Public and Catholic District School Board Writing Partnership

Course Profile

(for a Locally Developed Course)

Essential Mathematics

Grade 9

· *for teachers by teachers*

Course Profiles are professional development materials designed to help teachers implement the new Grade 9 secondary school curriculum. These materials were created by writing partnerships of school boards and subject associations. The development of these resources was funded by the Ontario Ministry of Education. This document reflects the views of the developers and not necessarily those of the Ministry. Permission is given to reproduce these materials for any purpose except profit. Teachers are also encouraged to amend, revise, edit, cut, paste, and otherwise adapt this material for educational purposes.
Any references in this document to particular commercial resources, learning materials, equipment, or technology reflect only the opinions of the writers of this sample Course Profile, and do not reflect any official endorsement by the Ministry of Education or by the Partnership of School Boards that supported the production of the document.

Acknowledgments

Public and Catholic School Board Writing Team – Essential Mathematics

John Dallan, Lead Writer, Upper Grand District School Board
Bernie McGarry, Halton District School Board
Tina Noel, Renfrew County Catholic District School Board
Rob Samson, Simcoe Muskoka Catholic District School Board
Shirley Scott, District School Board of Niagara
Emilia Veltri, Lakehead Public District School Board
Jim Vincent, Peel District School Board

Lead Board

Halton District Secondary School Board
Kit Rankin
Susan Orchard
Larry Zavitz
Kelly Terry

With assistance from:

The writing team for the Applied and Academic Grade 9 Public Course Profile

The new *Ontario Secondary Schools, Grades 9 to 12: Program and Diploma Requirements (OSS)*, 1999 enables school boards to develop three local compulsory-credit courses, one in each of the following subjects: English, Mathematics, and Science. To provide a model of how these courses could be developed, the Ministry of Education has funded the following sample Course Profiles: "Essential English," "Essential Mathematics," and "Essential Science."

The *Guide to Locally Developed Courses, Grades 9 and 10: Approval Requirements and Procedures* provides information to assist school boards in preparing their requests to the Ministry of Education for approval of their own Grade 9 locally developed courses, to be offered in the 1999-2000 school year, under OSS. The document is available on the ministry's web site at http://www.edu.gov.on.ca.

Course Overview (for a locally developed course)
Essential Mathematics, Grade 9

Identifying Information

School:
Department: Mathematics
District:
Course Title: Essential Mathematics
Grade: 9
Ministry Course Code:
Credit Value: 1.0

Description/Rationale

This course provides students who have experienced significant difficulties in previous Mathematics courses an opportunity to obtain sufficient background and skill development to prepare them for Grade 11 and 12 Workplace Preparation courses. Whenever possible, ideas will be presented in a real-life context, providing students with the opportunity to explore, organize, interpret, and use mathematical models to solve problems. Technology and manipulative materials will be used wherever appropriate. Assessment and evaluation will be done using a wide variety of strategies.

Unit Titles and Time

Unit 1	Making Sense of Data	28 hours
Unit 2	Applying Ratio and Rate	18 hours
Unit 3	Investigating Two-Dimensional Figures	14 hours
Unit 4	Investigating the Marketplace	18 hours
Unit 5	Exploring Geometric Relationships	8 hours
Unit 6	Investigating Three-Dimensional Figures	14 hours
Unit 7	Summative Assessment Activities	10 hours

Unit Descriptions

Unit 1: Making Sense of Data

Time: 28 hours

Description

Students develop an understanding of data analysis as a powerful tool for decision-making. Students are involved in activities to collect, organize and display data from primary and secondary sources. There are many contextual problems presented in which students construct, read, and interpret tables, charts, and graphs and select appropriate methods for displaying data from real-world situations. Points of emphasis include identifying patterns and relationships, summarizing trends, making predictions, and communicating observations. Through the use of tables, charts, mean line of best fit, and pattern descriptions, students conduct investigations, with and without technology, to verify or refute their own conjectures.

