

Concept of Production Function

1 Mark Questions

1. Give the meaning of returns to a factor. (Delhi 2014; All India 2009)

Ans. Returns to a factor refers to the behavior of output when only variable factor of production is increased in the short-run and fixed factors remaining constant.

2. Define Marginal Product. (All India 2014)

Ans. Marginal Product is the change in Total Product as a result of unit change in the input of a variable

$$MP_{nth} = TP_n - TP_{n-1}$$

Here, MP = Marginal Product
TP = Total Product

3. Define production function. (All India 2011, 2008, 2006; Delhi 2009,2007)

Ans. Production function studies the functional relationship between physical inputs and physical output.

It is expressed as $Q_x = F(t, K)$

Where, Q_x = Quantity of output

L = Labour

K = Capital

4. Give meaning of Marginal Physical Product. (All India 2007; Delhi 2006,2006C)

Ans. Marginal Physical Product refers to an additional output caused by use of an additional unit of the variable factor, fixed factor remaining constant, it is calculated as,

$$MP_{nth} = TP_n - TP_{n-1} \quad \text{or} \quad MP = \frac{\Delta TP}{\Delta L}$$

3 Mark Questions

5. State the relation between Marginal Revenue and Average Revenue. (Delhi 20014)

Ans. Relationship between MR and AR are:

- (i) When AR is constant, $MR = AR$.
(ii) When AR is diminishing, $AR > MR$.

Land (Acre)	Number of laborers	TPP (Quintal)	APP (Quintal)	MPP (Quintal)
1	0	0	0	–
				Stage I
1	1	2	2	2
1	2	6	3	4
1	3	12	4	6
V	4	16	4	4
1	5	18	3.6	2
				Stage II
1	6	18	3	0
1	7	14	2	(-) 4
				Stage III
1	8	8	1	H 6

- (iii) MR can be negative, but not AR.

6. Why is Average Revenue always equal to price? (All India 2014)

Ans. Average Revenue is the per unit revenue (price) received from the sale of one unit of a commodity.

With the help of following equation we can prove $AR = P$.

As we know,
$$AR = \frac{TR}{Q}$$

$$TR = P \times Q$$

(Here, $P =$ Price, $Q =$ Quantity or Output sold)

Thus,
$$AR = \frac{P \times Q}{Q}$$

Hence, it is proved $AR =$ Price.

7. Giving reasons, explain the Law of Variable Proportion. (All India 2014)

Ans. The Law of Variable Proportion shows the impact on output when units of variable factor are increased, keeping fixed factors constant in the short-run.

The law states that if more and more units of a variable factor are employed with fixed factors, Total Physical Product (TPP) increases at an increasing rate in the beginning, then increases at a diminishing rate and finally starts falling.

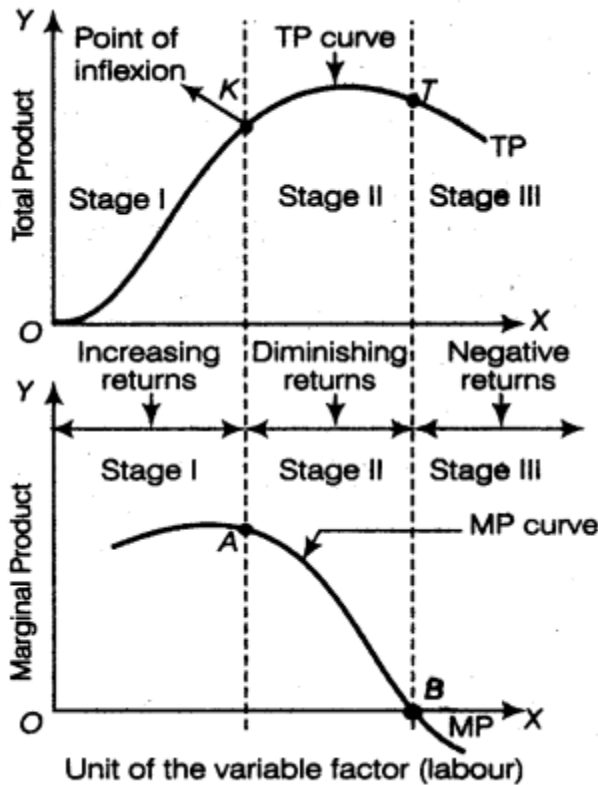


As per the above schedule,

In stage I, TPP tends to rise at an increasing rate. This corresponds to the situation of increasing return to a factor.

