Theory of Production

- Production is a process that create/adds value or utility
- It is the process in which the inputs are converted in to outputs.

Inputs	• The factors of production such as Land, Labour, Capital, Technology ,etc
Outputs	• The goods and service produced such as Soap, Omni Car ,etc

Production Function

- Production function means the functional relationship between inputs and outputs in the process of production.

- It is a technical relation which connects factors inputs used in the production function and the level of outputs

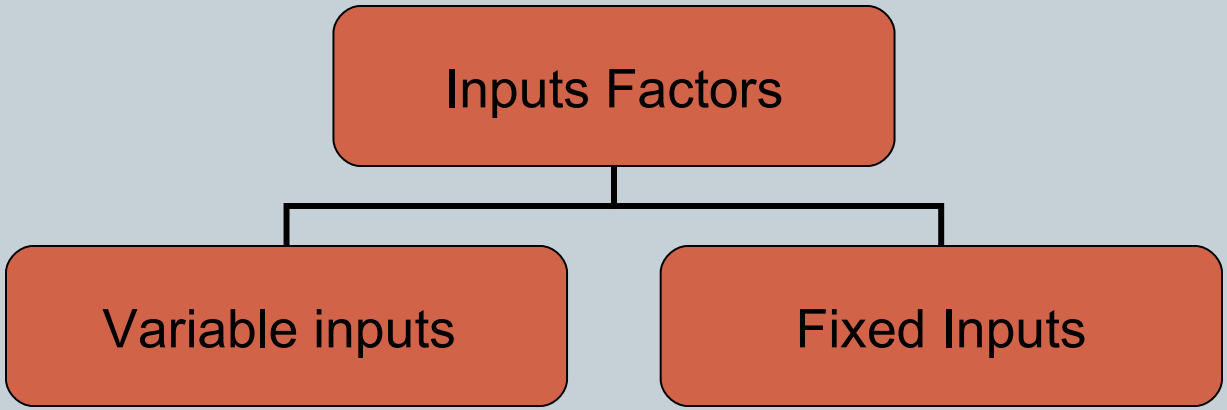
Q = f (Land, Labour, Capital, Organization, Technology, etc)

Factors of Production

Land	• Natural resources such as surface, mineral , air, rivers, sea, etc • Free gift of nature, fixed
Labour	• Mental or physical effort done by a man with the view of
Capital	• Man made goods used in the production process • Most mobile factor
Organization	• Entrepreneur or coordinator of all other factors of production

Inputs : Fixed inputs and Variable inputs

- The factors of production that is carry out the production is called inputs.
- Land, Labour, Capital, Organizer, Technology, are the example of inputs



Inputs : Fixed inputs and Variable inputs

Fixed inputs

- Remain the same in the short period .
- At any level of out put, the amount is remain the same.
- The cost of these inputs are called Fixed Cost
- Examples:- Building, Land etc
- (In the long run fixed inputs are become varies)

Variable inputs

- In the long run all factors of production are varies according to the volume of outputs.
- The cost of variable inputs is called Variable Cost
- Example:- Raw materials, labour, etc

