



**NIAGARA ACADEMY**  
**PRINCIPALS OF MATHEMATICS, GRADE 10, ACADEMIC**  
**COURSE OUTLINE**

COURSE CODE: MPM2D

DEVELOPED BY: R. Cooper, September, 2006

REVISED BY: R. Cooper (2007, 2009), L. Cousineau, (2011), M. Wilson (2012, 2013), T. Bozza (2014), S. Davis (2015, 2016), J. Pauls (2017, 2018), J. Delgado (2019)

DEVELOPED FROM: The Ontario Curriculum Grades 9 and 10, Mathematics, 2005  
<http://www.edu.gov.on.ca/eng/curriculum/secondary/math910curr.pdf>

PREREQUISITE: Grade 9 Mathematics, Academic or Applied Level

COURSE DURATION: 110 hours

COURSE VALUE: 1.0 credits

**COURSE DESCRIPTION AND RATIONALE**

This course enables students to broaden their understanding of relationships and extend their problem-solving and algebraic skills through investigation, the effective use of technology, and abstract reasoning. Students will explore quadratic relations and their applications; solve and apply linear systems; verify properties of geometric figures using analytic geometry; and investigate the trigonometry of right and acute triangles. Students will reason mathematically and communicate their thinking as they solve multi-step problems.

## OVERALL CURRICULUM EXPECTATIONS

### **Quadratic Relations of the Form $y = ax^2 + bx + c$**

By the end of this course, students will:

- determine the basic properties of quadratic relations;
- relate transformations of the graph  $y = x^2$  to the algebraic representation  $y = a(x - h)^2 + k$ ;
- solve quadratic equations and interpret the solutions with respect to corresponding relations;
- solve problems involving quadratic relations.

### **Analytic Geometry:**

By the end of this course, students will:

- model and solve problems involving the intersection of two straight lines;
- solve problems using analytic geometry involving properties of lines and line segments;
- verify geometric properties of triangles and quadrilaterals, using analytic geometry.

### **Trigonometry:**

By the end of this course, students will:

- use their knowledge of ratio and proportion to investigate similar triangles and solve problems related to similarity;
- solve problems involving right triangles, using the primary trigonometric ratios and the Pythagorean theorem;
- solve problems involving acute triangles, using the sine law and the cosine law.

### COURSE CONTENT AND EVALUATION

Unit	Description	Evaluation	Hours
Unit 1	<i>Solving Linear Systems: Graphing</i> 1.1 Representing Linear Equations 1.2 Solving Linear Systems: Graphing 1.3 Solving Linear Systems: Substitution 1.4 Solving Linear Systems: Elimination 1.5 Application of Linear Systems	8%	13 hrs
Unit 2	<i>Analytic Geometry</i> 2.1 Mid-point on a Line Segment 2.2 Length of a Line Segment 2.3 Equation of a Circle 2.4 Classifying Figures on a Coordinate Grid 2.5 Verifying Properties of Geometric Figures	9%	14 hrs
Unit 3	<i>Graphs of Quadratic Relations</i> 3.1 Exploring Quadratic Relations 3.2 Properties of Graphs of Quadratic Relations 3.3 Factored Form of Quadratic Relation 3.4 Expanding Quadratic Equations 3.5 Quadratic Models Using Factored Form	9%	14 hrs
Unit 4	<i>Factoring Algebraic Expressions</i> 4.1 Common Factors in Polynomials 4.2 Exploring the Factorization of Trinomials 4.3 Factoring Quadratics: $x^2 + bx + c$ 4.4 Factoring Quadratics: $ax^2 + bx + c$ 4.5 Factoring Quadratics: Special Cases	9%	14 hrs
Unit 5	<i>Applying Quadratics</i> 5.1 Stretching/Reflecting Quadratic Relations 5.2 Exploring Translations 5.3 Graphing Quadratics in Vertex Form 5.4 Problem Solving Using Quadratic Relations	9%	14 hrs
Unit 6	<i>Quadratic Equations</i> 6.1 Solving Quadratic Equations 6.2 Completing the Square 6.3 The Quadratic Formula 6.4 Interpreting Quadratic Equation Roots 6.5 Solving Problems Using Quadratic Models	9%	14 hrs
Unit 7	<i>Similar Triangles and Trigonometry</i> 7.1 Congruence and Similarity Triangles 7.2 Solving Similar Triangle Problems 7.3 The Primary Trigonometric Ratios 7.4 Solving Right Triangles 7.5 Applications: Right Triangle Trigonometry	9%	14 hrs
Unit 8	<i>Acute Triangle Trigonometry</i> 8.1 Exploring the Sine Law 8.2 Exploring the Cosine Law 8.3 Solving Acute Triangle Problems	8%	13 hrs
	<b>Total Term Work</b>	<b>70%</b>	<b>110 hrs</b>
<b>Final Evaluation</b>	<b>Culminating Activity Exam</b>	<b>10%</b> <b>20%</b>	
	<b>Final Mark</b>	<b>100%</b>	