In stage II, TPP tends to rise at a diminishing rate. This corresponds to a situation of diminishing returns to a factor.

In stage III, TPP starts declining. This is a situations of negative returns to a factor.



8. Complete the following data (Delhi 2013)

Units of labour	Average Product (AP) (units)	Marginal Product (MP) (units)
1	8	–
2	10	–
3	–	10
4	9	–
5	–	4
6	7	–

Ans.

Labour t(Q) (Units)	Total Product (TP) (units)	Average Product (AP) (units)	Marginal Product (MP) (units)
1	8	8	8
2	20	10	12

3	30	10	10
4	36	9	6
5	40	8	4
6	42	7	2

$$AP = TP/Q, MP_{nth} = TP_n - TP_{n-1}, TP = AP \times Q$$

9. Complete the following table (Delhi 2013)

Units of labour	Average Product (AP) (units)	Marginal Product (MP) (units)
1	16	–
2	20	–
3	–	20
4	18	–
5	–	8
6	14	–

Ans.

Labour (Q) (Units)	Total Product (TP) (units)	Average Product (AP) (units)	Marginal Product (MP) (units)
1	16	16	16
7	40	20	24
7	60	20	20
4	72	18	12
5	80	16	8
6	84	14	4

10. What is meant by returns to a factor? State the law of diminishing returns to a factor. (Delhi 2006)

Ans. Returns to a factor refers to the behavior of output when only variable factor of production is increased in the short-run and fixed factors remaining constant.

Law of diminishing returns to a factor This law states that with the increase in a variable factor, keeping all other factors constant, the Marginal Product of the variable factor first increases then falls and eventually becomes negative.

4 Marks Questions

11. What does the Law of Variable Proportion show? State the behavior of Marginal Product according to this law.(All India 2012)

Ans. The Law of Variable Proportion shows the impact on output when units of variable factor are increased, keeping fixed factors constant in the short-run.

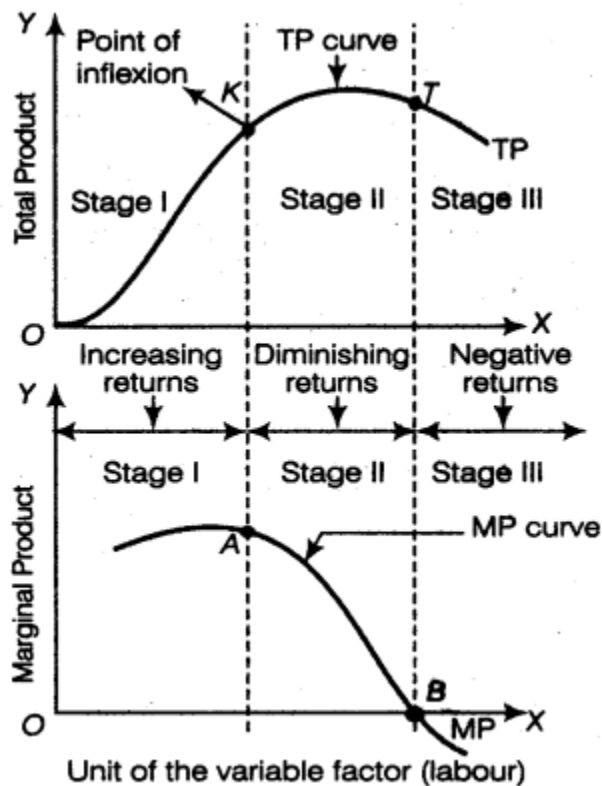
The law states that if more and more units of a variable factor are employed with fixed factors, Total Physical Product (TPP) increases at an increasing rate in the beginning, then increases at a diminishing rate and finally starts falling.

