Stuart Bathurst Catholic High School

Mathematics Department

Long-term sequencing Year 12 Pure Mathematics

HALF TERM 1:
STUDENTS MUST KNOW:

Chapter 2: Quadratics
- Solve quadratic equations using factorisation, the quadratic formula and completing the square.
- Read and use $f(x)$ notation when working with functions.
- Sketch the graph and find the turning point of a quadratic function.
- Find and interpret the discriminant of a quadratic expression
- Use and apply models that involve quadratic functions.

Chapter 3: Equations and Inequalities
- Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation.
- Solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions.
- Express solutions through correct use of 'and' and 'or', or through set notation.
- Represent linear and quadratic inequalities such as $y > x + 1$ and $y > ax^2 + bx + c$ graphically.

Chapter 4: Graphs and Transformations
- Understand and use graphs of functions; sketch curves defined by simple equations including polynomials, and (including their vertical and horizontal asymptotes; interpret algebraic solution of equations graphically; use intersection points of graphs to solve equations.
- Understand and use proportional relationships and their graphs.
- Understand the effect of simple transformations on the graph of $y = f(x)$ including sketching associated graphs, and combinations of these transformations.

Chapter 5: Straight line graphs
- Understand and use the equation of a straight line;
- Know and be able to apply the gradient conditions for two straight lines to be parallel or perpendicular;
- Find lengths and areas using equations of straight lines;
- Use straight-line graphs in modelling.

Chapter 6: Circles
- Find the midpoint of a line segment;
- Understand and use the equation of a circle;
- Find points of intersection between a circle and a line;
- Solve geometric problems involving straight lines and circle;
- Know and be able to use the properties of chords and tangents

Chapter 7: Algebraic Methods
- Be able to use algebraic division;
- Know and be able to apply the factor theorem;
- Be able to fully factorise a cubic expression;

HOW THIS WILL BE ASSESSED:
Recall and Retrieval tasks
End of unit assessments

HALF TERM 2:
STUDENTS MUST KNOW:

Chapter 8: The binomial expansion
- Understand and use the binomial expansion of for positive integer *n*; the notations *n*! and *n*C*r*; link to binomial probabilities

Chapter 9: Trigonometry ratios
- Understand and be able to use the definitions of sine, cosine and tangent for all arguments;
- Understand and be able to use the sine and cosine rules;
- Understand and be able to use the area of a triangle in the form $\frac{1}{2} ab \sin C$;
- Understand and be able to use the sine, cosine and tangent functions; their graphs, symmetries and periodicity.

Chapter 10: Trigonometric identity and equations
- Understand and be able to use $\tan \theta = \frac{\cos \theta}{\sin \theta}$
- Understand and use $\sin^2 \theta + \cos^2 \theta = 1$
- Solve trigonometric equations within a given interval.

HOW THIS WILL BE ASSESSED:
Recall and Retrieval tasks
End of unit assessments.

HALF TERM 3:
STUDENTS MUST KNOW:

Chapter 11: Vectors
- Use vectors in two dimensions
- Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form
- Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations
- Understand and use position vectors; calculate the distance between two points represented by position vectors
- Use vectors to solve problems in pure mathematics and in context, (including forces).

Chapter 12: Differentiation
- Understand and use the derivative of as the gradient of the tangent to the graph of at a general point (x, y);the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient function for a given curve; second derivatives; differentiation from first principles for small positive integer powers of x.
- Understand and use the second derivative as the rate of change of gradient
- Differentiate, for rational values of xn and related constant multiples, sums and differences.
- Apply differentiation to find gradients, tangents and normal, maxima and minima and stationary points
- Identify where functions are increasing or decreasing.

Chapter 14: Exponentials and Logarithms
- Know and use the functions function a^x and e^x and its graph
- Know that the gradient of e^{kx} is equal to ke^{kx} and hence understand why the exponential model is suitable in many applications
- Know and use the definition of $\log_a x$ as the inverse of a^x, where a is positive and $x \geq 0$
- Know and use the function $\ln x$ and its graph; Know and use $\ln x$ as the inverse function of e^x
- Understand and use the laws of logarithms; Solve equations of the form $a^x = b$
- Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^x$, given data for x and y
- Understand and use exponential growth and decay; use in modelling (examples may include the use of e in continuous compound interest, radioactive decay, drug concentration decay, exponential growth as a model for population growth); consideration of limitations and refinements of exponential models.

HOW THIS WILL BE ASSESSED:
Recall and Retrieval tasks
End of unit assessments

HALF TERM 4:
STUDENTS MUST KNOW:

Chapter 13: Integration
- Know and use the Fundamental Theorem of Calculus
- Integrate (excluding $n = -1$), and related sums, differences and constant multiples nx
- Evaluate definite integrals; use a definite integral to find the area under a curve.

HOW THIS WILL BE ASSESSED:
Recall and Retrieval tasks
End of unit assessments

HALF TERM 5:
STUDENTS MUST KNOW:

Chapter 1: Algebraic methods
- Proof by contradiction (including proof of the irrationality of $\sqrt{2}$ and the infinity of primes, and application to unfamiliar proofs)
- Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem.
- Simplify rational expressions including by factorising and cancelling, and algebraic division (by linear expressions only)
- Decompose rational functions into partial fractions (denominators not more complicated than squared linear terms and with no more than 3 terms, numerators constant or linear).

Chapter 2: Functions
- Understand what is meant by a modulus of a linear function;
- Be able to sketch graphs of functions involving modulus functions;
- Be able to solve equations and inequalities involving modulus functions.
- Be able to work out the domain and range of functions;
- Be able to work out the composition of two functions;
- Be able to work out the inverse of a function and sketch its graph;
- Understand the effect of simple transformations on the graph of y = f(x) including sketching associated graphs and *combinations* of the transformations:
  $y = a$f(x), $y =$ f(x) + a, $y =$ f($x + a$), $y =$ f(ax);
- Be able to transform graphs to produce other graphs;
- Understand the effect of composite transformations on equations of curves and be able to describe them geometrically.

Chapter 3: Sequences
- Understand and work with arithmetic sequences and series, including the formulae for nth term and the sum to n terms.
- Understand and work with geometric sequences and series including the formulae for the nth term and the sum of a finite geometric series; the sum to infinity of a convergent geometric series, including the use of |r| < 1; modulus notation.
- Work with sequences including those given by a formula for the nth term and those generated by a simple relation of the form $x_{n+1} = f(x_n)$; increasing sequences; decreasing sequences; periodic sequences.
- Understand and use sigma notation for sums of series; Use sequences and series in modelling.

Chapter 4: Binomial Expansion
- Understand and use the binomial expansion of $(a + bx)^n$ for positive integer n; the notations n! and nCr; link to binomial probabilities
- Extend to any rational n, including its use for approximation
- Be aware that the expansion is valid for $\left|\frac{bx}{a}\right| < 1$. (proof not required)
- Use partial fractions to expand fractional expressions.

HOW THIS WILL BE ASSESSED:
Recall and Retrieval tasks
End of unit assessments

HALF TERM 6:
STUDENTS MUST KNOW:

Revision and review of topics based on QLA.

HOW THIS WILL BE ASSESSED:
- Recall and Retrieval tasks
- End of unit assessments