



Ontario eSecondary School Course Outline 2026-2027

Ministry of Education Course Title: Mathematics of Data Management, University Preparation	
Ministry Course Code: MDM4U-30	
Course Type: University Preparation	
Grade: 12	
Credit Value: 1.0	
Prerequisite(s): Functions, Grade 11, University Preparation	
Department: Mathematics	
Course developed by: Marieta Angjeli and Vince Reel	Date: April 15th 2025 Revised: March 18th 2026 Revised: August 1, 2026
Length: One Semester	Hours: 110
This course has been developed based on the following Ministry documents: 1. <i>The Ontario Curriculum, Grades 11 and 12 Mathematics, Revised 2007</i> 2. <i>Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)</i> 3. <i>Learning for All (2013)</i>	

COURSE DESCRIPTION/RATIONALE

This course broadens students' understanding of mathematics as it relates to managing data. Students will apply methods for organizing and analysing 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. Students planning to enter university programs in business, the social sciences, and the humanities will find this course of particular interest.

OVERALL CURRICULUM EXPECTATIONS

Unit 1

By the end of this course, students will solve problems involving the probability of an event or a combination of events for discrete sample spaces. Students will solve problems involving the application of permutations and combinations to determine the probability of an event.

Unit 2

By the end of this course, students will identify a broad range of options for present and future learning, work, and community involvement. 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 will 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.

Unit 3

By the end of this course, 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. Students will 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.

Unit 4

By the end of this course, students will analyse, interpret, and draw conclusions from one-variable data using numerical and graphical summaries. Students will analyse, interpret, and draw conclusions from two-variable data using numerical, graphical, and algebraic summaries; Students will demonstrate an understanding of the applications of data management used by the media and the advertising industry and in various occupations.

Unit 5

By the end of this course, students will 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. Students will communicate the findings of a culminating investigation.

COURSE CONTENT

<i>Unit</i>	<i>Length</i>
Unit 1: Counting and Probability	30 hours
Unit 2: Probability Distributions	27 hours
Unit 3: Organization of Data for Analysis	20 hours
Unit 4: Statistical Analysis	28 hours
Unit 5: Investigation and Final Exam	5 hours
Total	110 hours

UNIT DESCRIPTIONS

Unit 1 - Counting and Probability

In this unit students will solve probability problems involving discrete sample spaces and problems using counting principles.

Unit 2 - Probability Distribution

In this unit students will explore and understand probability distributions for discrete random and for continuous random variables

Unit 3 - Organization of Data for Analysis

In this unit students will explore and understand data concepts and collect and organize data.

Unit 4 - Statistical Analysis

In this unit students will analyse one-variable data and two-variable data. In addition, students will evaluate the validity of the study.

Unit 5 - Data Management Investigation

In this unit students will design and carry out a culminating investigation. In addition students will be presenting and critiquing the culminating investigation.

TEACHING AND LEARNING STRATEGIES

In this course, students will experience the following activities.

Participation activities are seven standardized, course-wide prompts (Teach the Teacher, Concept in Action, Spot the Error, Concept Connections, Take a Position, Claim/Support/Question, and a Course Takeaways video) embedded at set points throughout the course. They build metacognitive engagement with unit concepts and contribute to the course's participation grade.

Presentations with embedded videos are utilized to outline concepts, explain theory with the use of examples and practice questions, and incorporate multi-media opportunities for students to learn more (e.g. online simulations, quizzes, etc.).

End of unit conversations are opportunities for students to express their ideas, problem solving, and thought processes with a teacher who provides timely feedback.

Reflection is an opportunity for students to look back at concepts and theories with new eyes, to relate theory to practice, and to align learning with their own values and beliefs.

Discussions with the instructor are facilitated through video conferencing, discussing the concepts and skills being studied. This enables two-way communication between the student and the instructor, to share ideas and ask questions in dialogue. This also helps to build a relationship between the student and instructor.

Instructor demonstrations (research skills, etc.) are opportunities for the instructor to lead a student through a concept or skill through video conferencing, videos, or emailing with the student.

Discussion forums are an opportunity for students to summarize and share their ideas and perspectives with their peers, which deepens understanding through expression. It also provides an opportunity for peer-to-peer feedback.

Practical extension and application of knowledge are integrated throughout the course. The goal is to help students make connections between what they learn in the classroom and how they understand and relate to the world around them and their own lives. Learning becomes a dynamic opportunity for students to be more aware that their learning is all around them and enable them to create more meaning in their lives.

