

MATHEMATICS, SCIENCE AND IT ACADEMY

SEMESTER 1 2019

Course Title	Specialist Mathematics (T) Integrating Australian Curriculum	Course Code	2317
Semester Unit	Unit 1: Specialist Mathematics	Unit Code, Value	14592, 1.0
Term 1 Unit	Unit 1a: Specialist Mathematics	Unit Code, Value	14593, 0.5
Term 2 Unit	Unit 1b: Specialist Mathematics	Unit Code, Value	14594, 0.5

Specific Unit Goals

By the end of this unit, students:

- understand the concepts and techniques in combinatorics, geometry and vectors
- apply reasoning skills and solve problems in combinatorics, geometry and vectors
- communicate their arguments and strategies when solving problems
- construct proofs in a variety of contexts including algebraic and geometric
- interpret mathematical information and ascertain the reasonableness of their solutions to problems.

Content Descriptions

Topic 1: Combinatorics

Permutations (ordered arrangements):

- solve problems involving permutations
- use the multiplication principle
- use factorial notation
- solve problems involving permutations and restrictions with or without repeated objects.

The inclusion-exclusion principle for the union of two sets and three sets:

- determine and use the formulas for finding the number of elements in the union of two and the union of three sets.

The pigeon-hole principle:

- solve problems and prove results using the pigeon-hole principle.

Combinations (unordered selections):

- solve problems involving combinations
- use the notation $\binom{n}{r}$ or ${}^n C_r$
- derive and use simple identities associated with Pascal's triangle

Topic 2: Vectors in the plane

Representing vectors in the plane by directed line segments:

- examine examples of vectors including displacement and velocity
- define and use the magnitude and direction of a vector
- represent a scalar multiple of a vector
- use the triangle rule to find the sum and difference of two vectors.

Algebra of vectors in the plane:

- use ordered pair notation and column vector notation to represent a vector
- define and use unit vectors and the perpendicular unit vectors i and j
- express a vector in component form using the unit vectors i and j
- examine and use addition and subtraction of vectors in component form
- define and use multiplication by a scalar of a vector in component form
- define and use scalar (dot) product
- apply the scalar product to vectors expressed in component form
- examine properties of parallel and perpendicular vectors and determine if two vectors are parallel or perpendicular
- define and use projections of vectors
- solve problems involving displacement, force and velocity involving the above concepts

Topic 3: Geometry

The nature of proof:

- use implication, converse, equivalence, negation, contrapositive
- use proof by contradiction
- use the symbols for implication (\Rightarrow), equivalence (\Leftrightarrow), and equality ($=$)
- use the quantifiers 'for all' and 'there exists'
- use examples and counter-examples.

Circle properties and their proofs including the following theorems:

- an angle in a semicircle is a right angle
- the angle at the centre subtended by an arc of a circle is twice the angle at the circumference subtended by the same arc
- angles at the circumference of a circle subtended by the same arc are equal
- the opposite angles of a cyclic quadrilateral are supplementary
- chords of equal length subtend equal angles at the centre and conversely chords subtending equal angles at the centre of a circle have the same length
- the alternate segment theorem
- when two chords of a circle intersect, the product of the lengths of the intervals on one chord equals the product of the lengths of the intervals on the other chord
- when a secant (meeting the circle at A and B) and a tangent (meeting the circle at T) are drawn to a circle from an external point M, the square of the length of the tangent equals the product of the lengths to the circle on the secant. ($AM \times BM = TM^2$)
- suitable converses of some of the above results
- solve problems finding unknown angles and lengths and prove further results using the results listed above

Geometric proofs using vectors in the plane including:

- the diagonals of a parallelogram meet at right angles if and only if it is a rhombus
- midpoints of the sides of a quadrilateral join to form a parallelogram
- the sum of the squares of the lengths of the diagonals of a parallelogram is equal to the sum of the squares of the lengths of the sides.

COST OF MATERIALS

There may be a cost associated with the hire of a graphics calculator.

ASSESSMENT

TASK	DUE DATE	WEIGHTING
Test 1	Exam Week Term 1	30%
Assignment 1	Week 9	20%
Assignment 2	Week 14	20%
Test 2	Exam Week Term 2	30%

SPECIFIC ENTRY & EXIT REQUIREMENTS FOR TERM UNITS

It is possible to enter this course at Term 2. Entry into this course for Term 2 is by negotiation with the Executive teacher.

Test 1 and Assignment 1 must be completed for Unit 14593.

Test 2 and Assignment 2 must be completed for Unit 14594.

ASSESSMENT CRITERIA FOR ASSESSMENT AND REPORTING OF STUDENT ACHIEVEMENT

Students will be assessed on the degree to which they demonstrate:

- Knowledge – knowledge of mathematical facts, techniques and formulae presented in the unit
- Application – appropriate selection and application of mathematical skills in mathematical modelling and problem solving
- Reasoning – ability to use reasoning to support solutions and conclusions (in T courses only)
- Communication – interpretation and communication of mathematical ideas in a form appropriate for a given use or audience.

