on a bar graph.

Children will be able to define accuracy and precision, and differentiate between the two terms.

Sample Assessment:

Students display, analyze, compare and interpret different data sets, including data sets that are not the same size:

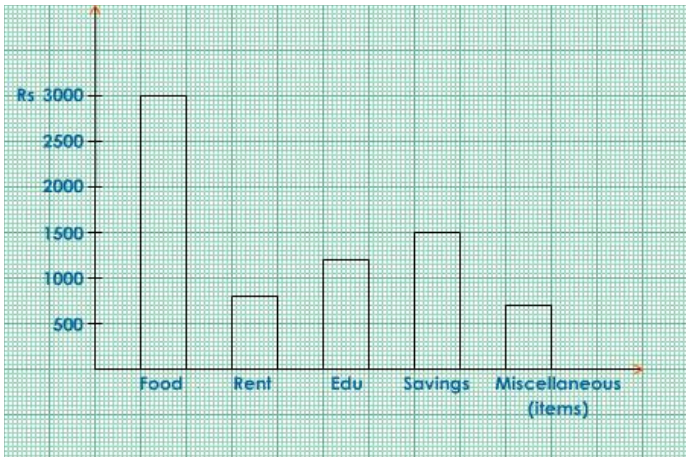
organizing and displaying single-variable data in appropriate graphs and representations (e.g., histogram, line graphs, circle graphs) and explaining which types of graphs are appropriate for different kinds of data sets

Demonstrate an understanding of precision, accuracy, and error in measurement by performing several task as teacher observe and listen to explanations and reasons given for responses.

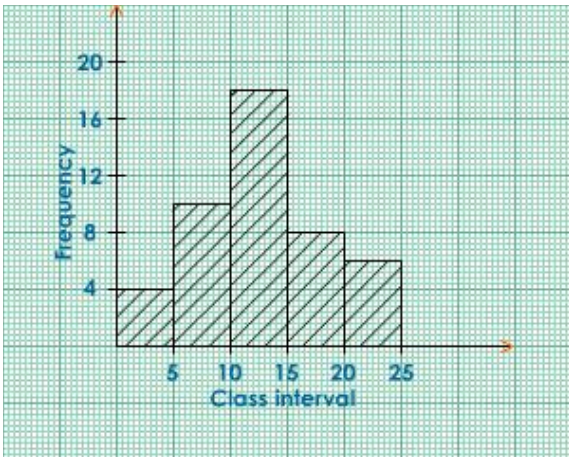
Specific Content:

Teach children that data can be represented by the use of any of the graphical forms they have learnt. These include bar graph, histograms, line graph, etc. Children should be made aware that the graph should used depends on what information is to be displayed.

Histogram



Bar Graph



Standard IV

Comparison of Histogram and Bar Graph

Histogram	Bar graph
1. It consists of rectangles touching each other.	1. It consists of rectangles, normally separated from each other with equal space.
2. The frequency is represented by the area of each rectangle.	2. The frequency is represented by height. The width has no significance.
3. It is two dimensional (width and height are considered)	3. It is one dimensional (only height is considered)
	4. It is used a visual aid to represent data.

Precision
A characteristic of data. It means that the data values should be just large enough to support the application or process.

Accuracy
A characteristic of data. It describes the closeness or agreement of a data value to the truth or an expected range of values.

Error - A term used to describe a deviation from the expected, especially if data integrity is jeopardized

Sample Activities [student]:	Teacher Support:
• Have children explore various ways to display data. Challenge children to form working groups and display the same data using different graphs. Have the children explain their choices. • Children can perform several tasks to explore precision and accuracy.	Brainstorm the terms precision, accuracy, error. Discuss findings and how they can affect the outcome of a problem. Teacher will clarify information so that students understand fully the concepts.

Print Resources:	Technology Resources:
Teaching Student-Centered Mathematics Grades 5–8	http://www.tutorvista.com/math/double-line-graph www.shodor.org › Interactivate

Linkages [Math]:	Linkages [content areas]:

M19: Analyse, describe and summarize data using appropriate statistical methods and measures [M19.11 – M19.12]

Comments: This standard deals with the revision of data collected. Students will use charts and graphs to help them analyze the data and patterns they will need to perform calculations on their raw data in order to get the results from which they will generate a conclusion. They will make summaries through the calculations for the "middle" or "average" of their data; these are called measures of central tendency,

Sample Lesson Objectives:

Given a pie chart displaying the salary earned by a person, children will be able to state correctly what portion is used for different expenses.

Children will be able to compute correctly the mean and median of a given a set of numbers.

Sample Assessment:

a) Observe and listen to children as they collect and process data which will be used to create various types of graphs. Children should display a clear understanding of the terms used, and define accurately the types of charts and graphs used to display data. Interpretation of tables, charts, and graphs will be displayed by how accurate their responses to set questions are.

b) Steps used to compute mean, medium, mode, and range should be clear and logical. Children must know the correct definition for each term.