Overall Expectations: all those from the Relationship and Number Sense Strand
Specific Expectations: all those from the Relationship Strand as identified in the activities and some others from the Number Sense Strand

Unit 2: Applying Ratio and Rate

Time: 18 hours

Description

Students explore ratio and rate in real-life contexts. They apply proportional reasoning through investigations in real-life contexts to solve problems related to measurement, geometry, and data management. Students build on and extend their understanding of fractions to include ratios, decimals, proportions, and percent. Students use manipulative materials, diagrams, charts, and drawings to gain a greater understanding of concepts such as scale drawings, unit pricing, and sampling. Students develop the facility to translate between and among equivalent numerical forms choosing the representation to best fit the context of the problem. Opportunities to practise the skills of estimation and judging the reasonableness of an answer are provided throughout the unit.

Overall Expectations: all those from the Number Sense and Relationship Strand
Specific Expectations: all those from the Number Sense Strand as identified in the activities and some others from the Relationship Strand

Unit 3: Investigating Two-Dimensional Figures

Time: 14 hours

Description

Students are engaged in a variety of activities dealing with two-dimensional geometry that allows them to solve measurement problems in real-life contexts. Through the use of concrete materials students develop and apply formulas. They select appropriate tools that allow them to measure to the degree of accuracy required. Concrete materials, drawings, and technology are used to investigate the effect that varying one dimension has on perimeter and area. Opportunities are also given to explore geometric properties and optimal values of various measurements of two-dimensional figures. Students communicate their findings and apply them to identify and solve familiar problems. The Pythagorean theorem is developed through the use of concrete materials and is used to solve simple problems. Students continue to develop skills for estimation and judging the reasonableness of an answer.

Overall Expectations: all those from the Relationship and Number Sense Strand and MGV.01 and MGV.02 from the Measurement and Geometry Strand
Specific Expectations: all those from the Measurement and Geometry Strand as identified in the activities and some others from the other Strands

Unit 4: Investigating the Marketplace

Time: 18 hours

Description

Students are involved in various investigations and activities that allow them to use their knowledge of ratios and rates to understand and apply percent. They illustrate the meaning of percent and solve simple contextual problems. The marketplace is rich with applications as well as opportunities to use rates, ratios, and percents to solve problems that increase student awareness as consumers and decision-makers. Some activities provide opportunities to use previously developed methodologies and strategies for investigations. Technology is used to aid in the analysis of data. Students are encouraged to use mental mathematics and estimation to ensure that their calculations, use of technology, and problem-solving strategies produce reasonable results.

Overall Expectations: all those from the Number Sense and Relationship Strand
Specific Expectations: all those from the Number Sense Strand as identified in the activities and some other from the Relationship Strand

Unit 5: Exploring Geometric Relationships

Time: 8 hours

Description

Students use concrete materials, diagrams, drawings and dynamic geometric software to develop their spatial sense. Students explore geometric patterns and use appropriate mathematical language in identifying and applying geometric concepts to gain a better understanding of geometric relationships. Investigations include those related to angle properties of parallel lines and two-dimensional figures. Through the use of the tools of dynamic geometry software, students construct geometric designs, explore and solve simple problems and then clearly explain the use of geometric properties in constructions.

Overall Expectations: all those from the Number Sense and Relationship Strand and MGV.3 from the Measurement and Geometry Strand
Specific Expectations: all those from the Measurement and Geometry Strand as identified in the activities and some other from the other Strands

Unit 6: Investigating Three-Dimensional Figures

Time: 14 hours

Description

Students engage in a variety of activities dealing with three-dimensional geometry that allows them to solve measurement problems in real-life contexts. With or without the aid of technology, students construct three-dimensional models. Through the use of concrete materials, drawings, and technology, students investigate the effect that varying one dimension has on surface area and volume. They also investigate optimal values of various measurements of three-dimensional figures. Students communicate their findings and apply them to identify and solve problems in familiar settings.

Overall Expectations: all those from the Relationship and Number Sense Strand and MGV.01 and MGV.02 from the Measurement and Geometry Strand
Specific Expectations: all those from the Measurement and Geometry Strand as identified in the activities and some others from the other Strands

Unit 7: Summative Assessment Activities

Time: 10 hours

Description

This unit models a final assessment in Grade 9 Mathematics. Individual and group performance skills are assessed using traditional and performance-based tasks, over a period of several days. Thirty per cent of the final evaluation is based on this summative unit, which includes performance tasks and pencil and paper tests.
To address the particular needs of students, assessment activities are paired so that students have more than one opportunity to demonstrate their level of understanding of course materials. That is, two similar evaluation tools may be administered consecutively so students can focus on key expectations. This allows students to gain a better understanding of the expectations of a summative assessment and gain confidence in their abilities.
It is suggested that the form and substance of this summative assessment unit be shared with students, their parents, resource teachers, and other support staff near the beginning of the course, so that each student's energies can be directed towards acquisition of the required skills and knowledge.

