

Need for Marginal Costing

Fixed expenses remain constant in aggregate amount and do not vary with the increase or decrease in production upto a particular level of output. Just contrary to this variable expenses increase or decrease in proportion to increase or decrease in output and remain constant per unit of output. Fixed expenses per unit continue to vary with the increase or decrease in production because these expenses remain constant upto a certain level of production. Thus, fixed overheads lead to different costs per unit at different levels of production. On account of this, a special technique known as marginal costing has been developed which excludes fixed overheads entirely from cost of production and gives us the same cost per unit upto a particular level of output. Thus, under this technique fixed expenses are not allocated to cost units but are charged against "fund" which arises out of excess of selling price over total variable costs.

Meaning of Marginal Cost

The Chartered Institute of Management Accountants, London, defines the term 'marginal cost' as follows :

Marginal Cost is the amount at any given volume of output by which aggregate costs are changed if the volume of output is increased or decreased by one unit. In this context a unit may be a single article, a batch of articles, an order, a stage of production capacity or a department. It relates to the change in output in the particular circumstances under consideration.

For example, if variable costs per unit are Rs. 10 and fixed expenses are Rs. 1,50,000 per annum, an output of 30,000 units per annum results in the following expenditure :

	Rs.
Variable cost of 30,000 units @ Rs. 10	= 3,00,000
Fixed cost	<u>= 1,50,000</u>
Total cost	<u>= 4,50,000</u>

If output is increased by one unit, the following expenditure will be incurred :

	Rs.
Variable cost of 30,001 units @ Rs. 10	= 3,00,010
Fixed costs	= 1,50,000
	<hr/>
Total cost	4,50,010
<i>Less : Total cost for output of 30,000 units</i>	4,50,000
Marginal cost of 1 unit	10

Meaning of Marginal Costing

According to CIMA Terminology *Marginal Costing* is the ascertainment of marginal costs and of the effect on profit of changes in volume or type of output by differentiating between fixed costs and variable costs. In this technique of costing only variable costs are charged to operations, processes or products, leaving all indirect costs to be written off against profits in the period in which they arise.

It is clear from the above that only variable costs form part of product cost in the technique of marginal costing because only variable costs are changed if output is increased or decreased and fixed costs remain the same.

Marginal costing is different from direct costing. *Direct costing* is the practice of charging all direct costs to operations, processes or products, leaving all indirect costs to be written-off against profit in the period in which they arise. Thus, in direct costing some fixed costs could be considered to be direct costs in appropriate circumstances but fixed cost is never taken in marginal cost.

Features of Marginal Costing

The following are the main features of Marginal Costing :

- (i) It is a technique of costing which is used to ascertain the marginal cost and to know the impact of variable cost on the volume of output.
- (ii) All costs are classified into fixed and variable cost on the basis of variability. Even semi fixed is segregated into fixed and variable cost.
- (iii) Variable cost alone are charged to production. Fixed costs are recovered from contribution.
- (iv) Valuation of stock of work in progress and finished goods is done on the basis of marginal cost.
- (v) Selling price is based on marginal cost plus contribution.
- (vi) Profit is calculated by deducting marginal cost and fixed cost from sales.
- (vii) Cost Volume Profit (or Break Even) Analysis, is one of the integral part of marginal costing.
- (viii) The profitability of a product/department is based on contribution made available by each product/department.

From the above, it is to be noted carefully that there are two aspects which require detailed treatment. These are :

1. Ascertainment of Marginal Cost.
2. Cost Volume Profit (or Break Even) Analysis.

These will be discussed in detail one by one.

Ascertainment of Marginal Cost

Ascertainment of marginal cost is different from total or absorption cost. In marginal cost it is assumed that the difference between the aggregate sales value and the aggregate marginal cost of the output sold provides a fund to meet the fixed cost and profit of the firm. In respect of each product, the difference between its sales value and the marginal cost is known as "contribution" made by the product to this fund. This contribution is the difference between the sale value and the marginal cost of sales and it contributes towards fixed expenses and profit.

Contribution can be represented as :

$$\text{Contribution} = \text{Selling Price} - \text{Marginal Cost}$$

$$\text{Contribution} = \text{Fixed Expenses} + \text{Profit}$$

$$\text{Contribution} - \text{Fixed Expenses} = \text{Profit}$$

If more than one products are produced, contribution of all products are merged into the fund out of which fixed expenses are deducted to get the figure of the profit. The following diagram represents a firm manufacturing three products and shows how individual product contributions are merged into the fund, the total amount of which should be sufficient to meet the fixed expenses and provide the desired profit.

<i>Product A</i>	<i>Product B</i>	<i>Product C</i>
Total sales value (Rs. 2,00,000)	Total sales value (Rs. 1,00,000)	Total sales value (Rs. 3,00,000)
minus	minus	minus
Marginal (or variable) cost of goods sold (Rs. 1,50,000)	Marginal (or variable) cost of goods sold (Rs. 80,000)	Marginal (or variable) cost of goods sold (Rs. 2,20,000)
Yields Contribution (Rs. 50,000)	Yields Contribution (Rs. 20,000)	Yields Contribution (Rs. 80,000)
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Fund (Rs. 1,50,000)		
minus		
Fixed Expenses (Rs. 1,00,000)		
leaves		
Profit (Rs. 50,000)		

ILLUSTRATION 2. The Himalayan House Ltd. is a large retailer in manufacturing equipment. The company's profit and loss account for the year ended 31st March, 2006 is given below :

	Rs.
Sales	24,00,000
Less : Cost of goods manufactured (variable)	<u>15,00,000</u>
Gross Margin (or Contribution)	9,00,000
Less : Operating Expenses :	Rs.
Selling Expenses	3,00,000
Administration Expenses	<u>1,50,000</u>
	4,50,000
Net Profit	<u>4,50,000</u>

The selling expenses are 90% variable and the administration expenses are 20% variable.
You are required to prepare income statement under the marginal costing.

SOLUTION

INCOME STATEMENT
for the year ended 31st March, 2006

Sales	Rs.
Less : Variable cost :-	
Cost of goods manufactured	15,00,000
Variable selling expenses	2,70,000
Variable administration expenses	<u>30,000</u>
	18,00,000
Contribution	6,00,000
Less : Fixed cost :	
Fixed selling expenses	30,000
Fixed administration expenses	<u>1,20,000</u>
	1,50,000
Net Profit	<u>4,50,000</u>

Advantages of Marginal Costing

The following are the main advantages of marginal costing :

- (1) It is simple to understand and easy to operate.
- (2) The valuation of closing stock under marginal costing is done at marginal cost and thus prevents the illogical carry forward of fixed costs of one period to the next one as part of value of closing stock.
- (3) There is no problem of computing fixed overhead recovery rates and their under or over recovery as fixed overheads are charged against the contribution.
- (4) In marginal costing, it is established that profit is a function of sale and not of production as profit depends on sales volume and not on production volume. This can be verified by preparing a profit statement under marginal costing.
- (5) It facilitates control over variable costs by avoiding arbitrary apportionment or allocation of fixed costs.
- (6) It is a very useful tool of profit planning. It guides the management about the profitability of earning profit at various levels of production and sales.
- (7) It is very valuable technique in decision-making. It provides information to management in making-decisions like make or buy, selling price fixation, export decision etc.
- (8) It provides the management with useful techniques like break even analysis, P/V ratio etc.
- (9) It helps in cost control by concentrating on variable cost as the fixed cost is non-controllable in the short period.
- (10) It helps in evaluation of performance of different departments, divisions and salesmen.
- (11) It is a valuable adjunct to standard costing and budgetary costing.

Limitations (or Disadvantages) of Marginal Costing

Marginal costing technique has certain limitations which must be kept in mind while making use of this technique.

