Erindale College

Assessment Period:	**2021 S2**
Course:	**SPECIALIST MATHEMATICS**
Unit:	**Unit 2: Specialist Mathematics (1.0)**
Accreditation:	**T**
Year:	**11**

Unit Goals

- understand the concepts and techniques in trigonometry, real and complex numbers, and matrices
- apply reasoning skills and solve problems in trigonometry, real and complex numbers, and matrices
- communicate their arguments and strategies when solving problems
- construct proofs of results
- interpret mathematical information and ascertain the reasonableness of their solutions to problems

Content Description

Topic 1: Trigonometry

- The basic trigonometric functions:
  - find all solutions of $f(a(x-b))=c$ where f is one of sin, cos or tan
  - graph functions with rules of the $y=f(a(x-b))$ where f is one of sin, cos, or tan
- Compound angles:
  - prove and apply the angle sum, difference and double angle identities
- The reciprocal trigonometric functions, secant, cosecant and cotangent:
  - define the reciprocal trigonometric functions, sketch their graphs, and graph simple transformations of them
- Trigonometric identities:
  - prove and apply the Pythagorean identities
  - prove and apply the identities for products of sines and cosines expressed as sums and differences
  - convert sums $a\cos x+b\sin x$ to $R\cos(x\pm\alpha)$ or $R\sin(x\pm\alpha)$ and apply these to sketch graphs, solve equations of the form $a\cos x+b\sin x=c$ and solve problems
  - prove and apply other trigonometric identities such as $\cos 3x=4\cos^3 x-3\cos x$
- Applications of trigonometric functions to model periodic phenomena:
  - model periodic motion using sine and cosine functions and understand the relevance of the period and amplitude of these functions in the model

Topic 2: Matrices

- Matrix arithmetic:
  - understand the matrix definition and notation
  - define and use addition and subtraction of matrices, scalar multiplication, matrix multiplication, multiplicative identity and inverse
  -

calculate the determinant and inverse of 2 × 2 matrices and solve matrix equations of the form AX = B, where A is a 2 × 2 matrix and X and B are column vectors

- Transformations in the plane:
  - translations and their representation as column vectors
  - define and use basic linear transformations: dilations of the form $(x, y) \to (\lambda_1 x, \lambda_2 y)$, rotations about the origin and reflection in a line which passes through the origin, and the representations of these transformations by 2x2 matrices
  - apply these transformations to points in the plane and geometric objects
  - define and use composition of linear transformations and the corresponding matrix products
  - define and use inverses of linear transformations and the relationship with the matrix inverse
  - examine the relationship between the determinant and the effect of a linear transformation on area
  - establish geometric results by matrix multiplications; for example, show that the combined effect of two reflections in lines through the origin is a rotation

Topic 3: Real and complex numbers

- Proofs involving numbers:
  - prove simple results involving numbers
- Rational and irrational numbers:
  - express rational numbers as terminating or eventually recurring decimals and vice versa
  - prove irrationality by contradiction for numbers such as $\sqrt{2}$ and $\log_2 5$
- An introduction to proof by mathematical induction:
  - understand the nature of inductive proof including the 'initial statement' and inductive step
  - prove results for sums, such as $1 + 4 + 9 \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$ for any positive integer *n*
  - prove divisibility results, such as $3^{2n+4} - 2^{2n}$ is divisible by 5 for any positive integer *n*
- Complex numbers:
  - define the imaginary number *i* as a root of the equation $x^2 = -1$
  - use complex numbers in the form *a* + *bi* where *a* and *b* are the real and imaginary parts
  - determine and use complex conjugates
  - perform complex-number arithmetic: addition, subtraction, multiplication and division
- The complex plane:
  - consider complex numbers as points in a plane with real and imaginary parts as Cartesian coordinates
  - examine addition of complex numbers as vector addition in the complex plane
  - understand and use location of complex conjugates in the complex plane
- Roots of equations:
  - use the general solution of real quadratic equations
  - determine complex conjugate solutions of real quadratic equations
  - determine linear factors of real quadratic polynomials