Various concept of production

Total Product

Average Product- **Ratio of Total Product and one variable inputs**

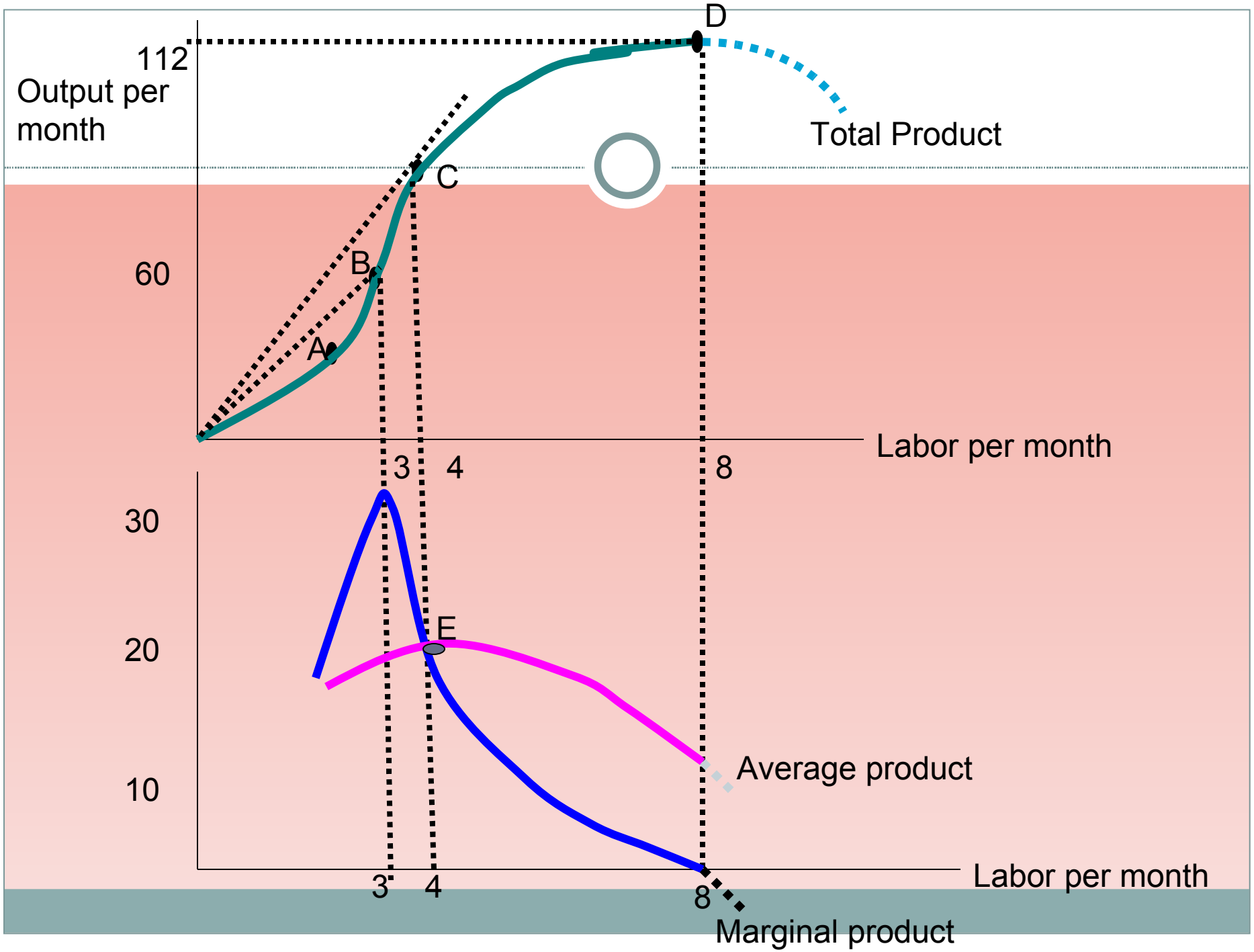
Marginal Product – **The rate of change of out put as a result changes in one variable input**

Short run Production Function with Labour as Variable factor

Labour (L)	Capital (K)	Total Output (TP)	Average Product (AP)	Marginal Product (MP)
0	10	0		
1	10	10		
2	10	30		
3	10	60		
4	10	80		
5	10	95		
6	10	108		
7	10	112		
8	10	112		
9	10	108		
10	10	100		

Short run Production Function with Labour as Variable factor

Labour (L)	Capital (K)	Total Output (TP)	Average Product (AP)	Marginal Product (MP)
0	10	0	-	
1	10	10	10	10
2	10	30	15	20
3	10	60	20	30
4	10	80	20	20
5	10	95	19	15
6	10	108	18	13
7	10	112	16	4
8	10	112	14	0
9	10	108	12	-4
10	10	100	10	-8


D
112
Output per month
Total Product
C
B
60
A
Labor per month
3
4
8
30
20
E
Average product
10
Labor per month
3
4
8
Marginal product

Law of Production Function

- **Laws of Variable proportion**- Law of Diminishing Return (Short run production function with at least one input is variable)

- **Laws of Return scales** – Long run production function with all inputs factors are variable.

