

## **PRODUCTION FUNCTION:**

**Production is an activity that transforms inputs into output. so in economics production is creation of activity.**

**Example: a sugar mill uses such inputs as labour,raw material like sugarcane, and capital invested in machinery ,factory building to produce sugar.**

# Factors affecting production:

- Inputs
- Technology
- Time period of production

## Theory of production:

Theory of production provides a formal

Frame work to help the managers of firms in deciding how to combine various factors or inputs most efficiently to produce the desired output of product or service.

# Production function:

the production function is purely a technological relationship which expresses the relation between output of a good and the different combination of inputs used in its production

.algebraically production function can be written as

$$Q=f(a, b, c, d, e, \dots)$$

- If it is two variable then it is  $Q=f(l, k)$

# TYPES OF PRODUCTION FUNCTION:

1. short run production function

2. long run production function

- TOTAL AVERAGE AND MARGINAL PRODUCT:

**Total product:** total product of a variable factor is the amount of total output produced by a given quantity of the variable factors keeping the quantity of other factors such as capital fixed

### Average product:

average product of a variable factor is the total output divided by the amount of labour employed with a given quantity of capital used to produce a commodity .thus  $AP_L = Q/L$

**Marginal product:** marginal product of a variable factor is the addition made to the total production by the employment of an extra unit of a factor.

$$MP_L = \Delta Q / \Delta L$$

$\Delta Q$ =change in output

$\Delta L$ = change in labour

# TP,AP,AND MP

Labour	TP	MP( $\Delta Q/\Delta L$ )	AP(Q/L)
1	80	80	80
2	170	90	85
3	270	100	90
4	368	98	92
5	430	62	86
6	480	50	80
7	504	24	72
8	504	0	63
9	495	-9	55
10	480	-15	48

# Theory of production function:

- 1.Law of variable proportion
- 2.Law of return to scale

- LAW OF VARIABLE PROPORTION:

This law states that as more and more of one factor inputs is employed, all other input quantities held constant, a point will eventually be reached where additional quantities of the varying input will yield diminishing marginal contributions to total product.

Prof Benham states that: "As the proportion of one factor in a combination of factors is increased, after a point, the average and marginal product of that factor will diminish.

- **Assumption:**

1. The state of technology is assumed to be given and unchanged
2. There must be some other inputs such as capital must be kept fixed.
3. Labour is the only variable
4. labour is homogeneous

To illustrate the working of this law, let us assume a production schedule of a firm as given in:



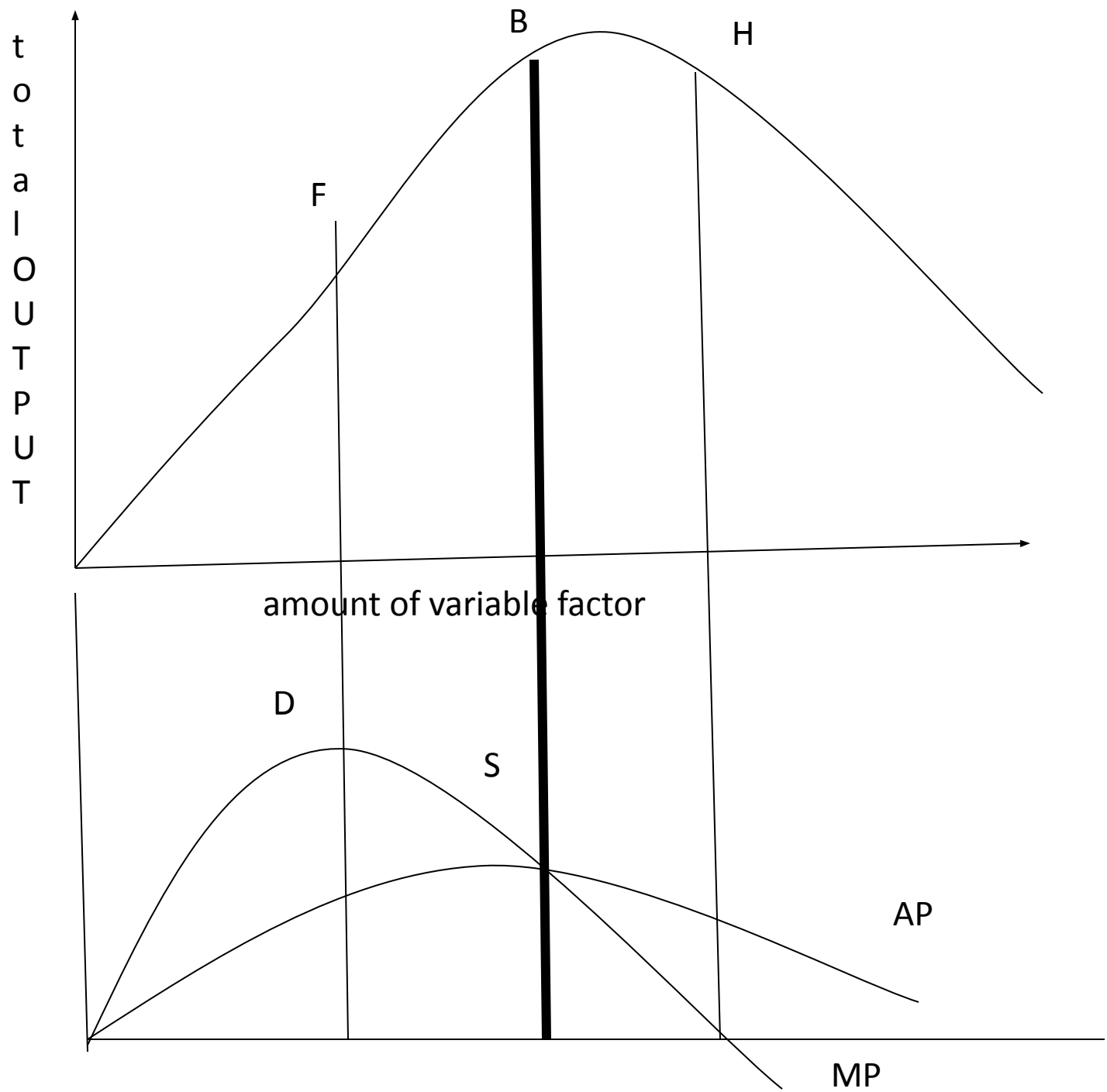
# Table: production schedule:

Units of variable input (labour)	TP	AP	MP
1	20	20	20
2	50	25	30
3	90	30	40
4	120	30	30
5	135	27	15
6	144	24	9
7	147	21	3
8	148	18.5	1
9	148	16.4	0
10	145	14.5	-3

# Three stages of production:

the behaviour of output when the varying quantity of one factor is combined with a fixed quantity of the other can be divided into three distinct stages:

- Increasing return
- Diminishing return
- Negative return



## Increasing return:

In this stage TP increases at an increasing rate to a point from the origin to the point F. that means upto point f total product increases at an increasing rate. from point F onwards during the stage-1 ,the total product goes on rising but at a diminishing rate, i. e from point F to H.

note: the point f is called the point of inflection when the total product stop increasing at an increasing rate and starts increasing at a diminishing rate

## DIMINISHING RETURN:

In this stage the TP continue to increase at a diminishing rate until it reaches its maximum point H, where the second stage ends. in this stage both the mp and AP of the variable factor are diminishing but are positive .at the end of 2<sup>nd</sup> stage ,that is at point M,MP of the variable factor is zero

## NAGATIVE RETURN:

- in stage -3 ,total product declines and therefore the total product curve TP slopes downward .as a result, mp of the variable factor is negative and the mp curve goes below the x-axis. this stage is called the stage of negative returns.

# Summary

- The Law of Variable Proportions states that while varying only one input, output will go through three stages:
  - Increasing returns
  - Diminishing returns (ideal)
  - Negative returns

# Conclusions

- While adding units of an input (labor), the marginal product goes through three stages:
- **Stage I (Increasing returns):** Marginal product increases throughout
  - This means that every additional unit increases productivity as well as total output
  - This is shown on the graph by an increasing slope of total Product curve



# Conclusions

□ **Stage II (diminishing returns):** Marginal product decreases throughout.

- This means that every additional unit decreases productivity, though total output still increases.
- This is shown on the graph by a decreasing positive slope of total product curve

□ **Stage III (negative returns):** Marginal product is negative throughout.

- This means that each additional unit actually decreases total output.
- A waste of money and resources.

*This is shown on the graph by a negative slope*

# Conclusions

- The greatest productivity is at the end of Stage I
- The greatest output is at the end of Stage II
- Therefore, **Stage II is ideal**, because there is a balance between productivity and total output

# LAW OF RETURN TO SCALE:

The law of return to scale explain the behaviour of output in response to a proportional and simultaneous change in inputs.

