

1. Explain the concept of a production function.

The production function is defined as the relationship between physical inputs used in production and the corresponding physical output. This shows how many units of inputs produce the maximum output. It can be represented as

$$Q_x = f(L, K)$$

Where Q_x = Total Physical Output

L = Total physical labour employed

K = Total capital employed

2. What is the total product of input?

It refers to the total volume of goods and services that are produced in a firm with the provided input during a specific time period.

3. What is the average product of input?

The Average Product of an input is the Total Product divided by the total amount of the variable input used to produce it.

4. What is the marginal product of input?

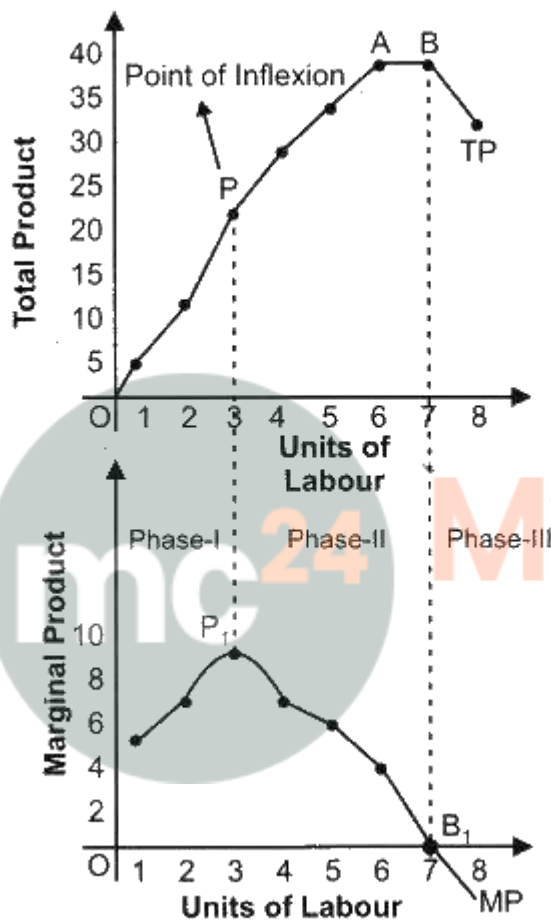
The marginal product of an input is the improvement in output that is achieved by using an additional unit of input.

5. Explain the relationship between the marginal products and the total product of an input.

This can be explained with the help of the law of variable proportions. As per this law, when only one variable factor input is allowed to increase with all other inputs kept constant, the following changes are observed:

1. With an increase in Marginal Product (MP), there is a corresponding increase in Total Product (TP). A convex curve is obtained with the effect till the MP curve is at its maximum.

2. When MP declines but is positive, then TP increases with a decline in rate, giving the total product a concave shape.
3. When MP is at zero, the TP is at maximum
4. When MP becomes negative, the TP falls.



6. Explain the concepts of the short run and the long run.

The long run is a period of time in which the producer can change all the variables involved in the production, like building, machine etc. The short-run is a period of time in which the producer can only make limited changes in the production process. It is the period in which at least one factor of production is fixed while others can be changed or improved. The examples of short run can be farmer having a fixed piece of land.

7. What is the law of diminishing marginal product?

According to the law of diminishing marginal product, there will initially be an increase in the total amount of production when one of the factors is increased while keeping the others constant.

Eventually, this strategy would not keep increasing production. For example, think of a factory where the machinery is a factor of production. Increasing the number of machines would initially increase production. But if the company keeps increasing the number of machines without correspondingly hiring new workers to operate them, the productivity will decrease.

8. What is the law of variable proportions?

The Law of Variable Proportions is also called the Law of Diminishing Returns.

According to the law, when one of the inputs involved in the production is changed while keeping the other inputs constant, there will be a point after which the output per unit of that input will start to decrease. This law is theorised under certain assumptions.

- i) The technology should remain the same.
- ii) The possibility that the factors of production can be changed within a short period of time.
- iii) Some inputs should be kept constant

9. When does a production function satisfy constant returns to scale?

Constant returns to scale is achieved when the change in the factors of production matches with the changes in the total output. This means that the efforts of the producer to improve production yield appropriate and equivalent returns.

