



**TORONTO WORLD SCHOOL**

## **COURSE OUTLINE**

**Department: MATHEMATICS**

**Course Developer:** Ms. Taylor Cavers

**Course Development Date:** February 2024

**Course Reviser/ Revision Date:** TBD

**Course Title/ Grade/ Type:** Mathematics of Data Management, Grade 12,  
University Preparation

**Ministry Course Code:** MDM4U

**Credit Value:** 1.0

**Total Hours:** 110 hours

**Policy Document:** The Ontario Curriculum Grades 11 and 12 Mathematics,  
Ministry of Education 2007

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

## **Course Description:**

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 the mathematical processes necessary for success in senior mathematics.

## **Overall Curriculum Expectations**

### **Counting and Probability**

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 permutation and combinations to determine the probability of an event

### **Probability Distributions**

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

### **Organization of Data for Analysis**

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 organize data to solve a problem

### **Statistical Analysis**

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, graphical, and algebraic summaries

D3 – Demonstrate an understanding of the applications of data management used by the media and the advertising industry and in various occupations

### **Culminating Data Management Investigation**

E1 – Design and carry out a culminating investigation that requires the integration and application of the knowledge and skills related to the expectation of this course

E2 – Communicate the findings of a culminated investigation and provide constructive critiques of the investigation of others

## Outline of Course Content

Unit	Titles and Descriptions	Time and Sequence
Unit 1	<p><b>Tools for Data Management and Statistical Analysis</b></p> <p>In this unit students will demonstrate an understanding of the role of data in statistical studies and the variability inherent in data, and distinguish different types of data; 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; demonstrate an understanding of the applications of data management used by the media and the advertising industry and in various occupations. To summarize data and recognize the trends, we use tables and graphs. Another way of representing data is by using indices. Students will analyze, interpret, and draw conclusions from one-variable data using numerical and graphical summaries as well as draw conclusions from two-variable data using numerical, graphical, and algebraic summaries.</p>	30 hours
Unit 2	<p><b>Organized Counting and Permutations</b></p> <p>In this unit students will demonstrate an understanding of the role of data in statistical studies and the variability inherent in data, and distinguish different types of data; 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. This unit will also introduce students to a type of diagram that helps them organize data about groups of items when the order of the items is not important. These are called Venn diagrams and they show all possible relationships between sets. In this unit students will 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. Students are now ready to solve problems for which order does not matter. This is the branch of combinatorics called Combinations. For example, in many card games, what is in your hand is important, but the order in which it was dealt is not. In Combinations the number of ways of choosing <math>r</math> objects from <math>n</math> objects with no order involved is calculated. In this unit students will solve problems involving the probability of an event or a combination of events for discrete sample spaces; solve problems involving the application of permutations and combinations to determine the probability of an event. The Binomial Theorem is an important formula giving the expansion of powers of sums. This formula and the triangular arrangement of the binomial coefficients are often attributed to Pascal who described them in the 17th century. This triangle is referred to as Pascal's</p>	21 hours

	<p>Triangle. Pascal's method for building his triangle is a simple iterative process similar to those described in Unit 1. Pascal made the triangle famous by finding many applications for it. In this unit students will 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 using the Binomial theorem and Pascal's triangle.</p>	
Unit 3	<p><b>Introduction to Probability</b></p> <p>In this unit students will solve problems involving the probability of an event or a combination of events for discrete sample spaces; solve problems involving the application of permutations and combinations to determine the probability of an event; 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; 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.</p>	18 hours
Unit 4	<p><b>Distributions</b></p> <p>In this unit students will solve problems involving the probability of an event or a combination of events for discrete sample spaces; solve problems involving the application of permutations and combinations to determine the probability of an event; 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; 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. Students will also solve problems involving the probability of an event or a combination of events for discrete sample spaces; solve problems involving the application of permutations and combinations to determine the probability of an event; 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; 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.</p>	21 hours
Unit	<p><b>Culminating Investigation A and Presentations</b></p> <p>It is not enough to understand the mathematics of statistics. One must also</p>	15 hours

