

1. If the average product of labor (APL) is $30L - L^2$, the maximum possible total product (TPL) is _____?

Conceptual Note:

$$TP_L = AP_L \times L$$

$$MP_L = \partial TP_L / \partial L \text{ (first difference of } TP_L \text{)}$$

TP_L is maximum when $MP_L = 0$

Answer :

$$AP_L = 30L - L^2$$

$$TP_L = AP_L \times L = 30L^2 - L^3$$

TP_L can be maximized when $MP_L = 0$

$$\text{Therefore, } \partial TP_L / \partial L = 60L - 3L^2 = 0$$

$$L(60 - 3L) = 0$$

$$L = 0 \text{ or } L = 20.$$

\therefore Output can be maximized by employing 20 labors.

$$\therefore \text{ Maximum possible } TP_L = 30(20)^2 - (20)^3 = 12,000 - 8,000 = 4,000 \text{ units.}$$

2. For a firm, the average cost function is estimated as

$$AC = 100/Q + 20 + 4Q$$

What is total variable cost for the firm at an output of 15 units.

Conceptual Note:

$$TC = AC \times Q$$

From TC, we can find TVC by taking terms which have Q as a factor.

Answer :

$$AC = 100/Q + 20 + 4Q$$

$$TC = 100 + 20Q + 4Q^2$$

$$TVC = 20Q + 4Q^2 \quad \text{----- (100 is TFC)}$$

$$\text{At output 15, } TVC = 20(15) + 4(15)^2$$

$$= 300 + 900 = \text{Rs. } 1200$$

3. A firm operating under perfect competition has the following cost functions :-

$$MC = 75 - 20Q + 1.5Q^2,$$

$$AVC = 75 - 10Q + 0.5Q^2$$

The price below which the firm shut down its operation in the short-run is

- a. Rs. 20 b. Rs. 25 c. Rs.40 d. Rs.50 e. Rs.75

Conceptual Note: In the short run, even if the firm cannot cover its average total cost of production, it continues its operations, as it cannot shutdown because of the heavy investments (fixed costs) made in equipment like plant, machinery, etc. To continue in the market, the firm must earn revenues, which are at least equivalent to the average variable cost in the short run, even if the firm fails to cover the fixed costs. Thus, in other words, if the firm cannot cover its variable costs (i.e. $AVC < P$) in the short run then the firm has to shut down.

Answer : (b)

The minimum price below which the firm is shut down its operation is the minimum average variable cost.

The average variable cost will be equal to price or marginal revenue at the minimum point on average variable cost curve.

$$\therefore MC = AVC.$$

$$75 - 20Q + 1.5Q^2 = 75 - 10Q + 0.5Q^2$$

$$1.5Q^2 - 0.5Q^2 - 20Q + 10Q = 0.$$

$$Q^2 - 10Q = 0$$

$$Q(Q - 10) = 0$$

$$Q = 10.$$

$$\text{At } Q = 10, AVC = 75 - 10(10) + 0.5(10)^2$$

$$= 75 - 100 + 50 = \text{Rs.}25.$$

4. The demand function of a monopolist is estimated to be

$$Q=100-10P$$

If the marginal revenue is Rs. 4, what is the price elasticity of demand for the good?

- a. 6.33 b. 2.33 c. 4.44 d. 5.12 e. 6.12

Answer:

$$Q=100-10P$$

Can be restated as

$$10P = 100 - Q$$

$$\text{Or, } P = 10 - 0.1Q$$

$$TR = 10Q - 0.1Q^2$$

$$MR = \frac{\partial TR}{\partial Q} = 10 - 0.2Q = 4$$

$$\text{Or, } 0.2Q = 6$$

$$\text{Or, } Q = 30$$

$$\text{When } Q = 30, P = 10 - 0.1(30) = 7.$$

$$\text{When } P = 7,$$

$$\text{Elasticity of demand} = \frac{\partial Q}{\partial P} \times \frac{P}{Q} = -10 \times \frac{7}{30} = -2.33$$

5. A firm operating in a monopolistic competition has the following demand function :

$$P=1000-Q$$

If the marginal cost of the firm is constant at Rs. 10, the equilibrium output in the long run is

- a. 720 units b. 990 units c. 525 units d. 495 units e. 690 units

Answer : (b)

The equilibrium output in the long run is determined where $P=AC$

Note that when MC is constant at Rs.10, AC would also be Rs.10.

$$1,000 - Q = 10$$

$$Q = 1000 - 10 = 990 \text{ units.}$$