Individual activities/assignments assessments are completed individually at a student's own pace and are intended to expand and consolidate the learning in each lesson. Individual activities allow the teacher to accommodate interests and needs and to assess the progress of individual students. For this reason, students are encouraged to discuss IEPs (Individual Education Plans) with their teacher and to ask to modify assessments if they have a unique interest that they feel could be pursued in the assessment. The teacher plays an important role in supporting these activities by providing ongoing feedback to students, both orally and in writing.

Research is an opportunity to apply inquiry skills to a practical problem or question. Students perform research to gather information, evaluate quality sources, analyse findings, evaluate their analysis, and synthesize their findings into conclusions. Throughout, students apply both creative thinking and critical thinking. New questions are also developed to further learning.

Writing as a learning tool helps students to think critically about course material while grasping, organizing, and integrating prior knowledge with new concepts. Good communication skills are important both in and out of the classroom.

Virtual simulations are interactive websites that provide students with an opportunity to ask questions, relate variables, and examine relationships.

Diagrams are visual representations of mathematical ideas and concepts. They provide another perspective to organize ideas. Visuals are thought to promote cognitive plasticity - meaning, they can help us change our minds or help us to remember an idea.

Graphs and charts are visual representations of math concepts and analysis. This helps us to see the relationships within and between sets of data.

Tables involve organizing information in terms of categories (rows and columns). This helps us to understand the relationships between ideas and data, as well as highlight trends.

Practice problems provide students with a scenario/problem to solve by applying concepts and skills learned in a context. This helps students to understand the relevance of their learning.

ASSESSMENT, EVALUATION, AND REPORTING

Assessment: The process of gathering information that accurately reflects how well a student is achieving the identified curriculum expectations. Teachers provide students with descriptive feedback that guides their efforts towards improved performance. These assessments are not for marks.

- In assessment for learning (AFL), teachers provide students with descriptive feedback and coaching for improvement.
- In assessment as learning (AAL), teachers help students develop their capacity to be independent, autonomous learners who are able to set individual goals, monitor their own progress, determine next steps, and reflect on their thinking and learning.

Evaluation: Assessment of Learning (AOL) focuses on evaluation which is the process of making a judgement about the quality of student work on the basis of established criteria over a limited, reasonable period of time.

Reporting: Involves communicating student achievement of the curriculum expectations and Learning Skills and Work Habits in the form of marks and comments as determined by the teacher's use of professional judgement.

Assessment & Evaluation at OES: Triangulation of Learning

In alignment with the Ontario Ministry of Education's *Growing Success* policy, student achievement across all high school courses at Ontario eSecondary School (OES) is evaluated through the **triangulation of evidence: observations, conversations, and student products**.

OES courses incorporate each of these evidence sources in a variety of ways to provide every student with equitable opportunities to demonstrate their learning:

- **Observations:** Collected through video recordings, interactive digital tools, learning logs, and synchronous task demonstrations.
- **Conversations:** Gathered via teacher-student conferences, oral defenses, virtual check-ins, and reflective feedback dialogues.
- **Products:** Demonstrated through major projects, essays, lab reports, performance tasks, and final assessments.

By evaluating a balanced variety of evidence, OES teachers apply professional judgment to ensure accurate, fair, and comprehensive assessment of each student's progress.

STRATEGIES FOR ASSESSMENT

Assessment practices can nurture students' sense of progress and competency and information instruction. Many diagnostic tools, e.g. checklists and inventories, are used at regular intervals throughout the units to encourage students' understanding of their current status as learners and to provide frequent and timely reviews of their progress. Assessment of student acquisition of listening and talking, reading and viewing and writing skills also occurs regularly through unobtrusive teacher observation and conferencing.

Units conclude with performance tasks. Teachers are encouraged to share goals with students early in the course and to connect unit learning experiences frequently and explicitly with big ideas, overall expectations, and performance tasks, i.e. check bricks; teacher-adapted generic rubrics available in many sources, including the *Ontario Secondary School Literacy Course (OSSLC) Profile*, so that they are more task-specific. The teacher might ask: "What does the criteria look like for this particular task?" Or "What does limited effectiveness look like?" The teacher could involve students in the discussion or creation of rubrics, and teach students to use rubrics as a learning tool that can support the writing process and practice.

