OMCA

Project for the Revised

MBF 3C

Department:	Mathematics		
Course Title:	Foundations for college Mathematics	**Course Code:**	MBF3C
Ministry Documentation:	The Ontario Curriculum, Grades 11 (Revised) 2006		

Ministry Documents:
Think Literacy (Mathematics 7-12)

Level of Difficulty: [*if applicable*]:	College Prep	**Credit Value [*if applicable*]:**	1.0
School Year:	2006-2007	**Grade Level:**	11

Description of Course:

This course enables students to develop an understanding of mathematical concepts related to trigonometry, quadratic relations, data management, finance and geometry.

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MBF 3C
EVALUATION OF STUDENT ACHIEVEMENT

Term Work (70%)

Knowledge and Understanding	35%
Thinking	20%
Application	30%
Communication	15%

} *Replace the percentage breakdown with your school's policy.*

Final Evaluation (30%)

The Final evaluation could take various forms.
For example: a) formal written exam
b) performance task
c) combination of the above

Note: After each unit students can complete a summative assessment to be placed in a growth portfolio. Along with the assessment students write a self-reflection piece where they analyse their performance in each of the achievement chart categories and compare with previous work. The growth portfolio could be counted towards part of their final evaluation mark.

The Final mark will be calculated as follows:

70% (Term Work) + 30% (Total of three summative evaluations) = Final

The following lists are not comprehensive. They serve only as a guide for the assessment and evaluation of student achievement.

Achievement Categories

Knowledge and Understanding

Achievement in this category reflects the student's ability to demonstrate an understanding for mathematical concepts and to perform algorithms.

These may include:

- skill-based calculations on assignments, tests, and exams;
- student-teacher conferencing;
- accuracy of mathematical answers in presentation

Thinking

Achievement in this category reflects the student's ability to demonstrate reasoning and to apply the steps of a problem solving process effectively.
These may include:

- assignments that require extensions to those skills obtained in Applications or Knowledge and Understanding;
- tasks requiring complexity of mathematical reasoning in reports and presentations;
- open – ended questions;
- exploring tasks (investigations) requiring interpretation of the results;
- observations of problem solving strategies used in group work;
- student-teacher conferencing.

Applications

Achievement in this category reflects the student's ability to apply concepts and procedures to familiar and unfamiliar settings.
These may include:

- problems requiring the selection and application of formulas and algorithms;
- appropriate application of technological tools.

