

BREAK EVEN ANALYSIS

Concept : The measure of success of any business unit in today's world is the quantum of profits earned by it. This quantum of profit is generally influenced by the cost of the product, quantity of sales and rate of purchase price. Profit is the function and resultant of the interplay of cost and volume. A close relationship exists between these elements. Cost is dependent on quantity of production and the quantity of production depends on a large extent on the sales price and demand of the product. When a economic analyst studies the relationship of cost of production, quantity, sales prices and profit, it is termed cost volume profit analysis or CVP Analysis. It is also termed as Break Even Analysis.

Under this analysis, the inflows and outflows on various sales quantities of a firm are studied and profit situation is found out. Break even point is also found out. The Total Cost (TC) equals to the amount of Total Revenue (TR) at Break even point and so profit is zero. If the production falls below this point, loss occurs and if production is more than this point, profit occurs. **Matz, Curry and Frank** say, "Break Even Analysis indicates at what level cost and revenue are in equilibrium." This is a very useful technique for profit planning and evaluation of profitability capability.

ASSUMPTIONS OF BREAK-EVEN ANALYSIS

Following are the assumptions of Break Even Analysis—

1. Each cost, be it production, sales or administrative, can be divided into two parts : Fixed and Variable.
2. At every production level, the total amount of fixed cost remains unchanged while variable costs fluctuate according to the quantity of production. So, the variable cost per unit remains fixed.
3. At every production level, the sales price per unit remains the same or fixed. In other words, there is no change in the sales price, if the supply of the product fluctuates.
4. There is no change in the prices and costs of materials, labour, rent, advertising and other inputs.
5. The production and sales are synchronised i.e. whatever is produced, is immediately sold off so there is no stock in short-run.
6. The firm either produces and sells only one product or if more than one

- products are produced, their production and sales ratio remains same.
7. The productivity of labour and efficiency of machines remains unchanged.
 8. The cost control remains the same in the firm.
 9. Cost is an important factor to decide the quantum of production and sales.
 10. The comparison of revenues and cost is made on the basis of sales amount or on the unit of production.

The conclusions derived from the Break Even Analysis should be interpreted on the basis of above assumptions. If anyone of the above is altered, the Break-Even point and the conclusions there from are changed.

LIMITATIONS OF BREAK EVEN ANALYSIS

The Break-Even Analysis is dependent on many unreal and impractical assumptions, which leads to the limited use of it as a tool for management. In fact, the assumptions inherent in the technique of Break-Even (BE) Analysis are its only limitations. The principal limitations are—

1. Sales Price—It is presumed in the BE analysis that the per unit sales price remains same notwithstanding the increase in sales. The sales price cannot remain stagnant upto unlimited quantum of sales unless the situation is of perfect competition. In practice, the sales price has to be reduced for more sales.

2. Fixed Costs—In this analysis, some costs are considered fixed and are shown as a straight line but, in practice after a certain level of production fixed costs are also increased.

3. Per Unit Variable Cost—It is presumed in the Break Even analysis that the per unit variable cost remains fixed but in real life it fluctuates.

4. The Division of Costs—In this analysis, costs are divided into fixed costs and variable costs which is not done on any scientific basis but on personal basis. So, this analysis is based on human will rather than scientific basis which limits its utility.

5. Congruence of Sales and Production—The production and sales are always synchronised, this assumption is also wrong as in any trading house the entire production is not sold which leads to increase in closing stock.

6. Stability of Sales Mixture—This is wrong to assume that there is no change in product offering and sales mixture. It has to be altered keeping in mind the demand in market.

7. Static Picture—The BE analysis presents a static view which is more useful for comparatively fixed situations. This cannot be universally applied in fluctuating revenues and cost situations.

8. Capital Invested—This analysis ignores the capital invested in the

business whereas in many decision the capital invested is an important decision.

9. Short term analysis : This analysis is related to short term i.e. of one year and not long term. Everything changes in the long run, even fixed costs are also changed. So, this analysis is an important technique for short term analysis only.

MEANING OF BREAK EVEN POINT

The calculation of Break Even Point is the foundation of the Break Even Analysis. As said earlier Break-Even Point (BEP) is the point at which total revenue is equal to total costs and so net profit is zero. This point is also termed No Profit No Loss point.

Charles T Hongren says, "The Break Even point is that point of activity (sales volume) where total revenues and expenses are equal, it is the point of zero profit and zero loss."

