KIRWAN STATE HIGH SCHOOL	SUBJECT: MATHEMATICAL METHODS	UNIT: 1

Unit Description	Unit Objectives
In Unit 1, students will develop mathematical understandings and skills to solve problems relating to the topics: • Topic 1: Arithmetic and geometric sequences and series 1 • Topic 2: Functions and graphs • Topic 3: Counting and probability • Topic 4: Exponential functions 1 • Topic 5: Arithmetic and geometric sequences and series 2. Arithmetic and geometric sequences are introduced and their applications are studied. Simple relationships between variable quantities are reviewed and these are used to introduce the key concepts of a function and its graph. Quadratic functions and index rules are revised. The study of inferential statistics begins in this unit with a review of the fundamentals of probability and the introduction of the concepts of conditional probability and independence. The algebraic expansion of powers of a binomial are found using the binomial theorem.	Students will: 1. select, recall and use facts, rules, definitions and procedures drawn from all Unit 1 topics 2. comprehend mathematical concepts and techniques drawn all Unit 1 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 1 topics.

Assessment Plan:

Task	%	Objectives to be assessed	Conditions	Date
IA1 – Internal Assessment 1 PSMT – *Unit 1 – Topic 2*	20	As above – all objectives included on assessment item	4 weeks – including 3 hours of class time	Term 1 Week 9
Task	**%**	**Objectives to be assessed**	**Conditions**	**Date**
IA2 – Internal Assessment 2 Examination – *representatively sample all Unit 1 topics not assessed by the PSMT*	15	As above – all objectives included on assessment item	Closed Book QCAA formula sheet provided Technology Free Technology Active 120 mInutes + 5 minutes perusal	Term 2 Week 5

Monitoring and Reviewing:			
Strategies for Monitoring Student Progress *Strategies as a team to ensure that students are recycling through content*	**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 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:

Technical –
- arithmetic sequence /series / progression
- common difference
- transformation (translation, reflection, dilation, stretching, squeezing)
- piece-wise function, domain
- function, relation
- parameter
- factor of a polynomial function
- axis of symmetry
- quadratic, cubic, fourth-degree polynomial aka parabola, cubic, quartic
- discriminant
- continuous
- local and global minimum / maximum
- turning point
- zero of a polynomial function
- inverse proportion
- direct proportion
- asymptote
- factorised form
- vertex

Procedural –
- transform
- graph
- sketch
- factorise, expand
- complete the square
- solve

Literacy Skills

Written
using technical / procedural vocabulary
using conventions (symbols, abbreviations) e.g.
- AP, S_n, a, d, n, t_1, t_2...t_n
- $f(x)$, $f(x+2)$, $f(x)=4$ $0 \leq x \leq 2$
- A, A', P($\bar{\bar{A}}$), $A \cap B$, $A \cup B$,$\emptyset$, $P(A|B)$, $P(A)$, $\Pr(A) \geq 0$, *for each event A,* $0 \leq P(A) \leq 1$, $\binom{n}{r}$
- $\sqrt[b]{x^a} = x^{\frac{a}{b}}$, $a^b \times a^c = a^{b+c}$, $\frac{a^b}{a^c} = a^{b-c}$, $(a^b)^c = a^{b \times c}$
- $t_n = t_1 r^{n-1}$, $S_n = t_1 \frac{r^n - 1}{r-1}$, $S_\infty = \frac{t_1}{1-r}$

Oral
articulating patterns and generalisations — putting thoughts into words

Visual
using graphs, tables, diagrams, symbols

21st Century Skill/s

Critical thinking analytical thinking
- problem-solving
- decision-making
- reflecting and evaluating

Communication
- using language, symbols and texts

Creative thinking
- seeing new links

C**ollaboration and teamwork**
- relating to others
- participating and contributing

Numeracy Skills

- calculating with whole numbers, percentages and surd/index form
- developing an understanding of the meaning of decimals and percentages and how they can be applied in real-life situations
- recognising and using patterns and relationships
- selecting and using digital tools
- interpreting data
- managing information, e.g. graphs, tables
- making decisions and judgments with critical orientation
- interpreting solutions in the context of a problem
- using reasoning to check solutions

Cognitive Verbs

Retrieval and comprehension – use, define, recall, construct (graphs), identify, understand, recognise, explain, sketch, calculate

Analysis - consider, determine, apply, analyse, deduce, identify

Knowledge utilisation – investigate, devise, discuss, develop, solve, design, create (a mathematical model), explore, generate

TEACHING AND LEARNING PLAN:

Hours/ Weeks	Unit Objectives	Subject Matter	Learning Experiences [reflecting DQ 3, 4, 5 and 6]	Possible Resources
Unit 1 *Weeks 1-2* Term 1 Week 1-2 3 hours	1, 2, 3, 4, 5, 6	**Arithmetic and geometric sequences and series 1** **Arithmetic sequences** • recognise and use the recursive definition of an arithmetic sequence: $t_{n+1}=t_n+d$ • use the formula $t_n=t_1+(n-1)d$ for the general term of an arithmetic sequence and recognise its linear nature • use arithmetic sequences in contexts involving discrete linear growth or decay, such as simple interest • establish and use the formula for the sum of the first n terms of an arithmetic sequence: $S_n=n/2(2t_1+(n-1)d)=n/2(t_1+t_n)$	Refer to the QCAA TLAP	Textbooks Maths Quest - Mathematical Methods Units 1&2 (Jacaranda) Digital version also available *Classic Mistake.co.uk*, 'Classic mistakes', www.calculatorsoftware.co.uk/classicmistake/about.htm.
Unit 1 *Weeks 3–8* Term 1 Weeks 3 – 8 19 hours		**Functions and graphs** **Functions** • understand the concept of a relation as a mapping between sets, a graph and as a rule or a formula that defines one variable quantity in terms of another • recognise the distinction between functions and relations and use the vertical line test to determine whether a relation is a function • use function notation, domain and range, and independent and dependent variables • examine transformations of the graphs of $f(x)$, including dilations and reflections, and the graphs of $y=a(x)$ and $y=f(b)$, translations, and the graphs of $y=f(x+c)$ and $y=f(x)+d$; $a,b,c,d \in R$ • recognise and use piece-wise functions as a combination of multiple sub-functions with restricted domains • identify contexts suitable for modelling piece-wise functions and use them to solve practical problems (taxation, taxis, the changing velocity of a parachutist). • **Review of quadratic relationships** • examine examples of quadratically related variables • recognise and determine features of the graphs of $y=x^2$, $y=ax^2+bx+c$, $y=a(x-b)^2+c$, and $y=a(x-b)(x-c)$, including their parabolic nature, turning points, axes of symmetry and intercepts • solve quadratic equations algebraically using factorisation, the quadratic formula (both exact and approximate solutions), and completing the square and using technology • identify contexts suitable for modelling with quadratic functions and use models to solve problems with and without technology; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis • understand the role of the discriminant to determine the number of solutions to a quadratic equation • determine turning points and zeros of quadratic functions with and without technology.	Formative assessment item Week 5 PSMT – 4 weeks Out W6 - Tuesday Due W9 - Tuesday	Refer to the QCAA TLAP

		Powers and polynomials • identify the coefficients and the degree of a polynomial • expand quadratic and cubic polynomials from factors • recognise and determine 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 $x\to\infty$ and $x\to-\infty$ • use the factor theorem to factorise cubic polynomials in cases where a linear factor is easily obtained • solve cubic equations using technology, and algebraically in cases where a linear factor is easily obtained • recognise and determine features of the graphs $y=a(x-b)^4+c$, including shape and behaviour • solve equations involving combinations of the functions above, using technology where appropriate. **Inverse proportions** • examine examples of inverse proportion • recognise features of the graphs of $y=1/x$ and $y=a/(x-b)$, including their hyperbolic shapes, their intercepts, their asymptotes and behaviour as $x\to\infty$ and $x\to-\infty$. **Graphs of relations** • recognise and determine features of the graphs of $x^2+y^2=r^2$ and $(x-a)^2+(y-b)^2=r^2$, including their circular shapes, centres and radii • recognise and determine features of the graph of $y=x$, including its parabolic shape and axis of symmetry.		
Unit 1 Weeks 9-11 Term 1 Weeks 9-10 Term 2 Week 1 11 hours		**Counting and probability** **Language of events and sets** • recall-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∩B for the intersection of events A and B, and A∪B for the union, and recognise mutually exclusive events • use everyday occurrences to illustrate set descriptions and representations of events, and set operations, including the use of Venn diagrams. **Review of the fundamentals of probability** • recall probability as a measure of 'the likelihood of occurrence' of an event • recall the probability scale: $0\leq P(A)\leq 1$ for each event AA, with $P(A)=0$ if A is an impossibility and $P(A)=1$ if A is a certainty • recall the rules $P(\bar{A})=1-P(A)$ 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 • use the notation $P(A\mid B)$ and the formula $P(A\cap B)=P(A\mid B)P(B)$ to solve problems • understand and use the notion of independence of an event A from an event B, as defined by $P(A\mid B)=P(A)$ • establish and use the formula $P(A\cap B)=P(A)P(B)$ for independent events A and B • use relative frequencies obtained from data as point estimates of conditional probabilities and as indications of possible independence of events.		

		Binomial expansion • understand the notion of a combination as an unordered set of r objects taken from a set of n distinct objects • recognise and use the link between Pascal's triangle and the notation $\binom{n}{r}$ • expand $(x+y)^n$ for small positive integers n.		
Unit 1 *Week 12* Term 2 Week 2 1.5 hours		**Exponential functions I** **Indices and the index laws** • recall indices (including negative and fractional indices) and the index laws • convert radicals to and from fractional indices • understand and use scientific notation.		
Unit 1 *Weeks 12-13* Term 2 Weeks 2-3 4 hours		**Arithmetic and geometric sequences and series 2** **Geometric sequences** • recognise and use the recursive definition of a geometric sequence: $t_{n+1} = rt_n$ • use the formula $t_n = r^{n-1}t_1$ for the general term of a geometric sequence and recognise its exponential nature • understand the limiting behaviour as $n \to \infty$ of the terms t_n in a geometric sequence and its dependence on the value of the common ratio • establish and use the formula $S_n = t_1 \frac{r^n-1}{r-1}$ for the sum of the first n terms of a geometric sequence • establish and use the formula $S_\infty = \frac{t1}{1-r}$ for the sum to infinity of a geometric progression • use geometric sequences in contexts involving geometric growth or decay, including compound interest and annuities.		