Land (Acre)	Number of laborers	TPP (Quintal)	APP (Quintal)	MPP (Quintal)
1	0	0	0	–
1	1	2	2	2
1	2	6	3	4
1	3	12	4	6
V	4	16	4	4
1	5	18	3.6	2
1	6	18	3	0
1	7	14	2	(-) 4
1	8	8	1	H 6

As per the above schedule, In stage I, TPP tends to rise at an increasing rate. This corresponds to the situation of increasing return to a factor.

In stage II, TPP tends to rise at a diminishing rate. This corresponds to a situation of diminishing returns to a factor.

In stage III, TPP starts declining. This is a situations of negative returns to a factor.



As per the above schedule, in stage I Marginal Product is rising but in stage II Marginal Product tends to decline and in stage III Marginal Product becomes negative.

12. What does the Law of Variable Proportion show? State the behavior of Total Product according to this law. (Delhi 2012)

Ans. The Law of Variable Proportion shows the impact on output when units of a variable factor are increased, keeping fixed factors constant in the short-run. It states that as more and more units of the variable factors are used (along with the fixed factor), a stage must come when Total Product of the variable factor starts declining, and eventually starts falling.

Three Phases of Production

Land (Acre)	Number of Labourers	Total Physical Product (TPP) (Quintal)	Average Physical Product (APP) (Quintal)	Marginal Physical Product (MPP) (Quintal)	Remarks/Phases
1	0	0	0	—	
1	1	2	2	2	Phase I (Increasing returns to factors)
1	2	6	3	4	
1	3	12	4	6	
1	4	16	4	4	Phase II (Decreasing returns to factors)
1	5	18	3.6	2	
1	6	18	3	0	
1	7	14	2	(-) 4	Phase III (Negative returns to factors)
1	8	8	1	(-) 6	

$$AP = TP/Q, MP_{nth} = TP_n - TP_{n-1}, TP = AP \times Q$$

As per the above schedule, in phase I, Total Product tends to rise at an increasing rate. This corresponds to the situation of increasing returns to a factor. In phase II, Total Product tends to rise at a diminishing rate this corresponds to a situation of diminishing returns to a factor. In Phase III, Total Product starts declining, -this is actuation of negative returns to a factor.

13. Prepare a Marginal Product schedule for increasing production when only one input is increased. Indicate the phases of the Law of Variable Proportion. (All India 2010)

Ans. The Law of Variable Proportion shows the impact on output when units of variable factor are increased, keeping fixed factors constant in the short-run.

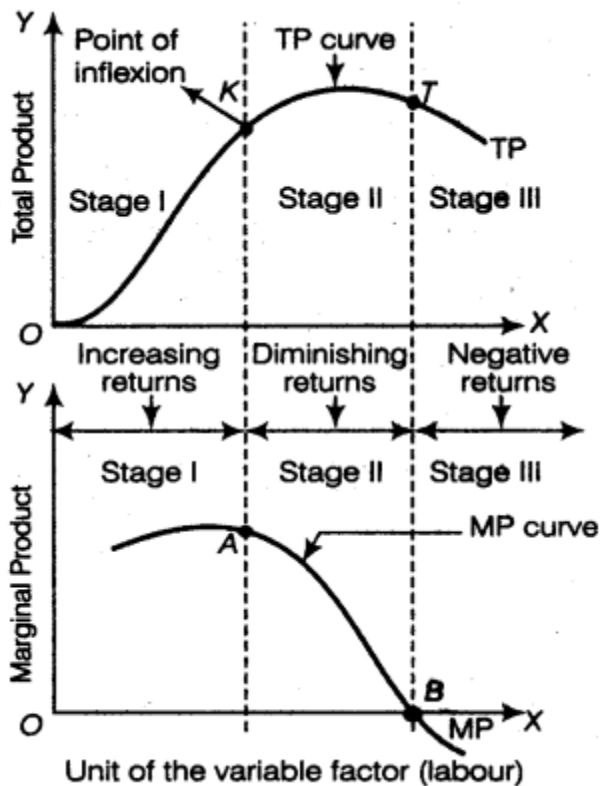
The law states that if more and more units of a variable factor are employed with fixed factors, Total Physical Product (TPP) increases at an increasing rate in the beginning, then increases at a diminishing rate and finally starts falling.