G. R. Crowningshield has said, "Break Even point is the point at which sales revenue equals the cost to make and sell the product and no profit or loss is reported."

The profit only comes after this point. The more the sales ahead of this point, the better would it be for the firm.

METHODS OF CALCULATION OF BREAK EVEN POINT

It is calculated by two techniques or methods :

- (a) Algebraic Technique, and
- (b) Graphic Technique

(a) Algebraic Technique—Following two techniques are used under this technique to calculate the Break Even point :

(i) Equation Technique : At the BEP, total revenues equal to the total cost, so it is written as—

$$\begin{aligned}\text{Total Revenues} &= \text{Total Cost} \\ &= \text{Fixed Cost} + \text{Variable Cost}\end{aligned}$$

$$\begin{aligned}\text{or Per Unit Sale Price} \times \text{Quantity} &= \text{Fixed Cost} \\ &\quad + \text{Per Unit Variable Cost} \times \text{Quantity}\end{aligned}$$

Illustration 1.

From the following data relating to ABC Co. Ltd., ascertain the BEP :

	₹	₹
Sales (10,000 Units @ ₹ 20 per unit)		2,00,000
Variable cost @ ₹ 12 per unit	1,20,000	
Total Fixed Cost	<u>60,000</u>	1,80,000
Net Profit		<u>20,000</u>

Solution :

Let Break Even sales quantity is x units, therefore Break Even Sales
 $= \text{Total fixed cost} + \text{Variable cost per unit} \times \text{Volume}$

$$\therefore ₹ 20x = ₹ 60,000 + ₹ 12x$$

$$\therefore ₹ (20x - 12x) = ₹ 60,000$$

$$\therefore x = 7,500 \text{ units}$$

\therefore Break Even Sales = 7,500 units

(ii) **Contribution Technique** : Under this technique, first contribution is calculated which is the difference of sales and variable costs. On the basis of contribution the BEP is calculated on the basis of following formulae :

$$1. \text{ Total Contribution} = \text{Total Sales} - \text{Total Variable Cost}$$

$$2. \text{ Contribution Per unit} = \text{Selling Price per unit} - \text{Variable cost per unit}$$

$$3. \text{ BEP (in Units)} = \frac{\text{Total Fixed Cost}}{\text{Contribution per unit}}$$

$$4. \text{ BEP (in ₹)} = \frac{\text{Total fixed cost}}{1 - \frac{\text{Variable cost per unit}}{\text{Selling price per unit}}}$$

$$5. \text{ BEP (in ₹)} = \frac{\text{Total Fixed Cost}}{\text{P/V Ratio}}$$

Note : Profit - Volume Ratio or P/V Ratio can also be calculated by

$$\frac{\text{Contribution}}{\text{Sales}} \times 100$$

Illustration 2.

From the following revenue and cost structure of Shubham Corporation Ltd. calculate BEP in units & ₹ :

Output = 3,000 Units

Selling Price Per unit = ₹ 30

Variable Cost Per unit = ₹ 20

Total Fixed Cost = ₹ 20,000

Solution :

$$\begin{aligned} \text{Contribution per unit} &= \text{SP Per unit} - \text{VC Per unit} \\ &= ₹ (30 - 20) = ₹ 10 \end{aligned}$$

$$\begin{aligned} \text{BEP (in Units)} &= \frac{\text{Total Fixed Cost}}{\text{Contribution per unit}} = \frac{₹ 20,000}{₹ 10} \\ &= 2,000 \text{ units} \end{aligned}$$

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{₹ 10}{₹ 30} \times 100$$

$$= 33 \frac{1}{3} \%$$

$$\text{BEP (in ₹)} = \frac{\text{Total Fixed Cost}}{\text{P/V Ratio}}$$

$$= \frac{\text{₹ } 20,000}{\frac{1}{3} \times 3}$$

$$= \text{₹ } 60,000$$

(b) Graphic Technique : This is also termed Break Even Chart technique so Break Even chart is drawn in this technique. **Matz, Curry and Frank** say, "A break even chart is an analysis in graphic form of the relationship and sales to profit."

J. Baitey says that BE Chart is that chart or diagram which reveals—

- (a) Estimated profits or losses at various production levels,
- (b) Relation between marginal and fixed costs,
- (c) Margin of safety,
- (d) The rate of increase in profits at a fixed unit of production,
- (e) BE Point, and
- (f) Contribution and relation between cost & volume.

