

## Course Outline

School Name: KEEWAYTINOOK INTERNET HIGH SCHOOL  
Department Name: Mathematics

Ministry of Education Course Title: Principles of Mathematics

Grade Level: 10

Ministry Course Code: MPM2D

Teacher's Name: Nikki Osborne

Developed by: Erik Tu

Date: September 2016

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Developed from:

Ontario Ministry of Education. (2005). *The Ontario curriculum, grades 9 and 10: Mathematics*. Toronto ON: Queen's Printer for Ontario.

Text:

Knill, G., Collins, E., Conrad, E., Ferneyhough, F., Hamilton, M., Miller, R., Wardrop, H. & Webb, M. (2000). *Mathpower 10 (Ontario Edition)*. McGraw-Hill Companies.

Prerequisite: None

Credits: One

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval:



Approval Date: September 15, 2022

## Course Description/Rationale

This course enables students to broaden their understanding of relations, extend their skills in multi-step problem solving, and continue to develop their abilities in abstract reasoning. Students will model linear and quadratic relationships arising from a variety of contexts. Using trigonometric ratios and analytic geometry techniques, students will learn how to find exact measures in geometric contexts, as opposed to the approximate measures they have found using scale drawings and measurement tools. Geometric relationships investigated in Grade 9 will be confirmed, analytically, in specific cases, and students will be introduced to proof in general. Algebraic skills will be extended to generate factored, expanded, and completed square forms of quadratic expressions, and to solve linear systems and quadratic equations. Fundamental mathematical ideas of modeling, patterning, optimization, and superimposing a grid onto a geometric situation are reinforced. Connections among the various strands of the course are intentionally developed.

## Overall Curriculum Expectations

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

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

### Analytic Geometry

- 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

- 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

Unit	Length
1. Quadratic Functions	40 hours
2. Linear Systems	20 hours
3. Analytic Geometry	20 hours
4. Similar Triangles and Trigonometry	30 hours
<b>Total</b>	<b>110 hours</b>

## Unit Descriptions

### Unit 1 – Quadratic Functions

This unit enables students to broaden their understanding of relations, extend their skills in multi-step problem solving, and continue to develop their abilities in abstract reasoning. Students will gather, organize, manipulate, and analyse data from primary and secondary sources to model and communicate results about quadratic situations. A variety of problems will be studied to ensure that students will gain depth of understanding of quadratics through meeting the same specific expectations in different contexts. Students will conduct investigations to verify or refute their own conjectures about relationships, using lines or curves of best fit, tables, and pattern descriptions.

They will communicate their findings and describe trends. A rich foundation for quadratics, built on experiences from a variety of real world contexts, will be built before subsequent algebraic studies are undertaken.

### **Unit 2 – Linear Systems**

This unit will focus on the use of two linear equations to model a problem. In some cases, both lines are graphical models where the point of intersection of the lines has meaning in the context of the problem. Points of intersection will be found through numerical, graphical, and algebraic analysis. In other cases, only parts of two lines are needed to model a single situation. These result in consideration of a range of values for solution to an optimization problem through linear programming analysis. This unit also contains multi-step problems in analytic geometry which require solutions of a linear system.

### **Unit 3 – Analytic Geometry**

This unit provides contexts for developing formulas for midpoint, distance between points, and circles centered at the origin. Then geometric relationships investigated in Grade 9 mathematics are confirmed through the use of the Cartesian system and formulas. Properties of triangles and quadrilaterals are investigated analytically.

### **Unit 4 – Similar Triangles and Trigonometry**

Students are introduced to applications of similar triangles and trigonometry through a variety of activities that use concrete materials and allow students to move about inside and outside the classroom. Primary trigonometric ratios, Sine and Cosine Laws are used to solve problems that are modelled by right-angled or acute triangles. As students move from the first unit to the second unit, they investigate how the tangent ratio for the angle of inclination is connected to the slope of a line.