Land (Acre)	Number of labourers	TPP (Quintal)	APP (Quintal)	MPP (Quintal)
1	0	0	0	–
1	1	2	2	2
1	2	6	3	4
1	3	12	4	6
V	4	16	4	4
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As per the above schedule, In stage I, TPP tends to rise at an increasing rate. This corresponds to the situation of increasing return to a factor.

In stage II, TPP tends to rise at a diminishing rate. This corresponds to a situation of diminishing returns to a factor.

In stage III, TPP starts declining. This is a situations of negative returns to a factor.



14. Explain the likely behavior of Total Product when only one input is increased for increasing production? Use diagram. (Delhi 2010c)

Ans. The Law of Variable Proportion shows the impact on output when units of variable factor are increased, keeping fixed factors constant in the short-run.

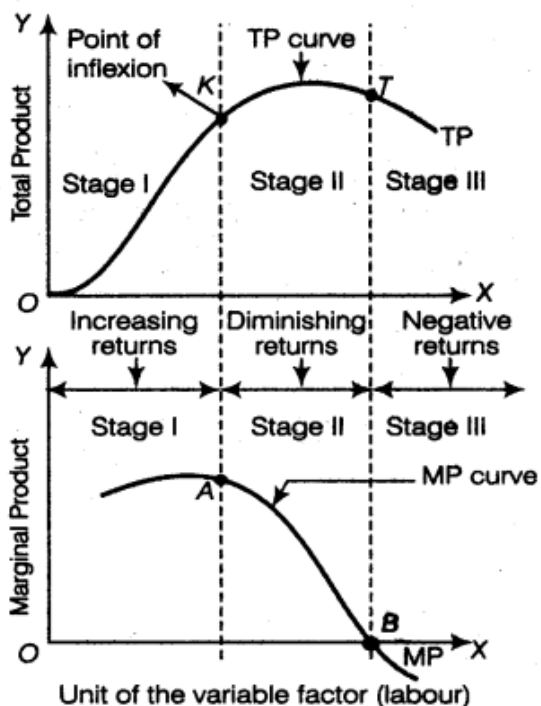
The law states that if more and more units of a variable factor are employed with fixed factors, Total Physical Product (TPP) increases at an increasing rate in the beginning, then increases at a diminishing rate and finally starts falling.

Land (Acre)	Number of laborers	TPP (Quintal)	APP (Quintal)	MPP (Quintal)	
1	0	0	0	–	Stage I
1	1	2	2	2	
1	2	6	3	4	
1	3	12	4	6	
V	4	16	4	4	
1	5	18	3.6	2	Stage II
1	6	18	3	0	
1	7	14	2	(-) 4	Stage III
1	8	8	1	H 6	

As per the above schedule, In stage I, TPP tends to rise at an increasing rate. This corresponds to the situation of increasing return to a factor.

In stage II, TPP tends to rise at a diminishing rate. This corresponds to a situation of diminishing returns to a factor.

In stage III, TPP starts declining. This is a situations of negative returns to a factor.



15. Identify different phases of the Law of Variable Proportion from the following schedule. Give reasons for your answer. (Delhi 2006C)

Variable input (units)	Total Physical Product (TPP) (units)	Marginal Physical Product (MPP) (units)
1	4	4
2	9	5
3	13	4
4	15	2
5	12	(-) 3

Ans.