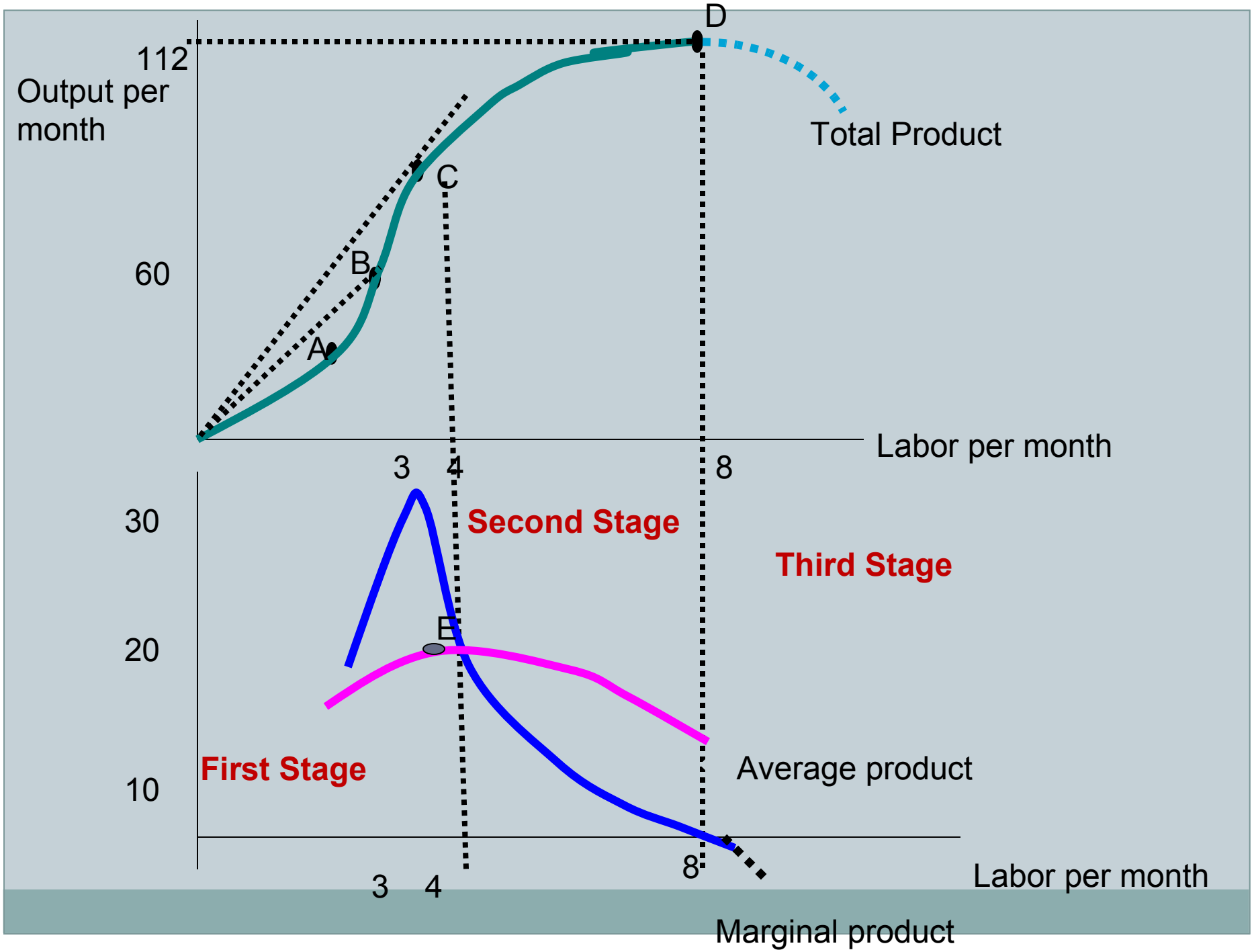
• Law of variable proportion: Short run Production Function