To prepare this chart, sales volume, costs and revenues are shown on X axis & Y axis respectively. The fixed costs at Y axis are drawn parallel to X axis and variable costs are shown advancing forward. Thereafter, total cost line is drawn. Total sales line is drawn from origin. Total cost line and sales line intersect at a point and that point is BE point. The area left to it is loss and right to it is profit.

Illustration 3.

From the following data draw a BE chart—

Fixed Cost = ₹ 80,000

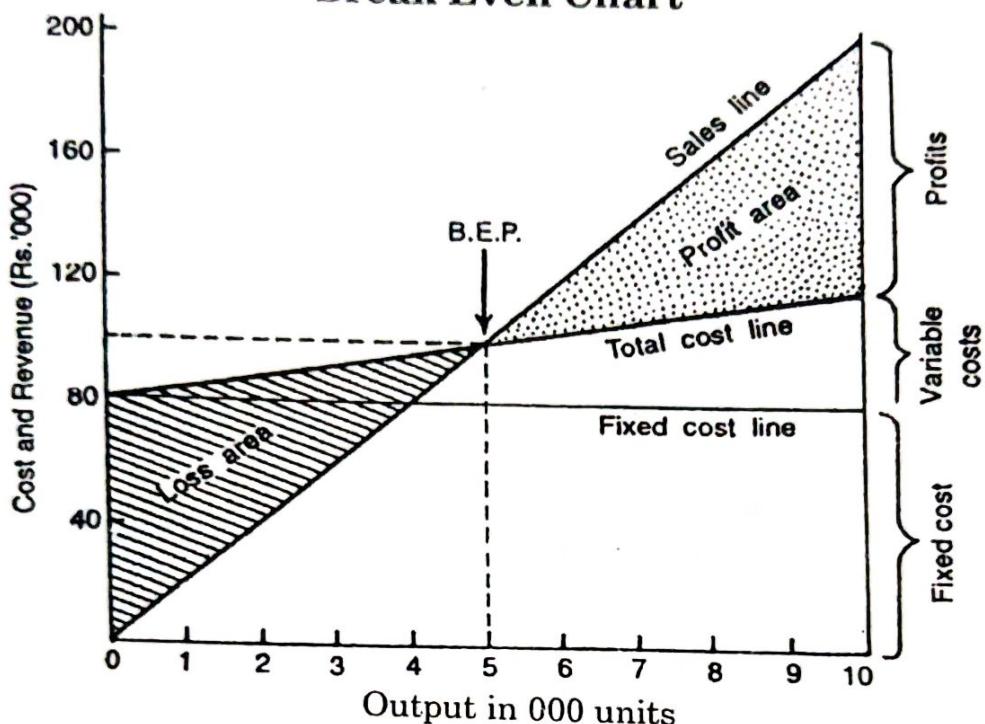
Sales 10,000 Units (at 100% of Capacity) at ₹ 20 per unit

Variable Cost ₹ 4 per Unit

Solution :

Output Unit	Break-Even Table			In ₹	
	Fixed Cost	Variable Cost	Total Cost	Sales	Profits or Loss
0	80,000	—	80,000	—	-80,000
1,000	80,000	4,000	84,000	20,000	-64,000
2,000	80,000	8,000	88,000	40,000	-48,000
3,000	80,000	12,000	92,000	60,000	-32,000

4,000	80,000	16,000	96,000	80,000	-16,000
5,000	80,000	20,000	1,00,000	1,00,000	BEP
6,000	80,000	24,000	1,04,000	1,20,000	+ 16,000
7,000	80,000	28,000	1,08,000	1,40,000	+ 32,000
8,000	80,000	32,000	1,12,000	1,60,000	+ 48,000
9,000	80,000	36,000	1,16,000	1,80,000	+ 64,000
10,000	80,000	40,000	1,20,000	2,00,000	+ 80,000

Break Even Chart**CASH BEP**

In today's competitive world, it is difficult for any newly established firm to achieve the BEP in the initial years. So, cash break even point, concept is developed. This is that volume of sales where total income equals total cash cost. The total cash cost is calculated by deducting depreciation and deferred expenditures from total costs. This point helps the management to decide that level of the sales on which liquidity remains balanced.

$$\text{Cash BEP (In Units)} = \frac{\text{Cash Fixed Cost}}{\text{Cash Contribution Per Unit}}$$

Illustration 4.