In this summative assessment unit, students demonstrate their achievement of the expectations of the course. They do this by demonstrating their abilities to solve problems, which require them to:

- model appropriate strategies used in investigations;
- gather, organize, and display data for a purpose;
- decide, with awareness, what is important and what can be ignored within a problem;
- communicate reasoning and results;
- use technology as a tool for enhancing their learning;
- carry out paper and pencil routines.

Key Messages

- Skills in context

Students who have yet to master the ability to punctuate are not stopped from the experience of reading a book or writing a poem. Similarly, students who have yet mastered basic arithmetic skills should not be denied the opportunity to experience mathematics in real contexts, gain some understanding of its power, and be given opportunities to engage in the joy of discovery. Within these broader experiences, students also have opportunities to further develop key numeric skills.

- Student as learner

A primary goal of this course is to expand and develop students' knowledge and ability to apply mathematical concepts in real life applications. It should foster confidence in their ability to do mathematics. Students arrive in the classroom from varied backgrounds with a wide range of experiences and for many, with limited success in mathematics. Attention must be given to both cognitive and affective issues. Academic weaknesses may be centred in a specific area, but in many cases these are broad-based and to low self-esteem and other attitudinal concerns. Keeping this in mind, it is important to structure the program and classroom routines to strengthen common weaknesses so that learning may take place.

- Learning environments

Students require an appropriate or reasonable length of time and varied experiences to come to understand mathematical concepts. A climate that actively involves students in doing mathematics is beneficial. Along with opportunities for skills development, particular attention might be given to providing opportunities for students to be engaged in explorations, investigations and instances for them to communicate their understanding. By encouraging students to justify and clarify their thinking and to be open to opposing opinions, students foster genuine respect for another's point of view.

- Skills are taught within a context

It is beneficial for students to widen their views of mathematics so as to recognize its usefulness and relevance both inside and outside of school. In this course profile, concepts are not addressed in isolation. Teachers need to take time to develop specific skills but should do so as a result of dealing with situations in a larger context. Activities and problems are presented in a real-life context and opportunities are given for students to explore each specific expectation at various times throughout the units. Teachers are encouraged to explore cross-curricular activities with other disciplines (e.g., science, geography) and to investigate with students, different career opportunities in related mathematical fields. It is important that students connect ideas both among and within the areas of mathematics. It may be necessary for teachers to highlight these connections for students, as they may not see them for themselves.

- Classroom routines

Teachers may find it necessary to develop a variety of new classroom routines as they provide their students with opportunities for investigations, explorations, and communication of findings. It is important that routines be structured with well-communicated expectations. To address the varied needs of the students, especially with some of the more non-traditional activities, teachers may find it advantageous to keep a variety of teaching strategies in mind to allow them to deal with the unexpected as it arises. It may be necessary to re-teach skills and to provide opportunities for practice as the need arises.

- Role of technology

Technology has not only made calculations and graphing simpler but it has changed the very nature of the problems important to mathematics and the methods used to investigate them. Furthermore, the changes in technology have broadened the areas in which mathematics is applied. Technological tools such as graphing calculators, spreadsheets, dynamic geometry software, calculators with fraction-solving capabilities, and scientific probes for data collection are recommended components of this course profile.

- Assessment

This course profile gives attention to a broad range of assessment practices that take a holistic view of mathematics to help centre on what students do know as opposed to what they do not know. An emphasis can be placed on what students have been able to accomplish rather than on the difficulties they may have had in trying to reach their level of achievement. As champion bowlers are judged on their most consistent scores, and not on the scores from their earliest games, similarly students' level of achievement should be based on their most consistent results in a wide range of assessment activities.