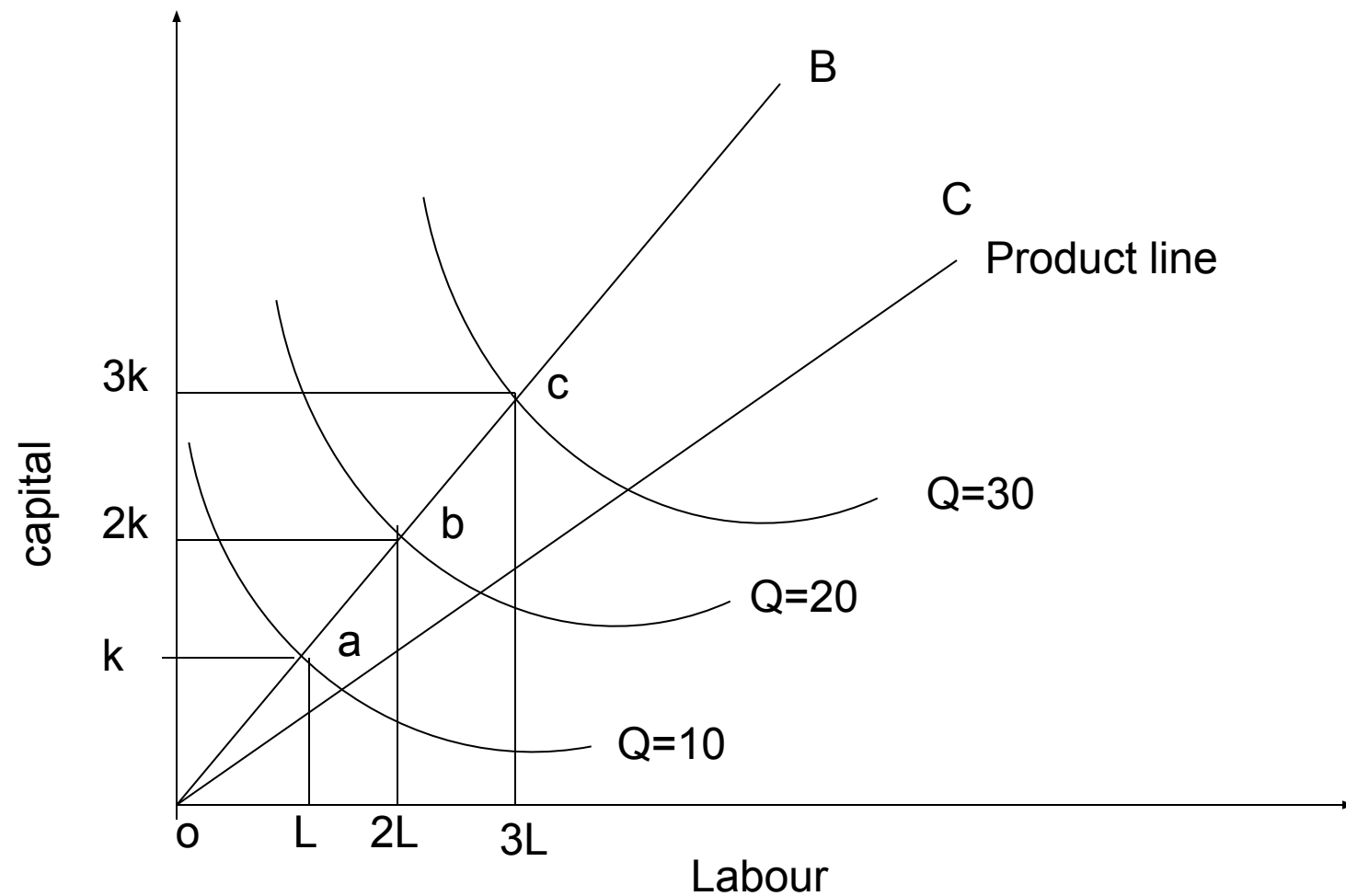
When a firm expands its scale ,i.e. it increases both the inputs proportionately .then there are three technical possibilities.