- Explain short run production function
- Production function with at least one variable factor keeping the quantities of others inputs as a Fixed.
- Show the input-out put relation when one inputs is variable

"If one of the variable factor of production used more and more unit,keeping other inputs fixed, the total product(TP) will increase at an increase rate in the first stage, and in the second stage TP continuously increase but at diminishing rate and eventually TP decrease."

Short run Production Function with Labour as Variable factor

Labour (L)	Land	Capital (K)	Total Output (TP)	Average Product (AP)	Marginal Product (MP)	
0	10	10	0	-		
1	10	10	10	10	10	First Stage
2	10	10	30	15	20	
3	10	10	60	20	30	
4	10	10	80	20	20	
5	10	10	95	19	15	Second Stage
6	10	10	108	18	13	
7	10	10	112	16	4	
8	10	10	112	14	0	
9	10	10	108	12	-4	Third Stage
10	10	10	100	10	-8	


D
112
Output per month
Total Product
C
B
60
A
Labor per month
3
4
8
30
Second Stage
Third Stage
E
20
First Stage
Average product
10
8
3
4
Labor per month
Marginal product

Stages in Law of variable proportion

First Stage: Increasing return

- TP increase at increasing rate till the end of the stage.
- AP also increase and reaches at highest point at the end of the stage.
- MP also increase at it become equal to AP at the end of the stage.
- MP>AP

Second Stage: Diminishing return

- TP increase but at diminishing rate and it reach at highest at the end of the stage.
- AP and MP are decreasing but both are positive.
- MP become zero when TP is at Maximum, at the end of the stage
- MP<AP.

Third Stage: Negative return

- TP decrease and TP Curve slopes downward
- As TP is decrease MP is negative. AP is decreasing but positive.

Where should rational firm produce?

Where should rational firm produce?

- **Stage I:** MP is above AP implies an increase in input increases output in greater proportion.
- The firm is not making the best possible use of the fixed factor.
- So, the firm has an incentive to increase input until it crosses over to stage II.
- **Stage III:** MP is negative implies contribution of additional labor is negative so the total output decreases .
- In this case it will be unwise to employ an additional labor.

- **Stage II:** MP is below AP implies increase in input increases output in lesser proportion.

- ***A rational producer/firm should produce in stage II.***

- But where exactly the firm will operate within stage II cannot be determined only on the basis of the product curves.

- We need information about input costs and price of output.

2. Law of return to scales: Long run Production Function

- Explain long run production function when the inputs are changed in the same proportion.
- Production function with all factors of productions are variable..
- Show the input-out put relation in the long run with all inputs are variable.

“Return to scale refers to the relationship between changes of outputs and proportionate changes in the in all factors of production ”

