Application of Calculus in Commerce and Economics

ISC Previous Years Board Questions with Answers

from

2005 to 2020

1. A company is selling a certain product. The demand function of the product is linear. The company can sell 2000 units when the price is ₹ 8 per unit and 3000 units when the price is ₹ 4 per unit. Determine :
   (i) the demand function,
   (ii) the total revenue function. [ISC 2005]

2. Given the total cost function for x units of a commodity as $C(x) = \frac{1}{3}x^3 + x^2 - 8x + 5$. Find :
   (i) the marginal cost function,
   (ii) the average cost function,
   (iii) the slope of average cost function. [ISCBM 2005]

3. A firm has the following total cost and demand functions :
   $C(x) = \frac{x^3}{3} - 7x^2 + 111x + 50 \quad and \quad p = 100 - x$.
   Find the profit maximizing output. [ISCBM 2005]

4. A television manufacture finds that the total cost for the production and marketing of x number of television sets is $C(x) = 300x^2 + 4200\,x + 13500$. Each product is sold for ₹ 8400. Determine the break even points. [ISC 2006]

5. The fixed cost of a new product is ₹ 18,000 and the variable cost is ₹ 550 per unit. If the demand function $p(x) = 4000 - 150\,x$, find the break-even points. [ISC 2007]

6. The average cost function associated with producing and marketing x units of an item is given by $AC = 2x - 11 + \frac{50}{x}$. Find :
   (i) the total cost function and the marginal cost function.
   (ii) the range of values of output x for which AC is decreasing. [ISC 2008]

7. The cost of manufacturing of certain items consists of ₹ 1600 as overheads, ₹ 30 per item as the cost of the material and the labour cost ₹ $\frac{x^2}{100}$ for x items produced. How many items must be produced to have a minimum average cost ? [ISC 2009]

8. The average cost function AC for a commodity is given by $AC = x + 5 + \frac{36}{x}$ in terms of output x. Find the
   (i) total cost and the marginal cost as the function of x.
   (ii) output for which AC increases. [ISC 2010]

9. Given that the total cost function for x units of a commodity is : $C(x) = \frac{x^3}{3} + 3x^2 - 7x + 16$.
   (i) Find the marginal cost (MC).
   (ii) Find the average cost (AC).
   (iii) Prove that : $Marginal\ Average\ cost\ (MAC) = \frac{x(MC)-C(x)}{x^2}$. [ISC 2011]

10. If total cost function is given by $C = a + bx + c\,x^2$, $where$ x is the quantity of output show that :
   $\frac{d}{dx}(AC) = \frac{1}{x}(MC - AC)$, where (MC) is the marginal cost and (AC) is the average cost. [ISC 2012]

11. A company produces a commodity with ₹ 24,000 fixed cost. The variable cost is estimated to be 25% of the total revenue recovered on selling the product at a rate of ₹ 8 per unit. Find the following:
   (i) cost function,
   (ii) revenue function,
   (iii) break-even Point. [ISC 2013]

12. A firm has the cost function $C = \frac{x^3}{3} - 7\,x^2 + 111\,x + 50$ and demand function $x = 100 - p$.
   (i) Write down the total revenue function in terms of x.
   (ii) Formulate the total profit function **P** in terms of x.
   (iii) Find the profit maximizing level of output x. [ISC 2014]

13. The average cost function , AC for a commodity is given by $AC = x + 5 + \frac{36}{x}$, in terms of output x. Find :
   (i) The total cost C and marginal cost MC as a function of x.
   (ii) The outputs for which AC increases. [ISC 2015]

14. The demand function is $x = \frac{24-2\,p}{3}$, where x is the number of units demanded and p is the price per unit. Find:
   (i) the revenue function R in terms of p,
   (ii) the price and the number of units demanded for which the revenue is maximum. [ISC 2016]

15. The demand for a certain product is represented by the equation $p = 500 + 25\,x - \frac{x^2}{3}$ in rupees where x is the number of units and p is the price per unit . Find :
   (i) marginal revenue function,
   (ii) the marginal revenue when 10 units are sold . [ISC 2017]

16. Given the total cost function for x units of a commodity as :
   $C(x) = \frac{1}{3}\,x^3 + 3\,x^2 - 16\,x + 2.$

Find :

(i) marginal cost function.