For a variety of reasons, students in this course may have had limited success with evaluation tasks. It may be beneficial for students to have more than one opportunity to complete similar evaluation tasks within a unit. Paired evaluation tasks in which one task is similar to the second may help students to better demonstrate understanding.

Other points to consider

- When conducting investigations, with or without technology, teachers are advised to carry out the experiments themselves, beforehand. It is essential to consider all of the special needs of the students in the class and structure the activity accordingly.
- Use of the Achievement Chart for Mathematics as the basis of evaluation of the course expectations in this course profile.
- The course expectations of the various strands are woven throughout this course profile. The units and have been linked by recurring key concepts and skills. These include estimations, judging the reasonableness of answers, relationships, and problem solving.

Teaching/Learning Strategies

Student acquisition of useful mathematical skills and knowledge is related to awareness and engagement in real-life, to contextual learning tasks, and to guidance through the activities so that mathematical connections are made. Through the use of a wide variety of teaching/learning strategies, assessment strategies, and mathematical tools, teachers can assist students to achieve these expectations in preparation for the Grade 11 and 12 Workplace courses.

In applying this course profile, teachers:

- become familiar with any student I.E.P.'s and address the requirements included in them;
- modify instructional and assessment strategies to address a variety of learning styles;
- include a balance of whole class, small group, and individual instruction;
- include a balance of student-centred and teacher-directed activities;
- address the overall and specific expectations in planning and tracking student progress;
- provide students with materials, technological tools, and software for use in experiments, demonstrations, and investigations;

- engage students in activities that provide opportunities to solve problems connected to real-life experiences;
- assume a variety of roles, including guide, facilitator, and director of learning;
- provide many opportunities for students to demonstrate their ability to meet course expectations;
- provide within each learning/performance task, many opportunities for students to demonstrate their learning growth;
- be aware of opportunities for students to link mathematics to other aspects of their lives;
- provide ongoing, informal assessment that assists them in taking more responsibility for their own learning.

In achieving the expectations of this course, students:
- develop increasing responsibility for their own learning;
- carry out investigations and engage in the inquiry process;
- are involved by actively exploring and making hypotheses, manipulating or transforming ideas or data, drawing conclusions or making inferences, and communicating with others during an inquiry;
- engage in explorations involving the use of technology (e.g., graphing software, dynamic geometric software, data bases, the Internet, statistical programs, spreadsheets, and multimedia resources) and the collection of data;
- follow examples and take notes provided;
- apply and develop individual and group learning skills;
- pose and answer questions in a context;
- demonstrate understanding in writing, verbally, and visually (e.g., tables, graphs, and posters).

Assessment/ Evaluation

Assessment is a systematic process of collecting information or evidence about student learning; evaluation is the judgement teachers make about the assessments of student learning based on established criteria. This profile will provide specific examples of assessment strategies and tools, and general statements about how these assessments might be used in evaluation. Evaluation requires that the teacher not simply average marks. In forming an evaluative judgement, the student's highest, most consistent level of achievement should be used.

Knowledge and understanding continue to be important. Assessment looks at students meeting course expectations at a variety of levels, with an emphasis on growth over time. Assessment should be used to gather information for diagnostic, formative, and summative purposes. It is important to note that assessment and evaluation is to be criterion-referenced, comparing student performance to the Ministry standard, not to other students. Level 3 is defined as the provincial standard. Level 4 performance expectations may be demonstrated through opportunities to answer open-ended questions.

Assessment strategies and tools must address the variety of teaching and learning styles as well as the variety of expectations. High quality assessment can measure individual and group performance, and individual performance within a group. A balanced assessment program is based on the provincial curriculum expectations and the achievement levels.

For example:
- Assess *Understanding of Conceptual* and *Procedural Knowledge/Understanding* through tests, quizzes, and observation of performance tasks.
- Assess *Thinking/Inquiry/Problem Solving* and *Application* in unfamiliar settings through performance assessment, observation, and conferencing.

- Assess *Communication* through journals, portfolios, performance assessments, observations and presentations.
- Assess *Application* in familiar settings through tests, quizzes, performance assessments.
- Assess *Learning Skills*, including goal setting, through journals, portfolios, and observations.