### **Unit 3 – Summative Assessment Activities**

This unit will be used to model a final assessment in grade10 mathematics. Individual and group performance skills will be assessed using traditional and performance based tasks, over a period of several days. Thirty percent of the final evaluation for the course will be based on this summative assessment unit and it is recommended that at least 2/3 be based on performance tasks, and at most 1/3 be based on pencil and paper tests. It is suggested that the form and substance of this summative assessment unit be shared with students and their parents near the beginning of the course, so that their energies can be directed towards acquisition of the required skills and knowledge.

In this summative assessment unit, students will demonstrate their achievement of the expectations of the course. They will do this by solving problems which require them to: form and test conjectures, model situations, gather, organize, and display data for a purpose, identify necessary and/or sufficient conditions in a problem, decide, with awareness, what is important and what can be ignored in a problem, communicate reasoning and results, demonstrate their skills using technology for a purpose, and carry out pencil and paper routines.

## ***Teaching/Learning Strategies***

This course is organized into an eight-week series of lessons and activities that is presented to students in remote northern communities via the internet. The eighth week is used for course consolidation, review, and the final examination. Teacher and students communicate over the internet through timely activity feedback, emails, messages, video and audio calls. Classroom mentors assume the role of liaison between the teacher and student while also supporting a holistic approach to motivate, engage and support each individual student.

A variety of strategies will be used in the online delivery of this course. Some instructional strategies include:

- Promote the role of teacher as a guide and facilitator in the classroom.

- Use electronic technology in investigations as appropriate (including computer software, calculators, video, and digital effects).
- Promote direct involvement in a variety of concrete experiences with the natural world which enable students to construct their own understanding of concepts and principles.
- Use formative assessment to provide opportunities for re-learning.
- Address a variety of learning styles in each unit.
- Plan so that sufficient class time is spent in engaging students in the solution of rich contextual problems.
- Be accountable to addressing the overall and specific expectations in their planning, and accountable to tracking student progress in the overall expectations, including the most specific expectations.
- Provide many opportunities for students to demonstrate their ability to meet course expectations.
- Ensure that the culmination of an activity helps the students to build a solid understanding of the mathematical concepts arising from that activity and sets the stage for future learning
- Prompt at the beginning of an activity, provide suggestions in the middle, and support a challenge at the end, by the class as a whole.
- Use learning/performance tasks that are designed to link several expectations and give the students occasion to demonstrate their optimal levels of achievement through the communication of results, the ability to pose extending questions following an inquiry, and to provide the solution to unfamiliar problems.
- Provide remedial or extension opportunities.

Learning goals will be discussed at the beginning of each assignment and success criteria will be provided to students. The success criteria are used to develop the assessment tools in this course, including rubrics and checklists.

## Evaluation

The final grade will be determined as follows (Ontario Ministry of Education, 2010):

- Seventy per cent of the grade will be based on evaluation 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.
- Thirty percent of the grade will be based on a final evaluation administered at or towards the end of the course. This evaluation will be based on evidence from one or a combination of the following: an examination, a performance, an essay, and/or another method of evaluation suitable to the course content. The final evaluation allows the student an opportunity to demonstrate comprehensive achievement of the overall expectations for the course (p. 41).

Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario schools*. Toronto ON: Queen's Printer for Ontario.

Type of Assessment	Category	Details	Weighting (%)
Term Work (70%)	Knowledge/ Understanding	Use their knowledge of ratio and proportion to investigate similar triangles and solve problems related to similarity.	13
	Thinking	Relate transformations of the graph of $y = x^2$ to the algebraic representation $y = a(x - h)^2 + k$ . Verify geometric properties of triangles and quadrilaterals, using analytic geometry. Determine the basic properties of quadratic relations.	19

	Communication	Solve quadratic equations and interpret the solutions with respect to the corresponding relations. Solve problems involving quadratic relations. Solve problems using analytic geometry involving properties of lines and line segments. 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.		19
	Application	Model and solve problems involving the intersection of two straight lines.		19
Final Evaluation (30%)	Culminating Activity (15%)	Solve real life application problems using a variety of methods Choose from among all the skills learned in the course to solve given questions Solve problems ranging from all strands of the course Show insight into how skills and formula can be applied to different problems and situations	K/U	3
			T	4
			C	4
			A	4
	Exam (15%)	Written examination designed to cover all of the overall expectations of the course	K/U	3
			T	4
			C	4
			A	4
			<b>TOTAL</b>	<b>100</b>

## Assessment/Evaluation Strategies

A variety of assessment and evaluation methods, strategies and tools are required as appropriate to the expectation being assessed. These include diagnostic, formative, and summative within the course and within each unit.