5	learn how to use statistics to put forward arguments, and how others might use statistics to tell - or distort- the truth. In this section, students will build upon their knowledge and skills from the first four units to investigate the statistical validity of sample literature.	
	<b>Final Examination and Presentations</b>  The final assessment task is a proctored exam worth 20% and a presentation worth 10%.	5 hours
	<b>Total</b>	<b>110 hours</b>

### Teaching and Learning Strategies

The strategies used are varied to meet the needs and the range of learning styles encountered and they include the following:

Demonstrations	Homework	Discussions
Problem Solving	Work and Task Sheets	Information Analysis
Decision Making	Teacher Led Review	Problem-based Learning
Direct Instruction	Co-operative Learning	

### Strategies for Assessment and Evaluation of Student Performance

Diagnostic assessment is used at the beginning of a unit to assist in determining a starting point for instruction. Assessment for Learning (AFL) provides information to students as they are learning and refining their skills. Assessment as Learning (AAL) acts as a stepping-stone for students to begin applying their understanding using critical thinking; it bridges the gap between AFL and AOL. Assessment of Learning (AOL), at the end of units and course, provides students with the opportunity to synthesize/apply/demonstrate their learning and the achievement of the expectations. The following is a list of specific assessment/evaluation strategies that the teacher may use but is not limited to.

### **Assessment and Evaluation**

Evaluation in this course will be continuous throughout the year and will include a variety of evaluation methods. The tools highlighted in yellow will be used for the three different types of assessments:

Assessment as Learning	Assessment for Learning	Assessment of Learning
<b>Student Product</b>	<b>Student Product</b>	<b>Student Product</b>
<input type="checkbox"/> Journals/Letters/Emails (checklist)	<input type="checkbox"/> Assignment <input type="checkbox"/> Journals/Letters/Emails	<input type="checkbox"/> <b>Assignment</b> <input type="checkbox"/> Journals/Letters/Emails

<ul style="list-style-type: none"> <li><input type="checkbox"/> Learning Logs (anecdotal)</li> <li><input type="checkbox"/> Learning Goals (Checklist)</li> <li><input type="checkbox"/> Homework Assignments</li> <li><input type="checkbox"/> Entrance tickets</li> <li><input type="checkbox"/> Exit tickets</li> </ul>	<p>(checklist)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Pre-tests (scale/rubric)</li> <li><input type="checkbox"/> Peer feedback (anecdotal/checklist)</li> <li><input type="checkbox"/> Entrance ticket</li> <li><input type="checkbox"/> Vocabulary notebooks (anecdotal)</li> </ul>	<p>(checklist)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Tests (scale/rubric)</li> <li><input type="checkbox"/> Exam</li> <li><input type="checkbox"/> Reports (rubric)</li> <li><input type="checkbox"/> Essays (rubric)</li> </ul>
<p><b>Observation</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Whole class discussions (anecdotal)</li> <li><input type="checkbox"/> Self-proofreading (checklist)</li> </ul>	<p><b>Observation</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Class discussions (anecdotal)</li> <li><input type="checkbox"/> Debate (rubric)</li> <li><input type="checkbox"/> Performance tasks (anecdotal/scale)</li> </ul>	<p><b>Observation</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> PowerPoint presentations (rubric)</li> <li><input type="checkbox"/> Performance tasks (anecdotal/scale)</li> </ul>
<p><b>Conversation</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Student teacher conferences (checklist)</li> <li><input type="checkbox"/> Small Group Discussions (checklist)</li> <li><input type="checkbox"/> Pair work (checklist)</li> </ul>	<p><b>Conversation</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Student teacher conferences (checklist)</li> <li><input type="checkbox"/> Small group discussions (checklist)</li> <li><input type="checkbox"/> Pair work (anecdotal)</li> <li><input type="checkbox"/> Peer-feedback (anecdotal)</li> <li><input type="checkbox"/> Peer-editing (anecdotal)</li> <li><input type="checkbox"/> Oral pre-tests (scale/rubric)</li> </ul>	<p><b>Conversation</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Student teacher conferences (checklist)</li> <li><input type="checkbox"/> Question and Answer Session (checklist)</li> <li><input type="checkbox"/> Oral tests (scale/rubric)</li> </ul>