1. The separation of expenses into fixed and variable presents certain technical difficulties whereas marginal costing technique assumes that all expenses can be divided into fixed and variable. In fact, no variable cost is completely variable and no fixed cost is completely fixed. Actually, most of the expenses are semi-variable and it is difficult to segregate them into fixed and variable.
2. Time taken for the completion of jobs is not given due attention because marginal cost excludes fixed expenses which are connected with time. Fixed expenses should be considered if the suitable comparison of two jobs is to be made.
3. With the development of technology, fixed expenses have increased and their impact on production is much more than that of variable expenses. So, a system of costing which ignores fixed expenses is less effective because a significant portion of the cost representing fixed expenses is not taken care of.
4. It is possible that a concern using marginal costing technique may value work-in-progress and finished stock at marginal cost. The arguments against valuing these items at marginal costs are as follows :
 - (a) Balance Sheet will not exhibit a true and fair view because work-in-progress and finished stock will be shown at marginal costs which do not include fixed expenses. Thus, finished stock and work-in-progress will be understated in the Balance Sheet.
 - (b) In case of loss by fire, full loss on account of stock destroyed by fire cannot be recovered from the insurance company because marginal costing technique of valuation of stock will not take fixed expenses into consideration.
5. Marginal costing technique does away with the difficulties involved in the apportionment of overheads because fixed expenses are deducted from total contribution. But the problem of apportionment of variable costs still arises.
6. Marginal costing technique is difficult to apply in contract or shipbuilding industry where the value of work-in-progress is high in relation to turnover. If fixed expenses are not included in the valuation of work-in-progress, losses may occur every year till the contract is completed, while on the completion of the contract there may be huge profits.

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|---|---|
| <p>6. Apportionment of fixed expenses on an arbitrary basis gives rise to over or under absorption of overheads which ultimately makes the product cost inaccurate and unreliable.</p> <p>7. Absorption costing is not very helpful in taking managerial decisions such as whether to accept the export order or not, whether to buy or manufacture, the minimum price to be charged during the depression etc.</p> <p>8. Costs are classified according to functional basis such as production cost, office and administrative cost and selling and distribution cost.</p> <p>9. Absorption costing fails to establish relationship of cost, volume and profit as costs are seldom classified into fixed and variable.</p> | <p>6. Only variable costs are charged to products, marginal cost technique does not lead to over or under absorption of fixed overheads.</p> <p>7. Technique of marginal costing is very helpful in taking managerial decisions because it takes into consideration the additional cost involved only assuming fixed expenses remaining constant.</p> <p>8. Costs are classified according to the behaviour of costs i.e., fixed costs and variable costs.</p> <p>9. Cost, Volume and Profit (i.e., CVP) relationship is an integral part of marginal cost studies as costs are classified into fixed and variable costs.</p> |
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Marginal Cost Equation

For the sake of convenience, elements of costs can be written in the form of an equation as follows :

$$\text{Sales} = \text{Variable Cost} + \text{Fixed Expenses} \pm \text{Profit/Loss}$$

$$\text{Or Sales} - \text{Variable Costs} = \text{Fixed Expenses} \pm \text{Profit/Loss}$$

Or $S - V = F \pm P$ where 'S' stands for sales, V for variable costs, F for fixed expenses, + P for profit and - P for loss.

Or $S - V = C$ because $F \pm P$, i.e., Fixed Expenses + Profit/Loss = Contribution.

In order to make profit, contribution must be more than the fixed expenses and to avoid any loss, contribution must be equal to the fixed expenses.

Marginal cost equation of $S - V = F \pm P$ is very useful to find any of the four factors, i.e., S, V, F or P if three of these factors are known.

ILLUSTRATION 4. Determine the amount of fixed expenses from the following particulars :

Sales Rs. 2,40,000 ; Direct Materials Rs. 80,000 ; Direct Labour Rs. 50,000 ; Variable Overheads Rs. 20,000 and Profit Rs. 50,000.

SOLUTION

The Marginal Cost Equation is

$$S - V = F + P$$

$$S \text{ or Sales} = \text{Rs. } 2,40,000$$

$$V \text{ or Variable Costs} = \text{Rs. } 80,000 + \text{Rs. } 50,000 + \text{Rs. } 20,000 = \text{Rs. } 1,50,000$$

(Direct Materials + Direct Labour + Variable Overheads)

$$P \text{ or Profit} = \text{Rs. } 50,000$$

$$F \text{ or Fixed Expenses} = ? \text{ (not given)}$$

Applying the figures in the equation, we get

$$\text{Rs. } 2,40,000 - \text{Rs. } 1,50,000 = F + \text{Rs. } 50,000$$

$$\text{Or } \text{Rs. } 2,40,000 - \text{Rs. } 1,50,000 - \text{Rs. } 50,000 = F$$

$$\text{Or } \text{Rs. } 40,000 = F$$

$$\therefore \text{Fixed Expenses} = \text{Rs. } 40,000.$$

Break Even (or Cost-Volume-Profit) Analysis

Break even analysis is a logical extension of marginal costing. It is based on the same principles of classifying the operating expenses into fixed and variable. Now-a-days it has become a powerful instrument in the hands of policy makers to maximise profits.

There may be change in the level of production due to many reasons, such as competition, introduction of a new product, trade depression or boom, increased demand for the products, scarce

resources, change in the selling prices of products, etc. In such cases management must study the effect on profit on account of the changing levels of production. A number of techniques can be used as an aid to management in this respect. One such technique is the break even analysis.

The term 'break even analysis' is interpreted in the narrower as well as broader sense. Used in its *narrower sense*, it is concerned with finding out the break even point, i.e., level of activity where the total cost equals total selling price. Used in its *broader sense*, it means that system of analysis which determines the probable profit at any level of production. The break even analysis establishes the relationship of costs, volume and profit ; so this analysis is also known as 'Cost-Volume-Profit Analysis'.

Objectives of Cost-Volume-Profit Analysis

There exists close relationship between the cost, volume and profit. If volume is increased, the cost per unit will decrease and profit per unit will increase. Thus there is direct relation between volume and profit but inverse relation between volume and cost. Analysis of this relationship has become interesting and useful for the cost and management accountant. This analysis may be applied for profit-planning, cost control, evaluation of performance and decision making. The main objectives of such analysis are given below :

- (i) This analysis helps to forecast profit fairly accurately as it is essential to know the relationship between profits and costs on one hand and volume on the other.
- (ii) This analysis is useful in setting up flexible budgets which indicates costs at various levels of activity. We know that sales and variable costs tend to vary with the volume of output. It is necessary to budget the volume first for establishing budgets for sales and variable costs.
- (iii) This analysis assists in evaluation of performance for the purpose of control. In order to review profits achieved and costs incurred, it is necessary to evaluate the effects on costs of changes in volume.
- (iv) This analysis also assists in formulating price policies by showing the effect of different price structures on costs and profits. We are aware that pricing plays an important part in stabilizing and fixing up volumes especially in depression period.
- (v) This analysis helps to know the amount of overhead costs to be charged to the products cost at various levels of operation as we know that pre-determined overhead rates are related to a selected volume of production.

The study of cost volume profit relationship can be made by (i) mathematical relationship between cost, volume and profit and (ii) by preparing break even charts.

In order to understand mathematical relationship between cost, volume and profit, it is desirable to understand the following four concepts, their calculation and applications.

- (i) Contribution
- (ii) Contribution/Sales (C/S) or Profit/Volume (P/V) Ratio
- (iii) Break Even Point
- (iv) Margin of Safety.

