**Lecture 3. Comparative Statics and the concept of derivative**

The problem under consideration is one of finding a rate of change: the rate of change of the equilibrium value of an endogenous variable with respect to the change in a particular parameter of exogenous variable => the mathematical concept of derivative takes on preponderant significance in comparative statics.

Y=f(x) when x changes from initial value xo to a new value (x0­+Δx) the value of the function y=f(x) changes from f(x0) to f(x0+ Δx)

Difference quotient <=

Example:

=0+3∆x

 , then the average rate of change y is 6(3)+3(4)=30. This means that, on the average, as x changes from 3 to 7, the change in y is 30 units per unit change in x.

The derivative:



 – an infinitesimal change concept of the slope of a curve is merely the geometric counterpart of the concept of the derivative.

Or the slope of AB => this is a measure of average rate of change the average MC for – a difference quotient as 0 => AB => KG which is the tangent line. Slope of KG or slope of TC at A.

**Continuity and Differentiability of a Function**

When a function q=g() possesses a limit as tends to the point N in the domain and when this limit is also equal to g(N) => the function is said to be continuous. The term continuity involves 3 requirements. (1) the point N must be in the domain of the function. (2) The . (3) =g(N).

Differentiability of a Function

1. Continuity condition (necessary condition=>differentiability)
2. Differentiability condition

For example

Rules of a differentiation for a function of one variable

, the slope of the fixed cost curve is zero.

The power function rule:

**The derivative**

 -- Difference quotient

**The derivative and the slope of a curve**

The slope at point Q0 corresponds to the particular derivative value if exists, => the function is continuous.

TC

 α

Relationship between MC and AC functions

The rate of change of AC when output varies

TC=TC(Q) => AC = TC(Q)/Q Q>0,

The rate of change of AC is

=> if

$ MC AC

 Q

**Chain Rule:**

**Partial Derivative :**

 are all independently of one another.

 partial derivative with respect to x1

Geometric interpretation of Partial Derivative

Is a measure of the instantaneous rate of change of some variable – the slope of a particular curve.

Gradient vector all the partial derivatives of a function

 can be collected under a single mathematical entity called the gradient vector.

, where

 (Ex. 7.3 (1,4), 7.4)

**Jacobian Determinant**

We use Jacobian determinant to define (linear or nonlinear) dependence among set of n functions of n variables. For example:

J=

=>functions and are dependent.