**The Final Grade:**

The percentage grade represents the quality of the students’ overall achievement of the expectations for the course and reflects the corresponding achievement as described in the achievement chart for Mathematics. The distribution of marks into a grade is based on

the departmental assessment and evaluation guide for the course and will reflect the student's most consistent level of achievement where appropriate. Comments on the development of learning skills and contributions to the course will be provided on reports. Term work will be 70% of the overall grade for the course; the final evaluation will be 30% of the overall grade, incorporating a final written examination and student/teacher conference at the end of the semester.

<b>Assessment and Percentage of Final Mark</b>	
<b>(Term) 70%</b>	Unit 1: Tools for Data Management and Statistics of One and Two Variables <b>(14%)</b> <ul style="list-style-type: none"> <li>• Assignment 1 <b>(5%)</b> [Student Product]</li> <li>• Student/Teacher Conference <b>(2%)</b> [Conversation]</li> <li>• Unit 1 Test <b>(7%)</b> [Student Product]</li> </ul>
	Unit 2: Counting Techniques <b>(14%)</b> <ul style="list-style-type: none"> <li>• Assignment 2 <b>(5%)</b> [Student Product]</li> <li>• Student/Teacher Conference <b>(2%)</b> [Conversation]</li> <li>• Unit 2 Test <b>(7%)</b> [Student Product]</li> </ul>
	Unit 3: Probability <b>(14%)</b> <ul style="list-style-type: none"> <li>• Presentation <b>(7%)</b> [Observation]</li> <li>• Unit 3 Test <b>(7%)</b> [Student Product]</li> </ul>
	Unit 4: Distributions <b>(14%)</b> [Student Product] <ul style="list-style-type: none"> <li>• Assignment 4 <b>(5%)</b> [Student Product]</li> <li>• Student/Teacher Conference <b>(2%)</b> [Conversation]</li> <li>• Unit 4 Test <b>(7%)</b> [Student Product]</li> </ul>
	Unit 5: Cumulative Investigation A <b>(14%)</b> [Student Product/Conversation] <ul style="list-style-type: none"> <li>• Project Part 1 <b>(2.4%)</b> [Student Product]</li> <li>• Project Part 2 <b>(2.4%)</b> [Student Product]</li> <li>• Project Part 3 <b>(2.4%)</b> [Student Product]</li> <li>• Project Part 4 <b>(2.4%)</b> [Student Product]</li> <li>• Project Part 5 <b>(2.4%)</b> [Student Product]</li> <li>• Student/Teacher Conference <b>(2%)</b> [Conversation]</li> </ul>
<b>30%</b>	Final Evaluation: Presentation <b>(10%)</b> [Observation] Written Exam <b>(20%)</b> [Student Product]

- **Each Assessment of Learning (AoL) will be broken into the following categories and given the following weights: Knowledge/Understanding (25%), Inquiry/Thinking (25%), Communication (25%), and Application/Making Connections (25%).**

A Summary Description of Achievement in Each Percentage Grade Range and Corresponding Level of Achievement		
Percentage Grade Range	Achievement Level	Summary Description
80-100%	Level 4	A very high to outstanding level of achievement. Achievement is <i>above</i> the provincial standard.
70-79%	Level 3	A high level of achievement. Achievement is <i>at</i> the provincial standard.
60-69%	Level 2	A moderate level of achievement. Achievement is <i>below, but approaching</i> , the provincial standard.
50-59%	Level 1	A passable level of achievement. Achievement is <i>below</i> the provincial standard.
below 50%	Level R	Insufficient achievement of curriculum expectations. A credit will not be granted.