# Stages of Long run return

- Total output may increase more than proportionately.
  - 2.Total output may increase proportionately.
  - 3.Total output may increase less than proportionately.
- Accordingly there are three kinds of returns to scale:
- 1.increasing return to scale.
  - 2.Constant return to scale.
  - 3.decreasing return to scale

# 1.CONSTANT RETURN TO SCALE:

- If we increase all factors in a given proportion and the output increases in a same proportion ,return scale are said to be the constant.
- so constant return to scale means that with the increase in the scale or the amount of all factors leads to a proportionate increase in output ,i.e. doubling of all inputs doubles the output.



constant return to scale:  
 $oa = ab = bc$

If quantities of both the inputs ,K and L are doubled and output is also doubled .if quantities of both the inputs K and L are doubled output is also doubled. the line oa and ob are product line indicating two hypothetical technique of production with optimum capital,labour ratio. here when input L and C increases from 1 To 2L and K to 2K.output also increases from X to 2X or 10to 20

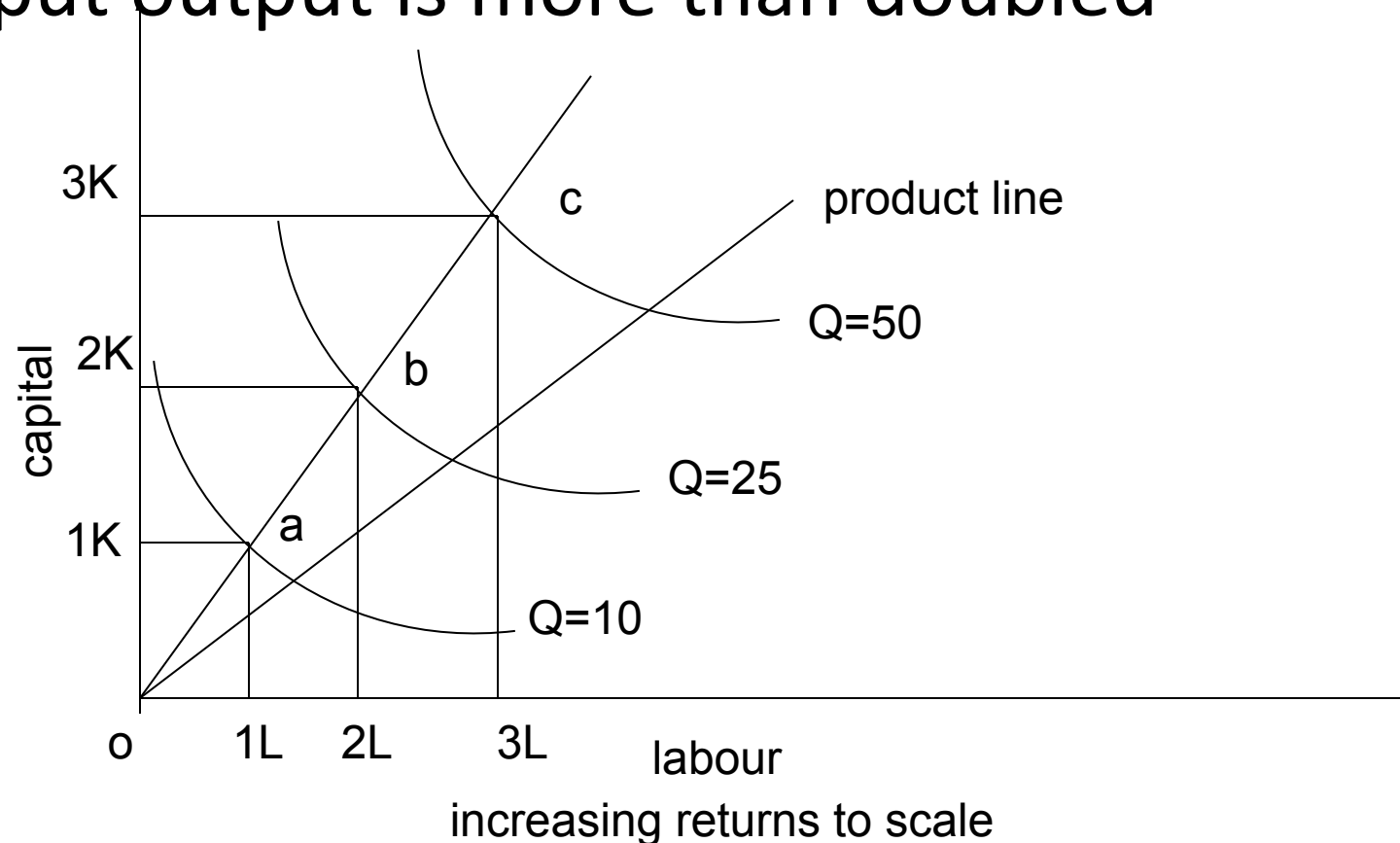
$$1k+1l=10$$

$$2k+2l=20$$

$$3k+3l=30$$

# INCREASING RETURN TO SCALE:

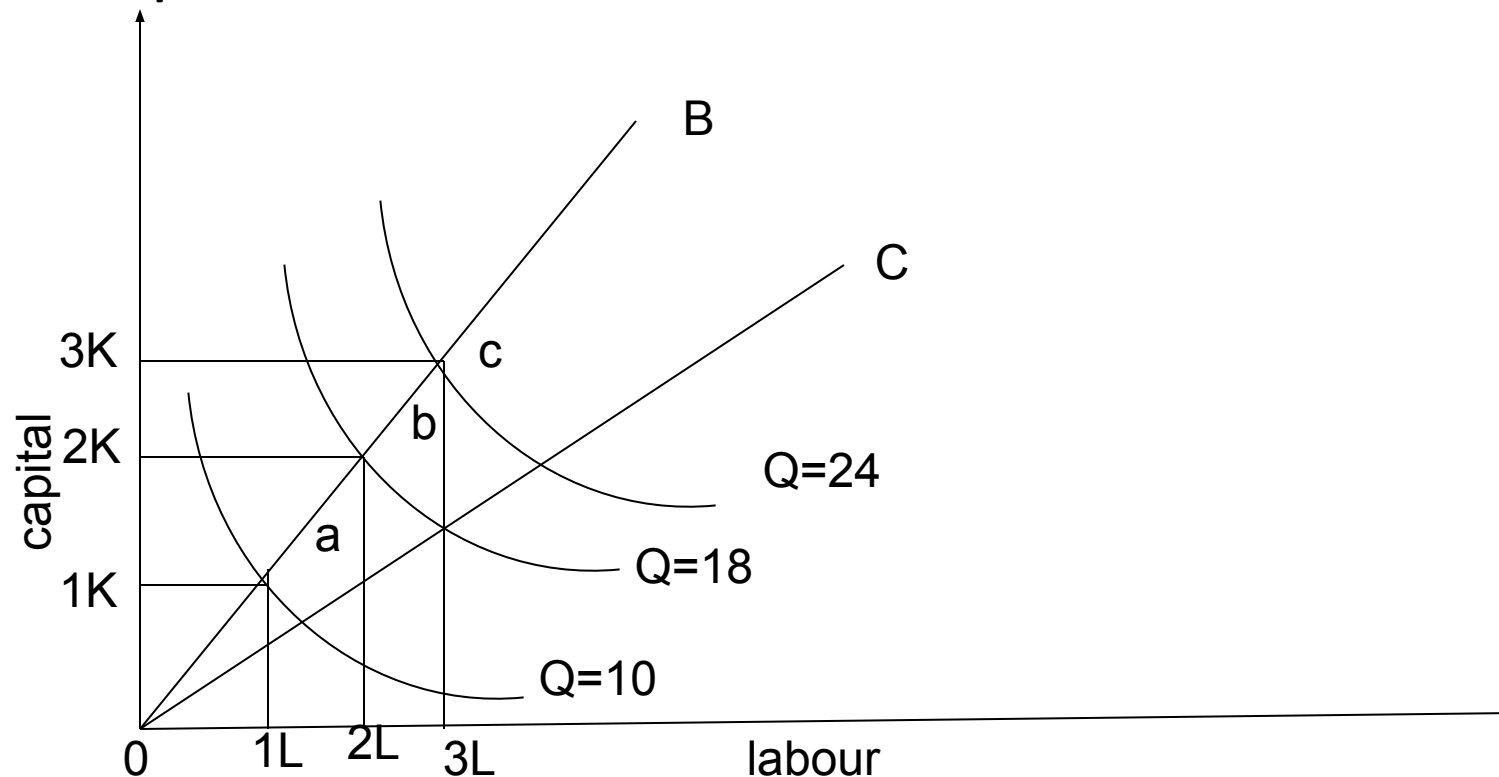
increasing return to scale means that output increases in a greater proportion than the increase in input. by doubling the input output is more than doubled





## DECREASING RETURN TO SCALE:

when output increases in a smaller proportion than the increase in all inputs i.e. called decreasing return to scale, when inputs are doubled and output is less than doubled then decreasing return to scale is in operation



# Implication

- They guide companies in optimizing production efficiency and making informed decisions about resource allocation and expansion strategies.