Contribution

Contribution is the difference between the sales and the marginal cost of sales and it contributes towards fixed expenses and profit. Suppose selling price per unit is Rs. 15, variable cost per unit Rs. 10, fixed cost Rs. 1,50,000, then contribution per unit will be Rs. 5 (selling price – marginal cost i.e., Rs. 15 – Rs. 10). Contribution for 30,000 units @ Rs. 5 is Rs. 1,50,000 which is sufficient only to meet the fixed costs of Rs. 1,50,000 and no amount is left for profit. If output is 20,000 units, contribution is Rs. 1,00,000 (i.e., 20,000 × Rs. 5) which is not sufficient to meet fixed expenses of Rs. 1,50,000 and the result is a loss of Rs. 50,000. An output of 40,000 units will give a contribution of Rs. 2,00,000 (i.e., 40,000 × Rs. 5) which will be sufficient to meet fixed costs of Rs. 1,50,000 and leave a profit of Rs. 50,000. Thus, contribution will first go to meet fixed expenses and then to earn profit. Contribution can be represented as :

$$\begin{aligned} \text{Contribution} &= \text{Selling Price} - \text{Marginal Cost} \\ \text{or} \quad \text{Contribution} &= \text{Fixed Expenses} + \text{Profit} \\ \text{or} \quad \text{Contribution} - \text{Fixed Expenses} &= \text{Profit} \end{aligned}$$

Difference Between Contribution and Profit

Contribution is different from the profit which is the net gain in activity or the surplus and remains after deducting fixed expenses from the total contribution. The following are the main differences between Contribution and Profit :

<i>Contribution</i>	<i>Profit</i>
(i) Includes fixed cost and profit.	(i) Does not include fixed cost.
(ii) Based on marginal cost concept.	(ii) Based on common man concept.
(iii) Contribution above break even point contributes to profit.	(iii) Profit is expected only after covering variable and fixed costs.
(iv) Contribution analysis requires a knowledge of break even concept.	(iv) Profit does not require any such concept.

In marginal costing, contribution is very important as it helps to find out the profitability of a product, department or division, to have better product mix, for profit planning and to maximise the profits of a concern.

Contribution/Sales (C/S) or Profit/Volume (P/V) Ratio

Profit/volume ratio is one of the most important ratios for studying the profitability of operations of a business and establishes the relationship between contribution and sales. This ratio is calculated as under :

$$\begin{aligned}
 \text{P/V Ratio} &= \frac{\text{Contribution}}{\text{Sales}} \left(\text{i.e., } \frac{C}{S} \right) \\
 \text{Or} &= \frac{\text{Fixed Expenses + Profit}}{\text{Sales}} \left(\text{i.e., } \frac{F + P}{S} \right) \\
 \text{Or} &= \frac{\text{Sales - Variable Costs}}{\text{Sales}} \left(\text{i.e., } \frac{S - V}{S} \right) \\
 \text{Or} &= \frac{\text{Change in Profits or Contributions}}{\text{Change in Sales}}
 \end{aligned}$$

Ratio can also be shown in the form of a percentage if the formula is multiplied by 100.

Thus, if selling price is Rs. 15 and the marginal cost is Rs. 10 then P/V ratio

$$= \frac{\text{Rs. } 15 - \text{Rs. } 10}{\text{Rs. } 15} = \frac{5}{15} = \frac{1}{3} \quad \text{or} \quad \frac{1 \times 100}{3} = 33\frac{1}{3}\%$$

In the above example, for every Rs. 100 of sales, contribution is $33\frac{1}{3}\%$. A sale of every Rs. 100 will bring a profit of Rs. $33\frac{1}{3}$ after fixed expenses are met. Comparison of P/V ratios for different products can be made to find out which product is more profitable. Higher the P/V ratio, more will be the profit and lower the P/V ratio, lesser will be the profit. Hence, it should be the goal of every concern to increase or improve the P/V ratio. It can be done by :

- (a) Increasing the selling price per unit ;
- (b) Reducing direct and variable costs by effectively utilising men, machines and materials ;
- (c) Switching the production to more profitable products showing a higher P/V ratio.
- (d) Reducing the share of low margin products in the total sales and increasing the share of high margin products.

P/V ratio is very useful and is used for the calculation of :

$$(i) \text{ Break Even Point} = \frac{\text{Fixed Costs (i.e. FC)}}{\text{P/V Ratio}}$$

$$(ii) \text{ Value of sales to earn a desired amount of profit :}$$

$$\frac{\text{Fixed Costs + Desired Profit}}{\text{P/V Ratio}}$$

- (iii) Variable Costs = Sales (1 - P/V Ratio)
- (iv) Profit = (Sales × P/V Ratio) - Fixed Cost
- (v) Fixed Cost = (Sales × P/V Ratio) - Profit
- (vi) Margin of Safety = $\frac{\text{Profit}}{\text{P/V Ratio}}$

ILLUSTRATION 5. Calculate P/V Ratio from the following information :

Given : Selling price Rs. 10 per unit, Variable cost per unit Rs. 6.

Given the profits and sales of two periods as under :

	<i>Sales</i>	<i>Profits</i>
	Rs.	Rs.
2005	1,50,000	20,000
2006	1,70,000	25,000

SOLUTION

$$(i) \text{ P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{\text{Rs. 4}}{\text{Rs. 10}} \times 100 = 40\%$$

$$\text{Contribution} = \text{S.P.} - \text{V.C. i.e., Rs. 10} - \text{Rs. 6} = \text{Rs. 4}$$

$$(ii) \text{ P/V Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 = \frac{\text{Rs. 5,000}}{\text{Rs. 20,000}} \times 100 = 25\%$$

Break Even Point

A business is said to break even when its total sales are equal to its total costs. It is a point of profit no loss. At this point, contribution is equal to fixed cost. A concern which attains break point at less number of units will definitely be better from another concern where break even is achieved at more units of production.

The break even point can be calculated by the following formula :

Break Even Point (in units)

$$= \frac{\text{Total Fixed Expenses}}{\text{Selling Price per unit} - \text{Marginal Cost per unit}}$$

$$= \frac{\text{Total Fixed Expenses}}{\text{Contribution per unit}}$$

Cash Break Even Point

$$= \frac{\text{Cash Fixed Cost}}{\text{Contribution per unit}}$$

Break Even Point Based on Total Sales

Marginal cost equation is :

$$S - V = F \pm P$$

Or $S - V = F + \text{Nil}$ (at break even point profit is nil)

∴ For BEP, the equation is : .

$$S - V = F$$

$$\text{Or } \frac{S - V}{S - V} = \frac{F}{S - V} \text{ (dividing both sides by } S - V)$$

$$\text{Or } 1 = \frac{F}{S - V}$$

$$\text{Or } S \times 1 = \frac{F \times S}{S - V} \text{ (multiplying both sides by } S)$$

∴ Formula for the calculation of break even sales is : $\frac{F \times S}{S - V}$ or $\frac{\text{Fixed Cost}}{\text{P/V Ratio}}$

ILLUSTRATION 6. From the following particulars calculate (i) Contribution (ii) P/V Ratio (iii) Break even point in units and in rupees. (iv) What will be the selling price per unit if the break even point is brought down to 25,000 units?