### **Program Planning Considerations:**

**English language learners:** As our school can have multilingual student population, special accommodation will be made to bring a rich diversity of background knowledge and experience to the classroom.

TWS courses can provide a wide range of options to address the needs of ESL/ELD students. Assessment and evaluation exercises will help ESL students in mastering the English language. In addition, since all occupations require employees with a wide range of English skills and abilities, many students will learn how the operation of their own physical world can contribute to their success in their social world. The student whose first language is not English enters Ontario Secondary schools with diverse linguistic and cultural backgrounds. All of these students bring a rich array of background knowledge and experience to the classroom, and all teachers must share in the responsibility for their English-language development. Teachers must incorporate appropriate strategies for instructions and assessment to facilitate the success of the English language learners in their classrooms. These strategies include:

- modification of some or all of the course expectations so that they are challenging but attainable for the learner at his or her present level of English proficiency, given the necessary support from the teacher;
- use of a variety of instructional strategies (e.g., extensive use of visual cues, scaffolding, manipulatives, pictures, diagrams, graphic organizers; attention to clarity of instructions);
- modelling of preferred ways of working in English; previewing of textbooks; pre-teaching of key vocabulary; peer tutoring; strategic use of students' first

- languages);
- use of a variety of learning resources (e.g., visual material, simplified text, bilingual dictionaries, materials that reflect cultural diversity);
  - use of assessment accommodations (e.g., granting of extra time; simplification of language used in problems and instructions; use of oral interviews, learning logs, portfolios, demonstrations, visual representations, and tasks requiring completion of graphic organizers or cloze sentences instead of tasks that depend heavily on proficiency in English).

**Literacy education:** Communication skills are fundamental to the development of literacy. Fostering students' communication skills is an important part of the teacher's role in the curriculum. When students read they need to understand vocabulary and terminology. Students are encouraged to use language with care and precision in order to communicate effectively. Students are encouraged to ask questions to their peers/teachers and to also be proactive with solving their own questions.

**The role of information and communications technology:** Information and communication technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' learning. Teachers can use ICT tools and resources both for whole-class instruction and to design programs that meet diverse student needs. Technology can help to reduce the time spent on routine tasks, allowing students to devote more of their efforts to thinking and concept development.

Information technology is considered a learning tool that must be accessed by students when the situation is appropriate. As a result, students will develop transferable skills through their experience with word processing, internet research, and presentation software, as would be expected in any environment.

Technology also makes possible simulations of complex systems that can be useful for problem-solving purposes or when field studies on a particular topic are not feasible. Information and communications technologies can be used in the classroom to connect students to other schools, at home and abroad, and to bring the global community into the local classroom. Although the Internet is a powerful electronic learning tool, there are potential risks attached to its use. All students must be made aware of issues of Internet privacy, safety, and responsible use, as well as of the ways in which this technology is being abused – for example, when it is used to promote hatred.

Teachers, too, will find the various ICT tools useful in their teaching practice, both for whole class instruction and for the design of curriculum units that contain varied approaches to learning to meet diverse student needs.

**Equity and Inclusive Education:** The TWS equity and inclusive education strategy focuses on respecting diversity, promoting inclusive education, and identifying and eliminating discriminatory biases, systemic barriers, and power dynamics that limit the ability of students to learn, grow, and contribute to society. In an environment based on

the principles of inclusive education, all students, parents, caregivers, and other members of the school community - regardless of ancestry, culture, ethnicity, sex, physical or intellectual ability, race, religion, gender identity, sexual orientation, socio-economic status, or other similar factors - are welcomed, included, treated fairly, and respected. Diversity is valued, and all members of the TWS community feel safe, comfortable, and accepted. Every student is supported and inspired to succeed in a culture of high expectations for learning. In an inclusive education system, all students see themselves reflected in the curriculum, their physical surroundings, and the broader environment, so that they can feel engaged in and empowered by their learning experiences. In addition, TWS differentiates the instruction and assessment strategies to take into account the background and experiences, as well as the interests, aptitudes, and learning needs, of all students.

