

# Erindale College

Assessment Period:	2022 S1
Course:	MATHEMATICAL METHODS
Unit:	Unit 1: Mathematical Methods (1.0)
Accreditation:	T
Year:	11

## Specific Unit Goals

This unit should enable students to:

- understand the concepts and techniques in algebra, functions, graphs, trigonometric functions and probability
- solve problems using algebra, functions, graphs, trigonometric functions and probability
- apply reasoning skills in the context of algebra, functions, graphs, trigonometric functions and probability
- interpret and evaluate mathematical information and ascertain the reasonableness of solutions to problems
- communicate their arguments and strategies when solving problems.

## Content Descriptions

### Topic 1: Functions and graphs

- Lines and linear relationships
  - determine the coordinates of the midpoint of two points
  - examine examples of direct proportion and linearly related variables
  - recognise features of the graph of  $y = mx + c$ , including its linear nature, its intercepts and its slope or gradient
  - find the equation of a straight line given sufficient information; parallel and perpendicular lines
  - solve linear equations.
- Review of quadratic relationships:
  - examine examples of quadratically related variables
  - recognise features of the graphs of  $y = x^2$ ,  $y = a(x - b)^2 + c$ , and  $y = a(x - b)(x - c)$ , including their parabolic nature, turning points, axes of symmetry and intercepts
  - solve quadratic equations using the quadratic formula and by completing the square
  - find the equation of a quadratic given sufficient information
  - find turning points and zeros of quadratics and understand the role of the discriminant
  - recognise features of the graph of the general quadratic  $y = ax^2 + bx + c$
- Inverse proportion:
  - examine examples of inverse proportion
  -

$$y = \frac{a}{x - b'}$$

recognise features of the graphs of  $y = \frac{1}{x}$  and  $y = \frac{1}{x^2}$ , including their hyperbolic shapes, and their asymptotes.

- Powers and polynomials:

- o recognise features of the graphs of  $y = x^n$  for  $n \in \mathbb{N}$ ,  $n = -1$ , and  $n = 1/2$ , including shape, and behaviour as  $x \rightarrow \infty$  and  $x \rightarrow -\infty$
- o identify the coefficients and the degree of a polynomial
- o expand quadratic and cubic polynomials from factors
- o recognise features of the graphs of  $y = x^3$ ,  $y = a(x - b)^3 + c$  and  $y = k(x - a)(x - b)(x - c)$  including shape, intercepts and behaviour as  $x \rightarrow \infty$  and  $x \rightarrow -\infty$
- o factorise cubic polynomials in cases where a linear factor is easily obtained
- o solve cubic equations using technology, and algebraically in cases where a linear factor is easily obtained.

- Graphs of relations:

- o recognise features of the graphs of  $x^2 + y^2 = r^2$  and  $(x - a)^2 + (y - b)^2 = r^2$ , including their circular shapes, their centres and their radii
- o recognise features of the graph of  $y^2 = x$  including its parabolic shape and its axis of symmetry.

- Functions:

- o understand the concept of a function as a mapping between sets, and as a rule or a formula that defines one variable quantity in terms of another
- o use function notation, domain and range, independent and dependent variables
- o understand the concept of the graph of a function
- o examine translations and the graphs of  $y = f(x) + a$  and  $y = f(x + b)$
- o examine dilations and the graphs of  $y = cf(x)$  and  $y = f(kx)$
- o recognise the distinction between functions and relations, and the vertical line test.

## Topic 2: Trigonometric functions

- Cosine and sine rules:

- o review sine, cosine and tangent as ratios of side lengths in right-angled triangles
- o understand the unit circle definition of  $\cos \theta$ ,  $\sin \theta$  and  $\tan \theta$  and periodicity using degrees
- o examine the relationship between the angle of inclination of a line and the gradient of that line establish and use the sine and cosine rules and the formula  $Area = \frac{1}{2}bc \sin A$  for the area of a triangle.

- Circular measure and radian measure:

- o define and use radian measure and understand its relationship with degree measure
- o calculate lengths of arcs and areas of sectors in circles.