	Rs.
Fixed Expenses	1,50,000
Variable Cost per unit	10
Selling Price per unit	15

SOLUTION

$$(i) \text{Contribution} = \text{Selling Price per unit} - \text{Variable Cost per unit}$$

$$= \text{Rs. } 15 - \text{Rs. } 10 = \text{Rs. } 5.$$

$$(ii) \text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{\text{Rs. } 5}{\text{Rs. } 15} \times 100 = 33\frac{1}{3}\%$$

$$(iii) \text{Break even point (in units)} = \frac{\text{Fixed Expenses}}{\text{Contribution per unit}} = \frac{\text{Rs. } 1,50,000}{\text{Rs. } 5} = 30,000 \text{ units.}$$

$$\text{Break even points (in rupees)} = \frac{\text{Fixed Expenses}}{\text{P/V Ratio}} = \frac{\text{Rs. } 1,50,000}{33\frac{1}{3}\%} = \text{Rs. } 4,50,000.$$

$$(iv) \text{Break even point (in units)} = \frac{\text{Fixed Expenses}}{\text{Contribution per unit}}$$

$$\text{Or Contribution per unit} = \frac{\text{Fixed Expenses}}{\text{Break even point (in units)}} = \frac{\text{Rs. } 1,50,000}{25,000} = \text{Rs. } 6.$$

$$\text{Selling price} = \text{Variable cost} + \text{Contribution per unit}$$

$$= \text{Rs. } 10 + \text{Rs. } 6 = \text{Rs. } 16.$$

Calculation of Output or Sales Value at which a Profit is Earned

Formula for the calculation of output to earn a certain amount (target) of profit is as follows :

$$\frac{\text{Fixed Expenses} + \text{Desired Profit}}{\text{Selling Price per unit} - \text{Marginal Cost per unit}}$$

$$\text{Or} \quad \frac{\text{Fixed Expenses} + \text{Desired Profit}}{\text{Contribution per unit}}$$

$$\text{Or} \quad \frac{\text{Target Profit}}{\text{Income Tax rate}} + \frac{\text{Fixed Expenses} + \text{Desired Profit}}{\text{Contribution per unit}}$$

The formula for the calculation of sales value to earn a certain amount of profit is $\frac{(F + P)S}{S - V}$. It is derived as follows :

The marginal cost equation is :

$$S - V = F + P$$

Multiplying both sides by S, we get

$$(S - V)S = (F + P)S$$

$$\text{Or} \quad S = \frac{(F + P)S}{S - V}$$

$$\text{Or Sales to earn a profit} = \frac{(F + P)S}{S - V} \quad \text{or} \quad \frac{F + P}{\text{P/V Ratio}}$$

ILLUSTRATION 7. From the following data, calculate :

(i) Break even point expressed in amount of sales in rupees.

(ii) Number of units that must be sold to earn a profit of Rs. 1,20,000 per year.

- (iii) How many units are to be sold to earn a net income of 15% of sales ?
 (iv) Number of units to be sold to earn a target profit of Rs. 1,05,000 after income tax.
 (Assume Income Tax Rate to be 50%)

	Rs.
Selling Price per unit	40
Variable Manufacturing Cost per unit	22
Variable Selling Cost per unit	3
Fixed Factory Overheads	1,60,000
Fixed Selling Cost	20,000

SOLUTION

- (i) Break Even Point (in units)

$$\begin{aligned} & \frac{\text{Fixed Expenses}}{\text{Selling Price per unit} - \text{Marginal Cost per unit}} \\ & = \frac{\text{Rs. } 1,60,000 + \text{Rs. } 20,000}{\text{Rs. } 40 - \text{Rs. } 25} = \frac{\text{Rs. } 1,80,000}{\text{Rs. } 15} = 12,000 \text{ units.} \end{aligned}$$

(Marginal Cost = Variable Manufacturing Cost + Variable Selling Cost)

$$\begin{aligned} \text{Break Even Point (In Sales value)} &= \text{Break even units} \times \text{Selling price per unit} \\ &= 12,000 \times \text{Rs. } 40 = \text{Rs. } 4,80,000. \end{aligned}$$

- (ii) Output to earn a profit of Rs. 1,20,000 :

$$\begin{aligned} & \frac{\text{Fixed Expenses} + \text{Profit}}{\text{Selling Price per unit} - \text{Marginal Cost per unit}} \\ & = \frac{\text{Rs. } 1,80,000 + \text{Rs. } 1,20,000}{\text{Rs. } 40 - \text{Rs. } 25} = \frac{\text{Rs. } 3,00,000}{\text{Rs. } 15} = 20,000 \text{ units} \end{aligned}$$

- (iii) Suppose Number of units to be sold = N.

$$N = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{Contribution per unit}}$$

$$N = \frac{\text{Rs. } 1,80,000 + \frac{15}{100}(\text{N} \times \text{Rs. } 40)}{\text{Rs. } 15}$$

$$15N = 1,80,000 + 6N$$

$$\text{or } 9N = 1,80,000$$

$$N = 20,000 \text{ units.}$$

$$(iv) \text{Sales in units} = \frac{\text{Fixed Cost} + \frac{\text{Target Profit}}{\text{Income Tax Rate}}}{\text{Contribution per unit}}$$

$$\begin{aligned} & = \frac{\text{Rs. } 1,80,000 + \frac{\text{Rs. } 1,05,000}{1 - .5}}{\text{Rs. } 15} \\ & = \frac{\text{Rs. } 3,90,000}{15} = 26,000 \text{ units} \end{aligned}$$

ILLUSTRATION 8. M Ltd. manufactures three products P, Q and R. The unit selling prices of these products are Rs. 100, Rs. 80 and Rs. 50 respectively. The corresponding unit variable costs are Rs. 50, Rs. 40 and Rs. 20. The proportions (quantity-wise) in which these products are manufactured and sold are 20%, 30% and 50% respectively. The total fixed costs are Rs. 14,80,000.

Given the above information, you are required to work out the overall break-even quantity and the product-wise break up of such quantity.

SOLUTION**CALCULATION OF BREAK EVEN QUANTITY**

	Products			Overall
	P	Q	R	
	Rs.	Rs.	Rs.	
	100 50	80 40	50 20	
Selling price per unit	50	40	30	
Less : Variable cost per unit				
Contribution per unit				
Quantity-wise proportion of the products manufactured and sold	20% Rs. 10 (50 × 20%)	30% Rs. 12 (40 × 30%)	50% Rs. 15 (30 × 50%)	Rs. 37
Weighted Contribution Margin (Contribution × Proportion of Quantity)				Rs. 14,80,000 40,000 units
Total Fixed Costs				
Overall Break Even Quantity	8,000 units	12,000 units	20,000 units	$\left(\frac{\text{Rs. } 14,80,000}{\text{Rs. } 37} \right)$ 40,000 units
$\left(\frac{\text{Total Fixed Cost}}{\text{Overall Contribution Margin}} \right)$				
Production-wise Break Even Quantity				
(Total Break Even Quantity × Proportion)	(40,000 × 20%)	(40,000 × 30%)	(40,000 × 50%)	

ILLUSTRATION 9. Sale of a product amounts to 1,000 units per annum at Rs. 500 per unit. Fixed overheads are Rs. 1,00,000 per annum and variable cost Rs. 300 per unit. There is a proposal to reduce the price by 20%. Calculate present and future P/V ratio and break even point (in units). How many units must be sold to maintain total profit ?

SOLUTION

	Present Position	After price reduction
	Rs.	Rs.
	500	400
	300	300
	<u>200</u>	<u>100</u>
Selling Price per unit		
Less : Variable Cost per unit		
Contribution per unit		
P/V Ratio		
$\frac{\text{Contribution}}{\text{Sales}} \times 100$	$\frac{200}{500} \times 100 = 40\%$	$\frac{100}{400} \times 100 = 25\%$ Break
Fixed Cost		
= $\frac{\text{Fixed Cost}}{\text{Contribution per unit}}$		
Present Profit = Contribution - Fixed Cost	$\frac{200}{500} \times 1,00,000 = 500 \text{ units}$ $200 \times 1,000 - 1,00,000 = \text{Rs. } 1,00,000$	$\frac{\text{Rs. } 1,00,000}{\text{Rs. } 100} = 1,000 \text{ units}$ Fixed Cost + Profit
Units to be sold to maintain total profit		$\text{Contribution per unit} = \frac{\text{Rs. } 1,00,000 + \text{Rs. } 1,00,000}{\text{Rs. } 100} = 2,000 \text{ units}$

ILLUSTRATION 10. An analysis of costs of Sullivan Manufacturing Company led to the following information :

Cost Elements	Variable Costs (Percentage of Sales)	Fixed Costs Rs.
Direct Materials	32.8	
Direct Labour	28.4	
Factory Overheads	12.6	1,39,900
Distribution Expenses	4.1	58,400
General and Administrative Expenses	1.1	66,700

Budgeted sales for the next year are Rs. 18,50,000.