ASSESSMENT ACTIVITIES

- ☐ Discussion forums
- ☐ Diagnostic tests
- ☐ Completed templates and graphic organizers
- ☐ Reflections
- ☐ Tests and quizzes
- ☐ Graphs - plotting and analyzing
- ☐ Drawings / diagrams / sketches / schematics - creating, labeling, and analyzing
- ☐ Problem solving calculations
- ☐ Lab reports
- ☐ Simulation, lab, and case study worksheets

- ☐ Research projects and reports
- ☐ End of unit conversations (Google Meets)
- ☐ Final exam

EVALUATION

The final grade will be determined as follows:

- ☐ 65% 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 will be given to more recent evidence of achievement.
- ☐ 25% of the grade will be based on a final evaluation administered at the end of the course. This evaluation will be based on a final written examination, comprehensive of the course. The final evaluation is an opportunity for the student to demonstrate comprehensive achievement of the overall expectations for the course.
- ☐ 10% of the grade will be based on the student's attendance and participation throughout the course, assessed according to Ministry criteria.

(*Growing Success: Assessment, Evaluation and Reporting in Ontario Schools*. Ontario Ministry of Education Publication, 2010 p.41)



TERM WORK EVALUATIONS (65%)

Evaluation Item	Description	Category	Relative Weight
Unit 1	Combination Quiz- Students will be evaluated on their knowledge of the lesson concepts thus far.	K	12.5
Unit 1	Unit 1 Test- Students will write a timed test evaluating their understanding and application of counting and probability concepts.	K, T, C, A	
Unit 2		T, A	
Unit 2	Unit Test- Students will write a timed test evaluating	K, T, C, A	

	their understanding and application of Probability Distributions.		12.5
Unit 3	Quiz- Students will be assessed on their knowledge and application of Bias and Surveys in a timed, multiple choice quiz.	K	12.5
Unit 3	Unit Test- Students will write a timed test evaluating their understanding and application of Organization of Data for Analysis.	K, T, C, A	
Unit 4		C, A	12.5
Unit 4	Unit Test- Students will write a timed test evaluating their understanding and application of Statistical Analysis.	K, T, C, A	
Final Investigation	Students will complete a final investigation task	KICA	15

FINAL EVALUATIONS (25%)

Evaluation Item	Description	Category	Weight
Final Exam	Students will write a timed proctored exam evaluating their understanding and application of all 4 units.	K, T, C, A	25

ATTENDANCE AND PARTICIPATION (10%)

Evaluation Item	Description	Category	Weight
Attendance	Assessed according to the Ministry's attendance criteria (Growing Success, September 2026 update), based on the proportion of unexcused absences over the course.	N/A	5
Participation	Assessed according to the Ministry's participation criteria (Growing Success, September 2026 update), based on engagement in class discussions and activities throughout the course, including the standardized participation prompts (see Teaching and Learning Strategies).	N/A	5

AFL/AAL/AOL Tracking Sheet

Unit 1: Counting and Probability (30 hours)

AAL	AFL	AOL
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● Lesson 1.1 Notes and Probability Basics Problem Set Assignment ● Lesson 1.2 Notes and Fundamental Counting Techniques Problem Set Assignment ● Lesson 1.6 Notes and Dependent, Independent, and Mutually Exclusive Events Problem Set Assignment ● Learning Log	● 1.1 Probability Quiz ● Lesson 1.3 Notes and Permutations Problem Set Assignment ● Lesson 1.4 Notes and Pascal's Triangle and Combinations Problem Set Assignment ● Gizmos: Independent or Dependent Events ● Unit 1 End of Unit Feedback	● 1.3 Combinations Quiz ● Unit 1 Question Response Interactive Content: Observation and Conversation ● Unit 1 Test
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Unit 2: Probability Distributions (27 hours)

AAL	AFL	AOL
● Lesson 2.2 Notes and Binomial Distribution Problem Set Assignment ● Lesson 2.2 Discussion Forum (Peer Engagement)	● Lesson 2.1 Notes and Random Discrete Probability Distribution and Expected Value Problem Set Assignment ● 2.1 Probability Distributions and Expected Value Quiz ● Lesson 2.2 Notes and Binomial Distribution Problem Set Assignment ● Lesson 2.3 Notes and Hypergeometric Distribution Problem Set Assignment ● Unit 2 End of Unit Feedback	● Unit 2 Culminating Assignment ● Unit 2 Question Response Interactive Content (Interview) ● Unit 2 Test

Unit 3: Organization of Data for Analysis (20 hours)