Law of return to scales: Long run Production Function

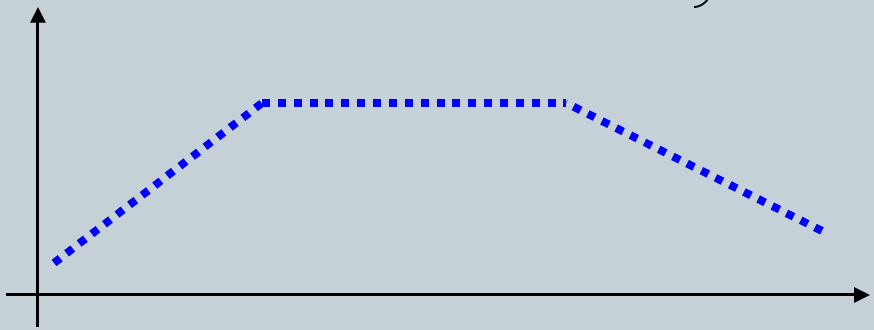
Labour	Capital	TP	MP	
2	1	8	8	Increasing returns to scale
4	2	18	10	
6	3	30	12	
8	4	40	10	Constant returns to scale
10	5	50	10	
12	6	60	10	
14	7	68	8	Decreasing returns to scale
16	8	74	6	
18	9	78	4	

• Law of return to scales: Long run Production Function

Inputs 10% increase – Outputs 15% increase } Increasing returns to scale

Inputs 10% increase – Outputs 10% increase } Constant returns to scale

Inputs 10% increase – Outputs 5% increase } Decreasing returns to scale



Homogeneous production function

In the long run all inputs are variable. The production function is homogeneous if all inputs factors are increased in the same proportions in order to change the outputs.

A Production function Q = f (L, K)
An increase in Q> Q^ = f (L+L.10%, K+K.10%)-
Inputs increased same proportion

Increasing returns to scale	**Inputs increased 10% => output increased 15%**
Constant returns to scale	**Inputs increased 10% => output increased 10%**
Decreasing returns to scale	**Inputs increased 10% => output increased 8%**

Homogeneous production function

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Inputs increased same proportion

Increasing returns to scale	**Inputs increased 10% => output increased 15%**
Constant returns to scale	**Inputs increased 10% => output increased 10%**
Decreasing returns to scale	**Inputs increased 10% => output increased 8%**

Linearly Homogeneous production function

In the long run all inputs are variable. The production function is Linearly homogeneous if all inputs factors are increased in the same proportions and the output is increased in the same proportion.

Constant returns to scale Homogeneous production function

Inputs increased 10% => output increased 10%

A Linearly homogeneous Production function Q = f (L, K)
if labour and capital increased 10% then output increased the same 10%