Assessment tools to be used throughout the course include:
- the four-level Achievement Chart to set standards for summative evaluation
- rubrics (both teacher-created and student-generated)
- checklists
- rating scales
- anecdotal comments

A selection of these tools has been designed for this course profile to accompany specific assessment activities. Teachers are encouraged to use them, then develop similar tools for other assessment activities. Some suggestions for increasing scoring consistency include:
- involve other teachers in the creation of rubrics for assessment;
- involve students, whenever appropriate, in the setting of criteria, and the use of self and peer assessments;
- gather exemplars of student work at the four levels, so that teachers and students can get a better image of the performance expected at each level.

In this course profile, assessment of the expectations using the four levels of the Achievement Chart is ongoing throughout the units. There is a summative performance activity and/or a summative pencil and paper test for each Unit. Assessment tools are designed to allow students to demonstrate performance at the full range of student learning (levels 1 to 4).

Accommodations

Appropriate accommodations should be part of the planning of each unit activity in terms of the particular students in the class and their specific needs.

Instructional and assessment activities must take into account the strengths, needs, learning expectations, and accommodations as identified in the Individual Education Plan (IEP) whether students are formally identified or not (Regulation 181/98).

Accommodations to curriculum, instruction, assessment and evaluation may include but are not limited to:
- more time for learning and completion of activities (e.g., some students may require greater time to become comfortable with the new technology emphasized in this course profile before they are able to demonstrate their understanding of a concept);
- use of specialized equipment and assistance (e.g., some students may require calculators with large keys or that are capable of fraction manipulation);
- simplified tasks and activities (e.g., some students may require pre-completed portions of an activity so that they can focus on the important concepts);
- varied assessment strategies;

- use of available adaptive technologies to assist students (e.g., students may require opportunities outside of regular class time to use new technologies such as dynamic geometric software);
- modified handout (e.g., some students will benefit from written visually appealing materials that are in a large font and not clustered on a page);
- modified settings, (e.g., resource room), where students can receive assistance on problems that are language-based or assistance with an evaluation tool.

Resources

Bouck, M. *Middle Grades Assessment: Balanced Assessment for the Mathematics Curriculum.* (Package 1), Dale Seymour Publications, 1999.

Bouck, M. *Middle Grades Assessment: Balanced Assessment for the Mathematics Curriculum.* (Package 2), Dale Seymour Publications, 1999.

Grade 9 Sample Assessment Document. E.Q.A.O., 1998.

Linking Assessment and Instruction in Mathematics: Connecting to the Ontario Provincial Standards. O.M.C.A., O.A.M.E., 1995.

ProQuest, http://www.uni.com.proquest
This website provides access to more than 3000 journals, magazines, dissertations, newspapers, and other publications, for a fee. This is a good source of secondary data. There are several similar services available.

Professional Reading

Baltzley, P. *Strengthening Your Math Instruction Using Cooperative Learning (Grades 6 - 12).* Bureau of Education and Research, 1995.

Burke, Kay. *What to Do With the Kid Who...Developing Cooperation, Self-Discipline and Responsibility in the Classroom.* Alexandria, VA: Association for Supervision and Curriculum Development, 1992.

Clarke, Judy et al. *Together We Learn: Co-operative Small Group Learning*. Prentice Hall, 1990.

Fleet, J., F Goodchild, and R. Zajchowski. *Learning for Success: Skills and Strategies for Canadian Students*. Harcourt Brace & Co., 1994.

Hewitt, J.D. *Teaching Teenagers*. Willsdowne Press, Thornhill, ON, 1994.

Kulm, G. *Mathematics Assessment: What works in the Classroom.* Jossey-Bass Publishers, 1994.

Celebrating Differences: Teaching and Learning Styles. Toronto: OSSTF, 1986.

Johnson, D.R. *Strengthening Student Achievement and Motivation in your Math Classes*. Bureau of Education and Research, 1994.

Grass Roots II. Toronto: OSSTF, 1993.

Mathematics Assessment: Myths, Models, Good Questions and Practical Suggestions. N.C.T.M.

Stenmark, J.K. *Assessment Alternatives in Mathematics*. Assessment Committee of the California Mathematics Council.