10. When does a production function satisfy increasing returns to scale?

Increasing returns to scale is achieved when the change in the factors of production yields more than the proportionate changes in the total output. This means that the company has improved its productivity.

11. When does a production function satisfy decreasing returns to scale?

Decreasing returns to scale is when the change in the factors of production results in a decrease in the changes in the total output. This is an indication that the changes have proved to be detrimental to productivity instead of increasing productivity

12. Briefly explain the concept of the cost function.

The relationship between the cost of production and the total output is known as the cost function.

13. What are the total fixed cost, total variable cost and total cost of a firm? How are they related?

A fixed cost is a cost that does not change in relation to the total number of goods and services produced by the company. On the other hand, a variable cost is a cost that changes in relation to the total number of goods and services produced by the company.

Total Fixed Cost: The cost incurred by a company in acquiring fixed production factors like buildings, cost of machinery and depreciation.

Total Variable Cost: Cost incurred by a company on variable production factors like wages and fuel charges.

Total Cost: The total cost of the firm is the total fixed cost and total variable cost put together. It is the actual cost incurred by the company when producing a given amount of output.

14. What are the average fixed cost, average variable cost and average cost of a firm? How are they related?

The average fixed cost is the fixed cost per unit of output produced.

The average variable cost is the variable cost per unit of output produced.

The average cost of a firm is the average fixed cost and average variable cost put together.

15. Can there be some fixed cost in the long run? If not, why?

The fixed cost cannot be set in the long run. Fixed costs can only be set for the short run. Since all factors of production and inputs can change in the long run, a fixed cost cannot be determined for the output.

16. What does the average fixed cost curve look like? Why does it look so?

The average fixed cost resembles a rectangular hyperbola. This is because of the constantly increasing output and the fixed cost, which remains the same at every point.

17. What do the short run marginal cost, average variable cost and short run average cost curves look like?

The curves of the short run marginal cost, the average variable cost and the short run average cost are all U-shaped.

18. Why does the SMC curve cut the AVC curve at the minimum point of the AVC curve?

It can be explained by the following points:

1. When AVC (Average Variable Cost) falls, SMC (Short Marginal Curve) is lesser than AVC.
2. When AVC rises, SMC becomes more than AVC
3. When AVC is constant and is minimum, SMC is equal to AVC.

Therefore, the SMC curve cuts the AVC curve at the minimum point.

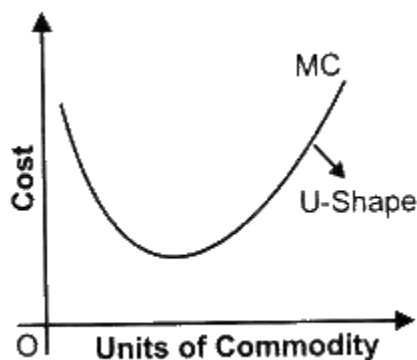
19. At which point does the SMC curve intersect SAC curve? Give reasons in support of your answer.

This can be explained with the following points:

1. When SAC falls, SMC is below the SAC.
2. When SAC rises, SMC is above SAC.

Therefore, the SMC curve cuts the SAC curve at its minimum point because at that point, $SMC = SAC$

20. Why is the short run marginal cost curve 'U'-shaped?

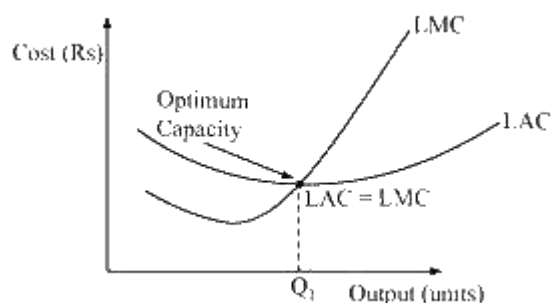


The Marginal Curve (MC) is U-shaped as per the Law of Variable Proportion.

