# Stuart Bathurst Catholic High School

## Mathematics Department

### Long-term sequencing Year 13 Statistics and Mechanics

**HALF TERM 1:**
**STUDENTS MUST KNOW:**

**Chapter 1: Regression and correlation (Statistics)**

- Change of variable may be required e.g. using knowledge of logarithms to reduce a relationship of the form $y = ax^n$ or $y = kb^x$ into linear form to estimate $a$ and $n$ or $k$ and $b$.
- Understand and calculate the product moment correlation coefficient.
- Understand and apply the language of statistical hypothesis testing, …., extend to correlation coefficients as measures of how close data points lie to a straight line and be able to interpret a given correlation coefficient using a given p-value or critical value (calculation of correlation coefficients is excluded).

**Chapter 5: Forces and friction (Mechanics)**

- Identify the forces acting on a particle and represent them in a force diagram;
- Understand how to find the resultant force (magnitude and direction);
- Find the resultant of several concurrent forces by vector addition;
- Resolve a force into components and be able to select suitable directions for resolution.
- Solve problems involving smooth or rough inclined planes.
- Understand friction and the coefficient of friction.
- Use $F \leq \mu R$

**Chapter 8: Further Mechanics (Mechanics)**

- Work with vectors of displacement, velocity and acceleration when using the vector equations of motion.
- Model motion under gravity in a vertical plane using vectors; projectiles.
- Use calculus with harder functions of time involving variable acceleration.
- Differentiate and integrate vectors with respect to time.

**HOW THIS WILL BE ASSESSED:**
Low stakes knowledge tests as starters.

**HALF TERM 2:**
**STUDENTS MUST KNOW:**

**Chapter 3: Normal Distribution (Statistics)**

- Understand the normal distribution and the characteristics of a normal distribution curve.
- Find percentage points on a standard normal curve.
- Calculate values on a standard normal curve.
- Find unknown means and/or standard deviations for a normal distribution.
- Approximate a binomial distribution using a normal distribution.
- Select appropriate distributions and solve real-life problems in context.
- Carry out a hypothesis test for the mean of a normal distribution.

**HOW THIS WILL BE ASSESSED:**
Low stakes knowledge tests as starters.

**HALF TERM 3:**
**STUDENTS MUST KNOW:**

**Chapter 7: Application of forces (Mechanics)**

- Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors); application to problems involving smooth pulleys and connected particles; resolving forces in 2 dimensions; equilibrium of a particle under coplanar forces.
- Understand and use addition of forces; resultant forces; dynamics for motion in a plane.

**Chapter 6: Projectiles (Mechanics)**

- Model motion under gravity for an object projected horizontally.
- Resolve velocity into components.
- Solve problems involving particles projected at an angle.
- Derive the formulae for time of flight, range and greatest height, and the equation of a projectile.

**Chapter 10: Numerical methods (PURE)**

- 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.

**Chapter 4: Moments (Mechanics)**

- Calculate the turning effect of a force applied to a rigid body.
- Calculate the resultant moment of a set of forces acting on a rigid body.
- Solve problems involving uniform and non-uniform rods in equilibrium.
- Solve problems involving rods on the point of titling.
- Understand and use moments in simple static contexts

**HOW THIS WILL BE ASSESSED:**
Low stakes knowledge tests as starters

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| **HALF TERM 4:**<br>**STUDENTS MUST KNOW:**<br><br>**Chapter 7: Application of forces (Mechanics)**<br>• Understand and solve problems involving limiting equilibrium esp. static rigid bodies.<br><br>**Chapter 12: Vectors (PURE)**<br>• Use vectors in two dimensions and in three dimensions.<br>• Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form.<br>• Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations.<br>• Understand and use position vectors; calculate the distance between two points represented by position vectors.<br>• Use vectors to solve problems in pure mathematics and in context, including forces and kinematics.<br><br>**HOW THIS WILL BE ASSESSED:**<br>Low stakes knowledge tests as starters | **HALF TERM 5:**<br>**STUDENTS MUST KNOW:**<br><br>• Revision<br>• Exams<br><br>**HOW THIS WILL BE ASSESSED:**<br>Low stakes knowledge tests as starters | **HALF TERM 6:**<br>**STUDENTS MUST KNOW:**<br><br>• Revision<br>• Exams<br><br>**HOW THIS WILL BE ASSESSED:**<br>Low stakes knowledge tests as starters |
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| **Home learning set:** Independent task set in class. | | |