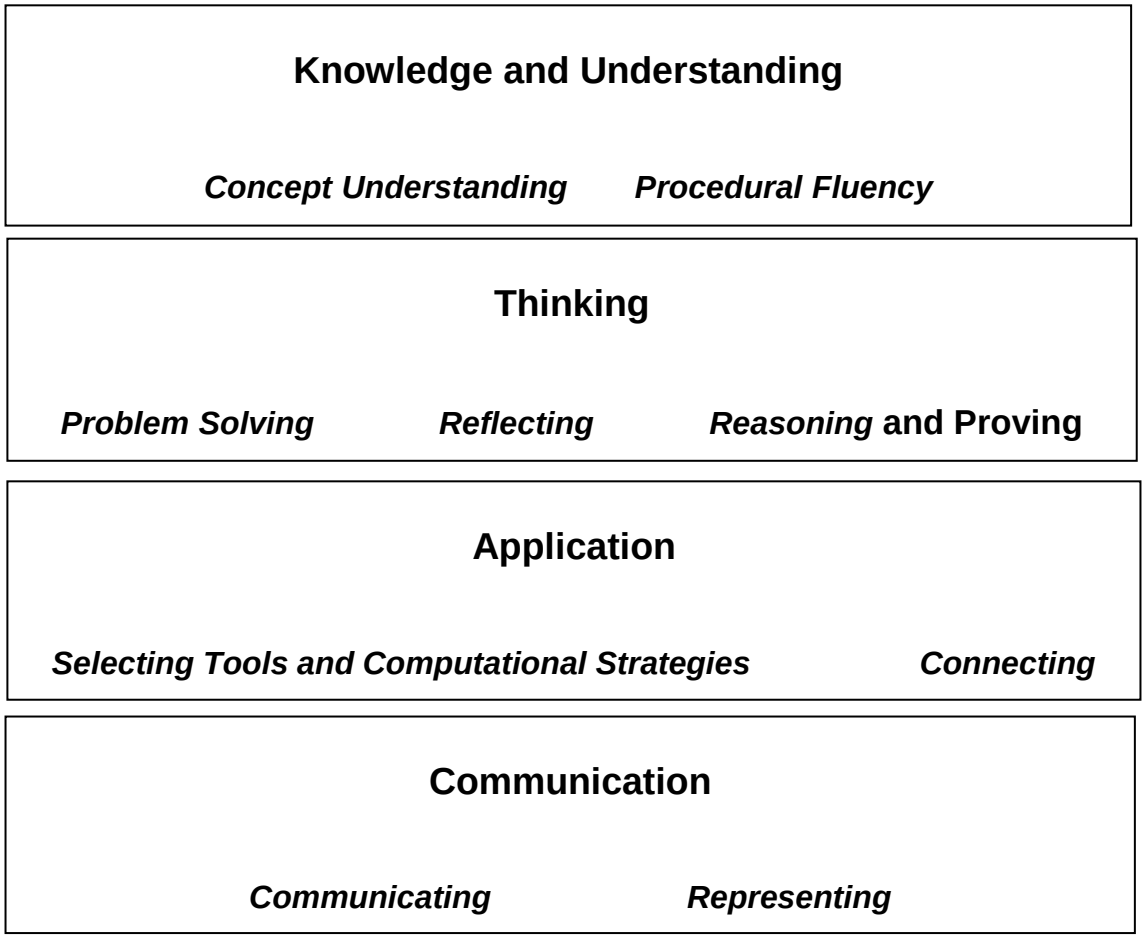
Communication

Achievement in this category reflects the student's ability to communicate his/her reasoning using appropriate mathematical language, symbols, and conventions.
These may include:

- verbal presentation of solutions and homework;
- demonstrate the correct use of mathematical language, symbols and conventions;
- communicate solutions to problems, orally and in written form using as effective integration of essay and mathematical form;
- explain the mathematical process, methods and concepts clearly to others;
- visual aids during presentations;
- reports and assignments;
- student–teacher conferencing.

Mathematical Processes and the Achievement Chart

The seven mathematical processes can be referred to as the '***actions of math***.'
The overall and the specific expectations can be referred to as the '***mathematical concepts'***.
The **combination** of the mathematical **processes** and **expectations** are **embedded** in the **achievement chart** as the following:



"The mathematical **processes** are **interconnected**. **Problem solving** and **communicating** have **strong links** to **all** the **other processes**. A problem –solving approach encourages students to reason their way to a solution or a new understanding. As students engage in reasoning, teachers further encourage them to make conjectures and justify solutions, orally and in writing. The communication and reflection that occur during and after the process of problem solving help students not only to articulate and refine their thinking but also to see the problem they are solving from different perspectives. This opens the door to recognizing the range of strategies that can be used to arrive at a solution. By seeing how others solve a problem, students can begin to think about their own thinking (metacognition) and the thinking of others, and to consciously adjust their own strategies in order to make their solutions as efficient and accurate as possible."

The Ontario Curriculum Grades 9 and 10 Mathematics 2005
Page 12

Mathematical Processes

Mathematical Processes should be integrated throughout all of the strands in the mathematics curriculum. The mathematical processes are a list of seven expectations that describe what students need to learn and apply as they work through the expectations outlined within the five strands. Students should be actively engaged in these processes on a regular and frequent basis rather than in connection with a particular strand. The process should be valued as much as the solution.

