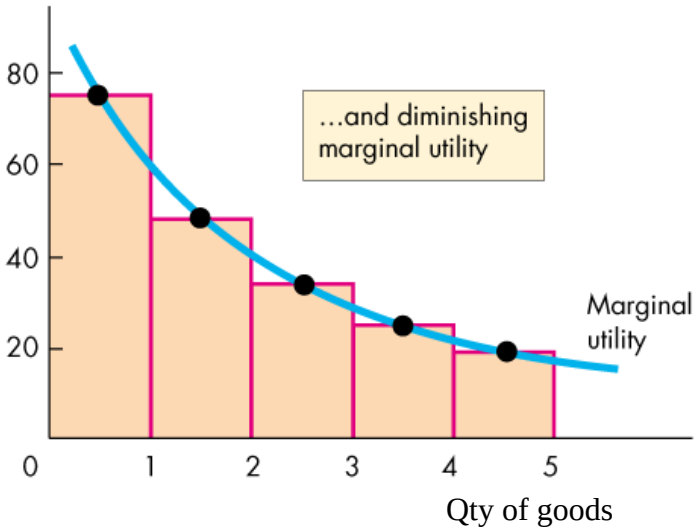


Production Function

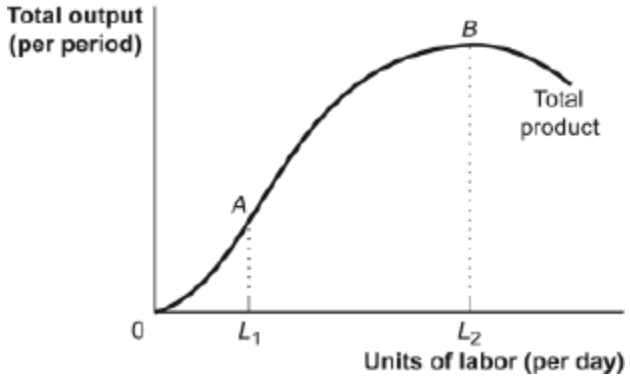
A production function illustrates the relationship between input and output. The technological relationship between output and inputs is called production function. The production function shows the maximum quantity of output that can be produced as a function of the quantities of inputs used in the production process. The production with n variable is defined as

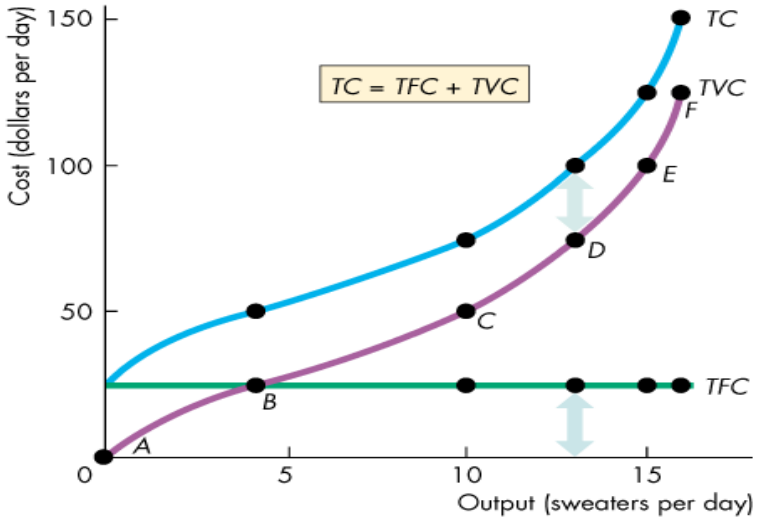
$Q = f(x_1, x_2, x_3, x_4 \ldots\ldots x_n)$ Where, $x_1 x_2 x_3 x_4 \ldots\ldots x_n$ are inputs
Or $Q = f(L,K)$ where L = Labour and K is capital

Short run versus long run production function: The **short run** is a time frame in which the quantity of one or more resources used in production is fixed. For most firms, the capital is fixed in the short run. Other resources used by the firm (such as labor, raw materials, and energy) can be changed in the short run. (law of variable proportion)
The Long Run The **long run** is a time frame in which the quantities of *all* resources can be varied. (Returns to Scale)

Total Product

Total Product is defined as the sum total volume of Production or total number of Units produced with the given fixed and variable inputs.