(ii) average cost function. [ISC 2018]

17. The average cost function associated with producing and marketing x units of an item is given by $AC = 2x - 11 + \frac{50}{x}$. Find the range of values of the output x , for which AC is increasing. [ISC 2018]

18. A product can be manufactured at a total cost $C(x) = \frac{x^2}{100} + 100\,x + 40$, where x is the number of units produced. The price at which each unit can be sold is given by $P = \left(200 - \frac{x}{400}\right)$. Determine the production level x at which the profit is maximum. What is the price per unit and total profit at the level of production? (ISC 2018]

19. A manufacturer's marginal cost function is $\frac{500}{\sqrt{2\,x+25}}$. Find the cost involved to increase production from 100 units to 300 units. [ISC 2018]

20. A company produces a commodity with ₹ 24,000 as fixed cost. The variable cost estimated to be 25% of the total revenue received on selling the product, is at the rate of ₹ 8 per unit. Find the break- even point. [ISC 2019]

21. The total cost function for a production is given by $C(x) = \frac{3}{4}\,x^2 - 7x + 27$.
Find the number of units produced for which $M.C. = A.C.$
($M.C. =$ Marginal Cost and $A.C. =$ Average cost) [ISC 2019]

22. The cost function of a product is given by $C(x) = \frac{x^3}{3} - 45\,x^2 - 900\,x + 36$ where x is the number of units produced. How many units should be produced to minimize the marginal cost? [ISC 2019]

23. The marginal cost function of x units of a product is given by $MC = 3\,x^2 - 10\,x + 3$. The cost of producing one unit is ₹ 7. Find the total cost function and average cost function. [ISC 2019]

24. The selling price of a commodity is fixed at ₹ 60 and its cost function is $C(x) = 35\,x + 250$

(i) Determine the profit function.

(ii) Find the break even points. (ISC 2020)

25. The revenue function is given by $R(x) = 100x - x^2 - x^3$. Find

(i) The demand function.

(ii) Marginal revenue function. (ISC 2020)

26. The marginal cost of the production of the commodity is $30 + 2x$, it is known that fixed costs are ₹ 200, find

(i) The total cost.

(ii) The cost of increasing output from 100 to 200 units. (ISC 2020)

27. The total cost function of a firm is given by $C(x) = \frac{1}{3}x^3 - 5x^2 + 30x - 15$ where the selling price per unit is given as ₹ 6. Find for what value of x will the profit be maximum? (ISC 2020)

Answer : [1] $(i) p = 16 - 0.004\,x$. $(ii) R(x) = 16\,x - 0.004\,x^2$ [2] $(i) MC = \frac{dc}{dx} = x^2 + 2x - 8$

$(ii)\ AC = \frac{C(x)}{x} = \frac{1}{3}\,x^2 + x - 8 + \frac{5}{x}$ $(iii)\ slope\ of\ AC = \frac{d(AC)}{dx} = \frac{2x}{3} + 1 - \frac{5}{x^2}$

[3] The profit is maximum for $x = 11$ units. [4] 5, 9 units [5] 15, 8 units

[6] (i) $C(x) = 2\,x^2 - 11\,x + 50,\ MC = \frac{dC}{dx} = 4x - 11$ $(ii)\ 0 < x < 5$

[7] 400 items [8] (i)$C = x^2 + 5\,x + 36$. $MC = 2x + 5$ (ii) $x > 6$

[9] $(i)\ x^2 + 6x - 7$ $(ii)\ \frac{x^2}{3} + 3x - 7 + \frac{16}{x}$

[11] (i) $C(x) =$ ₹ $(\ 2x + 24{,}000)$ (ii) $R(x) =$ ₹ $8x$ (iii) 4000

[12] (i) $R(x) = 100\,x - x^2$ (ii) $P(x) = -\frac{x^3}{3} + 6\,x^2 - 11\,x - 50$ (iii) $x = 11$

[13] (i) $C(x) = x^2 + 5\,x + 36$. $MC = 2\,x + 5$. $(ii)\ x > 6$

[14] (i) $R(x) = 8\,p - \frac{2}{3}\,p^2$ (ii) price per unit is ₹ 6 and no of units = 4

[15] (i) $MR(x) = 500 + 50\,x - x^2$ (ii) ₹ 900

[16] (i) $MC = x^2 + 6x - 16$ (ii) $AC = \frac{1}{3}\,x^2 + 3\,x - 16 + \frac{2}{x}$ [17] $x > 5$

[18] Profit is maximum when $x = 4{,}000$ units, price per unit = ₹ 190 and total profit is ₹ 1,99,960.

[19] ₹ 5,000 [20] 4000 [21] 6 units [22] 45 units

[23] $C(x) = x^3 - 5\,x^2 + 3\,x + 8,\quad AC = x^2 - 5\,x + 3 + \frac{8}{x}$

[24] (i) $P(x) = 25\,x - 250$ (ii) $x = 10$

[25] (i) $p(x) = 100 - x - x^2$ (ii) $MR = 100 - 2x - 3x^2$

[26] (i) $C(x) = (30x + x^2 + 200)$ (ii) ₹ 33000 [27] $x = 6$