The Mathematical Processes that support effective learning in mathematics are as follows:

- problem solving
- reasoning and proving
- reflecting
- selecting tools and computational strategies
- connecting
- representing
- communicating

MPS.01 PROBLEM SOLVING

When problem solving comes first in the teaching/learning process, it becomes a vehicle by which students make sense of mathematics and learn concepts, skills and strategies. Most problem solving processes involve the following steps:

- Understanding the problem (exploratory stage)
- Planning
- Doing (Carry out the plan)
- Looking Back at the solution

Strategies include:

- Check whether an answer is reasonable.
- Compare two problem-solving methods.
- Discuss a problem.
- Explain / justify a problem solving plan
- Explain / justify a problem solving solution
- Extend a problem.
- Guess and check
- Identify a pattern
- Identify key words.
- Identify needed information.
- Make a model, and/or use a picture or diagram.
- Role-play or act out a problem.
- Solve a simpler problem.
- Solve /create a similar problem.
- Use a list, chart, or table.
- Use appropriate technology.
- Use manipulatives.
- Work backward.

MPS.02 REASONING AND PROVING

The reasoning process supports deeper understanding of mathematics through developing ideas, making mathematical conjectures, and justifying results. Draw on students' natural ability, which initially may rely on viewpoints of others to justify their choices, then encourage students to reason from the evidence they find or from what they already know to be true. Help students to revisit conjectures that they have found to be true in one instance and determine if they are always true.

MPS.03 REFLECTING

Reflecting on the reasonableness of the answer by considering the original question or problem is another way in which students can improve their ability to make sense of problems. One of the best opportunities for students to reflect is immediately after they have completed an investigation, when the teacher brings students together to share and analyse their solutions. Students then share strategies, defend procedures they used, justify their answers, clarify any misunderstandings that they may have had, reflect on what made the problem difficult or easy, and think about how they might tackle the problem differently. Reflecting on their own thinking and the thinking of others helps students make important connections and internalize a deeper understanding of the mathematical concepts involved.

MPS.04 SELECTING TOOLS AND COMPUTATIONAL STRATEGIES

Students need to develop the ability to select appropriate electronic tools, manipulatives, and computational strategies to perform particular mathematical tasks, to investigate mathematical ideas, and to solve problems.

✓ Electronic Tools: Calculators, Computers, Communications Technology

Although students need to develop basic operational skills, the focus should be on the students' ability to extend their capacity to investigate and analyse mathematical concepts. For example, when using spreadsheets and dynamic statistical software, like TinkerPlots, teachers could supply students with prepared data sets so that students work with the software would be focused on the mathematics related to the data or manipulation of the sketch rather than the students' ability to input the data.

✓ Manipulatives

Encourage students to select and use concrete learning tools to make models of mathematical ideas. Using manipulatives to construct representations helps students to:

-see patterns and relationships;
-make connections between the concrete and abstract;
-test, revise and confirm their reasoning;
-remember how they solved a problem;
-communicate their reasoning to others.

✓ Computational Strategies

Problem solving requires students to select an appropriate computational strategy. They may need to apply the written procedures for an addition or subtraction problem or select technology for computation. They may also need to select strategies related to mental computation and estimation. Used effectively, mental computation can encourage students to think more deeply about numbers and number relationships. Knowing how to estimate, and knowing when it is useful to estimate and when it is necessary to have an exact answer, are important mathematical skills. Estimation is a useful tool for judging the reasonableness of a solution and for guiding students in their use of calculators. Estimation should not be taught as an isolated skill or a set of isolated rules and techniques.

MPS.05 CONNECTING

Experiences allow students to be able to make connections between concepts and skills. Seeing the relationships among procedures and concepts also helps students develop mathematical understanding. The more connections students make, the deeper their understanding. In addition, making connections between the mathematics they learn at school and its applications in their everyday lives not only helps students understand mathematics, but also allows them to see how useful and relevant it is in the world beyond the classroom.

MPS.06 REPRESENTING

Learning the various forms of representation that helps students to understand mathematical concepts and relationships; communicate their thinking, arguments, and understandings; recognize connections among related mathematical concepts; and use mathematics to model and interpret realistic problem situations.