Specific Content:

The **frequency** of a particular data value is the number of times the data value occurs

Mark	Tally	Frequency
4	II	2
5	II	2
6	IIII	4
7	𝍸	5
8	IIII	4
9	II	2
10	I	1

Frequency Table

We use the following steps to construct a frequency table:

Step 1: Construct a table with three columns. Then in the first column, write down all of the data values in ascending order of magnitude.

Step 2: To complete the second column, go through the list of data values and place one tally mark at the appropriate place in the second column for every data value. When the fifth tally is reached for a mark, draw a horizontal line through the first four tally marks as shown for 7 in the above frequency table. We continue this process until all data values in the list are tallied.

Step 3: Count the number of tally marks for each data value and write it in the third column.

Bar charts and **Pie charts** are two means of showing the information. The height of the columns in a bar chart and the portion of a pie chart show how much is being discussed.

Graph: A picture used to illustrate a given collection of data. It may be in the form of a bar graph, a circle graph, a line-segment graph, or a pictograph.

The Mean
To find the mean, you need to add up all the data, and then divide this total by the number of values in the data.

The Median
To find the median, you need to put the values in order, and then find the middle value. If there are two values in the middle then you find the mean of these two values.

The Mode
The mode is the value which appears the most often in the data. It is possible to have more than one mode if there is more than one value which appears the most.

The Range
To find the range, you first need to find the lowest and highest values in the data. The range is found by subtracting the lowest value from the highest value.

Sample Activities [student]:	Teacher Support:
Children can conduct surveys to get data which they can use to create graphs and charts. They can compare the two and discuss whether the information change or remain the same and which is easier to use. Allow children to find other charts and graphs, take it to the classroom and share it with the class. They can explain, using the correct terms, what information is shown on the charts or graphs. Students can then use them to practice finding mean, median, mode and range.	Use various source of information such as income, population, exports (cane, citrus), etc., and challenge children to create charts to display the information. Collect various kinds of data and have students find the various tasks associated with data handling (i.e.) frequency, mean, median, mode, and range.

Print Resources:	Technology Resources:
Newspapers Statistics Reports Teaching Student-Centered Mathematics Grades 5-8	exchange.smarttech.com/search.html?q=mode www.shodor.org › Interactivate

Linkages [Math]:	Linkages [content areas]:
	Social Studies

M20: Investigate inferences and apply probability concepts in the solution of problems
[M20.9 – M20.10]

Comments: Statistical inference concerns the problem of inferring properties of an unknown distribution from data generated by that distribution. It allows the formation of conclusions about the difference between populations with regard to any given parameter. The use of probability will help the learner to decide whether the outcome will be certain, impossible, equally or likely.

Sample Lesson Objectives:

Given two sets of data, students will be able to use a tree diagram to plot the possible combinations that can be made.

Given the probability of an event, students will be able to compute correctly the complementary of the events.

Sample Assessment:

a) Students should display a thorough understanding of what tree diagrams are and should be able to apply them accurately when making combinations using disjoint sets. Oral explanation by students should clue teacher whether there is a need to revisit the concepts.

b) As students compute the probability of sets, conduct a one to one interview with students to determine to what extent they understand the concepts. This will allow for individual help to slower students or for those who have problems understanding.

c) Use class discussions to gauge the progress of the class and to identify common misconceptions.

Specific Content:

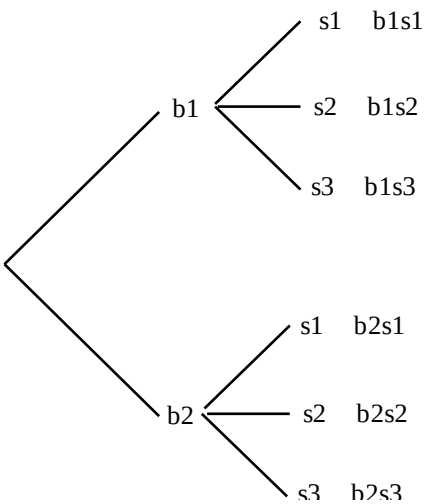
Example 1 If a woman has two blouses and three skirts, how many different outfits consisting of a blouse and a skirt can she wear?

Solution: Suppose we call the blouses b_1 and b_2, and skirts s_1, s_2, and s_3.

We can have the following six outfits.

$$b_1s_1,\ b_1s_2,\ b_1,s_3,\ b_2,s_1,\ b_2,s_2,\ b_2,s_3$$

Alternatively, we can draw a ***tree diagram***:



The tree diagram gives us all six possibilities. The method involves two steps. First the woman chooses a blouse. She has two choices: blouse one or blouse two. If she chooses blouse one, she has three skirts to match it with; skirt one, skirt two, or skirt three. Similarly if she chooses blouse two, she can match it with each of the three skirts, again. The tree diagram helps us visualize these possibilities.