Variable Input (Q)(units)	Total Physical Product (TPP) (units)	Marginal Physical Product (MPP) (units)	Remarks	Stages
1	4	4	TPP is increasing at an increasing rate	Increasing returns
2	9	5		
3	13	4	TPP is increasing and MPP starts declining	Diminishing returns
4	15	2		
5	12	(-) 3	MPP becomes negative and TPP falls	Negative returns

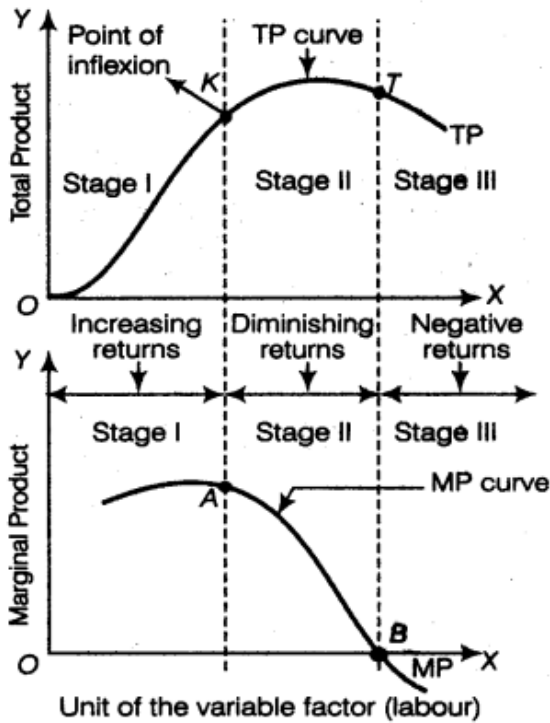
6 Marks Questions

16. State the behavior of Marginal Product is the Law of Variable Proportions. Explain the causes of this behavior. (Delhi 2014)

Ans. Law of Variable Proportion states that the Marginal Product of a factor input, initially rises with its employment level. But after reaching a certain level of employment, it starts falling.

This law may be explained with the help of following schedule and diagram:





$$AP = TP/Q, MP_{nth} = TP_n - TP_{n-1}$$

Land (Units)	Labour (Units)	Total Product (TP)	Marginal Product (MP)	Stages
1	1	2	2	Increasing returns
1	2	5	3	
1	3	9	4	
1	4	12	3	Diminishing returns
1	5	14	2	
1	6	15	1	Negative returns
1	7	15	0	
	8	14	-1	

Following observations can be made from the given table and curve:

- (i) MP rises till 3rd unit of labour are employed, in this condition TP increases at increasing rate, this condition is called condition of increasing returns.
- (ii) With the use of 4th unit of labour, MP starts decreasing and TP increases only at decreasing rate, this condition is called condition of diminishing returns.
- (iii) When decreasing MP reduces to zero, Total Product is maximum.
- (iv) When Marginal Product is negative, Total Product starts declining. (l)

Law of Variable Proportion basically depends on diminishing returns to marginal factor. Its main cause are:

- (a) Fixity of the factor. (b) Imperfect factor substitutability.
- (c) Poor coordination between the factors.

17. State giving reasons whether the following statements are true or false.

(i) Average Product will increase only when Marginal Product increases. (All India 2013)

(ii) Under diminishing returns to a factor, Total Product continues to increase till Marginal Product reaches zero. (All India 2011)

(iii) Where there are diminishing returns to a factor, Total Product first increases and then starts falling. (Delhi 2010)

(iv) When Marginal Product falls, Average Product will also fall. (Delhi 2010)

(v) Total Product always increases whether there is increasing returns or diminishing returns to a factor. (All India 2010)

(vi) When there are diminishing returns to a factor, Total Product always decreases. (Delhi 2009)

(vii) Product will increase only when Marginal Product increases. (Delhi 2009)

(viii) Increase in Total Product always indicates that there are increasing returns to a factor. (Delhi 2009)

(ix) When there are diminishing returns to a factor, Marginal product and Total Product both fall. (Delhi 2009; All India 2009)

Ans. (i) False, AP rise even when MP falls, and AP and MP are equal at the maximum point of AP.

(ii) True, under diminishing returns to a factor, Marginal Product tends to fall which implies that Total Product should be increasing at a diminishing rate.

(iii) False, under diminishing returns to a factor, Marginal Product tends to fall. Falling Marginal Product implies that Total Product should be increasing at a diminishing rate.

(iv) False, Average Product can rise even when Marginal Product falls.

(v) True, in a situation of increasing returns to a factor, Marginal Product tends to rise. Accordingly, Total Product should be increasing at an increasing rate. Under



diminishing returns to a factor, Marginal Product tends to fall which implies that Total Product should be increasing at a diminishing rate.