Students should be able to go from one representation to another, recognize the connections between representations, and use the different representations appropriately and as needed to solve problems. When students are able to represent concepts in various ways, they develop flexibility in their thinking about those concepts.

MPS.07 COMMUNICATING

Communication is an essential process in learning mathematics. Through communication, students are able to reflect upon and clarify their ideas, their understanding of mathematical relationships, and their mathematical arguments.

Teachers need to be aware of the various opportunities that exist in the classroom for helping students to communicate, i.e., modelling the use of numbers, symbols and words in oral, visual and written form, providing feedback, use of open ended questioning, think aloud, and encouraging students to seek clarification.

Effective classroom communication requires a supportive and respectful environment that make all members of the class feel comfortable when they speak and when they question, react to, and elaborate on the statements of their classmates and the teacher.

The ability to provide effective explanations, and the understanding and application of correct mathematical notation in the development and presentation of the mathematical ideas and solutions, are the key aspects of effective communication in mathematics.

Assessment and Evaluation of Student Achievement

The **primary purpose** of **assessment** and **evaluation** is to **improve student learning**.

Assessment is the process of gathering information from a variety of sources that accurately reflect how well a student is achieving the curriculum expectations in a course. Teachers are to ensure that each student is given clear directions for improvement.

Diagnostic Assessment
- provides information about the student's level of prior knowledge and skill.

The teacher:
- administers at the beginning of a year/unit/term/lesson
- uses the information as to where to begin instruction (review of concepts may be necessary)

Examples of ways to gather data:
- anticipation guides, checklists, games, observation , pre-test, think/pair/share of an introductory question

Formative Assessment
- provides information about how individual students are progressing toward successful achievement of the curriculum expectations

The teacher:
- administers during a unit of study/term, daily
- uses the information to differentiate instruction
- make decisions on what to change, add, delete in future lessons
- reflect on whether teaching methods are working – if not, change
- provide students an opportunity to practice without penalty
- provide students with specific and immediate feedback for improvement

Examples of ways to gather data:
- assignments, games, homework, observation, quizzes, reflection sheets

Summative Assessment
- assessment that is near the end of a learning period

The teacher:
- administers at the end of a unit/term/course
- provides students an opportunity to demonstrate their learning
- provides students with a variety of assessment opportunities

Examples of ways to gather data:
- assignments, journals, performance tasks, tests, portfolios, presentations

Evaluation refers to the process of judging the quality of student work on the basis of established criteria, and assigning a value to represent that quality.

All curriculum expectations must be accounted for in instruction, but evaluation focuses on students' achievement of the overall expectations. Teachers will use their professional judgement to determine which specific expectations should be used to evaluate achievement of the overall expectations.

Assessment and evaluation are to be based on the categories of the achievement chart.

