Calculus in Economics

Important in business economics and theory of the firm.

**Differentiate**: find the rate of change between two variables.  
(multiply the coefficient by the power then minus one from the power).

**Integration**: area under the curve, can be used for variables where one is not held constant – reverse of differentiation.  
(add on to the power then divide coefficient by the new power).

Calculus = the language of economics – good for analysing key principles in economics.

x and y are symbolic for particular variables.  
The derivate will therefore consider the rate of change between one variable relative to another.

Functions: examine functional relationships.  
e.g.) relationship between dependent variable (income) and independent variable such as education.  
If average income rises as years of education increases then a positive relationship exists.   
Differential calculus, enables economists to measure average change in income relative to a single year’s increase in education.

Effects:   
Derivate are identical to economic **concepts of marginalism**.   
- marginalism examines the change in outcome that results from a single-unit increase in another variable.   
- calculus can be used at the margin.

Benefits:   
Calculus, by determining marginal revenue and costs, businesses can measure the rate of increase in profit that results from an increase in production.

**Profit = revenue – cost   
maximum profit** is **MC=MR**

Calculus in microeconomics

**Differentiation**

Used for problem solving, costs & benefits, framework for determining which variables/parameters are important.   
Makes the analysis more precise – language of modern economics.

The derivate typically present a **marginal concept**:   
- derivate of benefits with respect to x = marginal benefit  
- derivative of cost with respect to x = marginal cost   
- derivative of revenue with respect to quantity sold = marginal revenue  
- derivative of production with respect to labour input = marginal product of labour  
- derivative of resource cost with respect to labour input = marginal resource cost of labour

Marginal tax rate is written as T’(x) (or dy/dt) – it is a pure number, such as a percentage.

- If you can work out gradient of a curve – you could out the marginal cost / benefit / revenue.

Optimisation  
Maximise or minimise a function – by d2y/dx2 you can find the stationary points, maximise revenue or minimise marginal cost.

- a necessary condition to achieve maximal revenues at a given price is that the elasticity of demand at price must be 1.

**Integration**

Presents the area under the curve  
- *ʃb/a* gives the area below y(x) and above the horizontal axis from x=a to x=b.

We need to integrate marginal cost to get back to total cost.   
Total cost is an **antiderivative of marginal cost**.   
-Restricting attention to non-negative values of the two variables.