<i>Knowledge/ Understanding</i>	<i>Thinking/ Inquiry</i>	<i>Communication</i>	<i>Application/Making Connections</i>
<i>(30%)</i>	<i>(30%)</i>	<i>(20%)</i>	<i>(20%)</i>
<ul style="list-style-type: none"> <li>• <i>Quizzes</i></li> <li>• <i>Worksheets</i></li> <li>• <i>Assignments</i></li> <li>• <i>Note making</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Tests</i></li> <li>• <i>Assignments</i></li> <li>• <i>Gizmos</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Assignments</i></li> <li>• <i>Gizmos</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Investigations</i></li> <li>• <i>Using technology</i></li> </ul>

## ASSESSMENT AND EVALUATION

### **Evaluation and Reporting of Student Achievement**

Student achievement is communicated formally to students and parents twice per semester by means of the Provincial Report Card, Grades 9–12. The report card provides a record of the student’s achievement of the curriculum expectations in every course, at particular points in the school year or semester, in the form of a percentage grade. The percentage grade represents the quality of the student’s overall achievement of the expectations for the course which are described in the achievement chart on pages 20-21 of The Ontario Curriculum Grades 9 and 10, Mathematics, 2005, <http://www.edu.gov.on.ca/eng/curriculum/secondary/math910curr.pdf>.

**Learning Skills** will also be assessed and reported on the Provincial Report Card, Grades 9-12. The quality of the learning skills demonstrated by a student are recorded in six categories – Responsibility, Organization, Independent Work, Collaboration, Initiative, Self-Regulation – and are assessed throughout the semester using a four-point scale (E-Excellent, G-Good, S-Satisfactory, N-Needs Improvement), and using the document Growing Success: Assessment, Evaluation and Reporting in Ontario Schools, 2010 (page 11), as a guide (<http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf>).

**Assessment for Learning** will be used as a process for seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go, and how best to get there. Teachers will use diagnostic assessment before instruction and formative assessment will occur frequently and in an ongoing manner to monitor students’ progress. Observation and conversation will be used to determine the needs of individual student learning.

**Assessment as Learning** will focus on the explicit fostering of student’s capacity over time to be their own best assessors, but teachers need to start by presenting and modeling external, structured opportunities for students to assess themselves. Formative assessment be used by students to monitor their own and their peers’ progress.

**Assessment of Learning** will be used as the assessment that becomes public and results in statements or symbols about how well students are learning. Summative assessment will be used by the teacher to summarize learning at a given point in time. (Ref: page 31 of Growing Success, or page 8 of this document)

Assessment and evaluation are based on the provincial expectations and levels of achievement out-lined in the provincial curriculum document for each subject in secondary school. A wide range of assessment and evaluation opportunities allows students to demonstrate their learning in a variety of ways. This information provides the basis for reporting student grades on the Provincial Report Card. Achievement (reflected in a final mark) will be calculated using the following categories:

A final grade is recorded for every course, and a credit is granted and recorded for every course in which the student's grade is 50% or higher. The final grade for each course in Grades 9–12 will be determined as follows:

- Seventy per cent of the grade will be based on evaluations conducted throughout the course. This portion of the grade should reflect the student's most consistent level of achievement throughout the course, although special consideration should be given to more recent evidence of achievement. Please see the following page for an explanation of how course work marks will be obtained.
- Thirty per cent of the grade will be based on a final evaluation in the form of an examination, performance task and/or other method of evaluation suitable to the course content and administered towards the end of the course. This final evaluation will include a Culminating Activity 10% and a Final Exam 20%.