AAL	AFL	AOL
● 3.1 Self Assessment of Learning Skills ● Unit 3 Learning Log	● Lesson 3.1 Notes and Types of Data and Sampling Problem Set Assignment ● Lesson 3.2 Notes and Bias and Surveys Problem Set Assignment ● Gizmos: Histograms ● Lesson 3.3 Displaying and Organizing Notes and Problem Set Assignment ● Unit 3 End of Unit Feedback	● 3.2 Bias and Surveys Quiz ● Unit 3 Question Response Interactive Content: Observation and Conversation ● Unit 3 Test

Unit 4: Statistical Analysis (28 hours)

AAL	AFL	AOL
● 4.1 Measures of Central Tendency Quiz ● 4.2 Measures of Spread and Dispersion Quiz ● Lesson 4.3 Notes and Normal Distribution Problem Set Assignment ● Gizmos: Correlation and Regression ● Lesson 4.5 Discussion Forum (Peer Engagement)	● Lesson 4.1 Notes and Measures of Central Tendency Problem Set Assignment ● Lesson 4.2 Measures of Spread, Standard Deviation, and Variance Notes and Problem Set Assignment ● Lesson 4.4 Notes and Quartiles and Percentiles Problem Set Assignment ● Unit 4 End of Unit Feedback	● Unit 4 Culminating Assignment ● Unit 4 Question Response Interactive Content: Observation and Conversation ● Unit 4 Test

Final Tasks

AOL
Final Project
Final Exam

CONSIDERATION FOR PROGRAM PLANNING**PLANNING PROGRAMS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS**

OES teachers are the key educators of students with special education needs and have a responsibility to help all students learn. Program planning for students with special education needs is guided by the principles set out in *Learning for All: A Guide to Effective Assessment and Instruction for All Students, Kindergarten to Grade 12* (2013): all students can succeed; each student has their own unique patterns of learning; successful instructional practices are founded on evidence-based research, tempered by experience; and universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students. Where a student has an Individual Education Plan (IEP), the accommodations identified in the IEP — instructional, environmental, and assessment — are implemented within the course, and the online learning environment is adapted accordingly. The asynchronous structure of OES courses provides built-in flexibility that supports many common accommodations, including extended time for assignments and assessments, breaks as needed, access to assistive technology, and the ability to review instructional material multiple times.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS

Ontario schools have some of the most linguistically diverse student populations in the world, and OES serves English language learners across Ontario and internationally. English language learners may be Canadian-born or newcomers; they may have experience of highly sophisticated educational systems or may have come from regions where access to formal schooling was limited. In planning this course, teachers consider the strengths and needs of English language learners and provide appropriate adaptations consistent with *English Language Learners / ESL and ELD Programs and Services: Policies and Procedures for Ontario Elementary and Secondary Schools, Kindergarten to Grade 12* (2007). Supports within the online environment include modification of instructional language without modification of curriculum expectations, use of visual and multimedia supports, opportunities to replay and review lesson content, extended time where appropriate, and teacher feedback

that models academic English. Assessment accommodations, such as granting additional time and permitting the use of bilingual dictionaries, are provided where appropriate.

ENVIRONMENTAL EDUCATION

Consistent with *Acting Today, Shaping Tomorrow: A Policy Framework for Environmental Education in Ontario Schools* (2009) and *Environmental Education: Scope and Sequence of Expectations* (2017), environmental education is embedded across the curriculum rather than treated as a separate subject. Teachers help students acquire knowledge about the environment, develop skills to address environmental issues, and foster attitudes that motivate responsible environmental action. As an online school, OES also models environmental responsibility through paperless course delivery and the elimination of daily commuting. In this course, students apply mathematical processes to real data, including data related to environmental issues such as resource consumption, climate trends, and population growth, reinforcing the role of mathematics in understanding and addressing environmental questions.

EQUITY AND INCLUSIVE EDUCATION

This course is planned and delivered in accordance with Ontario's Equity and Inclusive Education Strategy (2009) and Policy/Program Memorandum No. 119, *Developing and Implementing Equity and Inclusive Education Policies in Ontario Schools* (2013). OES is committed to an inclusive learning environment in which all students feel welcomed, respected, and able to succeed, regardless of ancestry, culture, ethnicity, sex, gender identity, sexual orientation, disability, race, religion, or socio-economic status. In this course, teachers select learning materials that reflect the diversity of Ontario and the wider world, address bias in texts and resources where it arises, and ensure that assessment practices are fair and free of cultural assumptions. Because OES students learn from communities across Ontario, Quebec, and around the world, discussion activities and teacher feedback are moderated to maintain a respectful, harassment-free environment for all learners.