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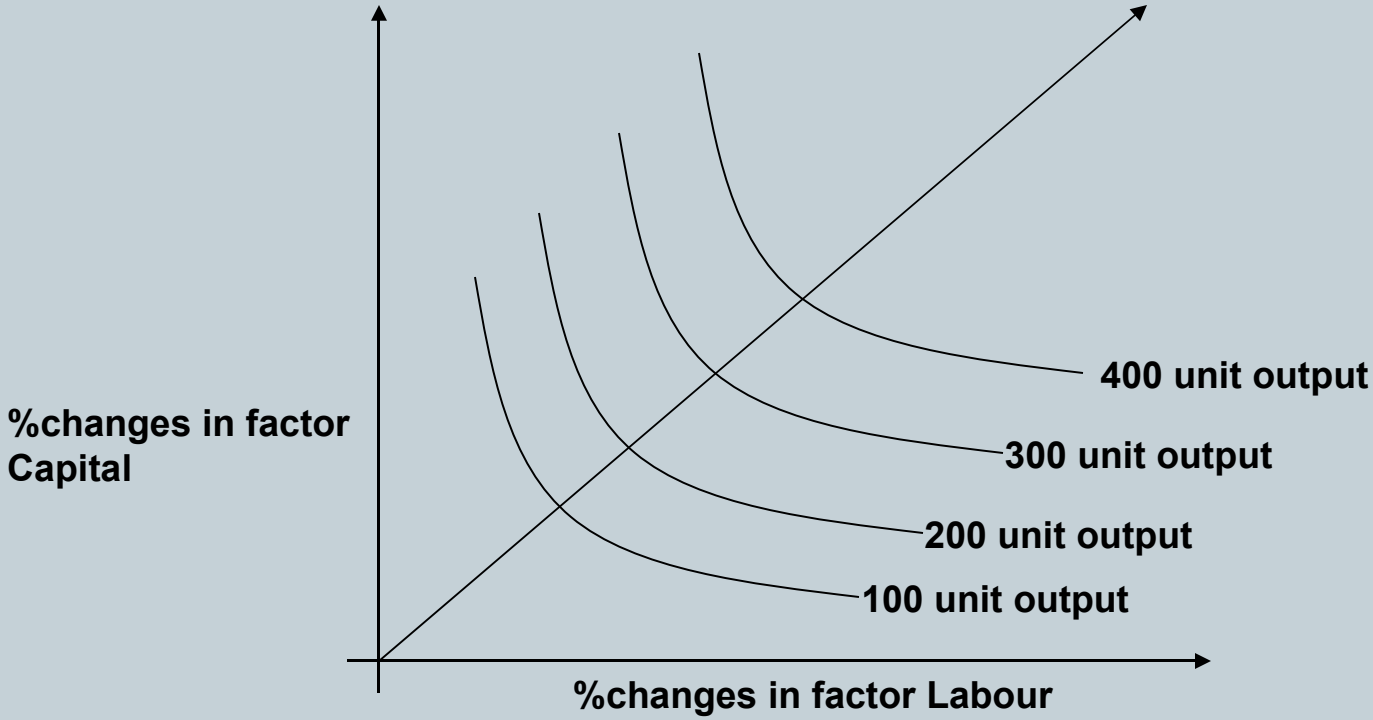
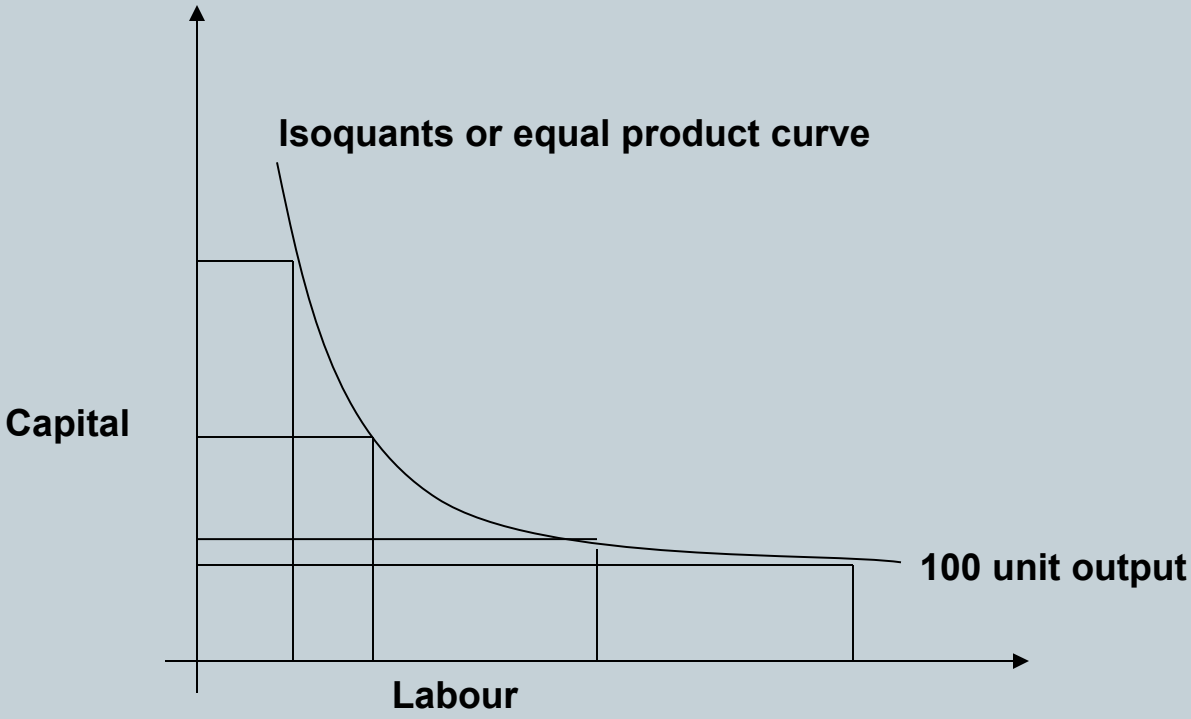