### **Plagiarism/Cheating:**

Any incident of plagiarism or cheating will result in a resubmission/rewrite of that particular assignment/test at the end of the course on the student's own time and at his/her own expense to pay for the creation and marking of a new assessment. The incident will be documented in the office. A second incident of plagiarism or cheating in any course will result in a mark of zero for that assignment. For example, if you cheat on a math test and then plagiarize an English essay, you will receive a zero.

### **Missed and Late Assignment Policy:**

Teachers will make it Clear to the students and parents/guardian early in the school year that they are responsible not only for their behaviour in the classroom/school but also for providing evidence of their achievement of the overall expectations within the time frame specified by the teacher and in a form approved by the teacher. Students must understand that there will be consequences for not completing assignments for evaluation or for submitting those assignments late. Where in the teacher's professional judgment it is appropriate to do so, a number of strategies will be used to encourage the student to modify his/her behaviour. Some of these may include:

- Asking the student to clarify the reason for not completing the assignment taking into consideration legitimate reasons for missed deadlines
- Maintaining ongoing communication with students and/or parents about due dates and late assignments, and scheduling conferences with parents if the problem persists
- Setting up a student contract
- Providing alternative assignments or tests/exams where, in the teacher's professional judgment, it is reasonable and appropriate to do so
- Deducting marks for late assignments, up to and including the full value of the assignment

Students and parent/guardians will be informed in a timely fashion via phone call, face to face conference, e-mail and if need be a formal letter about the importance of submitting assignments for evaluation when they are due and about the consequences for students

who submit assignments late or fail to submit assignments. **If the above measures have been put into place and the behaviour of the student has no provided sufficient evidence, then 0 will be inserted as the mark for the missed assignment.**

### **Resources:**

Mathematics of Data Management. McGraw-Hill Ryerson Ltd., 2002

**\*Sections from the text will be provided by the teacher**

Growing Success: Assessment Evaluation and Reporting in Ontario Schools, First Edition Covering Grades 1-12

### **Attendance Policy:**

Consistent log-in is crucial to a student's success in Toronto World School's online program. The guidelines of the Ministry of Education require that students receive at least 110 hours of scheduled instruction time for each credit course. Attendance patterns will be monitored to ensure a student is actively logging into their course.

### **Acceptable Online Use Policy**

Toronto World School uses the ConnectED Integrated Learning Platform and is intended for educational purposes only. The use of this program or any tools within TWS systems, other than for educational purposes, is strictly prohibited. The inappropriate uses include, but are not limited to, criminal, obscene, commercial, cyber-bullying or illegal purposes.

The administration has the right to review all student work in order to determine the appropriateness of computer use. If TWS online programs are deemed to be used inappropriately, the Administration will levy consequences which may include suspensions and/or removal from the program. In some cases, further action may be taken including contacting day schools, legal representation or the police.

Students need to be very vigilant in order to prevent them getting into a situation where they may be suspected for inappropriate use.

Therefore, students are reminded to

- Always protect their passwords and not share them with anyone
- Always inform their teachers of suspicious messages or other incidents that they encounter
- Always only access content that is intended for educational use.

### **Hardware/software requirements:**

#### *Hardware:*

- PC running Windows 8 or higher
- Mac running Apple OS X or higher

- Chromebook running Chrome OS

*High speed internet is recommended with access to a computer with the following:*

- A processor of 2GHz or faster
- 4 GB RAM or greater
- A high speed internet connection of 1.5 MB/s or faster
- Keyboard and mouse
- Headphone/Speakers/Microphone/Camera

*Recommended Software:*

- Adobe Reader, Shockwave, Flash Player, Java, Office suite

*Browser:*

- Mozilla Firefox4 or higher, Internet Explorer 7 or higher, Safari 5 or higher, Google Chrome 11 or higher