FINANCIAL LITERACY EDUCATION

In accordance with *A Sound Investment: Financial Literacy Education in Ontario Schools* (2010) and current Ministry direction on financial literacy, students are provided with opportunities to build the knowledge and skills needed to make informed financial decisions, understand their roles as consumers and citizens, and think critically about the economic forces that affect their lives. OES also supports students in meeting the Ministry's financial literacy graduation requirement, as described in the OES School Course Calendar. In this course, students apply data analysis and probability to financially relevant contexts, including the critical evaluation of statistics used in advertising, financial reporting, and public claims.

FIRST NATIONS, MÉTIS, AND INUIT EDUCATION

Program planning in this course aligns with the Ontario First Nation, Métis, and Inuit Education Policy Framework (2007), which supports improved outcomes for First Nations, Métis, and Inuit students and promotes awareness and understanding of Indigenous histories, cultures, perspectives, and contributions among all students. Where appropriate to the curriculum expectations, teachers incorporate Indigenous perspectives, authors, and content, and approach these topics with accuracy and respect, drawing on Ministry-recommended resources. All OES students benefit from opportunities to deepen their knowledge of the histories and contemporary realities of First Nations, Métis, and Inuit peoples, including the legacy of the residential school system and the Truth and Reconciliation Commission's Calls to Action related to education.

THE ROLE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

Information and communications technology (ICT) is integral to every OES course: instruction, learning activities, assessment, and teacher-student communication all take place through the school's learning management system. ICT tools — including multimedia lessons, digital texts, simulations, video conferencing for proctored assessments, and word-processing and productivity software — extend and enrich instruction and allow students to collect, organize, and present their learning in a range of formats. Teachers help students develop digital citizenship skills, including responsible and ethical use of technology, critical evaluation of online sources, protection of personal information, and academic integrity in digital environments, consistent with

OES's Acceptable Use, Academic Honesty, and Artificial Intelligence policies as published in the School Course Calendar.

CAREER EDUCATION

Consistent with *Creating Pathways to Success: An Education and Career/Life Planning Program for Ontario Schools* (2013), teachers support students in answering the four questions at the centre of education and career/life planning: Who am I? What are my opportunities? Who do I want to become? What is my plan for achieving my goals? Expectations in this course include many opportunities for students to apply their skills to work-related situations, explore educational and career options, and become self-directed learners. OES guidance staff support students in course selection, postsecondary application planning (including OUAC, CEGEP, and international pathways), and the development of individual pathways plans. The problem-solving, reasoning, and quantitative skills developed in this course support pathways into science, technology, engineering, mathematics, finance, data analysis, skilled trades, and many other fields, and connections to these destinations are highlighted throughout the course.

COOPERATIVE EDUCATION AND OTHER FORMS OF EXPERIENTIAL LEARNING

Planned learning experiences in the community, including job shadowing, work experience, and cooperative education, provide students with opportunities to see the relevance of their classroom learning, explore careers of interest, and develop essential workplace skills consistent with *The Ontario Curriculum, Grades 11 and 12: Cooperative Education* (2018). Students may earn up to two cooperative education credits toward their compulsory credit requirements for the Ontario Secondary School Diploma. Students interested in experiential learning opportunities related to this course are encouraged to contact OES guidance staff to discuss options available to them.

HEALTH AND SAFETY

Although OES students learn remotely, health and safety remain integral considerations in program planning. Teachers model and promote safe and healthy practices for online learning, including sound ergonomics, balanced screen time, regular breaks, and strategies that support positive mental health and well-being. OES maintains a safe and respectful virtual learning environment consistent with the school's codes of conduct, bullying prevention expectations, and privacy practices as published in the School Course Calendar, and students are provided with clear channels for reporting concerns to their teachers, guidance staff, or the Principal.

ACCOMMODATIONS

Accommodations will be based on meeting with parents, teachers, administration and external educational assessment reports. The following three types of accommodations may be provided:

- ☐ **Instructional accommodations:** such as changes in teaching strategies, including styles of presentation, methods of organization, or use of technology and multimedia.
- ☐ **Assessment accommodations:** such as allowing additional time to complete tests or assignments or permitting oral responses to test questions.

Other examples of modifications and aids, which may be used in this course, are:

- ☐ Provide step-by-step instructions.
- ☐ Help students create organizers for planning writing tasks.
- ☐ Allow students to report verbally to a scribe (teacher/ student) who can help in note taking.
- ☐ Permit students a range of options for reading and writing tasks.

- ☐ Where an activity requires reading, provide it in advance.
- ☐ Provide opportunities for enrichment.