This can be explained as follows:

1. Shape of the Marginal Cost Curve (MC) depends on the Total Variable Cost (TVC).
2. As TVC increases at a diminishing rate, the total product increases at an increasing rate, which creates a gap in the curve leading to the fall of MC.
3. Now, as TVC increases at an increasing rate and the total product increases at a diminishing rate, making the marginal cost increase and rise upward.
4. The increasing returns and then constant returns, along with the rise in decreasing returns, make it appear like the letter U from the English alphabet; hence, it is named so.

21. What do the long run marginal cost and the average cost curves look like?



The Long Run Marginal Cost (LMC) and Long Run Average Cost (LAC) are U-shaped, and the reason behind this is the law of returns to scale. As per this law, a company or a firm undergoes three stages in production which are IRS (Increasing Return to Scale), CRS (Constant Return to Scale) and DRS (Diminishing Return to Scale). The curve becomes U-Shaped due to the falling of LAC due to economies of scale (IRS); it attains constant output at

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the CRS level, and finally, if the firm experiences diseconomies of scale and if it is continuing production after this stage, it will see a rise or DRS.

22. The following table gives the total product schedule of labour. Find the corresponding average product and marginal product schedules of labour.

L	TP_L
0	0
1	15
2	35
3	50
4	40
5	48

The solution to this question is as follows:

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L	TP_L	$AP = \frac{TP}{L}$	$MP = TP_n - TP_{n-1}$
0	0	–	–
1	15	15	15
2	35	17.5	20
3	50	16.67	15
4	40	10	– 10
5	48	9.6	8

23. The following table gives the average product schedule of labour. Find the total product and marginal product schedules. It is given that the total product is zero at zero level of labour employment.

L	AP_L
1	2
2	3
3	4
4	4.25
5	4
6	3.5

The solution to this question is as follows:

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L	AP_L	$TP_L = AP \times L$	$MP_L = TP_n - TP_{n-1}$
1	2	$2 \times 1 = 2$	2
2	3	$3 \times 2 = 6$	$6 - 2 = 4$
3	4	$4 \times 3 = 12$	$12 - 6 = 6$
4	4.25	$4.25 \times 4 = 17$	$17 - 12 = 5$
5	4	$4 \times 5 = 20$	$20 - 17 = 3$
6	3.5	$3.5 \times 6 = 21$	$21 - 20 = 1$

24. The following table gives the marginal product schedule of labour. It is also given that the total product of labour is zero at zero level of employment. Calculate the total and average product schedules of labour.

L	MP_L
1	3
2	5
3	7
4	5
5	3
6	1

The solution to this question is as follows:

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L	MP_L	$TP_n = TP_{n-1} + MP_n$	$AP_L = \frac{TP_L}{L}$
1	3	3	$\frac{3}{1} = 3$
2	5	$3 + 5 = 8$	$\frac{8}{2} = 4$
3	7	$8 + 7 = 15$	$\frac{15}{3} = 5$
4	5	$15 + 5 = 20$	$\frac{20}{4} = 5$
5	3	$20 + 3 = 23$	$\frac{23}{5} = 4.6$
6	1	$23 + 1 = 24$	$\frac{24}{6} = 4$

25. The following table shows the total cost schedule of a firm. What is the total fixed cost schedule of this firm?

Calculate the TVC, AFC, AVC, SAC and SMC schedules of the firm.

L	TP_L
0	10
1	30
2	45
3	55
4	70

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5	90
6	120

The solution to this question can be as follows:

Q (units)	TC (Rs)	$TFC = TC - TVC$ $10 = 10 - 0$ (Rs)	$TVC = TC - TFC$ (Rs)	$AFC = \frac{TFC}{Q}$ (Rs)	$AVC = \frac{TVC}{Q}$ (Rs)	$SAC = AFC + AVC$ (Rs)	$SMC = TC_n - TC_{n-1}$ (Rs)
0	10	10	0	–	–	–	–
1	30	10	20	10	20	30	20
2	45	10	35	5	17.5	22.5	15
3	55	10	45	3.33	15	18.33	10
4	70	10	60	2.5	15	17.5	15
5	90	10	80	2	16	18	20
6	120	10	110	1.66	18.33	19.99	30

26. The following table gives the total cost schedule of a firm. It is also given that the average fixed cost at 4 units of output is Rs 5/-. Find the TVC, TFC, AVC, AFC, SAC and SMC schedules of the firm for the corresponding values of output.