Course Evaluation

Course improvement should be viewed as an ongoing and collaborative process among mathematics teachers. As new resources, new technology, and new insights about the programs develop, teachers must adapt their programs to better serve the needs of their students.

To meet these goals, teachers should evaluate the effectiveness of their courses, using a variety of information sources. While students' performance on summative evaluations such as class tests, the final assessment, and the Grade 9 E.Q.A.O. mathematics assessments are obvious indicators of a course's success, many other sources of information are available to teachers as well. These included students' reflections on their learning in their mathematics journals, parental feedback, and student performance in subsequent mathematics courses as well as other subject disciplines, which build on Grade 9 Mathematics.

Anecdotal evidence can be gathered from observing the following indicators:

- care taken by the students in their work;
- students' efforts to complete their work and seek help as needed;
- students' pursuit of extension activities;
- students' growth in independence and persistence when completing tasks.

Coded Expectations: Essential Mathematics (for a locally developed course)

Strand: Number Sense

Overall Expectations

NSV.01
- consolidate the meaning and use of key numerical skills through applications drawn from students' experiences.

Specific Expectations

Applying Key Numerical Skills

NS1.01
- apply strategies for mental mathematics and estimation throughout the course and in applications drawn from students' experiences;

NS1.02
- illustrate the meaning of the concept of percent through investigations and activities involving the construction and interpretation of models and diagrams and the use of manipulative materials;

NS1.03
- estimate percentages illustrated by models, diagrams, written descriptions, or manipulative materials;

NS1.04
estimate the percentage equivalent of a fraction in practical applications
(*Sample Problem:* A dress goes on sale for 35% off. Its regular price is $ 90. About how much will you save? *Solution:* 35% is about 1/3 and 1/3 of 90 is $30.);

NS1.05
- solve simple problems involving the calculation of percentages in applications drawn from students' experiences (e.g., sales tax, discount, tips, commissions, sports);

NS1.06
- use ratios to express the relationships among quantities illustrated by models, diagrams, or manipulative materials;

NS1.06
- draw diagrams to represent ratios described in oral or written form;

NS1.07
- carry out investigations in which variables are compared by forming and evaluating ratios (e.g., Is there a relationship between a person's height and his/her armspan? Is there a relationship between the height from which a ball is dropped and the height to which it rebounds? Is there a relationship between the number of blue smarties and the number of red smarties in a bag?);

NS1.08
- solve simple problems involving proportions arising from investigations involving the use of ratios (e.g., the ratio of the number of blue smarties in a bag to the total number of smarties is 2:7. There are 72 smarties in the bag. How many are blue?);

NS1.10
- identify rates drawn from students' experiences, the units used in them, and reasonable values for them (e.g., the speed of an automobile is measured in km/h, and a reasonable speed in the city is 50 km/h; the growth of a student's hair could be measured in cm/month and a reasonable monthly rate of growth would be?);

NS1.11
- calculate rates in activities drawn from students' experiences (e.g., heart rate in various situations, walking speed, keyboarding speed);
NS1.12
- solve simple problems involving rates drawn from activities in which rates were measured and from common student experiences (e.g., You type 130 words in 5 minutes. What is your typing speed? Your heart rate is 72 beats per minute. How many times will it beat in an hour? On a trip you drove 300 km in 3.5 hours. At what average speed were you travelling?);
NS1.13
- use a scientific calculator effectively for applications that arise throughout the course;
NS1.14
- solve problems involving the calculation of rates drawn from familiar social issues (e.g., the mass of garbage produced per person in a month; the number of plastic bags consumed by a person in a year);
NS1.15
- judge the reasonableness of answers to problems by considering likely results;
NS1.16
- judge the reasonableness of answers produced by a calculator or a computer, using mental mathematics and estimation.

Strand: Relationships

Overall Expectations

REV.01
- determine relationships between two variables by collecting and analysing data.

