

# Course Outline

School Name: Keewaytinook Internet High School

Department Name: Mathematics

Ministry of Education Course Title: Mathematics of Data Management

Grade Level: 12

Ministry Course Code: MDM4U

Teacher's Name: Mary Anne F. Barrett

Developed by: Erik Tu

Date: January 2018

Revision Date: September 2019

Developed from: The Ontario Curriculum, Grades 11 and 12,  
Mathematics, 2007

Text: None

Prerequisite: Functions, Grade 11, University Preparation, or  
Functions and Applications, Grade 11, University/College  
Preparation

Credits: One

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval (signature): *Angela Batsford-Mermans*

Approval Date: September 9, 2019

## ***Course Description/Rationale***

This course broadens students' understanding of mathematics as it relates to managing data. Students will apply methods for organizing and analyzing large amounts of information; solve problems involving probability and statistics; and carry out a culminating investigation that integrates statistical concepts and skills. Students will also refine their use of mathematical processes necessary for success in senior mathematics. Students planning to enter university programs in business, the social sciences, and the humanities will find this course of particular interest.

## ***Overall Curriculum Expectations***

A1) solve problems involving the probability of an event or a combination of events for discrete sample spaces;

A2) solve problems involving the application of permutations and combinations to determine the probability of an event.

B1) demonstrate an understanding of discrete probability distributions, represent them numerically, graphically, and algebraically, determine expected values, and solve related problems from a variety of applications;

B2) demonstrate an understanding of continuous probability distributions, make connections to discrete probability distributions, determine standard deviations, describe key features of the normal distribution, and solve related problems from a variety of applications.

C1) demonstrate an understanding of the role of data in statistical studies and the variability inherent in data, and distinguish different types of data;

C2) describe the characteristics of a good sample, some sampling techniques, and principles of primary data collection, and collect and organize data to solve a problem.

D1) analyze, interpret, and draw conclusions from one-variable data using numerical and graphical summaries;

D2) analyze, interpret, and draw conclusions from two-variable data using numerical and graphical summaries;

D3) demonstrate an understanding of the applications of data management used by the media and the advertising industry and in various occupations.

E1) design and carry out a culminating investigation\* that requires the integration and application of the knowledge and skills related to the expectations of this course;

E2) communicate the findings of a culminating investigation and provide constructive critiques of the investigations of others.

# Course Content

<i>Unit</i>	<i>Length</i>
Discrete Probability Distributions	20 hours
Statistics of One Variable	20 hours
Statistics of Two Variables	20 hours
Combination and Permutation	20 hours
Continuous Probability Distribution	20 hours
Culminating Activities and Assessments	10 hours
<b>Total</b>	110 hours

## Unit Descriptions

### Unit 1 – Discrete Probability Distributions

In this unit students will solve problems involving the probability of an event or a combination of events for discrete sample spaces; demonstrate an understanding of discrete probability distributions, represent them numerically, graphically, and algebraically, determine expected values, and solve related problems from a variety of applications.

### Unit 2 – Statistics with one Variable

This unit will focus on the analysis and presentation of one-variable data. Students will process raw data and develop the skills to summarize it in terms of central tendency, spread and distribution. Students will analyze, interpret, and draw conclusions from one-variable data using numerical and graphical summaries and explore methods of describing a single piece of data in the context of a wider data set. They develop the critical thinking skills necessary to interpret and assess the validity of secondary data and conclusions drawn from it.

### Unit 3 – Statistics with two Variables

Two-variable statistics are the basis for many decisions personally and as a society. Although most two variable statistical tests are beyond the scope of secondary school math, this unit will examine some of the basic topics in two-variable statistics. Two-variable statistics provide methods for detecting relationships between variables and for developing mathematics of these relationships. The visual pattern in a graph or plot can

often reveal the nature of the relationship between two variables. In this unit students will analyse, interpret, and draw conclusions from two-variable data using numerical, graphical, and algebraic summaries.

#### **Unit 4 – Combination and Permutation**

Combination and Permutation is the branch of mathematics dealing with ideas and methods for counting, especially in complex situations. The techniques and mathematical logic for counting possible arrangements or outcomes are useful for a wide variety of applications. Students will investigate the concepts of combinations and permutations, solve problems involving the application of permutations and combinations to determine the probability of an event. They will consider situations in which each should be used, and develop the skills to be able to determine which is most appropriate.