You are required to determine—

- (i) the break-even sales volume,
- (ii) the profit at the budgeted sales volume,
- (iii) the profit, if actual sales—
 - (a) drop by 10 per cent.
 - (b) increase by 5 per cent from budgeted sales.

(CS—Inter)

SOLUTION

Percentage of variable cost to sales is 79% calculated as follows :

Direct Materials	32.8% of sales
Direct Labour	28.4% of sales
Factory Overheads	12.6% of sales
Distribution Expenses	4.1% of sales
General and Administrative Expenses	1.1% of sales
Total Variable Cost	79% of sales

$$\therefore \text{Percentage of Contribution to Sales} = 100 - 79 = 21.$$

(Contribution = Sales – Variable Cost)

$$\text{P/V Ratio (Profit/Volume Ratio)} = \frac{\text{Contribution}}{\text{Sales}} = \frac{21}{100} \text{ or } 21\%$$

(i) Break Even Sales Volume

$$\begin{aligned} &= \frac{\text{Fixed Costs}}{\text{P/V Ratio}} = \frac{\text{Rs. } 1,89,900 + \text{Rs. } 58,400 + \text{Rs. } 66,700}{21/100} \\ &= \text{Rs. } 3,15,000 \times \frac{100}{21} = \text{Rs. } 15,00,000 \end{aligned}$$

(ii) Profit at the budgeted sales of Rs. 18,50,000

$$\text{Percentage of Contribution to Sales} = 21$$

∴ Contribution at the budgeted sales of Rs. 18,50,000

$$= \text{Rs. } 18,50,000 \times \frac{21}{100} = \text{Rs. } 3,88,500$$

$$\begin{aligned} \text{Profit} &= \text{Contribution} - \text{Fixed Expenses} \\ &= \text{Rs. } 3,88,500 - \text{Rs. } 3,15,000 = \text{Rs. } 73,500. \end{aligned}$$

(iii) (a) Profit if actual sales drop by 10%

	Rs.
Budgeted Sales	18,50,000
Less : 10% Decline	<u>1,85,000</u>
Actual Sales	<u>16,65,000</u>
Contribution @ 21% of sales = $\text{Rs. } 16,65,000 \times \frac{21}{100} =$	3,49,650
Less : Fixed Expenses	<u>3,15,000</u>
Profit	<u>34,650</u>

(b) Profit if actual sales increase by 5% from budgeted sales

Budgeted Sales	18,50,000
Add : 5% increase	92,500
Actual Sales	<u>19,42,500</u>
Contribution @ 21% on Sales = $\frac{\text{Rs. } 19,42,500 \times 21}{100} =$	4,07,925
Less : Fixed Expenses	<u>3,15,000</u>
Profit	<u>92,925</u>

ILLUSTRATION 11. The fixed costs amount to Rs. 1,50,000 and the percentage of variable costs to sales is given to be $66\frac{2}{3}\%$. If 100% capacity sales at normal are Rs. 9,00,000, find out the break even point and the percentage sales when it occurs. Determine profit at 80% capacity sales.

SOLUTION

Percentage of variable costs to sales is $66\frac{2}{3}\%$ i.e., $\frac{200}{3}$

Percentage of contribution to sales is $100 - \frac{200}{3} = \frac{100}{3}$

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{100}{3} \times \frac{1}{100} = \frac{1}{3} \text{ or } \frac{1}{3} \times 100 = 33\frac{1}{3}\%$$

$$\text{B.E.P.} = \frac{\text{Fixed Expenses}}{\text{P/V Ratio}} = \text{Rs. } \frac{1,50,000}{1/3} = 1,50,000 \times \frac{3}{1} = \text{Rs. } 4,50,000$$

100% Capacity Sales = Rs. 9,00,000

$$\therefore \text{B.E.P. occurs at } \frac{\text{Rs. } 4,50,000}{\text{Rs. } 9,00,000} \times 100 = 50\%$$

Profit at 80% capacity sales :

100% Capacity Sales Rs. 9,00,000

$$\therefore 80\% \text{ Capacity Sales } 9,00,000 \times \frac{80}{100} = \text{Rs. } 7,20,000.$$

	Rs.
Variable costs at 80% capacity sales ($66\frac{2}{3}\%$ of Rs. 7,20,000)	4,80,000
Fixed Costs	<u>1,50,000</u>
Total Cost	6,30,000
Sales	<u>7,20,000</u>
Profit at 80% capacity sales	<u>90,000</u>

Margin of Safety

Margin of safety is the difference between the actual sales and the sales at break even point. One of the assumptions of marginal costing is that output will coincide sales, so margin of safety is also the excess production over the break even point's output. Sales or output beyond break even point is known as margin of safety because it gives some profit, at break even point only fixed expenses are recovered. Margin of safety can also be expressed in percentage. For example, if present sales are Rs. 4,00,000 and break even sales are Rs. 3,00,000, margin of safety is Rs.

1,00,000 i.e., $\text{Rs. } 4,00,000 - \text{Rs. } 3,00,000$ or $25\% \left(\text{i.e. } \frac{\text{Rs. } 1,00,000}{\text{Rs. } 4,00,000} \times 100 \right)$. Thus, formula for the calculation of margin of safety is :

Margin of Safety (M/S) = Present Sales – Break Even Sales

Margin of Safety can also be calculated with the help of the following formula :

$$\text{Margin of Safety (M/S)} = \frac{\text{Profit}}{\text{P/V Ratio}}$$

Margin of safety is that sales or output which is above break even point. All fixed expenses are recovered at break even point ; so fixed expenses have been excluded from the formula of margin of safety given above. Margin of safety is that sales which gives us profit after meeting fixed costs ; so formula of its calculation takes only profit.

If the margin of safety is large, it is an indicator of the strength of a business because with a substantial reduction in sales or production, profit shall be made. On the other hand, if the margin is small, a small reduction in sales or production will be a serious matter and lead to loss. The margin of safety at break even point is nil because actual sales volume is just equal to the break even sales.

Efforts should be made by the management to increase (or improve) the margin of safety so that more profit may be earned. This margin can be increased by taking the following steps :

- (i) Increase the level of production. (Sales volume) provided the capacity is available.
- (ii) Increase the selling price.
- (iii) Reduce the fixed or the variable costs or both.
- (iv) Substitute the existing products by more profitable products.

ILLUSTRATION 12. A company has fixed expenses of Rs. 90,000 with sales at Rs. 3,00,000 and a profit of Rs. 60,000 during the first half year. If in the next half year, the company suffered a loss of Rs. 30,000, Calculate :

- (a) The P/V ratio, break even point and margin of safety for the first half year.
- (b) Expected sales volume for next half year assuming that selling price and fixed expenses remain unchanged.
- (c) The break even point and margin of safety for the whole year.