Specific Expectations

Determining Relationships

RE1.01
- make a hypothesis regarding a relationship between two variables
(*Sample Problem*: If you drop a ball from the same height each time, will the rebound height always be the same? As you vary the height from which the ball is dropped, what is the effect on the height of the rebound? What are the variables in this problem? How are they related?);
RE1.02
- demonstrate an understanding of some principles of sampling and surveying (e.g., randomization, representivity, the use of multiple trials) and apply the principles in carrying out experiments to investigate the relationships between variables
(*Sample Problem*: What factors might affect the outcome of this experiment? How could you design the experiment to account for them?);
RE1.03
- collect data, using appropriate equipment and/or technology (e.g., measuring tools, graphing calculators, scientific probes)
(*Sample Problem*: Drop a ball from varying heights, measuring the rebound height each time.);
RE1.04
- organize, display, and analyse data, using appropriate techniques and technology (e.g., graphing calculators, spreadsheets)
(*Sample Problem*: Enter the data into a spreadsheet. Decide what analysis would be appropriate to examine the relationship between the variables   a graph, measures of central tendency, ratios.);

RE1.05
- describe trends and relationships observed in data and compare them to the original hypotheses (*Sample Problem*: Is the data scattered or does it cluster around the shape of a straight line or a smooth curve? What does it mean if the data cluster around a straight line? Can you identify a pattern that would help you predict points on a straight line? Identify any outlying pieces of data and provide explanations for them. Is the outcome of the experiment consistent with your original hypothesis? Why or why not?);

RE1.06
- explain the procedure and the findings of an experiment clearly, using a variety of mathematical forms (e.g., oral or written explanations, formulas, charts, tables, graphs);

RE1.07
- solve and/or pose extending problems related to the design or the findings of an experiment (*Sample Problem:* Re-run the experiment with a different ball. Will the results be the same? Why or why not?).

Strand: Measurement and Geometry

Overall Expectations

MGV.01
- determine the optimal values of various measurements, through investigations facilitated by the use of manipulative materials, diagrams, and calculators or computer software;

MGV.02
- solve problems involving the measurement of two-dimensional figures and three-dimensional objects;

MGV.03
- demonstrate understanding of the properties of sides and angles in triangles and parallel lines, through investigations facilitated by the use of concrete materials and dynamic geometry software.

Specific Expectations

Investigating The Optimal Value of Measurements

MG1.01
- determine, through investigation, the effect on the perimeter and the area of a two-dimensional figure of varying one dimension of the figure (e.g., the effect on the perimeter and the area of a square of varying its side length);

MG1.02
- determine, through investigation, the effect on the volume and the surface area of an object, of varying one dimension of the object (e.g., the effect on the volume and the surface area of a cube of varying its side length);

MG1.03
- construct a variety of square-based prisms for a given volume and determine the minimum surface area for a given volume;

MG1.04
- describe applications in which it would be important to know the maximum area for a given perimeter or the minimum surface area for a given volume (e.g., building a fence, designing a container).

Solving Problems Involving Measurement

MG2.01
- measure lengths accurately using the metric system;

MG2.02
- illustrate the meanings of the concepts of perimeter, area, and volume, through investigations and activities involving estimation, hands-on measurement, and real-life applications;

MG2.03
- solve simple problems, using the formulas for the area of rectangles, squares, triangles, and circles, in applications drawn from students' experiences;

MG2.04
- solve simple problems, using the formulas for the surface area and the volume of prisms and cylinders, in applications drawn from students' experiences;

MG2.05
-judge the reasonableness of answers to measurement problems by considering likely results within the situation described in the problem;

MG2.06
- judge the reasonableness of answers produced by a calculator or a computer, using mental mathematics and estimation;

MG2.07
- illustrate the Pythagorean theorem, using concrete models;

MG2.08
- apply the Pythagorean theorem to sole simple problems drawn from familiar situations (e.g., the amount of distance saved by crossing a rectangular field on its diagonal instead of walking along two sides).

Understanding Properties of Triangles and Parallel Lines

MG3.01
- illustrate the meanings of key terms associated with angles and triangles (e.g., acute angle, obtuse angle, scalene triangle, isosceles triangle, equilateral triangle, right triangle, perpendicular lines, parallel lines) by constructing diagrams;

MG3.02
- illustrate properties of the angles of triangles and parallel lines;

MG3.03
- construct geometric designs, using the tools of dynamic geometry software;

MG3.04
- explain procedures and reasoning, using vocabulary, visuals, and symbols correctly;

MG3.05
- solve simple geometric problems;

MG3.06
-determine relationships between geometric figures through investigation.