Calculate Cash BEP from the following information of Ram Raj Ltd.

Selling Price Per Unit	₹ 100
Variable Cost Per Unit	₹ 70
Depn. included in above V.C.	₹ 10
Fixed Cost	₹ 1,20,000
Depreciation included in above fixed cost	₹ 20,000

□ ANGLE OF INCIDENCE

The angle of incidence is the angle between the sales line and the total cost line formed at the break-even point where the sales line and the total cost line intersect each other. The angle of incidence indicates the profit earning capacity of a business. A large angle of incidence indicates a high rate of profit and, on the other hand, a small angle of incidence indicates a low rate of profit. Usually, the angle of incidence and margin of safety are considered together to indicate the soundness of a business. A large angle of incidence with a high margin of safety indicates the most favourable position of a business.

□ PROFIT-VOLUME GRAPH

Solution :

$$\text{Cash Fixed Cost} = ₹ (1,20,000 - 20,000) = ₹ 1,00,000$$

$$\begin{aligned}\text{Cash Contribution per Unit} &= \text{Sales} - (\text{V.C.} - \text{Depreciation}) \\ &= ₹ 100 - ₹ (70 - 10) = ₹ 40\end{aligned}$$

$$\begin{aligned}\text{Cash BEP (in Units)} &= \frac{\text{Cash Fixed Cost}}{\text{Cash Contribution Per Unit}} \\ &= \frac{₹ 1,00,000}{₹ 40} = 2,500 \text{ Units}\end{aligned}$$

$$\text{Cash BEP (in ₹)} = 2,500 \times ₹ 100 = ₹ 2,50,000$$

PROFIT VOLUME RATIO OR P/V RATIO

This ratio expresses relationship between contribution and sales which is shown as percentage. It is also termed Contribution Sales ratio. It can be calculated as under :

$$\begin{aligned}\text{P/V Ratio} &= \frac{\text{Contribution}}{\text{Sales}} \times 100 \text{ or } \frac{C}{S} \times 100 \\ &= \frac{\text{Fixed Cost} + \text{Profit}}{\text{Sales}} \times 100 \text{ or } \frac{F + P}{S} \times 100 \\ &= \frac{\text{Sales} - \text{V.C.}}{\text{Sales}} \times 100 \text{ or } \frac{S - \text{V.C.}}{S} \times 100 \\ &= \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100\end{aligned}$$

Usefulness of P/V Ratio :

With the help of P/V Ratio the Contribution, Profits, Fixed Costs and Variable Costs can be easily calculated :

(i) Contribution = Sales × P/V Ratio (Ist Formula)

(ii) Profit = Sales × P/V Ratio – Fixed Cost (IIInd formula)

(iii) Fixed Cost = Sales × P/V Ratio – Profit (IIIrd formula)

(iv) V.C. = Sales × (1 – P/V Ratio) (IVth Formula)

This is very useful for calculating profitability of the firm. If this ratio is high it means higher profits and if it is low, it means lesser profit. The BEP (in ₹) can also be calculated from the P/V Ratio which is as under—

$$\text{BEP (in ₹)} = \frac{\text{Total Fixed Cost}}{\text{P/V Ratio}}$$

Desired Sales can also be calculated as under—

$$\text{Desired Sales} = \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P/V Ratio}}$$

MARGIN OF SAFETY

The margin of safety is the difference of actual sales and BEP sales. The higher this margin, the greater the profits of the firm and more secure the firm would be. On the contrary, if the margin of safety is low then even a small reduction in sales would lead to losses for the firm. **Charles T. Horngren** has said, "The margin of safety is the excess of budgeted or actual sales over the break even sales volume."

It can be expressed as—

$$\text{Margin of Safety} = \text{Actual Sales} - \text{BEP Sales}$$

Or

$$\text{Margin of Safety} = \frac{\text{Profit}}{\text{P/V Ratio}}$$

The margin of safety shows the strength of the business. The lower margin of safety is a matter of serious concern and following steps should be taken—

- (a) Stop production of unprofitable products and produce only profitable products,
- (b) Increase sales price,
- (c) Increase volume of production,
- (d) Reduce fixed costs, and
- (e) Reduce variable costs

Illustration 5.