Unit Grades for T Courses

	Knowledge	Application	Reasoning	Communication
A student who achieves the grade A	Demonstrates very high level of proficiency in the use of facts, techniques and formulae.	Selects, extends and applies appropriate modelling and problem solving techniques.	Uses mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions; justifies procedures.	Is consistently accurate and appropriate in presentation of mathematical ideas in different contexts.
A student who achieves the grade B	Demonstrates high level of proficiency in the use of facts, techniques and formulae.	Selects and applies appropriate modelling and problem solving techniques.	Uses mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions.	Is generally accurate and appropriate in presentation of mathematical ideas in different contexts.
A student who achieves the grade C	Demonstrates some proficiency in the use of facts, techniques and formulae studied.	With direction, applies a model. Solves most problems.	Uses some mathematical reasoning to develop logical arguments.	Presents mathematical ideas in different contexts.
A student who achieves the grade D	Demonstrates limited use of the facts, techniques and formulae studied.	Solves some problems independently.	Uses some mathematical reasoning to develop simple logical arguments.	Presents some mathematical ideas.
A student who achieves the grade E	Demonstrates very limited use of the facts, techniques and formulae studied.	Solves some problems with guidance.	Uses limited reasoning to justify conclusions.	Presents some mathematical ideas with guidance.

Teachers will consider, when allocating grades, the degree to which students demonstrate their ability to complete and submit tasks within a specified time frame.

ATTENDANCE AND PARTICIPATION

Students are expected to submit all assessment items and attend all classes, participate in a positive manner and seek support whenever it is required. Excursions, simulations and presentations by visitors (including lunchtime) may form part of classwork. It is your responsibility to catch up on missed work when absent from class.

Any student whose attendance falls below the 90% of the scheduled classes/contact time and has not provided substantial documentary evidence to cover the absence will be awarded a V grade. This means that 4 unexplained absences in a term or 8 unexplained absences in a semester could mean that a V grade may be awarded. However, the Principal has the right to exercise discretion in special circumstances if satisfactory documentation is supplied.

LATE SUBMISSION OF WORK

Students are encouraged to submit work on time, as it is a valuable organisational skill. Students are also encouraged to complete work even if it is late, as there are educational benefits in doing so.

Late work will receive a penalty of 5% (of possible marks) per calendar day late, unless an extension is granted by the class teacher prior to the deadline. This means that 5% is taken off the possible marks that could have been achieved eg. If a student achieved a score of 75/100, and the item is one day late, then five marks (5% of 100) would be taken from 75, which leaves the score as 70/100. 'Per calendar day late' means each day late whether it be a weekend or public holiday. Items due on any date must be submitted to the class teacher, faculty staff room, or front office at the college by 3.30pm on that day. After 3.30pm, the item will attract the late penalty. Submission of work on a weekend or public holiday is not acceptable. If you do not submit your work to your class teacher, make sure that it is signed and dated by either another member of staff in the faculty staffroom, or a member of the front office staff.

No work will be accepted after marked work has been returned, or accepted after the unit has completed. Computer and/or printer failure will not be accepted as a valid reason for late work. Make sure you backup, keep hard copies and rough notes.

Unless prior approval is granted, any student who fails to submit assessment tasks worth in total 70% or more of the assessment for the unit, will be considered to be unassessable and will receive a V grade. The Principal has the right to exercise discretion in the application of the late penalty in special circumstances where satisfactory documentation is supplied.

CHEATING AND DISHONEST PRACTICE

The integrity of the College's assessment system relies upon all involved acting in accordance with the highest standards of honesty and fairness. Any departure from such standards will be viewed very seriously."

Accordingly:

- Plagiarism - claiming authorship of someone else's work (intentionally or otherwise) - is a serious misdemeanour, and attracts severe penalties.
- Students are required to acknowledge the source of all material that is incorporated into their own work.
- Students may not submit the same item for assessment in more than one unit, unless specific agreement has been reached with the class teacher.

MODERATION

Throughout the semester, moderation in the form of common marking schemes, cross marking and joint marking occurs across all units in the Moderation Group to ensure comparability of standards. Moderation is a process whereby student's work is compared so that student performance can be graded fairly and consistently. Moderation takes some time, and so students may not receive their work back until ACT wide moderation of grades across all colleges has occurred. Small Group Moderation is carried out in courses with small class sizes.

RIGHT TO APPEAL

You can appeal against your assessment if you feel that the result you obtained is not fair. You should first talk to your class teacher, and if you are not satisfied with the explanation you must discuss the situation with the Executive Teacher of the faculty concerned. If you still do not feel that your result is fair you should talk to the Deputy Principal Programs for further advice on the 'appeal process'.

Executive Teacher: **Ruth Edge**

Class Teacher: **Terry Brady**

Date: 12 February 2019

