Introduction to Mathematics

Applications of Linear Functions

Agenda

01 Linear Functions

02 Revenue Functions

03 Cost Functions

04 Profit Functions

Learning Outcomes

After completion you will be able

- Discuss the linear functions, their behavior and practical applications followed by an analysis .
- Discuss Revenue, Cost and Profit Functions with help of linear functions.
- Illustrate the applications of Revenue, Cost and Profit in business, economic and other areas.

Revenue, Cost and Profit

- **Revenue:** The income generated from sale of goods or services.
- **Cost:** The price paid or required for acquiring, producing, or maintaining something.
- **Profit:** A profit is an amount of money that you gain when you are paid more for something than it.

$$\text{Profit (P)} = \text{Revenue (R)} - \text{Cost (C)}$$

Cost can be broadly classified into variable cost and overhead cost. Variable cost varies with the volume of production while overhead cost is fixed, irrespective of the production volume.

Revenue, Cost and Profit Functions

- **Linear Revenue Functions:** *Total Revenue = (Price)*(Quantity Sold)*
- **Linear Profit Functions:** *= Profit = Total Revenue – Total Cost*

❖ If Total Revenue $= R(x)$ and Total Cost $= C(x)$

x = The Quantity Produced and Sold, then

$$P(x) = R(x) - C(x)$$

- If *Total Revenue > Total Cost*, Profit is Positive (Net Gain or Net Profit)
- If *Total Revenue < Total Cost*, Profit is Negative (Net Loss or Deficit)

Revenue, Cost and Profit Functions

Example: *A firm sells a single product for $65 per unit. Variable costs per unit are $20 for materials and $27.50 for labor. Annual fixed costs are $ 100,000. construct the profit function stated in terms of x, the number of units produced and sold. What profit is earned if annual sales are 20,000 units?*

Solution:

$R(x) = 65x$
$C(x) = 20x + 27.50x + 100,000$
$C(x) = 47.50x + 100,000$

In order to find the value of profit at a sales of 20,000 . put x = 20,000 in profit function

❖ $P(x) = R(x) - C(x)$

$P(20,000) = 17.50(20,000) - 100,000$
$\qquad\qquad = 350,000 - 100,000$
$\qquad\qquad = 250,000$

$P(x) = 65x - (47.50x + 100,000)$
$\qquad\qquad P(x) = 17.50x - 100,000$

Marginal Cost and Revenue

- **Marginal Cost:**

Marginal cost of a product is the cost of producing an additional unit of that product. Let the cost of producing 20 units of a product be Rs. 10,000, and the cost of producing 21 units of the same product be Rs. 10,045. Then the marginal cost of producing the 21st unit is Rs. 45.

- **Marginal Revenue:**

Marginal revenue of a product is the incremental revenue of selling an additional unit of that product. Let, the revenue of selling 20 units of a product be Rs. 15,000 and the revenue of selling 21 units of the same product be Rs. 15,085. Then, the marginal revenue of selling the 21st unit is Rs. 85.

Revenue, Cost and Profit Functions

Example: *A manufacturer of microcomputers produces three different models. The following table summarizes wholesale prices, material cost per unit, and labor cost per unit. Annual fixed costs are $25 million.*

	Microcomputer		
	Model 1	*Model 2*	*Model 3*
Wholesale price/unit	$500	$1,000	$1,500
Material cost/unit	175	400	750
Labor cost/unit	100	150	225

(a) Determine a joint total revenue function for sales of the three different microcomputer models.

(b) Determine an annual total cost function for manufacturing the three models.

(c) Determine the profit function for sales of the three models.

(d) What is annual profit if the firm sells 20,000, 40,000 and 10,000 units, respectively, of the three models?

Revenue, Cost and Profit Functions

<u>Solution:</u>

Let x1, x2 and x3 represents the number of units of three different models respectively.

(a)

$R(x1,x2,x3) = 500x1 + 1000\ x2 + 1500x3$

(b)

$C(x1,x2,x3) = [(100+175)x1 + (400+150)x2 + (750+225)x3] + 2{,}50{,}00{,}000$

(c)

$P(x1,x2,x3) = R(x1,x2,x3) - C(x1,x2,x3)$

$P(x1,x2,x3) = (500-275)x1 + (1000-550)x2 + (1500-975)x3 - 25000000$

$$P(x) = 225x1 + 450x2 + 525x3 - 25000000$$

YouTube Links

https://www.youtube.com/watch?v=3UzKeiBBkWw

https://www.youtube.com/watch?v=KLgY7oAKKPs

Thank you

Question Answers Session