(vi) False, in a situation of diminishing returns to a factor, Marginal Product tends to fall which implies that Total Product should be increasing at a diminishing rate.

(vii) False, Total Product will also increase when Marginal Product decreases. In that case, Total Product increases at a diminishing rate.

(viii) False, it is not necessary because in the stage of diminishing returns to a factor, Total Product also increases, but at a diminishing rate.

(ix) False, in the case of diminishing returns to a factor, only Marginal Product tends to fall. Total Product tends to increase at a diminishing rate.

18. Explain the Law of Returns to a Factor with the help of Total Product and Marginal Product schedule. (Delhi 2013; All India 2010,2009)

or

Explain the Law of Variable Proportion with the help of Total Product and Marginal Product curves. (Delhi 2010,2008; All India 2006)

or

What are the different phases in the behavior of Total Product in the Law of Variable Proportion? Also give reasons behind the behaviour in each case. (Delhi 2009C, 2007)

Ans. The Law of Variable Proportion shows the impact on output when units of variable factor are increased, keeping fixed factors constant in the short-run.

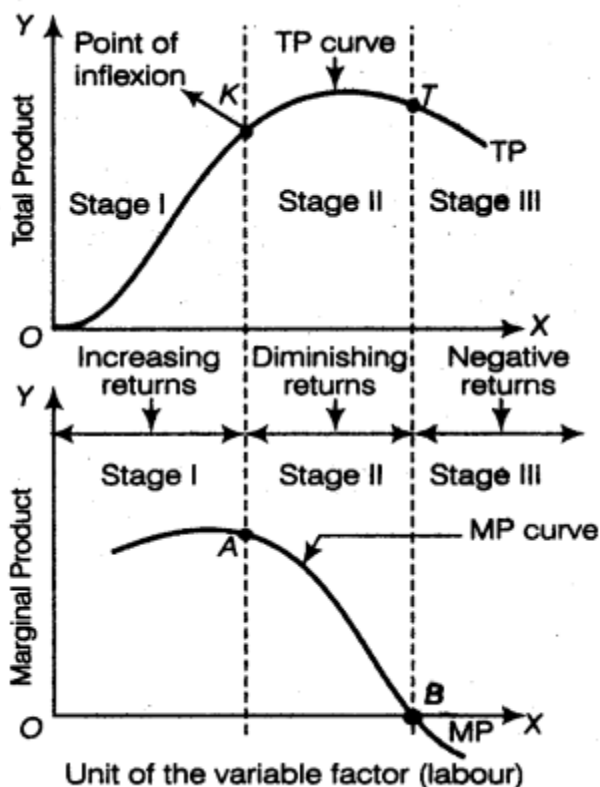
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1	0	0	0	–	Stage I
1	1	2	2	2	
1	2	6	3	4	
1	3	12	4	6	
V	4	16	4	4	
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1	7	14	2	(-) 4	Stage III
1	8	8	1	H 6	

As per the above schedule, In stage I, TPP tends to rise at an increasing rate. This corresponds to the situation of increasing return to a factor.

In stage II, TPP tends to rise at a diminishing rate. This corresponds to a situation of diminishing returns to a factor.

In stage III, TPP starts declining. This is a situations of negative returns to a factor.



19. Identify the three phases of the Law of Variable Proportion from the following and also give reasons behind each phase.

Unit of Variable Input	Total Physical Product (TPP) (units)	Marginal Physical Product (MPP) (units)
1	10	-
2	22	12
3	30	8
4	35	5
5	30	(-) 5

Ans.

Unit of Variable Input	Total Physical Product (TPP) (units)	Marginal Physical Product (MPP) (units)	Phases
1	10	10	Phase I Here, more and more units of variable factor are used, MP tends to rise and TPP increases at increasing rate
2	22	12	
3	30	8	Phase II In this situation, MPP starts declining and TPP increases at a diminishing rate.
4	35	5	
5	30	(-) 5	Phase III In this stage, TPP falls and MPP becomes negative.

