KIRWAN STATE HIGH SCHOOL	SUBJECT: GENERAL MATHEMATICS	UNIT: 3

Unit Description	Unit Objectives
In Unit 3, students will develop mathematical understandings and skills to solve problems relating to: • Topic 1: Bivariate data analysis • Topic 2: Time series analysis • Topic 3: Growth and decay in sequences • Topic 4: Earth geometry and time zones. Bivariate data analysis introduces students to some methods for identifying, analysing and describing associations between pairs of variables, including the use of the least-squares method as a method for analysing linear associations. Time series analysis continues students' study of statistics by introducing them to the concepts and techniques of time series analysis. Growth and decay in sequences employs recursion to generate sequences that can be used to model and investigate patterns of growth and decay in discrete situations. These sequences find application in a wide range of practical situations, including modelling the growth of a compound interest investment, the growth of a bacterial population or the decrease in the value of a car over time. Sequences are also essential to understanding the patterns of growth and decay in loans and investments that are studied in detail in Unit 4. Earth geometry and time zones offers an opportunity to use contexts relevant to students.	Students will: 1. select, recall and use facts, rules, definitions and procedures drawn from all Unit 3 topics 2. comprehend mathematical concepts and techniques drawn all Unit 3 topics 3. communicate using mathematical, statistical and everyday language and conventions 4. evaluate the reasonableness of solutions 5. justify procedures and decisions by explaining mathematical reasoning 6. solve problems by applying mathematical concepts and techniques drawn from all Unit 3 topics.

Assessment Plan:

Task	%	Objectives to be assessed	Conditions	Date
IA1 – Internal Assessment 1 PSMT – *based on Unit 3 - topic 1*	20	As above – all objectives included on assessment item	4 weeks – including 3 hours of class time	Term 1 Week 5
Task	**%**	**Objectives to be assessed**	**Conditions**	**Date**
IA2 – Internal Assessment 2 Examination – *representatively sample all Unit 3 topics not assessed by the PSMT*	15	As above – all objectives included on assessment item	Closed Book QCAA formula sheet provided Technology Active 120 mInutes + 5 minutes perusal	Term 2 Week 2

Monitoring and Reviewing:

Strategies for Monitoring Student Progress	Date	Planned Reviews at Key Intervals	Date
Student Summary Rule book – separate book following through all units Proficiency scales KNOW and be able to DO tables (KDT) Regular vocabulary review, HW – weekly review, Formative items Common mistakes recognition Use of online support – Education Perfect, Khan Academy, Text-based online support Graphic organisers – e.g. mind maps, Frayer model, KWL (what I know, what I want to know, what I have learnt)		10 minute review (weekly quiz) during one lesson a week Mathspace quizzes - weekly Formative items	Each week Week 5 Week 10

Underpinning Factors:

Guaranteed Vocabulary:

- bivariate data
- two-way table
- scatterplot
- correlation
- Pearson's correlation coefficient
- covariance
- standard deviation
- time series plot
- trend
- seasonal indices
- fluctuations
- outliers
- moving average
- average percentage method
- least-squares line
- recursion
- linear growth and decay
- reducing balance method
- response variable
- explanatory variable
- residual plot
- coefficient of determination
- intercept
- categorical
- causation
- causal relationship
- coincidence
- confounding
- coherence
- consistency
- plausibility, specificity
- great circle
- small circle
- latitude
- longitude
- parallel
- meridian
- common difference
- geometric sequence
- exponential growth and decay

Literacy Skills

Written
- using technical / procedural vocabulary
- using conventions (symbols and abbreviations)
  - %, (r), (R^2), n, a, d and t, n, a and r, °, θ, cos θ, GMT, UTC

Oral
- articulating patterns and generalisations

Visual
- two-way table
- least-squares line
- spreadsheets
- graphical
- scatterplot
- plots
- tabular

Numeracy Skills

- identifying mathematical information
- calculating percentages
- applying mathematical knowledge in a range of contexts — making decisions
- using measurement
- interpreting statistical information
- recognising and using patterns and relationships

21st Century Skill/s

Critical thinking
- problem-solving, decision-making, reasoning,analytical thinking

Communication
- effective oral communication, using language, symbols and texts
- communicating ideas effectively with diverse audiences

Creative thinking
- curiosity and imagination
- applying new ideas, seeing and making new links

Collaboration and teamwork
- participating and contribution, community connections

ICT skills
- being productive users of technology

Cognitive Verbs

Retrieval and Comprehension: define, construct, summarise, select, describe, explain, document, calculate, recognise, recall, identify, sketch, clarify

Analysis: interpret, analyse, compare, categorise, construct, interpret, derive, identify, reflect, determine, apply, consider

Knowledge Utilisation: decide, develop, discuss, draw a conclusion, create, comment, evaluate, investigation, discussion, solve, communicate, make predictions, make decisions, synthesise, investigate, generate, develop, justify

TEACHING AND LEARNING PLAN:

Hours/Weeks	Unit Objectives	Subject Matter	Learning Experiences [reflecting DQ 3, 4, 5 and 6]	Possible Resources
Unit 3 *Weeks 1-6* Term 4 (yr11) Weeks 5 – 8 12 hours Term 1 (Yr12) Weeks 1, 2 6 hours		**Bivariate data analysis** **Identifying and describing associations between two categorical variables (4 hours)** • define bivariate data • construct two-way frequency tables and determine the associated row and column sums and percentages • use an appropriately percentaged two-way frequency table to identify patterns that suggest the presence of an association • describe an association in terms of differences observed in percentages across categories in a systematic and concise manner, and interpret this in the context of the data **Identifying and describing associations between two numerical variables (6 hours)** • construct a scatterplot to identify patterns in the data suggesting the presence of an association • describe an association between two numerical variables in terms of direction (positive/negative), form (linear) and strength (strong/moderate/weak) • calculate and interpret the correlation coefficient (r) to quantify the strength of a linear association using Pearson's correlation coefficient, where covariance and standard deviation are determined, using appropriate technology **Fitting a linear model to numerical data** • identify the response variable and the explanatory variable • use a scatterplot to identify the nature of the relationship between variables • model a linear relationship by fitting a least-squares line to the data • use a residual plot to assess the appropriateness of fitting a linear model to the data • interpret the intercept and slope of the fitted line • use, not calculate, the coefficient of determination (R^2) to assess the strength of a linear association in terms of the explained variation • use the equation of a fitted line to make predictions • distinguish between interpolation and extrapolation when using the fitted line to make predictions, recognising the potential dangers of extrapolation **Association and causation (7 hours)** • recognise that an observed association between two variables does not necessarily mean that there is a causal relationship between them • identify and communicate possible non-causal explanations for an association, including • coincidence and confounding due to a common response to another variable • solve practical problems by identifying, analysing and describing associations between two categorical variables or between two numerical variables	Refer to QCAA TLAP	Textbook General Mathematics Units 3&4 (Cambridge) Digital version also available

Hours/Weeks	Unit Objectives	Subject Matter	Learning Experiences [reflecting DQ 3, 4, 5 and 6]	Possible Resources
Unit 3 *Weeks 7 – 9* Term 1 Weeks 3 – 5 *9* hours		**Time series analysis** **Describing and interpreting patterns in time series data (4 hours)** • construct time series plots • describe time series plots by identifying features such as trend (long-term direction), seasonality (systematic, calendar-related movements) and irregular fluctuations (unsystematic, short-term fluctuations), and recognise when there are outliers, e.g. one-off unanticipated events **Analysing time series data (10 hours)** • smooth time series data by using a simple moving average, including the use of spreadsheets to implement this process • calculate seasonal indices by using the average percentage method • deseasonalise a time series by using a seasonal index, including the use of spreadsheets to implement this process • fit a least-squares line to model long-term trends in time series data, using appropriate technology • solve practical problems that involve the analysis of time series data		
Unit 3 *Weeks 10 -12* Term 1 Weeks 6 – 8 *9* hour		**Growth and decay in sequences** **The arithmetic sequence** • use recursion to generate an arithmetic sequence • display the terms of an arithmetic sequence in both tabular and graphical form and demonstrate that arithmetic sequences can be used to model linear growth and decay in discrete situations • use the rule for the n^{th} term using $t_n = a + (n-1)d$, where t_n represents the n^{th} term of the sequence, a = first term, n = term number and d = common difference of a particular arithmetic sequence from the pattern of the terms in an arithmetic sequence, and use this rule to make predictions • use arithmetic sequences to model and analyse practical situations involving linear growth or decay, such as analysing a simple interest loan or investment, calculating a taxi fare based on the flag fall and the charge per kilometre, or calculating the value of an office photocopier at the end of each year using the straight-line method or the unit cost method of depreciation **The geometric sequence** • use recursion to generate a geometric sequence • display the terms of a geometric sequence in both tabular and graphical form and demonstrate that geometric sequences can be used to model exponential growth and decay in discrete situations • use the rule for the n^{th} term using $t_n = ar^{n-1}$ where t_n represents the n^{th} term of the sequence, a = first term, n = term number and r = common ratio of a particular geometric sequence from the pattern of the terms in the sequence, and use this rule to make predictions • use geometric sequences to model and analyse (numerically or graphically only) practical problems involving geometric growth and decay (logarithmic solutions not required), such as analysing a compound interest loan or investment, the growth of a bacterial population that doubles in size each hour		

Hours/Weeks	Unit Objectives	Subject Matter	Learning Experiences [reflecting DQ 3, 4, 5 and 6]	Possible Resources
Unit 3 *Weeks 13, 14* Term 1 Weeks 9, 10 6 hours		**Earth geometry and time zones** **Locations on the Earth (3 hours)** define the meaning of great circles • define the meaning of angles of latitude and longitude in relation to the equator and the prime meridian locate positions on Earth's surface given latitude and longitude, e.g. using a globe, an atlas, GPS and other digital technologies • state latitude and longitude for positions on Earth's surface and world maps (in degrees only) • use a local area map to state the position of a given place in degrees and minutes, e.g. investigating the map of Australia and locating boundary positions for Aboriginal language groups, such as the Three Sisters in the Blue Mountains or the local area's Aboriginal land and the positions of boundaries • calculate angular distance (in degrees and minutes) and distance (in kilometres) between two places on Earth on the same meridian using $D = 111.2 \times$ *angular distance* • calculate angular distance (in degrees and minutes) and distance (in kilometres) between two places on Earth on the same parallel of latitude using $D = 111.2 \cos(\theta) \times$ *angular distance* • calculate distances between two places on Earth, using appropriate technology **Time zones (5 hours)** define Greenwich Mean Time (GMT), International Date Line and Coordinated Universal Time (UTC) • understand the link between longitude and time • determine the number of degrees of longitude for a time difference of one hour • solve problems involving time zones in Australia and in neighbouring nations, making any necessary allowances for daylight saving, including seasonal time systems used by Aboriginal peoples and Torres Strait Islander peoples • solve problems involving GMT, International Date Line and UTC • calculate time differences between two places on Earth • solve problems associated with time zones, such as online purchasing, making phone calls overseas and broadcasting international events • solve problems relating to travelling east and west incorporating time zone changes, such as preparing an itinerary for an overseas holiday with corresponding times		