- Trigonometric functions:

- understand the unit circle definition of  $\cos \theta$ ,  $\sin \theta$ , and  $\tan \theta$  and periodicity using radians
- recognise the exact values of  $\sin \theta$ ,  $\cos \theta$ , and  $\tan \theta$  at integer multiples of  $\frac{\pi}{6}$  and  $\frac{\pi}{4}$
- recognise the graphs of  $y = \sin x$ ,  $y = \cos x$ , and  $y = \tan x$  on extended domains
- examine amplitude changes and the graphs of  $y = a \sin x$  and  $y = a \cos x$
- examine period changes and the graphs of  $y = \sin bx$ ,  $y = \cos bx$  and  $y = \tan bx$
- examine phase changes and the graphs of  $y = \sin(x + c)$ ,  $y = \cos(x + c)$  and  $y = \tan(x + c)$  and the relationships  $\sin\left(x + \frac{\pi}{2}\right)$  and  $\cos\left(x - \frac{\pi}{2}\right)$
- prove and apply the angle sum and difference identities
- identify contexts suitable for modelling by trigonometric functions and use them to solve practical problems
- solve equations involving trigonometric functions using technology, and algebraically in simple cases.

### Topic 3: Counting and Probability

- Combinations:
  - understand the notion of a combination as an unordered set of  $r$  objects taken from a set of  $n$  distinct objects
  - use the notation  $\binom{n}{r}$  and the formula  $\binom{n}{r} = \frac{n!}{r!(n-r)!}$  for the number of combinations of  $r$  objects taken from a set of  $n$  distinct objects
  - expand  $(x + y)^n$  for small positive integers  $n$
  - recognise the numbers  $\binom{n}{r}$  as binomial coefficients, (as coefficients in the expansion of  $(x + y)^n$ )
  - use Pascal's triangle and its properties.
- Language of events and sets:
  - review the concepts and language of outcomes, sample spaces and events as sets of outcomes
  - use set language and notation for events, including  $\bar{A}$  (or  $A'$ ) for the complement of an event  $A$ ,  $A \cap B$  for the intersection of events  $A$  and  $B$ , and  $A \cup B$  for the union, and recognise mutually exclusive events
  - use everyday occurrences to illustrate set descriptions and representations of events, and set operations.
- Review of the fundamentals of probability:
  - review probability as a measure of 'the likelihood of occurrence' of an event
  - review the probability scale:  $0 \leq P(A) \leq 1$  for each event  $A$ , with  $P(A) = 0$  if  $A$  is an impossibility and  $P(A) = 1$  if  $A$  is a certainty
  - review the rules:  $P(A') = 1 - P(A)$  and  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
  - use relative frequencies obtained from data as point estimates of probabilities.
- Conditional probability and independence:
  - understand the notion of a conditional probability and recognise and use language that

indicates conditionality

- o use the notation  $P(A|B)$  and the formula  $P(A \cap B) = P(A|B)P(B)$
- o understand the notion of independence of an event  $A$  from an event  $B$ , as defined by  $P(A|B) = P(A)$
- o establish and use the formula  $P(A \cap B) = P(A)P(B)$  for independent events  $A$  and  $B$ , and recognise the symmetry of independence
- o use relative frequencies obtained from data as point estimates of conditional probabilities and as indications of possible independence of events.

## Assessment Tasks

Name	Due Date	Weighting
Assignment	28 February - 21 March	25%
Exam 1	Exam week Term 1: 28 March - 1 April	30%
Validation Tasks	Ongoing online Mathspace tasks: 1 February - 17 June	15%
Exam 2	Exam week Term 2: 14 June - 17 June	30%

## Specific Unit Information

Students require a graphics calculator for this course. These are available for hire at a cost of \$100 per year, consisting of a \$50 hire fee and a \$50 refundable deposit. Students may choose to purchase or provide their own calculator.

## School Assessment Information

### For penalties for late and non-submission of work

See [BSSS Policy and Procedure Manual 4.3.10](#) for further information.

### For academic integrity

See [BSSS Policy and Procedure Manual 4.3.12](#) for further information.

### For appeals processes

See [BSSS Policy and Procedure Manual 7.2](#) for further information.

### For moderation procedures (internal and external)

See [BSSS Policy and Procedure Manual 5](#) for further information.