#### **Unit 5 – Continuous Probability Distributions**

Students will gain an understanding of continuous distributions, and will investigate different shapes of distribution, considering situations that may generate them. Students will explore the normal distribution in detail, and investigate its many applications. Students will solve problems involving the probability of an event or a combination of events for continuous distribution; demonstrate an understanding of continuous probability distributions, represent them numerically, graphically, and algebraically, determine expected values, and solve related problems from a variety of applications, maintaining an awareness of the possibility of bias and misrepresentation, either deliberate or accidental.

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

As in a conventional classroom, instructors employ a range of strategies for teaching a course:

- Clear writing that connects mathematics to relevant situational problems
- Examples of full solutions in various contexts and opportunities to practice
- Direct instruction and coaching on student work by the mentor

In addition, teachers and students have at their disposal a number of tools that are unique to electronic learning environments:

- Electronic simulation activities
- Discussion boards and email
- Assessments with real-time feedback
- Interactive activities that engage both the student and teacher in subject

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.

- *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, when appropriate, recognizing, encouraging, and applauding perseverance, discussing the relative 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 in context 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

## ***Evaluation***

The evaluation for this course is based on the student's achievement of curriculum expectations and the demonstrated skills required for effective learning. The final percentage grade represents the quality of the student's overall achievement of the expectations for the course and reflects the corresponding level of achievement as described in the achievement chart for the discipline. A credit is granted and recorded for this course if the student's grade is 50% or higher. The final grade will be determined as follows:

- 70% of the grade will be based upon evaluations conducted throughout the course. This portion of the grade will reflect the student's most consistent level of achievement throughout the course, although special consideration will be given to more recent evidence of achievement.
- 30% of the grade will be based on final evaluations administered at the end of the course. The final assessment is a combination of both an exam and culminating activities.

Our theory of assessment and evaluation follows the Ministry of Education's *Growing Success* document, and it is our firm belief that doing so is in the best interests of students. We seek to design assessment in such a way as to make it possible to gather and show evidence of learning in a variety of ways to gradually release responsibility to the students, and to give multiple and varied opportunities to reflect on learning and receive detailed feedback.

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	solve problems involving the probability of an event. determine expected values, standard deviations, and describe key features of the normal distribution	13%	
	Thinking	solve problems involving the application of permutations and combinations. distinguish different types of data and analyze data using numerical and graphical summaries;	19%	
	Communication	represent probability numerically, graphically, and algebraically. interpret, and draw conclusions using numerical and graphical summaries, and communicate findings.	19%	
	Application	solve problems from a variety of applications demonstrate an understanding of the applications of data management used by the media and the advertising industry and in various occupations.	19%	
Final Assessment (30%)	Culminating Activity	design and carry out a culminating investigation* that requires the integration and application of the knowledge and skills related to the expectations of this course; communicate the findings of a culminating investigation.	K/U	3%
			T	4%
			C	4%
			A	4%
	Final Exam	Written examination designed to cover all of the overall expectations of the course	K/U	3%
			T	4%
			C	4%
			A	4%
TOTAL			100%	

## ***Assessment/Evaluation Strategies***

Our assessment and evaluation follows the Ministry of Education's *Growing Success* document. We seek to design assessment in such a way as to make it possible to gather and show evidence of learning in a variety of ways to gradually release responsibility to the students, and to give multiple and varied opportunities to reflect on learning and receive detailed feedback. Below are fundamental principles that of assessment and evaluation by KHS teachers.

- are fair and transparent for all students;
- support all students, including those with special education needs.
- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible;

- are ongoing, 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.

## ***Resources***

*Note:* This course is entirely online and does not require or rely on any textbook.

- Access to a spreadsheet, *Excel* or similar
- A scanner, smart phone camera, or similar device to upload handwritten or hand-drawn work

## ***Program Planning***

This course is offered to students living in isolated northern Ontario communities which do not have access to regular high school facilities, equipment or teachers associated with secondary education. This course uses the internet for instruction, demonstration and research. It uses a student centered semi-virtual classroom which capitalizes on the strengths of the internet program delivery to minimize the disadvantages of geographic remoteness.

Students are presented with instruction/activity via the internet. All lessons, assignments, questions and course material is presented in this manner with approved print materials available as a student resource. The student and instructor communicate via the internet, and there are regular, interactive, internet-based lessons during which the instructor presents key information to the class, and students have an opportunity to interact verbally with their instructor. A classroom mentor (a fully qualified teacher) assists students in completing tasks in a timely manner and provides tutoring as required.