Iosquants

Combination	Labour	Capital	Output level
A	20	1	100 unit
B	18	2	100 unit
C	12	3	100 unit
D	9	4	100 unit
E	6	5	100 unit
F	4	6	100 unit

An isoquants represent all those possible combination of two inputs (labour and capital), which is capable to produce an equal level of output .

Iosquants



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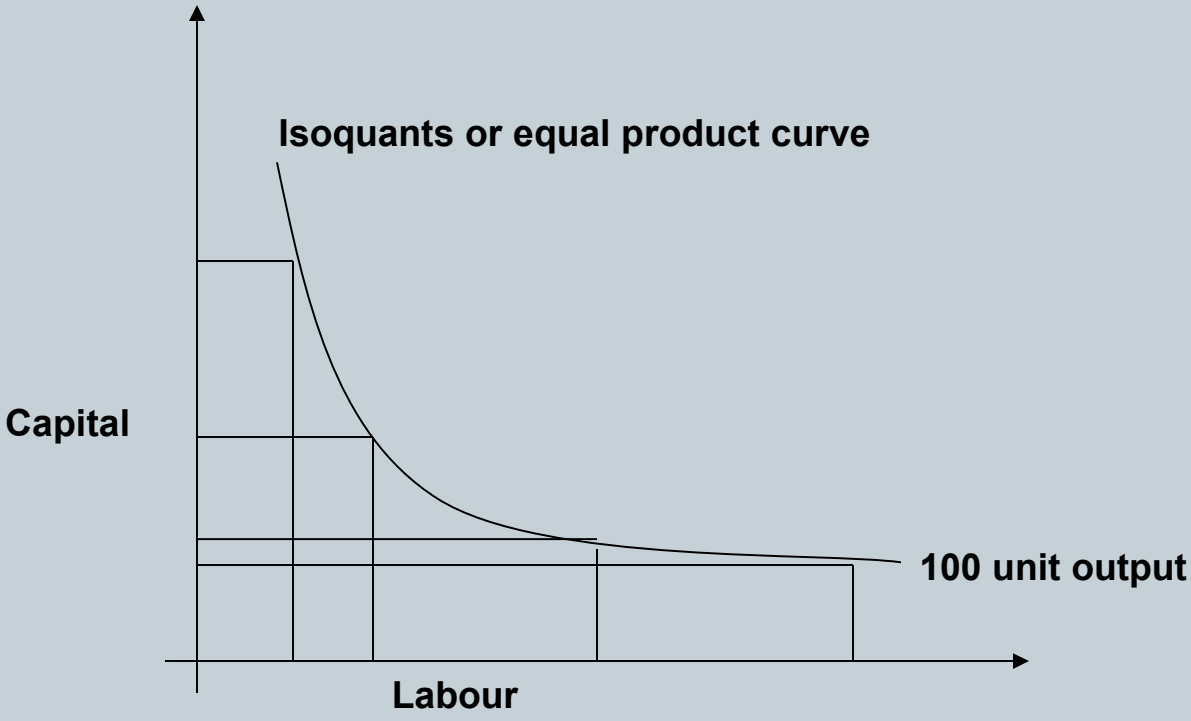
Marginal Rate Technical Substitute(MRTS)



The slop of isoquant is known as Marginal Rate of Technical Substitution (MRTS). It is the rate at which one factors of production is substitute with other factor so that the level of the out put remain the same.

MRTS = Changes in Labour / changes in capital