### For meshing procedures

See [BSSS Policy and Procedure Manual 5.4.1](#) for further information.

### For method of unit score calculation

See [BSSS Policy and Procedure Manual 4.3.6.2](#) for further information.

### For procedures for calculating course scores

See [BSSS Policy and Procedure Manual 4.3.13.2](#) for further information.

## Achievement Standards for MATHEMATICAL METHODS T - Year 11

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> <li>critically applies mathematical concepts in a variety of complex contexts to routine and non-routine problems</li> <li>selects and applies advanced mathematical techniques to solve complex problems in a variety of contexts</li> <li>constructs, selects and applies complex mathematical models to routine and non-routine problems in a variety of contexts</li> <li>uses digital technologies efficiently to solve routine and non-routine problems in a variety of contexts</li> </ul>	<ul style="list-style-type: none"> <li>applies mathematical concepts in a variety of contexts to routine and non-routine problems</li> <li>selects and applies mathematical techniques to solve routine and non-routine problems in a variety of contexts</li> <li>selects and applies mathematical models to routine and non-routine problems to a variety of contexts</li> <li>uses digital technologies effectively to solve routine and non-routine problems in a variety of contexts</li> </ul>	<ul style="list-style-type: none"> <li>applies mathematical concepts in some contexts to routine and non-routine problems</li> <li>applies mathematical techniques to solve routine and non-routine problems in some contexts</li> <li>applies mathematical models to routine and non-routine problems in some contexts</li> <li>uses digital technologies appropriately to solve routine and non-routine problems in some contexts</li> </ul>	<ul style="list-style-type: none"> <li>applies simple mathematical concepts in limited contexts to routine problems</li> <li>applies simple mathematical techniques to solve routine problems in limited contexts</li> <li>applies simple mathematical models to routine problems in limited contexts</li> <li>uses digital technologies appropriately to solve routine problems in limited contexts</li> </ul>	<ul style="list-style-type: none"> <li>applies simple mathematical concepts in structured contexts</li> <li>uses simple mathematical techniques to solve routine problems in structured contexts</li> <li>demonstrates limited familiarity with mathematical models in structured contexts</li> <li>uses digital technologies to solve routine problems in structured contexts</li> </ul>
Reasoning and Communications	<ul style="list-style-type: none"> <li>represents complex mathematical concepts in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts</li> <li>communicates mathematical judgements and arguments in oral, written and/or multimodal forms, which are succinct and well-reasoned, using appropriate and accurate language</li> <li>evaluates the reasonableness of solutions to routine and non-routine problems in a variety of contexts</li> <li>reflects with insight on their own thinking and that of others and evaluates planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>evaluates the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>represents mathematical concepts in numerical, graphical and symbolic form in routine and non-routine problems a variety of contexts</li> <li>communicates mathematical judgements and arguments in oral, written and/or multimodal forms, which are clear and reasoned, using appropriate and accurate language</li> <li>analyses the reasonableness of solutions to routine and non-routine problems</li> <li>reflects on their own thinking and analyses planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>analyses the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>represents mathematical concepts in numerical, graphical and symbolic form to some routine and some non-routine problems in some contexts</li> <li>communicates mathematical judgements and arguments in oral, written and/or multimodal forms, using appropriate and accurate language</li> <li>explains the reasonableness of solutions to some routine and non-routine problems</li> <li>reflects on their own thinking and explains planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>explains the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>represents simple mathematical concepts in numerical, graphical or symbolic form in routine problems in limited contexts</li> <li>communicates simple mathematical judgements or arguments in oral, written and/or multimodal forms, with some use of appropriate language</li> <li>describes the appropriateness of solutions to routine problems</li> <li>reflects on their own thinking with some reference to planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>describes the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>represents simple mathematical concepts in numerical, graphical or symbolic form in structured contexts</li> <li>communicates simple mathematical information in oral, written and/or multimodal forms, with limited use of appropriate language</li> <li>identifies solutions to routine problems in structured contexts</li> <li>reflects on their own thinking with little or no reference to planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>identifies some ways in which Mathematics is used to generate knowledge in the public good</li> </ul>