The trading results of Radhey Ltd. during two years is as under—

Years	Sales (₹)	Profits (₹)
2013	25,000	5,000
2014	37,500	10,000

Calculate : (a) P/V Ratio, (b) Fixed Costs, (c) Profit and Variable Cost when sales are ₹ 20,000, (d) Sales to earn a profit of ₹ 20,000.

Solution :

$$\begin{aligned}
 \text{(a) Profit Volume Ratio} &= \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100 \\
 &= \frac{\text{₹ } 10,000 - \text{₹ } 5,000}{\text{₹ } 37,500 - \text{₹ } 25,000} \times 100 \\
 &= \frac{5,000}{12,500} \times 100 = 40\%
 \end{aligned}$$

$$\text{(b) Fixed Cost} = (\text{S} \times \text{P/V Ratio}) - \text{P}$$

$$\therefore \text{for 2013} = \text{₹ } 25,000 \times 40\% - \text{₹ } 5,000 = \text{₹ } (10,000 - 5,000) = \text{₹ } 5,000$$

$$\begin{aligned}
 \text{and for 2014} &= \text{₹ } 37,500 \times 40\% - \text{₹ } 10,000 = \text{₹ } (15,000 - 10,000) \\
 &= \text{₹ } 5,000
 \end{aligned}$$

(c) Profit when sales are ₹ 20,000

$$\begin{aligned} P &= S \times P/V \text{ Ratio} - F \\ &= ₹ 20,000 \times 40\% - ₹ 5,000 = ₹ (8,000 - 5,000) \\ &= ₹ 3,000 \end{aligned}$$

Variable costs when sales are ₹ 20,000

$$\begin{aligned} V &= S (1 - P/V \text{ Ratio}) = ₹ 20,000 \left(1 - \frac{40}{100}\right) \\ &= ₹ 20,000 \times \frac{60}{100} = ₹ 12,000 \end{aligned}$$

(d) Sales to earn a profit of ₹ 20,000

$$\begin{aligned} \text{Desired Sales} &= \frac{F + P}{P/V \text{ Ratio}} = \frac{₹ (5,000 + 20,000)}{40\%} \\ &= \frac{₹ (5,000 + 20,000)}{40\%} = \frac{₹ 25,000}{40\%} \\ &= \frac{₹ 25,000 \times 100}{40} = ₹ 6,2500 \end{aligned}$$

Illustration 6.

Nagymaros (XYZ) Ltd. manufacture one uniform product. The following information are available for two years—

	Ist Year (₹)	IIInd Year (₹)
Sales	5,40,000	6,00,000
Total Cost	4,80,000	5,16,000

Assuming that there is no change in selling price and variable costs and the fixed expenses are incurred uniformly in both the years, calculate for the IIInd year—

(a) P/V Ratio, (b) Fixed Expenses, (c) BE Sales, (d) Margin of Safety.

Solution :

Profit for 1st year = ₹ (5,40,000 – 4,80,000) = ₹ 60,000

Profit for IIInd year = ₹ (6,00,000 – 5,16,000) = ₹ 84,000

$$(a) \quad P/V \text{ Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100$$

$$= \frac{₹ (84,000 - 60,000)}{₹ (6,00,000 - 5,40,000)} \times 100$$

$$= ₹ \frac{24,000}{60,000} \times 100 = 40\%$$

$$\begin{aligned}
 \text{(b) Fixed expenses} &= (S \times P/V \text{ Ratio}) - P \\
 \text{For 1st Year} &= ₹ (5,40,000 \times 40\%) - ₹ 60,000 \\
 &= ₹ (2,16,000 - 60,000) = ₹ 1,56,000 \\
 \text{for 2nd year} &= ₹ (6,00,000 \times 40\%) - ₹ 84,000 \\
 &= ₹ (2,40,000 - 84,000) = ₹ 1,56,000
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) Break Even sales} &= \frac{\text{Fixed Expenses}}{\text{P/V Ratio}} = \frac{\text{Rs. } 1,56,000}{40\%} \\
 &= \frac{₹ 1,56,000 \times 100}{40} = ₹ 390,000
 \end{aligned}$$

$$\begin{aligned}
 \text{(d) Margin of Safety} &= \text{Total sales} - \text{Break Even Sales} \\
 &= ₹ (6,00,000 - 3,90,000) = ₹ 2,10,000
 \end{aligned}$$

COMPOSITE BREAK EVEN POINT

Apart from calculation of Break Even point for different products separately, we can calculate the composite Break Even point of all products jointly. The formula is—

$$\text{Composite BEP} = \frac{\text{Total Fixed Cost}}{\text{Composite P/V Ratio}}$$

$$\text{Here, Composite P/V Ratio} = \frac{\text{Total Contribution} \times 100}{\text{Total Sales}}$$

Illustration 7.