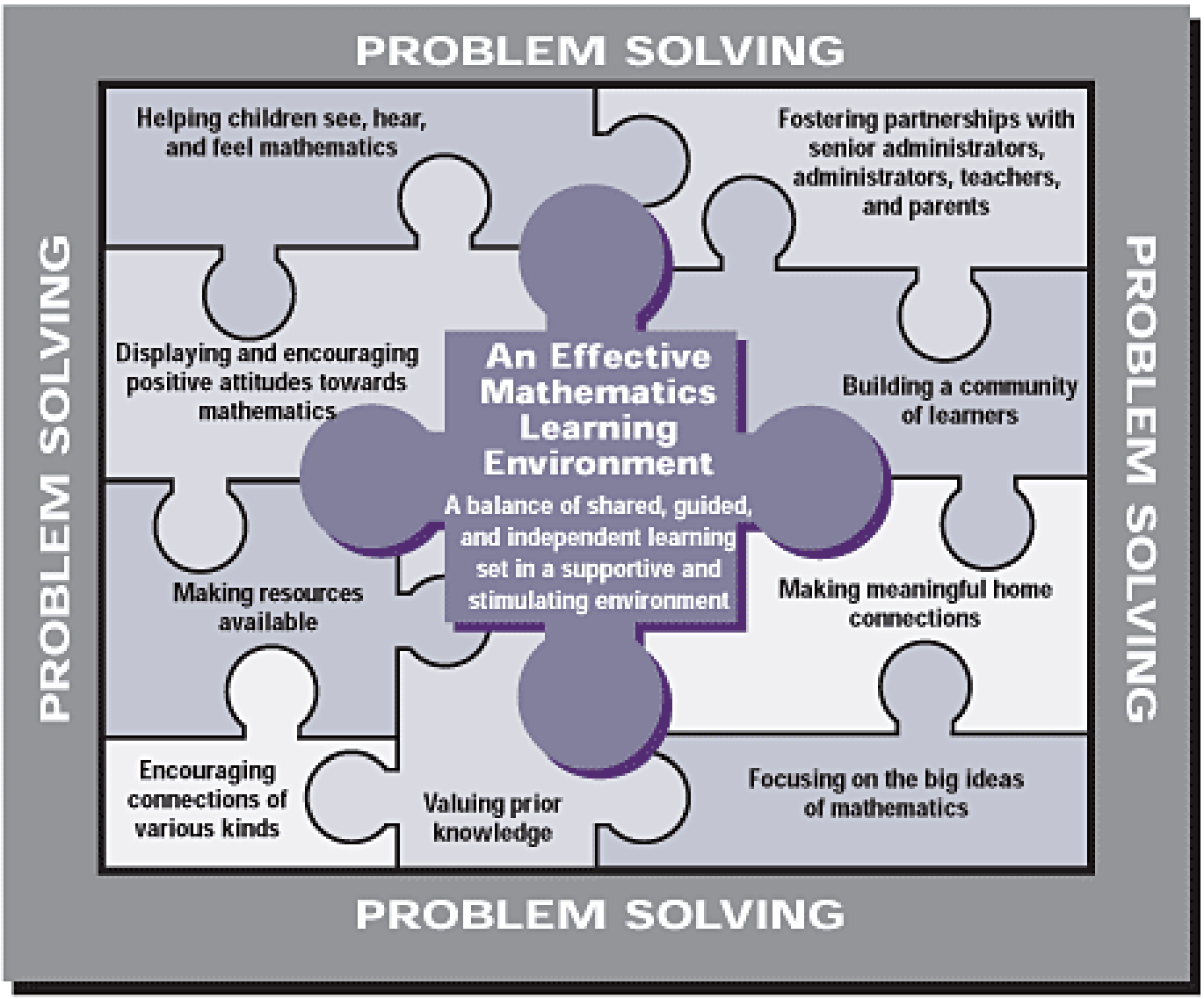
Achievement Chart – Mathematics, Grades 1 – 12

Categories	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding	**The student:**			
Knowledge of content (e.g. facts, terms, procedural skills, use of tools)	-demonstrates limited knowledge of content	-demonstrates some knowledge of content	-demonstrates considerable knowledge of content	-demonstrates thorough knowledge of content
Understanding of mathematical **concepts**	-demonstrates limited understanding of concepts	-demonstrates some understanding of concepts	-demonstrates considerable understanding of concepts	-demonstrates thorough understanding of concepts
Thinking	**The student:**			
Use of planning skills -understanding the problem (e.g. formulating and interpreting the problem, making conjectures) -making a plan for solving the problem	-uses planning skills with limited effectiveness	-uses planning skills with some effectiveness	-uses planning skills with considerable effectiveness	-uses planning skills with a high degree of effectiveness
Use of processing skills -carrying out a plan (e.g. collecting data, questioning, testing, revising, modelling, solving, inferring, forming conclusions) -looking back at the solution (e.g. evaluating, reasonableness, making convincing arguments, reasoning, justifying, proving, reflecting)	-uses processing skills with limited effectiveness	-uses processing skills with some effectiveness	-uses processing skills with considerable effectiveness	-uses processing skills with a high degree of effectiveness
Use of critical/creative thinking processes (e.g. problem solving, inquiry)	-uses critical/creative thinking processes with limited effectiveness	-uses critical/creative thinking processes with some effectiveness	-uses critical/creative thinking processes with considerable effectiveness	-uses critical/creative thinking processes with a high degree of effectiveness