A student's achievement of the overall curriculum expectations will be evaluated in accordance with the achievement charts in the provincial curriculum and will be reported using percentage marks. It is expected that both mathematical calculations and professional judgement will inform the determination of percentage marks.

### **TEACHING AND LEARNING STRATEGIES**

Since the over-riding aim of this course is to help students use the language of mathematics skillfully, confidently and flexibly, a wide variety of instructional strategies are used to provide learning opportunities to accommodate a variety of learning styles, interests and ability levels. Seven mathematical processes will form the heart of the teaching and learning strategies used.

- *Communicating:* To improve student success there will be several opportunities for students to share their understanding both in oral as well as written form.
- *Problem solving:* Scaffolding of knowledge, detecting patterns, making and justifying conjectures, guiding students as they apply their chosen strategy, directing students to use multiple strategies to solve the same problem, recognizing, encouraging, and applauding perseverance, discussing the merits of different strategies for specific types of problems.
- *Reasoning and proving:* Asking questions that get students to hypothesize, providing students with one or more numerical examples that parallel these with the generalization and describing their thinking in more detail.
- *Reflecting:* Modeling the reflective process, asking students how they know.

- *Selecting Tools and Computational Strategies:* Modeling the use of tools and having students use technology to help solve problems.
- *Connecting:* Activating prior knowledge when introducing a new concept in order to make a smooth connection between previous learning and new concepts and introducing skills to make connections between particular manipulations and problems that require them.
- *Representing:* Modeling various ways to demonstrate understanding, posing questions that require students to use different representations as they are working at each level of conceptual development - concrete, visual or symbolic, allowing individual students the time they need to solidify their understanding at each conceptual stage.

### **CONSIDERATIONS FOR PROGRAM PLANNING**

The planning and administering of this course is based on the premise that all students can be successful language learners. The teacher will provide quality instruction that respects students' strengths and address their learning needs, using assessment information to plan instruction. Accommodation for IEP students is not applicable at Niagara Academy, but the teacher will make appropriate adaptations for English Language Learners, such as the following:

- modification of some or all of the course expectations, based on the student's level of English proficiency;
- use of a variety of instructional strategies (e.g. extensive use of visual cues, manipulatives, pictures, diagrams, graphic organizers; attention to clarity of instructions; modelling of preferred ways of working in mathematics; previewing of textbooks; pre-teaching of key specialized vocabulary; encouragement of peer tutoring and class discussion; strategic use of students' first languages);
- use of a variety of learning resources (e.g., visual material, simplified text, bilingual dictionaries, culturally diverse materials);
- use of assessment accommodations (e.g., granting of extra time; use of alternative forms of assessment, such as oral interviews, learning logs, or portfolios; simplification of language used in problems and instructions).

Information and communications technology will be used throughout the course where it is appropriate. The program will also include opportunities for students to apply their skills to work-related situations, to explore educational and career options, and to become self-directed learners.

Teachers will model safe practices at all time and communicate safety requirements to students in accordance with the school, the Ministry of Education policies and Ministry of Labour regulations. This is particularly important in the case of off-site excursions. Teachers will also adhere to the policies of the First Nation, Métis and Inuit Education policy framework should the class include students from these communities.

## **RESOURCES**

Mathematics 10, Nelson, 2001, ISBN 0-17-615702-2

Principles of Mathematics 10 Nelson, ISBN 9780176678173

Kuta Software (Worksheets) <https://www.kutasoftware.com/>

Desmos Graphing Software <https://www.desmos.com/calculator>