Find out composite BEP when fixed cost is ₹ 50,000 :

Product	Sales Revenue (₹)	Variable Cost (₹)
A	60,000	36,000
B	40,000	14,000
C	20,000	10,000

Solution :

$$\begin{aligned}
 \text{Total Contribution} &= \text{Total Sales} - \text{Total Variable Cost} \\
 &= ₹ (1,20,000 - 60,000) = ₹ 60,000
 \end{aligned}$$

$$\begin{aligned}
 \text{Composite P/V Ratio} &= \frac{\text{Total Contribution} \times 100}{\text{Total Sales}} \\
 &= \frac{₹ 60,000}{₹ 1,20,000} = 50\%
 \end{aligned}$$

$$\begin{aligned}
 \text{Composite BEP} &= \frac{\text{Total Fixed Cost}}{\text{Composite P/V Ratio}} = \frac{50,000}{50\%} \\
 &= ₹ 1,00,000
 \end{aligned}$$

USE OF BREAK-EVEN ANALYSIS

The Break Even analysis provides a microscopic view of profits of a trading concern. It helps in assessing the financial strengths and weaknesses of the firm on the basis of computation of BEP, P/V Ratio, and margin of safety. Moreover, it also helps in profit planning and forecasting. Efforts can be made for cost control and increase in profitability on the basis of the Break Even analysis. The chief managerial uses and utility of the Break Even analysis are as under—

(1) Calculation of Profit for Different Sales Volume—The calculation of profit for different sales volume helps the managers to decide about what would be the optimum sales volume, which would lead to maximum profits. The following formulae are used for the said calculation :

- (i) Contribution = Sales – Variable Costs
- (ii) Profit = Contribution – Fixed Costs
- (iii) Profit = Sales × P/V Ratio – Fixed Costs
- (iv) Profit = Sales – (Fixed Costs + Variable Costs)

Illustration 8.

Following data is given of Gaurav Ltd. :

(1) Fixed Costs	₹ 10,000
(2) Variable Costs Per unit	₹ 5
(3) Selling Price Per Unit	₹ 10

Calculate profit when sales will be ₹ 1,00,000 & ₹ 1,20,000.

Solution :

(1) When sales will be ₹ 1,00,000 (10,000 units)

$$\begin{aligned} \text{Profit} &= \text{Sales} - (\text{Fixed Costs} + \text{Variable Costs}) \\ &= ₹ 1,00,000 - (₹ 10,000 + ₹ 50,000) = ₹ 40,000 \end{aligned}$$

(2) When Sales will be ₹ 1,20,000 (12,000 Units)

$$\begin{aligned} \text{Profit} &= \text{Sales} - (\text{Fixed Costs} + \text{Variable Costs}) \\ &= ₹ 1,20,000 - (₹ 10,000 + ₹ 60,000) \\ &= ₹ 50,000 \end{aligned}$$

(2) Calculation of Sales for Desired Profit—The management can come to know through the Break Even analysis that what should be the sales volume to achieve gains on the basis of desired and predetermined objectives. The calculation of said volume of sales can be done as under—

$$(i) \text{Sales (in units)} = \frac{\text{Fixed Costs} + \text{Desired Profit}}{\text{Price Per unit} - \text{Variable cost per unit}}$$

$$(ii) \text{Sales (in ₹)} = \frac{\text{Fixed Costs} + \text{Desired Profit}}{1 - \frac{\text{Variable cost per unit}}{\text{Price per unit}}}$$

Illustration 9.

Ram Ltd. manufactures and sells a single article at ₹ 10 each. The variable cost of production is ₹ 6 each and fixed cost is ₹ 400 per annum.

Find out—

- Sales at break even point,
- Sales to earn a profit of ₹ 600,
- Profit at sales of ₹ 4,000 and
- New break even point if sales price is reduced by 10%.