Achievement Chart – Mathematics Grade 1 - 12

Categories	Level 1	Level 2	Level 3	Level 4
Communication	**The student:**			
Expression and **organization** of **ideas** and **mathematical thinking** (e.g. clarity of expression, logical organization), using oral, visual, and written forms (e.g. pictorial, graphic, dynamic, numeric, algebraic forms, concrete materials)	-expresses and organizes mathematical thinking with limited effectiveness	-expresses and organizes mathematical thinking with some effectiveness	-expresses and organizes mathematical thinking with considerable effectiveness	-expresses and organizes mathematical thinking with a high degree of effectiveness
Communication for different audiences (e.g. peers, teachers) **and purposes** (e.g. to present data, justify a solution, express a mathematical argument) in oral, visual, and written forms	-communicates for different audiences and purposes with limited effectiveness	-communicates for different audiences and purposes with some effectiveness	-communicates for different audiences and purposes with considerable effectiveness	-communicates for different audiences and purposes with a high degree of effectiveness
Use of conventions, **vocabulary**, and **terminology** of the discipline (e.g. terms, symbols) in **oral, visual** and **written** forms	-uses conventions, vocabulary, and terminology of the discipline with limited effectiveness	-uses conventions, vocabulary, and terminology of the discipline with some effectiveness	-uses conventions, vocabulary, and terminology of the discipline with considerable effectiveness	-uses conventions, vocabulary, and terminology of the discipline with a high degree of effectiveness
Application	**The student:**			
Application of **knowledge and skills** in **familiar contexts**	-applies knowledge and skills in familiar contexts with limited effectiveness	-applies knowledge and skills in familiar contexts with some effectiveness	-applies knowledge and skills in familiar contexts with considerable effectiveness	-applies knowledge and skills in familiar contexts with a high degree of effectiveness
Transfer of knowledge and skills to new contexts	-transfers knowledge and skills to new contexts with limited effectiveness	-transfers knowledge and skills to new contexts with some effectiveness	-transfers knowledge and skills to new contexts with considerable effectiveness	-transfers knowledge and skills to new contexts with a high degree of effectiveness
Making connections within and between various contexts (e.g. connections between concepts, representations, and forms within mathematics; connections involving use of prior knowledge and experiences; connections between mathematics, other disciplines, and the real world)	-makes connections within and between various contexts with limited effectiveness	-makes connections within and between various contexts with some effectiveness	-makes connections within and between various contexts with limited effectiveness	-makes connections within and between various contexts with a high degree of effectiveness

An Effective Mathematics Learning Environment



Early Math Strategy: The Report of the Expert Panel on Early Math in Ontario 2003 p.12

A balanced math program incorporates a variety of strategies for students to learn in a variety of contexts. The following three charts from p35 – 37 of 'The Report of the Expert Panel on Early Math in Ontario 2003' focus on why, what and how to incorporate a shared, guided and an independent learning environment into your classroom.

Think Literacy Strategies

"Mathematics is the most difficult content area material to read because there are more concepts per word, per sentence, and per paragraph than in any other subject; the mixture of words, numerals, letters, symbols, and graphics requires the reader to shift from one type of vocabulary to another."

Report of the Expert Panel for Mathematical Literacy Gr. 7 – 12

The following is a list of literacy strategies that can be embedded in most lessons.

