

Linear Homogeneous Production Function

- **Definition:** The Linear Homogeneous Production Function implies that with the proportionate change in all the factors of production, the output also increases in the same proportion. Such as, if the input factors are doubled the output also gets doubled. This is also known as constant returns to a scale.
- The production function is said to be homogeneous when the elasticity of substitution is equal to one.
- The linear homogeneous production function can be used in the pragmatic studies because it can be handled wisely.

- That is why it is widely used in linear programming and input-output analysis.
- This production function can be shown symbolically:

$$nQ = f(nK, nL)$$

Where, n = number of times

nQ = number of times the output is increased

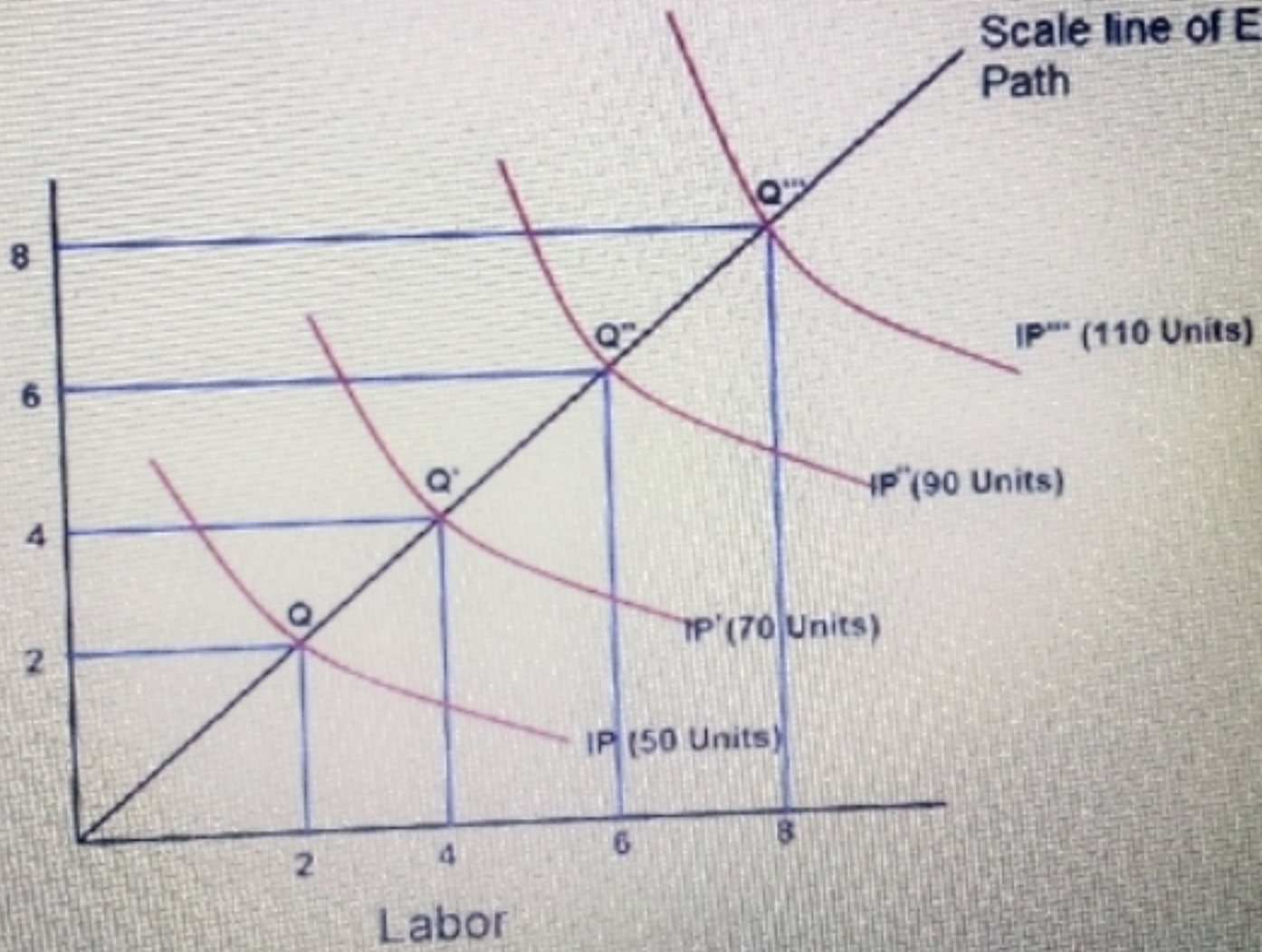
nK = number of times the capital is increased

nL = number of times the labor is increased

- Thus, with the increase in labor and capital by “ n ” times the output also increases in the same proportion. The concept of linear homogeneous production function can be further comprehended through the illustration given below:

Scale line of Expansion Path

Capital



Labor

- In the case of a linear homogeneous production function, the expansion is always a straight line through the origin, as shown in the figure. This means that the proportions between the factors used will always be the same irrespective of the output levels, provided the factor prices remain constant

- A function which is homogeneous of degree 1 is said to be linearly homogeneous, or to display linear homogeneity.
- A production function which is homogeneous of degree 1 displays constant returns to scale since a doubling all inputs will lead to an exact doubling of output. So, this type of production function exhibits constant returns to scale over the entire range of output. In general, if the production function $Q = f(K, L)$ is linearly homogeneous,

$$\text{Then } F(\lambda K, \lambda L) = \lambda f(K, L) = \lambda Q$$

- For any combination of labor and capital and for all values of λ . If λ equals 3, then a tripling of the inputs will lead to a tripling of output.