Total fixed cost is the same at each output level. Total variable cost increases as output increases. Total cost, which is the sum of *TFC* and *TVC* also increases as output increases.
The total variable cost curve gets its shape from the total product curve.

Average Costs: Average costs can be determined by dividing the firm's costs by the quantity of output it produces. The average cost is the cost of each typical unit of product. **Average total cost** *(ATC)* is total cost per unit of output. That is AC = [*f*(*q*) + *b*]/q

Average fixed cost *(AFC)* is total fixed cost per unit of output. AFC = b/q

Average variable cost *(AVC)* is total variable cost per unit of output. AVC = f(q)/q

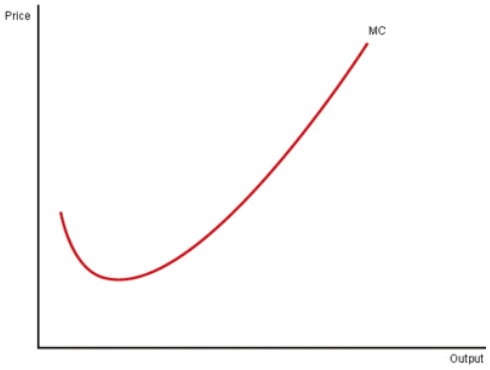
ATC = AFC + AVC or AC = [*f*(*q*) + *b*]/q
(AC and AVC are U shaped and AFC is rectangular hyperbola – separate graph may be given)

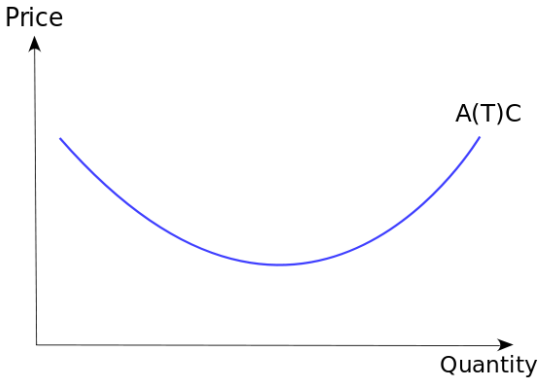
Marginal Cost: MC is the addition to the total cost generated by increasing production by one unit. It is the slope of the TC curve. *Marginal cost* (MC) measures the increase in total cost that arises from an extra unit of production.

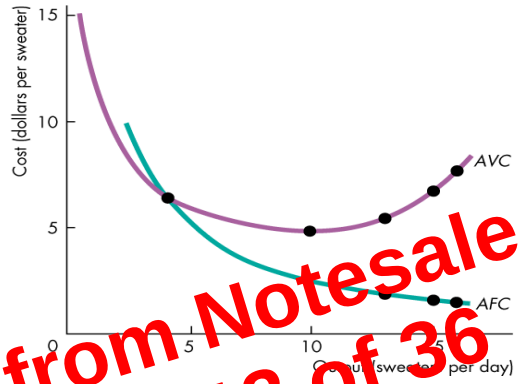
$$MC = \frac{\text{(change in total cost)}}{\text{(change in quantity)}} = \frac{\Delta TC}{\Delta Q}$$

$$\text{MC} = \mathbf{dc/dq = f'(q)}$$

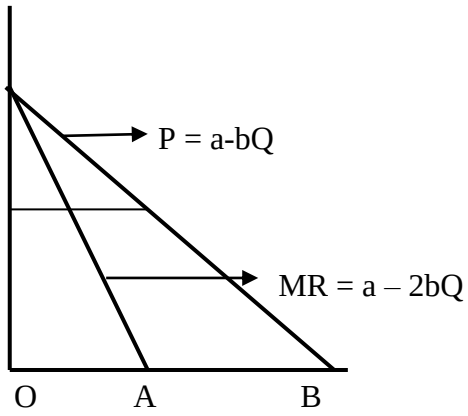
The shape of the MC curve is U shaped (draw)







AR and MR curves have well defined graphical and mathematical relationship. Given a linear AR curve, its MR curve has the same price axis intercepot and is twice as steep as the AR curve. See graph below.



