Stuart Bathurst Catholic High School

Mathematics Department

Long-term sequencing Year 13 Pure Mathematics

HALF TERM 1:
STUDENTS MUST KNOW:

Chapter 3: Sequences and series

- Understand and work with arithmetic sequences and series, including the formulae for *n*th 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 5: Radians

- Understand the definition of a radian and be able to convert between radians and degrees;
- Know and be able to use exact values of sin, cos and tan;
- Be able to derive and use the formulae for arc length and area of sector.
- Understand and be able to use the standard small angle approximations for sine, cosine and tangent.

Chapter 6: Trigonometric functions

- Understand the secant, cosecant and cotangent functions, and their relationships to sine, cosine and tangent;
- Be able to sketch the graphs of secant, cosecant and cotangent;
- Be able to simplify expressions and solve involving sec, cosec and cot;
- Be able to solve identities involving sec, cosec and cot;
- Know and be able to use the identities $1 + \tan^2 x = \sec^2 x$ and $1 + \cot^2 x = \text{cosec}^2 x$ to prove other identities and solve equations in degrees and/or radians
- Be able to work with the inverse trig functions $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$;
- Be able to sketch the graphs of $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$.

Chapter 7: Trigonometric modelling

- Be able to prove geometrically the following compound angle formulae for sin $(A \pm B)$, cos $(A \pm B)$ and tan $(A \pm B)$;
- Be able to use compound angle identities to rearrange expressions or prove other identities;
- Be able to use compound angle identities to rearrange equations into a different form and then solve;
- Be able to recall or work out double angle identities;
- Be able to use double angle identities to rearrange expressions or prove other identities;
- Be able to use double angle identities to rearrange equations into a different form and then solve.
- Be able to express $a\cos\theta + b\sin\theta$ as a single sine or cosine function;
- Be able to solve equations of the form $a\cos\theta + b\sin\theta = c$ in a given interval.
- Be able to construct proofs involving trigonometric functions and previously learnt identities.

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

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HALF TERM 2:
STUDENTS MUST KNOW:

Chapter 8: Parametric Equations

- Understand and use the parametric equations of curves and conversion between Cartesian and parametric forms
- Use parametric equations in modelling in a variety of contexts

Chapter 9: Differentiation

- Differentiate x^n, for rational values of *n*, and related constant multiples, sums and differences]
- Differentiate e^{kx} and a^{kx}, $\sin kx$, $\cos kx$, $\tan kx$ and related sums, differences and constant multiples Understand and use the derivative of ln*x*
- Differentiation from first principles for small positive integer powers of x and for $\sin x \ \ and \cos x$
- Understand and use the second derivative as the rate of change of gradient]; connection to convex and concave sections of curves and points of inflection
- Differentiate using the product rule, the quotient rule and the chain rule, including problems involving connected rates of change and inverse functions
- Construct simple differential equations in pure mathematics and in context,
- (contexts may include kinematics, population growth and modelling the relationship between price and demand)

Chapter 10: Numerical methods

- Locate roots of $\boldsymbol{f(x) = 0}$ by considering changes of sign of $\boldsymbol{f(x)}$ in an interval of *x* on which $\boldsymbol{f(x)}$ is sufficiently well-behaved Understand how change of sign methods can fail.
- Solve equations approximately using simple iterative methods; be able to draw associated cobweb and staircase diagrams Solve equations using the Newton-Raphson method and other recurrence relations of the form $\boldsymbol{x_{n+1} = g(x_n)}$
- Understand how such methods can fail.
- Use numerical methods to solve problems in context.

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

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HALF TERM 3:
STUDENTS MUST KNOW:

Chapter 9: Differentiation

- Differentiate x^n, for rational values of n, and related constant multiples, sums and differences]
- Differentiate e^{kx} and a^{kx}, $\sin kx$, $\cos kx$, $\tan kx$ and related sums, differences and constant multiples Understand and use the derivative of ln$x$
- Differentiation from first principles for small positive integer powers of x and for $\sin x \ \ and \ \cos x$
- Understand and use the second derivative as the rate of change of gradient]; connection to convex and concave sections of curves and points of inflection
- Differentiate using the product rule, the quotient rule and the chain rule, including problems involving connected rates of change and inverse functions
- Construct simple differential equations in pure mathematics and in context,
- (contexts may include kinematics, population growth and modelling the relationship between price and demand)

Chapter 11: Integration

- Integrate x^n (excluding n = -1), and related sums, differences and constant multiples
- Integrate e^{kx} , $\frac{1}{x}$, $\sin kx$, $\cos kx$ and related sums, differences and constant multiples
- Carry out simple cases of integration by substitution and integration by parts; understand these methods as the inverse processes of the chain and product rules respectively
- (Integration by substitution includes finding a suitable substitution and is limited to cases where one substitution will lead to a function which can be integrated; integration by parts includes more than one application of the method but excludes reduction formulae)
- Evaluate definite integrals; use a definite integral to find the area under a curve and the area between two curves
- Understand and use numerical integration of functions, including the use of the trapezium rule and estimating the approximate area under a curve and limits that it must lie between
- Evaluate the analytical solution of simple first order differential equations with separable variables, including finding particular solutions (Separation of variables may require factorisation involving a common factor)
- Interpret the solution of a differential equation in the context of solving a problem, including identifying limitations of the solution; includes links to kinematics.

Chapter 12: Vectors

- Use vectors in two dimensions and in three 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 and kinematics.

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

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HALF TERM 4:
STUDENTS MUST KNOW:

Chapter 11: Integration

- Integrate x^n (excluding n = -1), and related sums, differences and constant multiples
- Integrate e^{kx}, $\frac{1}{x}$, $\sin kx$, $\cos kx$ and related sums, differences and constant multiples
- Carry out simple cases of integration by substitution and integration by parts; understand these methods as the inverse processes of the chain and product rules respectively
- (Integration by substitution includes finding a suitable substitution and is limited to cases where one substitution will lead to a function which can be integrated; integration by parts includes more than one application of the method but excludes reduction formulae)
- Evaluate definite integrals; use a definite integral to find the area under a curve and the area between two curves
- Understand and use numerical integration of functions, including the use of the trapezium rule and estimating the approximate area under a curve and limits that it must lie between
- Evaluate the analytical solution of simple first order differential equations with separable variables, including finding particular solutions (Separation of variables may require factorisation involving a common factor)
- Interpret the solution of a differential equation in the context of solving a problem, including identifying limitations of the solution; includes links to kinematics.

Revision

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

HALF TERM 5&6:
STUDENTS MUST KNOW:

- Revision