Solution :

$$(a) \text{BEP (in ₹)} = \frac{\text{FC}}{1 - \text{VC/P}} = \frac{400}{1 - 6/10} = ₹ 1,000$$

$$\text{BEP (in units)} = \frac{F}{P - VC} = \frac{₹ 400}{10 - 6} = 100 \text{ units}$$

$$(b) \text{Desired Sales (in ₹)} = \frac{\text{Fixed Costs + Desired Profit}}{\frac{1 - \text{Variable Cost per unit}}{\text{Price per unit}}}$$

$$= \frac{₹ (400 + 600)}{1 - 6/10} = \frac{₹ 1,000}{4/10} = ₹ 2,500$$

$$\text{Desired Sales (in units)} = \frac{\text{Fixed Costs + Desired Profit}}{\text{Price per unit} - \text{Variable cost per unit}}$$

$$= \frac{₹ (400 + 600)}{₹ (10 - 6)} = \frac{₹ 1,000}{₹ 4} = 250 \text{ units}$$

$$(c) \text{Profit} = \text{Sales} \left(1 - \frac{\text{Variable cost per unit}}{\text{Price per unit}} \right) - \text{Fixed Costs}$$

$$= ₹ 4,000 \left(1 - \frac{6}{10} \right) - ₹ 400 = ₹ 4,000 \times \frac{4}{10} - ₹ 400$$

$$= ₹ (1,600 - 400) = ₹ 1,200$$

$$(d) \text{ New BEP (in ₹)} = \frac{\text{FC}}{1 - V/P} = \frac{₹ 400}{1 - 6/9} = \frac{₹ 400}{3/9} = ₹ 1200$$

$$\text{New BEP (in units)} = \frac{\text{FC}}{P - V} = \frac{₹ 400}{9 - 6} = 133 \text{ Units}$$

(3) Calculation of Sales Volume to Meet Proposed Expenditure—

The Sales expenses are bound to increase when planning is done for sales. In these circumstances, the top management will approve this additional expenditure only when it knows the volume of sales to be increased to cover up these additional expenditure. The additional sales volume required can be calculated as under—

$$\text{Additional Volume Required (in Units)} = \frac{\text{Proposed Expenditure}}{P - VC \text{ or Contribution per unit}}$$

$$\text{Additional Volume Required (in ₹)} = \frac{\text{Proposed Expenditure}}{P/V \text{ Ratio}}$$

Illustration 10.

The income statement of Satyam Software Ltd. is summarised as follows—

Net Income	₹ 400,000
Less Expenses (including fixed expenses ₹ 2,00,000)	<u>4,40,000</u>
Net Loss	<u>40,000</u>

The management believes that an increase of ₹ 1,00,000 in advertisement outlays will increase sales substantially. So, find out—

- (a) At which sales volume the company will be at break even ?
- (b) What additional sales will be required to offset the increase in advertisement outlays ?
- (c) What sales volume will result in net profit of ₹ 20,000 ?

Solution :

$$\begin{aligned} P/V \text{ Ratio} &= \frac{S - VC}{S} \times 100 \\ &= \frac{₹ (4,00,000 - 2,40,000)}{₹ 4,00,000} \times 100 = 40\% \end{aligned}$$

$$(a) \text{ Break Even Sales} = \frac{\text{FC}}{\text{P/V Ratio}} = \frac{₹ (2,00,000 + 1,00,000)}{40\%}$$

$$= \frac{\text{₹}(3,00,000 \times 100)}{40} = \text{₹ } 7,50,000$$

$$(b) \text{ Additional Sales Volume} = \frac{\text{Proposed expenditure}}{\text{P/V Ratio}} = \frac{\text{₹ } 1,00,000}{40\%}$$

$$= \text{₹ } 2,50,000$$

(c) Sales required to earn a profit of ₹ 20,000

$$= \frac{\text{FC} + \text{Desired Profit}}{\text{P/V Ratio}} = \frac{\text{₹}(3,00,000 + 20,000)}{40\%}$$

$$= \frac{\text{₹ } 3,20,000 \times 100}{40} = \text{₹ } 8,00,000$$

(4) Determination of Margin of Safety—The break even analysis also provides the indices of margin of safety. It is a measure of strength of the firm and is calculated by reducing break even sales from total sales, therefore,

(i) Margin of Safety = Total Sales – Break even Sales

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

Margin of safety can be also be expressed as percentage of total sales in the following manners :

$$\text{Margin of Safety Ratio} = \frac{\text{Sales} - \text{Break even Sales}}{\text{Sales}} \times 100$$

(5) Change in Sales Volume or Selling Price to Offset the Impact of Change in Costs—The fixed costs and variable are altered, if new production policies or policies regarding change in production process are adopted. To nullify these effects of changes in costs and to maintain the present profit level either sales price or volume of sales is altered.