SOLUTION

$$(a) \text{ P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{\text{Rs. } 1,50,000}{\text{Rs. } 3,00,000} \times 100 = 50\%$$

$$\text{Break Even Point} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{\text{Rs. } 90,000}{50\%} = \text{Rs. } 1,80,000.$$

$$\begin{aligned} \text{Margin of Safety} &= \text{Actual Sales} - \text{Break Even Sales} = \text{Rs. } 3,00,000 - \text{Rs. } 1,80,000 \\ &= \text{Rs. } 1,20,000. \end{aligned}$$

$$(b) \text{ Expected Sales Volume} = \frac{\text{Fixed Cost} - \text{Loss}}{\text{P/V Ratio}} = \frac{\text{Rs. } 90,000 - \text{Rs. } 30,000}{50\%} = \text{Rs. } 1,20,000.$$

$$(c) \text{ Break Even Point (for the whole year)} = \frac{\text{Fixed cost for the whole year}}{\text{P/V Ratio}} = \frac{\text{Rs. } 1,80,000}{50\%} = \text{Rs. } 3,60,000.$$

$$\begin{aligned} \text{Margin of Safety} &= \text{Actual Sales} - \text{Break Even Sales} = \text{Rs. } 4,20,000 - \text{Rs. } 3,60,000 \\ &= \text{Rs. } 60,000. \end{aligned}$$

ILLUSTRATION 13. Assuming that the cost structure and selling prices remain the same in Periods I and II, find out :

(a) Profit Volume Ratio ;

(b) Fixed Cost ;

(c) Break Even Point for Sales ;

(d) Profit when Sales are of Rs. 1,00,000 ; $1,00,000 \times 140,000$

(e) Sales required to earn a Profit of Rs. 20,000 ; and $150,000 \times 25,000$

(f) Margin of Safety at a profit of Rs. 15,000 ; $25,000 \times 35,000$

(g) Variable cost in Period II

Period	Sales	Profit
	Rs.	Rs.
I	1,20,000	130,000
II	1,40,000	150,000

SOLUTION

$$(a) \text{ P/V Ratio} = \frac{\text{Change in Profits}}{\text{Change in Sales}} \times 100 = \frac{\text{Rs. } 4,000}{\text{Rs. } 20,000} \times 100 = 20\%$$

$$\begin{aligned} (b) \text{ Fixed Cost} &= (\text{Sales} \times \text{P/V Ratio}) - \text{Profit} = \text{Rs. } \left(1,20,000 \times \frac{1}{5} \right) - \text{Rs. } 9,000 \\ &= \text{Rs. } 24,000 - \text{Rs. } 9,000 = \text{Rs. } 15,000. \end{aligned}$$

$$(c) \text{ Break Even Point (in rupees)} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{\text{Rs. } 15,000}{20\%} = \text{Rs. } 75,000.$$

$$(d) \text{ Profit} = (\text{Sales} \times \text{P/V Ratio}) - \text{Fixed Cost} = \left(1,00,000 \times \frac{1}{5}\right) - \text{Rs. } 15,000 = \text{Rs. } 5,000.$$

$$(e) \text{ Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{\text{Rs. } 15,000 + \text{Rs. } 20,000}{20\%} = \text{Rs. } 1,75,000.$$

$$(f) \text{ Margin of Safety} = \frac{\text{Profit}}{\text{P/V Ratio}} = \frac{\text{Rs. } 15,000}{20\%} = \text{Rs. } 75,000.$$

$$(g) \text{ Variable Cost in Period II} = (1 - \text{P/V Ratio}) \times \text{Sale}$$

$$= \frac{80}{100} \times \text{Rs. } 1,40,000 = \text{Rs. } 1,12,000.$$

ILLUSTRATION 14. The profit volume (P/V) ratio of B B & Co. dealing in precision instruments is 50% and the margin of safety is 40%.

You are required to work out the break-even point and the net profit if the sale volume is Rs. 50 lakhs.

SOLUTION

Calculation of Sales at Break-even Point

Sales	Rs. 50,00,000
<i>Less : Margin of Safety 40% (i.e. Rs. 50,00,000 × $\frac{40}{100}$)</i>	20,00,000
	<hr/>
	30,00,000
	<hr/>
	50%

P/V Ratio

Therefore, Contribution or Fixed Expenses at

B.E.P. (50% of Rs. 30,00,000)

Calculation of Net Profit at Sales Volume of Rs. 50,00,000

Contribution on Rs. 50,00,000 Sales

$\left(\text{Sales} \times \text{P/V Ratio i.e., Rs. } 50,00,000 \times \frac{50}{100} \right)$	Rs. 25,00,000
	<hr/>
	15,00,000
	<hr/>
<i>Less : Fixed Expenses</i>	10,00,000
	<hr/>

Profit

ILLUSTRATION 15. Comment on the economic soundness of the following firms :

	<i>Firm A</i>	<i>Firm B</i>
	Rs.	Rs.
Current Sales Volume	3,00,000	3,00,000
Break Even Sales Volume	2,00,000	2,00,000
Margin of Safety	1,00,000	1,00,000
Fixed Cost	1,00,000	60,000

SOLUTION

	<i>Firm A</i>	<i>Firm B</i>
	Rs.	Rs.
Break Even Sales	2,00,000	2,00,000
Fixed Cost or Contribution	1,00,000	60,000
(At B.E.P. Contribution is equal to Fixed Cost)	50%	30%
<i>P/V Ratio (i.e. $\frac{\text{Contribution}}{\text{Sales}} \times 100$)</i>	$\left(\frac{1,00,000}{2,00,000} \times 100 \right)$	$\left(\frac{60,000}{2,00,000} \times 100 \right)$

	Rs.	Rs.
Current Sales Volume	3,00,000	3,00,000
Contribution on Current Sales Volume (i.e., Sales \times P/V Ratio)	1,50,000	90,000
Less : Fixed Cost	$(3,00,000 \times 50\%)$	$(3,00,000 \times 30\%)$
Profit	$1,00,000$	60,000
	$50,000$	30,000

Comment : Firm A is more sound as compared to Firm B because it gives excess profit of Rs. 20,000 (i.e., Rs. 50,000 – Rs. 30,000). It is because of higher P/V ratio of 50%. Higher the P/V ratio, the better it is. Firm A will start earning profit @ 50% on sales after B.E.P. whereas firm B will earn profit @ 30% on sales in excess of break even sales.

Effect of Price Reduction on P/V Ratio, B.E. Point and Margin of Safety

In order to see the effect of certain changes on P/V ratio, breakeven point and margin of safety, the following data is assumed :

	Original	After 10% increase
No. of Units Produced & Sold	8,000	8,800
Unit Selling Price	Rs. 20	Rs. 22
Unit Variable Cost	Rs. 10	Rs. 11
Total Fixed Costs	Rs. 40,000	Rs. 44,000
Contribution	Rs. 10 (Rs. 20 – Rs. 10)	Rs. 22 – Rs. 10 = Rs. 12 II
		Rs. 20 – Rs. 11 = Rs. 9

	<i>Present Solution</i>	<i>Increase in per unit selling price</i>	<i>Increase in per unit variable cost</i>	<i>Increase in total fixed costs</i>	<i>Increase in no. of units sold</i>
P/V ratio = Contribution Sales	$\frac{\text{Rs. } 10}{\text{Rs. } 20} \times 100$ $= 50\%$	$\frac{\text{Rs. } 12}{\text{Rs. } 22} \times 100 =$ 54.55%	$\frac{9}{20} \times 100$ $= 45\%$	No effect	No effect
Break Even Point = Fixed Costs P/V Ratio	$\frac{\text{Rs. } 40,000}{50\%}$ $= \text{Rs. } 80,000$	$\frac{\text{Rs. } 40,000}{6}$ $= \frac{11}{\text{Rs. } 73,333}$	$\frac{\text{Rs. } 40,000}{45\%}$ $= \text{Rs. } 88,889$	$\frac{\text{Rs. } 44,000}{50\%}$ $= \text{Rs. } 88,000$	No effect
Margin of Safety = Total Sales – BEP Sales	$\text{Rs. } 1,60,000 -$ $\text{Rs. } 80,000$ $= \text{Rs. } 80,000$	$\text{Rs. } 1,76,000 -$ $\text{Rs. } 73,333$ $= \text{Rs. } 1,02,667$	$\text{Rs. } 1,60,000 -$ $\text{Rs. } 88,889$ $= \text{Rs. } 71,111$	$\text{Rs. } 1,60,000 -$ $\text{Rs. } 88,000$ $= \text{Rs. } 72,000$	$(8,800 \times \text{Rs. } 20) -$ $\text{Rs. } 80,000 =$ $\text{Rs. } 1,76,000 -$ $\text{Rs. } 80,000 =$ $= \text{Rs. } 96,000$

From the above it is clear that if

$S \cdot P \uparrow - P V \uparrow \rightarrow B E P \downarrow \rightarrow M O S \uparrow$

- (i) there is increase in selling price per unit it will increase the P/V ratio reduce the break even point and increase the margin of safety. If there is reduction in price per unit, it will decrease the P/V ratio, increase the break even point and shorten the margin of safety.
- (ii) there is increase in variable cost per unit, it will decrease the P/V ratio, increase the break even point and shorten the margin of safety.
- (iii) there is increase in total fixed costs, there will no effect on P/V ratio, increase the break even point and shorten the margin of safety.
- (iv) there is increase in no. of units sold, it will have no effect on P/V ratio and break even point but will increase the margin of safety.