The students should note that the process involves two steps. For the first step of choosing a blouse, there are **two** choices, and for each choice of a blouse, there are **three** choices of choosing a skirt. So altogether there are 2 x 3 = 6 possibilities.

Sample Activities [student]:	Teacher Support:
a) Group work with finding combinations of disjoint sets. Groups display final work and give explanation of it. Children can be challenged to make new sets, following the pattern set by given examples, and challenge other groups to find the possible combination. b) Some general discussion can be done by having students state what they understand by complementary sets. Whilst students are working, whether in groups or individually, make checks, conduct interview, or listen so that assessment can be made on whether the concepts are clear and understood.	a) Terms such as sets, disjoint sets should be revisited in order for students to understand the connection between them and probability. b) Some form of revision of sets will need to be done in order to prepare children for plotting the probability of complementary events. Demonstration by teacher will get students ready to practice examples on their own.

Print Resources:	Technology Resources:
Teaching Student-Centered Mathematics Grades 5 – 8	www.shodor.org › Interactivate www.lessonplanspage.com/MathJH.htm

Linkages [Math]:	Linkages [content areas]:

List of resources and manipulatives

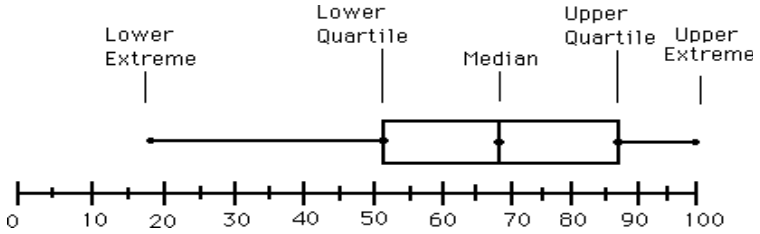
10-frameses
3-D models
5-frames
algebra tiles
aluminum foil
aluminum pans
ball large (beach ball)
balloons
base-10 blocks
baseball
basketball
bottle caps
bottles empty
bowls
brass paper fastener
bristol board
brown paper bags
bucket plastic
building blocks
cardboard(poster board)
clay / play doh
construction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

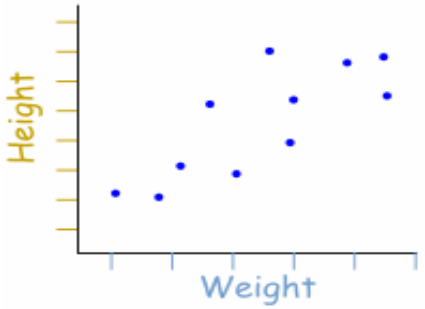
relative position – a point defined with reference to another position; the distance from an identified reference point

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 IV

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

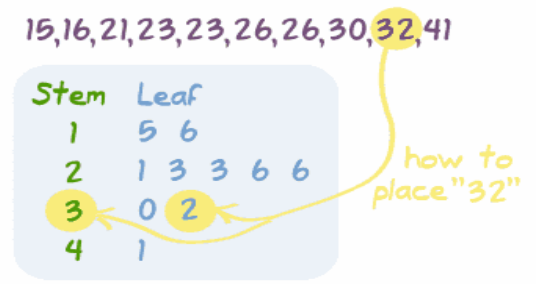
similarity – having the same shape but of different size

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)

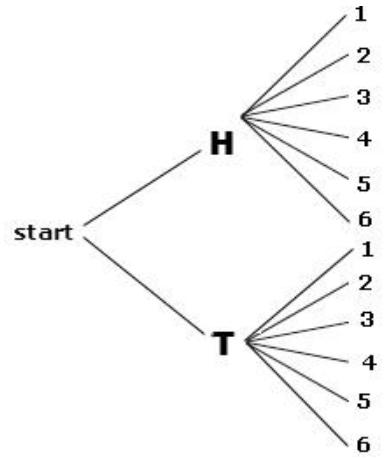


subitize – to perceive at a glance the number of the items presented based on their arrangement and without counting the maximum number

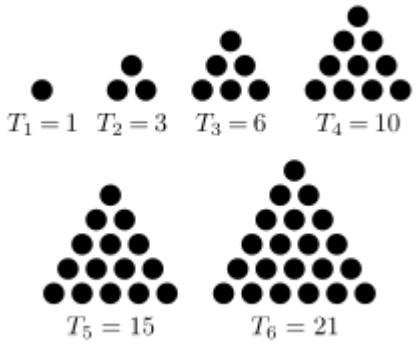
tessellations – a pattern made of identical shapes (could be more than one); the shapes must fit together without any gaps and the shapes should not overlap

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.



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/]