Assessment *for* learning and assessment *as* learning is obtained through a variety of means, including the following:

- Ongoing descriptive feedback;
- Graphic organizers;
- Rating scales;
- Checklists;
- Mentor observations;
- Conversations with student on a regular basis to verbalize observations, ask questions, and clarify understanding.

Evidence of student achievement (assessment *of* learning) is collected from various sources, including the following:

- Ongoing observations of most consistent work, with consideration given to most recent work;
- Conversations with students;
- Summative unit activities;
- Culminating activity;
- Exam.

The Ministry of Education's 2010 document, *Growing Success*, outlines the seven fundamental principles that guide best practice in the assessment and evaluation of students. KiHS teachers use practices that:

- are fair, transparent, and equitable for all students;
- support all students, including those with special education needs, those who are learning the language of instruction (English or French), and those who are First Nation, Métis, or Inuit;
- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students;
- are communicated clearly to students and parents at the beginning of the course and at other points throughout the school year or course;
- are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning;
- provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement;
- develop students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan next steps for their learning (p.6).

## Resources

EduGAINS. (n.d.). Mathematics K-12. <http://www.edugains.ca/newsite/HOME/index.html>

Indigenous knowledge. (n.d.). Indigenous Knowledge & Mathematics. <http://mkn-rcm.ca/indigenouknowledge/>

Knill, G., Collins, E., Conrad, E., Ferneyhough, F., Hamilton, M., Miller, R., Wardrop, H. & Webb, M. (2000). *Mathpower 10 (Ontario Edition)*. McGraw-Hill Companies.

Ontario Ministry of Education. (n.d.). *Indigenous education strategy*. <http://www.edu.gov.on.ca/eng/aboriginal/>

Ontario Ministry of Education. (2005). *The Ontario curriculum, grades 9 and 10: Mathematics*. <http://www.edu.gov.on.ca/eng/curriculum/secondary/ssciences.html>

Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario schools*. <http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf>

Ontario Ministry of Education. (2016). *Ontario schools, kindergarten to grade 12: Policy and program requirements*. <http://edu.gov.on.ca/eng/document/policy/os/index.html>

Tomlinson, C. (2014). *The differentiated classroom: Responding to the needs of all learners*. ASCD.

## Program Planning

This course is offered to Indigenous students living in isolated, northern Ontario communities. It is offered by qualified teachers in a blended classroom with a balance of academic, wellness, land-based learning, local language and culture to support the success of the whole student. This course uses the internet for instruction, demonstration and research. It utilizes a student-centered semi-virtual classroom which capitalizes on the strengths of internet program delivery to minimize the disadvantages of geographic remoteness.

Students are presented with 1320 minutes of instruction/activity via the internet over the period of one week. All lessons, assignments, questions and course material is presented in this manner, with approved print materials available as a student resource in each classroom. The student and

instructor communicate via the internet, while a classroom mentor (a fully qualified teacher) assists students in completing tasks in a timely manner and provides support as required.

Indigenous and local content is used throughout the course to meet students' learning needs. Opportunities for outdoor activities and land-based learning are also incorporated and students are encouraged to use local knowledge in their products. Considerations are made to the learning preferences of the student population and lessons can be adjusted for individual students as required. Opportunities have been provided for students to apply ideas and concepts encountered in this course to their lives as an individual and as a member of a First Nations community. Teachers consult the Ontario Ministry of Education policies, guidelines and important initiatives when planning a comprehensive program in this area.