**APPLICATIONS OF DIFFERENTIATION AND INTEGRATION**

**IN REAL LIFE**

In Isaac Newton's day, one of the biggest problems was poor navigation at sea.  
Before calculus was developed, the stars were vital for navigation.  
Shipwrecks occurred because the ship was not where the captain thought it should be. There was not a good enough understanding of how the Earth, stars and planets moved with respect to each other.  
Calculus (differentiation and integration) was developed to improve this understanding.  
Differentiation and integration can help us solve many types of real-world problems.   
We use the derivative to determine the maximum and minimum values of particular functions (e.g. cost, strength, amount of material used in a building, profit, loss, etc.).  
Derivatives are met in many engineering and science problems, especially when modeling the behavior of moving objects.  
Our discussion begins with some general applications which we can then apply to specific problems.  
1. It is used ECONOMIC a lot, calculus is also a base of economics   
2.it is used in history, for predicting the life of a stone   
3.it is used in geography, which is used to study the gases present in the atmosphere   
4. It is mainly used in daily by pilots to measure the pressure n the air.

Shipwrecks occurred because the ship was not where the captain thought it should be. There was not a good enough understanding of how the Earth, stars and planets moved with respect to each other.  
Calculus (differentiation and integration) was developed to improve this understanding.  
Differentiation and integration can help us solve many types of real-world problems.  
We use the derivative to determine the maximum and minimum values of particular functions (e.g. cost, strength, amount of material used in a building, profit, loss, etc.).  
Derivatives are met in many engineering and science problems, especially when modeling the behavior of moving objects.

INTEGRATION:

1. Applications of the Indefinite Integral shows how to find displacement (from velocity) and velocity (from acceleration) using the indefinite integral. There are also some electronics applications.

In primary school, we learnt how to find areas of shapes with straight sides (e.g. area of a triangle or rectangle). But how do you find areas when the sides are curved? e.g.  
2. Area under a Curve and  
3. Area in between the two curves. Answer is by Integration.  
4. Volume of Solid of Revolution explains how to use integration to find the volume of an object with curved sides, e.g. wine barrels.  
5. Centroid of an Area means the cenetr of mass. We see how to use integration to find the centroid of an area with curved sides.  
6. Moments of Inertia explain how to find the resistance of a rotating body. We use integration when the shape has curved sides.  
7. Work by a Variable Force shows how to find the work done on an object when the force is not constant.   
8. Electric Charges have a force between them that varies depending on the amount of charge and the distance between the charges. We use integration to calculate the work done when charges are separated.  
9. Average Value of a curve can be calculated using integration.

## Differentiation

In Isaac Newton's day, one of the biggest problems was poor **navigation at sea**.Shipwrecks occured because the ship was not where the captain thought it should be. There was not a good enough understanding of how the Earth, stars and planets moved with respect to each other.

**Calculus** (differentiation and integration) was developed to improve this understanding.

Differentiation and integration can help us solve many types of **real-world problems**.

We use the **derivative** to determine the **maximum and minimum values** of particular functions (e.g. cost, strength, amount of material used in a building, profit, loss, etc.).

Derivatives are met in many **engineering and science problems**, especially when modelling the behaviour of moving objects.

Our discussion begins with some general applications which we can then apply to specific problems.

### In this Chapter

1. Tangents and Normals which are important in physics (eg forces on a car turning a corner)

2. Newton's Method - for those tricky equations that you cannot solve using algebra

3. Curvilinear Motion, which shows how to find velocity and acceleration of a body moving in a curve

4. Related Rates - where 2 variables are changing over time, and there is a relationship between the variables

5. Curve Sketching Using Differentiation, where we begin to learn how to model the behaviour of variables

6. More Curve Sketching Using Differentiation

7. Applied Maximum and Minimum Problems, which is a vital application of differentiation

8. Radius of Curvature, which shows how a curve is almost part of a circle in a local region