ILLUSTRATION 16. The selling price of a product was Rs. 200 per unit, as against its variable cost of Rs. 100 per unit. The total fixed costs were Rs. 2,00,000. Calculate the effect of a reduction in price by Rs. 40 on the P/V Ratio, Break Even Point and Margin of Safety, if 4,000 units were produced and sold.

SOLUTION

	<i>Before Price Reduction</i>	<i>After Price Reduction</i>
	Rs.	Rs.
Selling Price per unit	200	160
Less : Variable cost per unit	100	100
Contribution per unit	100	60
Total Fixed Cost	Rs. 2,00,000	Rs. 2,00,000
P/V Ratio $\left[\frac{\text{Contribution}}{\text{Sales}} \times 100 \right]$	$\frac{100}{200} \times 100 = 50\%$	$\frac{60}{160} \times 100 = 37.5\%$
Break Even Point		
	$\frac{\text{Fixed Cost}}{\text{P/V Ratio}}$	$\frac{2,00,000}{37.5\%}$
		= Rs. 5,33,333
Total Sales	4,000 \times Rs. 200	4,000 \times Rs. 160
Margin of Safety = (Total Sales - Break even Sales)	= Rs. 8,00,000 Rs. 8,00,000 - Rs. 4,00,000 = Rs. 4,00,000	= Rs. 6,40,000 = Rs. 6,40,000 - Rs. 5,33,333 = Rs. 1,06,667

From the above, it is clear that effect of price reduction is always to reduce P/V ratio, to raise the break even point and to shorten the margin of safety.

BREAK EVEN CHART

A break-even chart is a graphical representation of marginal costing. It is considered to be one of the most useful graphic presentation of accounting data. It is a readable reporting device that would otherwise require voluminous reports and tables to make the accounting data meaningful to the management. This chart shows the inter-relationship between cost, volume and profit. It shows the break-even point and also indicates the estimated cost and estimated profit or loss at various volumes of activity. There are three methods of drawing a break-even chart. These have been explained with the help of the following illustration :

ILLUSTRATION 17. From the following data, calculate the break even point and profit if output is 50,000 units by drawing a break even chart.

<i>Production</i>	<i>Fixed Expenses</i>	<i>Variable Cost per unit</i>	<i>Selling Price per unit</i>	<i>Total Cost</i>	<i>Total Sales</i>
(Units)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)
0	1,50,000	10	15	1,50,000	0
10,000	1,50,000	10	15	2,50,000	1,50,000
20,000	1,50,000	10	15	3,50,000	3,00,000
30,000	1,50,000	10	15	4,50,000	4,50,000
40,000	1,50,000	10	15	5,50,000	6,00,000
50,000	1,50,000	10	15	6,50,000	7,50,000
60,000	1,50,000	10	15	7,50,000	9,00,000

SOLUTION

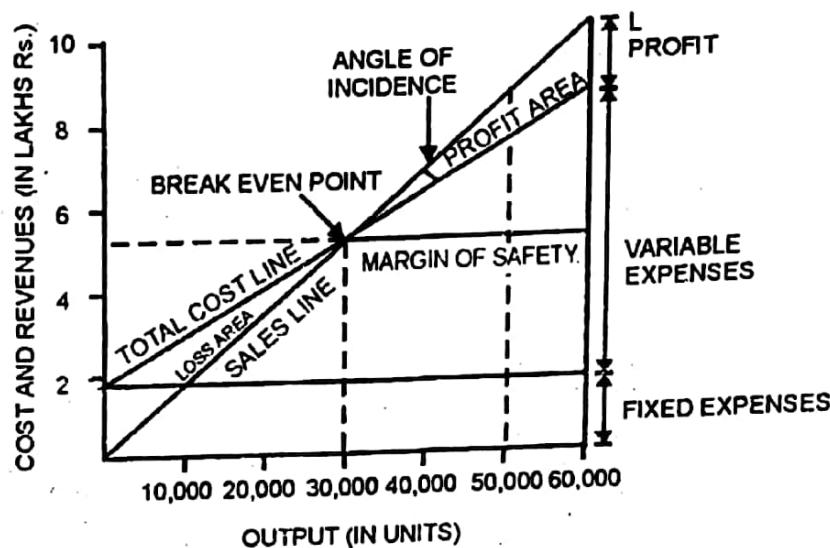
First Method. On the X-axis of the graph is plotted the number of units produced, sold and on the Y-axis are shown costs and sales revenues.

The fixed cost line is drawn parallel to X-axis. This line indicates that fixed expenses remain the same with any volume of production. The variable costs for different levels of activity are plotted over the fixed cost line. The variable cost line is joined to fixed cost line at zero volume of production. This line can also be regarded as the total cost line because it starts from the point where fixed cost has been incurred and variable

Absorption Costing and Marginal Costing

cost is zero. Sales values at various levels of output are plotted, joined and the resultant line is the sales line. The sales line will cut the

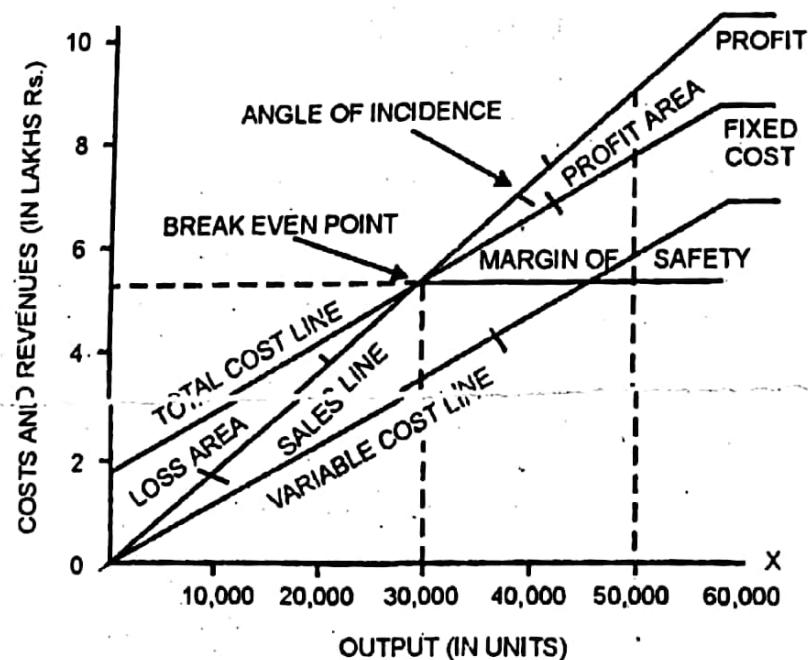
BREAK EVEN CHART



total cost line at a point where the total costs are equal to total revenues and this point of intersection of two lines is known as break even point—the point of no profit no loss. The number of units to be produced at the break even point is determined by drawing a perpendicular to the X-axis from the point of intersection and measuring the horizontal distance from the zero point to the point at which the perpendicular is drawn. The sales value at break even point is determined by drawing a perpendicular to the Y-axis from the point of intersection and measuring the vertical distance from the zero point to the point at which the perpendicular is drawn. Loss and profit are as have been shown in the chart which show that if production is less than the break even point, the business shall be running at a loss and if the production is more than the break even level, profit shall result.

