<u>Year 12.</u>

<u>Applied Chapter 8, Modelling</u>: Requires knowledge of Quadratics which is covered under **Pure Chapter 2, Quadratics.**

One of the objectives of **Applied Chapter 8, Modelling,** is to understand how the concept of a mathematical model applies to mechanics. Quadratic equations of different natures often illustrate this, be it positive or negative.

Pure Chapter 2, Quadratics, covers the use and application of models that involve quadratic functions.

A typical example of **Applied Chapter 8 Modelling** could be a basketball leaving a player's hand and modelled by a quadratic equation followed by calculating the height when the ball is released, distance covered horizontally, calculating the elevation at different horizontal distances and making predictions.

<u>Applied Chapter 9, Constant Acceleration</u>: Not related to any Pure chapters. However, gradients can be introduced and covered in detail under **Pure 5. Straight Line Graphs** and prior knowledge of solving simultaneous equations will be covered under **Pure Chapter 3, Equations and Inequalities.**

<u>Applied Chapter 10, Forces and Motion</u>: Requires knowledge of unit vectors covered under **Pure Chapter 11 Vector**s.

One of the objectives of **Applied Chapter 8, Forces and Motion,** is to calculate resultant forces by adding vectors.

Pure Chapter 11, Vectors, will cover how a vector is described by its change in position or displacement relative to the x and y axes.

A typical example of Forces and Motion is representing a unit vector "**i**" due East and "**j**" due North, and a particle is acted upon forces such as (2i+j) N, (3i-2j) N and (-i+4j) N, followed by calculating its resultant force, magnitude and bearing of the resultant forces.

<u>Applied Chapter 11, Variable Acceleration</u>: Requires knowledge of Pure 11: Differentiation and Chapter 12: Integration.

One of the objectives of Chapter 11, Variable Acceleration, is to use differentiation and integration to solve kinematics problems.

Pure Chapter 12 Differentiation will help find and calculate the velocity being the rate of change of displacement and find the acceleration being the rate of change of velocity.

A typical example of Variable Acceleration using Differentiation would be to find the velocity of a particle given its movement along a quadratic or any line/curve and to find the acceleration at a given point.

Pure Chapter 13 Integration will help reverse differentiated answers by integrating acceleration concerning time to find velocity and/or integrating velocity with respect to time to find displacement.

A typical example of Variable Acceleration using Integration would be to calculate the displacement of a particle after "t" seconds and/or the distance of a particle from its starting point given a specific time interval.

Year 13.

Applied Chapter 8, Further Kinematics: Requires knowledge of Differentiation and Integration, covered under Pure Chapter 2 and 11, respectively.

One of the objectives of **Applied Chapter 8, Further Kinematics,** is to differentiate and Integrate vectors concerning time. This is done by using calculus with vectors to solve problems involving motion in 2D with variable acceleration. Learners will differentiate or Integrate a vector quantity in the form $f(t)\mathbf{i} + g(t)\mathbf{j}$ separately.

Pure Chapter 9 Differentiation covers the use of differentiation to solve problems involving connected rates of change and construct simple differential equations together with using differentiation to solve different functions.

A typical example of differentiation application in Further Kinematics would be, given the mass of a particle acting on a specific force and a function, to calculate the speed, acceleration and distance with differentiation.

Pure Chapter 11 Integration will assist in solving differential equations and model real-life situations with differential equations.

A typical example of integration application in Further Kinematics would be, given a particle is moving at a certain velocity and calculating its position vectors after t seconds by reversing the differential equation.