- Anticipation Guide
- Visualizing
- Concept Maps
- Frayer Model
- adding words/concepts to class Word Wall
- encouraging use of academic vocabulary (referencing Word Wall)
- encouraging students to verbalize their thinking
- using math journals
- "inking their thinking" (encouraging students to write it down)
- using highlighters, highlighting signal words
- using sticky notes
- thinking aloud (to demonstrate a thinking process or literacy skill)
- retelling
- modeling (by teacher)
- drawing conclusions
    - summarizing
    - predicting
- connecting to background knowledge
    - making inferences

Literacy strategies are also embedded naturally within the type of groupings we have for the lessons and in the strategy for delivering the lesson. The following is a list of groupings and strategies to consider as you are planning your 3 part lesson (**M**inds On, **A**ction, **C**onsolidation and Debriefing).

Groupings	Strategies	
Whole Class	Acting	Investigation
Small Groups	Activity	Jigsaw
Groups of 4	Activity Instructions	Journal
Groups of 3	Brainstorm	Note Making
Pairs	Carousel	Peer Coaching
Individual	Conference	Peer Editing
Think/Pair/Share	Demonstration	Performance Assessment
Pair/Share	Discussion	Portfollio
Think/Share	Experiment	Practise
Expert Groups	Exploration	Presentation
4 Corners	Field Trip	Research
Opposite Sides	Game	Role Play
Numbered Heads	Guest Speaker	Self Assessment
Placemat	Independent Study	Simulation
	Interview	Summarizing
		Timed Retell

WEBSITES

Note: Click for direct link to the following websites

Website Address	Description
http://www.edu.gov.on.ca/eng/document/reports/numeracy/	*Report of the expert panel for Mathematical Literacy Gr. 7 - 12*
http://oame.on.ca/main/index1.php?lang=en&code=ThinkLit	*Think Literacy Mathematics Grade 7 - 10*
http://nlvm.usu.edu/en/nav/vlibrary.html	*National Library of Virtual Manipulatives for Intermediate Mathematics* *-interactive activities for all strands*
http://www.learner.org	*Learning Math Series* *-assessment activities for both math and science* *-videos and instruction for teachers*
http://arcytech.org/java/	*-complete lessons, user friendly for students e.g. Pythagorean, Number Sense, circles*
http://www.nrich.maths.org.uk/	*Rich math tasks*
http://mathcentral.uregina.ca	*Easy to use lessons. Good glossary.*
www.mathforum.org	*Posts weekly math problems from different strands. Previous problems and various solutions are available in the archives.*
www.mathforum.org/dr.math	*Dr. Math will answer questions that are baffling you.*
http://mathforum.org/trscavo	*Activities and links for various learning tools ie. geoboards, tangrams, statistics*
http://illuminations.nctm.org/index.aspx	*National Council of Teachers of Mathematics* *-lesson plans*
http://math.rice.edu/~lanius/Lessons/	*NCTM standards math activities*
http://standards.nctm.org/document/eexamples/index.html#6-8	*NCTM independent lessons across strands*
www.aimsedu.org	*Association for the Integration of Math and Science (AIMS)* *-lessonware, puzzles, professional articles*

Grade 11 MBF 3C Mathematics Scope and Sequence

Unit	Lesson Days	Review Days (Instructional Jazz Days)	Evaluation	Total Days
1.Introductory Unit – review from grades 9 and 10	4	0	1	5
2. Trigonometry	8	1	1	10
3. Mathematical Models – Connecting Graphs and Equations of Quadratic Relations - Part I	6	1	1	8
4. Mathematical Models – Connecting Graphs and Equations of Quadratic Relations – Part II	6	1	1	8
5. Data Management – Statistics	8	1	1	10
6. Data Management - Probability	6	1	1	8
7. Mathematical Models –Connecting Graphs of Equations of Exponential Relations and Solving Problems Involving Exponential Relations	8	1	1	10
8. Finance	14	1	1	16
9. Geometry	8	0	0	8
Course Review	2	0	0	2
Course Summative Performance Task and Portfolio Time	0	0	3	3
Totals:	68	7	11	88

Note: Days are defined to have 76 minutes.