Second Method. A variation of the first method is that variable cost line is plotted first and then fixed cost line over the variable cost line. The latter line is the total cost line because it is drawn over the variable cost line and represents the total cost (variable and fixed) at various levels of output. This method is more helpful to the management for decision making because it shows the recovery of fixed costs at various levels of production before profits are realised. Contributions at various levels of production are automatically disclosed in the chart.

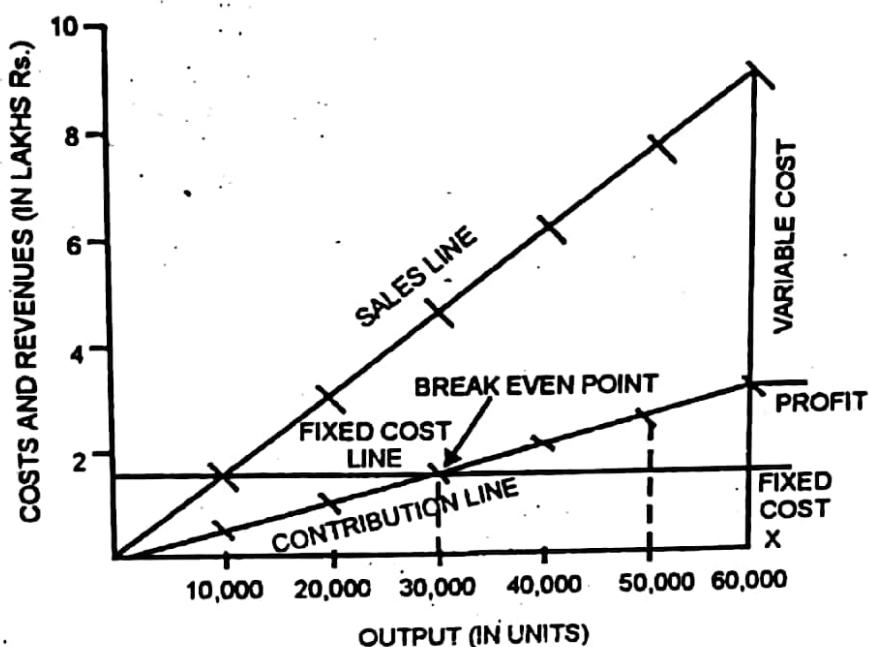
BREAK EVEN CHART



Third Method. Under this method, the fixed cost line is drawn parallel to the X-axis. The contribution line is drawn from the origin and this line goes up with the increase in output. The sales line is plotted as usual. The question of interaction of sales line with cost line does not arise because the total cost line is not

drawn in this method. In this method, break even point is that point where the contribution line cuts the fixed cost line. At this point, contribution is equal to fixed expenses and there is no profit no loss.

BREAK EVEN CHART



If the contribution is more than the fixed expenses, profit shall arise and if the contribution is less than the fixed expenses, loss shall arise. In this example there is a profit of Rs. 1,00,000 when the output is 50,000 units. At this level of output, contribution is Rs. 2,50,000 (i.e., 50,000 units @ Rs. 5), and fixed cost is Rs. 1,50,000, resulting in a profit of Rs. 1,00,000, i.e., contribution minus fixed cost.

Arithmetical Verification

$$\text{Break Even Point} = \frac{\text{Fixed Expenses}}{\text{Contribution per unit}} = \frac{\text{Rs. } 1,50,000}{\text{Rs. } 5} = 30,000 \text{ units of output}$$

or $30,000 \text{ units} \times \text{Selling price}$
 $= 30,000 \times \text{Rs. } 15 = \text{Rs. } 4,50,000 \text{ sales}$

Profit when the output is 50,000 units	
Contribution for 50,000 units @ Rs. 5	= Rs. 2,50,000
Less : Fixed Expenses	= Rs. 1,50,000
Profit	<u><u>= Rs. 1,00,000</u></u>

Angle of Incidence

This is the angle formed at the break even point at which the sales line cuts the total cost line. This angle indicates *rate at which profits are being made*. Large angle of incidence is an indication that profits are being made at a high rate. On the other hand, a small angle indicates a low rate of profit and suggests that variable costs form the major part of cost of production. A large angle of incidence with a high margin of safety indicates the most favourable position of a business and even the existence of monopoly conditions.

Relationship between Angle of Incidence, Break even Sales and Margin of Safety

When break even sales are very low, with large angle of incidence, it indicates that the firm is enjoying business stability and in that case margin of safety sales will also be high.

When break even sales are low, but not very low with moderate angle of incidence, in that case, though the business is stable, the profit earning rate is not very high as in earlier case.

Contrary to above, when break even sales are high, angle of incidence will be narrow with much low margin of safety sales.

Assumptions Underlying Break Even Chart

1. All costs can be separated into fixed and variable costs.
2. Fixed costs will remain constant and will not change with the change in level of output.

3. Variable costs will fluctuate in the same proportion in which the volume of output varies. In other words, prices of variable cost factors i.e., wage rates, price of material etc. will remain unchanged.
4. Selling price will remain constant even though there may be competition or change in volume of production.
5. The number of units produced and sold will be the same so that there is no opening or closing stock.
6. There will be no change in operating efficiency.
7. There is only one product or in the case of many products, product mix will remain unchanged.
8. Product specifications and methods of manufacturing and selling will not change.

Advantages of Break Even Charts

1. Information provided by the break even chart can be understood by the management more easily than contained in the Profit and Loss Account and the Cost Statements because a break even chart is the simple presentation of cost, volume and profit structure of the company. It summarises a great mass of detailed information in a graph in such a way that its significance may be grasped even with a cursory glance.
2. A break even chart is useful for studying the relationship of cost, volume and profit. The chart is very useful for taking managerial decisions because it shows the effect on profits of changes in fixed costs, variable costs, selling price and volume of sales.
3. The chart is very useful for forecasting costs and profits at various volumes of sales.
4. A break even chart is a tool for cost control because it shows the relative importance of the fixed costs and the variable costs.
5. Profitability of various products can be studied with the help of these charts and a most profitable product mix can be adopted. Profits at different levels of activity can also be ascertained.
6. The profit potentialities can be best judged from a study of the position of the break even point and the angle of incidence in the break even chart. Low break even point and large angle of incidence in the break even chart indicate that fixed costs are low and margin of safety is high. It is a sign of financial stability. In such a case, some monopolistic conditions prevail and high profits are earned over a large range of production activity. Low break even point and small angle of incidence show that fixed costs are low and margin of safety is high, but rate of profit is not high because of absence of monopolistic conditions. High break even point and large angle of incidence show that fixed costs are high and margin of safety is low. A small fall in volume may put the business into losses and a small increase in volume may give a high profit because of large angle of incidence. Last, high break even point and small angle of incidence is the worst position because it indicates a low margin of safety and a low rate of profit.
7. It is helpful in the determination of sale price which would give desired profits or a B.E.P.
8. It is helpful in knowing the effect of increase or reduction in selling price.

Limitations

1. A break even chart is based on a number of assumptions (discussed earlier) which may not hold good. Fixed costs vary beyond a certain level of output. Variable costs do not vary proportionately if the law of diminishing or increasing returns is applicable in the business. Sales revenues do not vary proportionately with changes in volume of sales due to reduction in selling price as a result of competition or increased production.

In the break even chart, we have seen that the total cost line and the sales line look straight lines. This is possible only with a number of assumptions. But, in practice, the total cost line and the sales line are not straight lines because the assumptions do not hold good. Thus, there might be several break even points at different levels of activity.

2. A limited amount of information can be shown, in a break even chart. A number of charts will have to be drawn up to study the effects of changes in fixed costs, variable costs and selling prices.
3. The effect of various product mixes on profits cannot be studied from a single break even chart.