A general expression for a linear AR curve is given by

AR = a – bq
TR = pq = (a-bq)q = aq –bq^2
Differentiating with respect to q we obtain MR function
MR = d(pq)/dq = a – 2bq

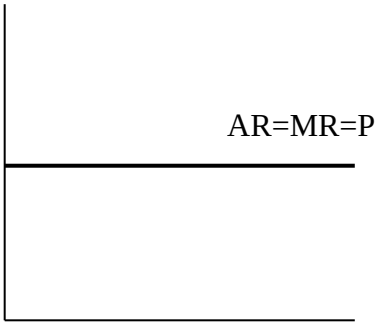
Comparing the equations for AR and MR we note that the MR cure has the same price axis intercept as the AR curve, but its absolute is twice as steep as that of the AR curve

Another Method: for a demand function p = a-bq, setting p=0 we can obtain output at zero price level. Similarly setting MR function equal to zero we can get output at zero MR.

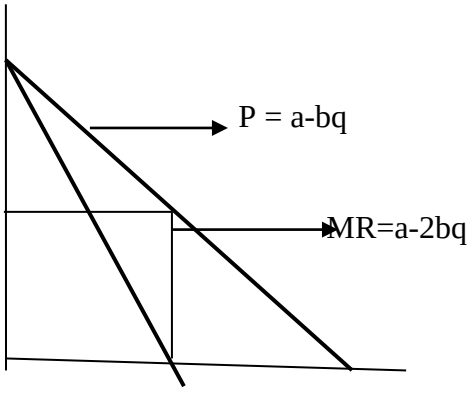
Therefore, a-bq = 0, q = a/b
Similary MR = a – 2bq = 0, q = a/2b(that is half of a/b).
In the graph, it is seen that OA is half of OB

Revenue curves under Perfect Competition: Since the price is same for all the sellers, in a perfectly competitive market, AR=MR=P is a horizontal line parallel to output axis. (see gaph)

Revenues curves under Monopoly: For a monopolist the slope of MR Function is twice the slope of AR function. Therefore, MR curve passes through the mid of AR and Y axis. (see graph) – the above proof can be given here also.



AR and MR under PC



AR and MR under Monopoly

KEY WORDS

Simplex Method: An algorithm for solving LP problems investigates feasible corner points, only always maintaining or improving the objective function, until an optimal solution is obtained.
Slack variable: A variable used to convert a less than or equal to a constraint into an equality constraint by subtracting it from the left hand side of the constraint
A Feasible solution: It is a solution which satisfies all the constraints including the non negativity constraints
Feasible region : It is the collection of all feasible solutions.
The **Optimum solution** of a LPP is a the solution where the objective function is maximised or minimised
The **Dual problem** corresponding to a LPP is another linear programming problem formulated from the parameters of the original problem. The dual variables are the variables of the dual LPP

1. In the I-O model, we find an appropriate relationship between the final goods sector and the outputs of various industries in an economy. Similarly, we may use the method in planning, company transactions, social accounting, military mobilisation, transport, location, trade, regional economics, etc.
2. It is useful in the study of effects generated in the economy as a result of changes made in one or more sectors of the economy
3. A comparison of I-O tables for two or more countries or regions can help in determining the types of investment needed to stimulated growth and can be useful as a development tool
4. In a situation of less than full employment resulting from the deficiency of aggregate demand, suitable changes in final demand in the I-O table can suggest the level of economic activity necessary to achieve full employment. This policy makers can project full employment levels of demand with the help of I-O table.
5. It helps in solving structural disequilibrium in UDC's. Structural disequilibrium arises when there is inefficient, improper use of available resources, shortage of entrepreneurs, unemployment, scarcity of capital and foreign exchange, etc. I-O analysis may be used for the projection of growth of various sectors, balancing of resources, allocation of investment funds, projection of
6. production, consumption and balance of payments, etc.

Limitations of I-O Analysis

1. It does not allow for substitution among inputs. In reality, there is the possibility of substitutions even in the short period.
2. It assumes fixed coefficients which amount to proportionality or constant returns to scale for all sectors. In practice, these assumptions hold only in a stationary economy. Even the dynamic
3. Model does not tell us anything as to how technical coefficients would change with changed conditions.
4. The assumption of linear equations which relates output of one industry to inputs of others appears to be unrealistic since factors are mostly indivisible, increase in outputs do not always
5. Require proportionate increases in inputs.
6. The rigidity of the model cannot reflect such phenomena as bottlenecks, rising costs, et.
7. It gives exclusive emphasis on production side of the economy.