L	TP_L
1	50
2	65

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3	75
4	95
5	130
6	185

The solution to this question is as follows:

Q (units)	TC (Rs)	$TFC = \text{Rs } 20$ (Rs)	$TVC = TC - TFC$ (Rs)	$AVC = \frac{TVC}{Q}$ (Rs)	$AFC = \frac{TFC}{Q}$ (Rs)	$SAC = AFC + AVC$ (Rs)	$SMC = TC_n - TC_{n-1}$ (Rs)
1	50	20	30	30	20	50	30
2	65	20	45	22.5	10	32.5	15
3	75	20	55	18.33	6.66	24.99	10
4	95	20	75	18.75	5	23.75	20
5	130	20	110	22	4	26	35
6	185	20	165	27.5	3.33	30.83	55

27. A firm's SMC schedule is shown in the following table. The total fixed cost of the firm is Rs 100. Find the TVC, TC, AVC and SAC schedules of the firm.

L	TP_L
0	–
1	500

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2	300
3	200
4	300
5	500
6	800

The solution to this question is as follows:

Q (units)	SMC (Rs)	TFC = Rs 100 (Rs)	$TVC_n = SMC_n + TVC_{n-1}$ (Rs)	$TC = TVC + TFC$ (Rs)	$AVC = \frac{TVC}{Q}$ (Rs)	$SAC = \frac{TC}{Q}$ (Rs)
0	–	100	–	100	–	–
1	500	100	500	600	500	600
2	300	100	800	900	400	450
3	200	100	1000	1100	333.33	366.67
4	300	100	1300	1400	325	350
5	500	100	1800	1900	360	380
6	800	100	2600	2700	433.33	450

28. Let the production function of a firm be $Q = 5L^{\frac{1}{2}}K^{\frac{1}{2}}$.

Find out the maximum possible output that the firm can produce with 100 units of L and 100 units of K .

The solution is as follows:

From the question

$$Q = 5L^{\frac{1}{2}} K^{\frac{1}{2}} \text{ – Equation (1)}$$

$L = 100$ units of labour

$K = 100$ units of capital

Putting these values in equation (1)

$$\begin{aligned} Q &= 5(100)^{\frac{1}{2}} (100)^{\frac{1}{2}} \\ &= 5(10)(10) \\ &= 500 \text{ units} \end{aligned}$$

Therefore, the maximum possible output produced by firm is 500 units.

29. Let the production function of a firm be $Q = 2L^2 K^2$.

Find out the maximum possible output that the firm can produce with 5 units of L and 2 units of K . What is the maximum possible output that the firm can produce with zero unit of L and 10 units of K ?

The solution is as follows

For 1st condition

$$Q = 2L^2 K^2 \text{ - (Eq.1)}$$

$$L = 5 \text{ units of labour}$$

$$K = 2 \text{ units of capital}$$

Putting these values in equation (1)

$$Q = 2 (5)^2 (2)^2$$

$$= 2 (25) (4)$$

$$Q = 200 \text{ units}$$

For the 2nd condition

$$Q = 2L^2 K^2 \text{ - (Eq.1)}$$

$$\text{If } L = 0 \text{ units and } K = 100 \text{ units}$$

Putting these values in equation (1)

$$Q = 2 (0)^2 (100)^2$$

$$Q = 0 \text{ units}$$

30. Find out the maximum possible output for a firm with zero unit of L and 10 units of K when its production function is $Q = 5L = 2K$.

The solution will be as follows:

As per question

$$Q = 5L + 2K \text{ (eq.1)}$$

If $L = 0$ and $K = 10$, then putting these values in equation (1)

$$Q = 5(0) + 2(10)$$

$$= 20 \text{ units of output}$$

Therefore, maximum possible output will be 20 units.