Assessment Tasks

Name	Due Date	Weighting
Assignment 1	30 August	15%
Test 1	31 August	35%
Assignment 2	8 November	15%
Test 2	9 November	35%

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 SPECIALIST MATHEMATICS T - Year 11

	*A student who achieves an **A** grade typically*	*A student who achieves a **B** grade typically*	*A student who achieves a **C** grade typically*	*A student who achieves a **D** grade typically*	*A student who achieves an **E** grade typically*
Reasoning and Communications	• represents complex mathematical concepts in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts • communicates mathematical judgements and arguments in oral, written and/or multimodal forms, which are succinct and well-reasoned, using appropriate and accurate language • evaluates the reasonableness of solutions to routine and non-routine problems in a variety of contexts • 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 • evaluates the potential of Mathematics to generate knowledge in the public good	• represents mathematical concepts in numerical, graphical and symbolic form in routine and non-routine problems a variety of contexts • communicates mathematical judgements and arguments in oral, written and/or multimodal forms, which are clear and reasoned, using appropriate and accurate language • analyses the reasonableness of solutions to routine and non-routine problems • reflects on their own thinking and analyses planning, time management, use of appropriate strategies to work independently and collaboratively • analyses the potential of Mathematics to generate knowledge in the public good	• represents mathematical concepts in numerical, graphical and symbolic form to some routine and some non-routine problems in some contexts • communicates mathematical judgements and arguments in oral, written and/or multimodal forms, using appropriate and accurate language • explains the reasonableness of solutions to some routine and non-routine problems • reflects on their own thinking and explains planning, time management, use of appropriate strategies to work independently and collaboratively • explains the potential of Mathematics to generate knowledge in the public good	• represents simple mathematical concepts in numerical, graphical or symbolic form in routine problems in limited contexts • communicates simple mathematical judgements or arguments in oral, written and/or multimodal forms, with some use of appropriate language • describes the appropriateness of solutions to routine problems • reflects on their own thinking with some reference to planning, time management, use of appropriate strategies to work independently and collaboratively • describes the potential of Mathematics to generate knowledge in the public good	• represents simple mathematical concepts in numerical, graphical or symbolic form in structured contexts • communicates simple mathematical information in oral, written and/or multimodal forms, with limited use of appropriate language • identifies solutions to routine problems in structured contexts • reflects on their own thinking with little or no reference to planning, time management, use of appropriate strategies to work independently and collaboratively • identifies some ways in which Mathematics is used to generate knowledge in the public good
Concepts and Techniques	• critically applies mathematical concepts in a variety of complex contexts to routine and non-routine problems • selects and applies advanced mathematical techniques to solve complex problems in a variety of contexts • constructs, selects and applies complex mathematical models to routine and non-routine problems in a variety of contexts • uses digital technologies efficiently to solve routine and non-routine problems in a variety of contexts	• applies mathematical concepts in a variety of contexts to routine and non-routine problems • selects and applies mathematical techniques to solve routine and non-routine problems in a variety of contexts • selects and applies mathematical models to routine and non-routine problems to a variety of contexts • uses digital technologies effectively to solve routine and non-routine problems in a variety of contexts	• applies mathematical concepts in some contexts to routine and non-routine problems • applies mathematical techniques to solve routine and non-routine problems in some contexts • applies mathematical models to routine and non-routine problems in some contexts • uses digital technologies appropriately to solve routine and non-routine problems in some contexts	• applies simple mathematical concepts in limited contexts to routine problems • applies simple mathematical techniques to solve routine problems in limited contexts • applies simple mathematical models to routine problems in limited contexts • uses digital technologies appropriately to solve routine problems in limited contexts	• applies simple mathematical concepts in structured contexts • uses simple mathematical techniques to solve routine problems in structured contexts • demonstrates limited familiarity with mathematical models in structured contexts • uses digital technologies to solve routine problems in structured contexts