In such a situation, new sales price and new volume of sales can be found out with the help of Break even Analysis by using following formulae :

(a) Change in variable costs—

$$(i) \text{ New sales quantity} = \frac{\text{Fixed cost} + \text{Profit}}{\text{Selling Price} - \text{New Variable Cost}}$$

(ii) New Selling Price = Selling Price + (New Variable Cost per unit – Variable Cost per unit)

(b) Change in fixed costs—

$$(i) \text{ New Sales Quantity} = \frac{\text{New Fixed Cost} + \text{Profit}}{\text{Selling Price} - \text{New Variable Cost}}$$

$$(ii) \text{ New Selling Price} = \text{Selling Price} + \frac{\text{New Fixed Cost} - \text{Fixed Cost}}{\text{Quantity}}$$

(6) Inter Firm Comparison—The Break Even analysis is also helpful in comparison of profitability of various firms and departments. The most profitable products from various products can be chosen with the help of Break Even analysis.

Illustration 11.

Two companies Millissich Ltd. and Merivale Ltd. sell the same type of product in the same type of market. Their budgeted income statement for the next year are as follows :

	Millissich Ltd (₹)	Merivale Ltd. (₹)
Sales	3,00,000	3,00,000
Less : Variable Costs	2,40,000 <u>30,000</u>	2,00,000 <u>70,000</u>
Profit	<u>30,000</u>	<u>30,000</u>

Calculate—

- (i) BEP of each company,
- (ii) State which company is likely to earn more profit in conditions of (a) Heavy demand of product and (b) Low demand of the product.

Solution :

$$(i) \text{ P/V Ratio} = \frac{S - V}{S} \times 100 = \frac{3,00,000 - 2,40,000 \times 100}{3,00,000} = \frac{3,00,000 - 2,00,000}{3,00,000} \times 100$$

$$= \frac{60,000}{3,00,000} \times 100 = 20\% \quad \frac{1,00,000}{3,00,000} \times 100 = 33\frac{1}{3}\%$$

$$(ii) \text{ BEP} = \frac{\text{FC}}{\text{P/V Ratio}} = \frac{30,000}{20\%} \text{ ₹ } 1,50,000 = \frac{\text{₹ } 70,000}{33\frac{1}{3}\%} = \text{₹ } 2,10,000$$

$$(iii) \text{ Margin of Safety} = \text{₹ } (300,000 - 150,000) = \text{₹ } (300,000 - 210,000) \\ (\text{Actual Sales} - \text{BEP Sales}) = \text{₹ } 150,000 - \text{₹ } 90,000$$

(ii) (a) When demand for product is high, then it is more profitable to produce the product having high P/V Ratio. In this situation, the profits will increase when demand is high. So, since P/V Ratio of Merivale Ltd. is high, it would reap more profits.

(b) When demand of the product is low then it is advisable to produce the product having high margin of safety as low demand would lead to losses at a reduced pace and greater time. The lesser the margin of safety, the faster the company reaches the position of loss. So, Millissich Ltd. would be in a safer situation as its margin of safety is high.

ESSAY TYPE QUESTIONS & NUMERICAL QUESTIONS

1. "In fact, the assumptions inherent in the technique of Break Even analysis are its own limitations." Examine carefully this statement and state the concept of P/V Ratio and Margin of Safety.
2. What is meant by Break Even analysis? Describe the assumptions and limitations of this technique.
3. Explain the term 'Break Even Point' and describe the techniques for its calculation.
4. Clearly explain the utility, assumptions and limitations of cost volume profit analysis.
5. Write an explanatory note on Break Even Chart, Profit Volume Ratio and Margin of Safety.
6. Explain the meaning of break even point. Calculate break even point and profit volume ratio if fixed costs are ₹ 20,000, variable costs per unit are ₹ 20 and the sales price is ₹ 30 per unit.
7. The Sophia Instrumentation Ltd. manufacture one identical product X. The following data are available for two successive years.

	Year I	Year II
	₹	₹
Sales	3,00,000	3,60,000
Fixed Cost	90,000	1,20,000
Variable Cost	1,50,000	2,16,000

8. Drumianrig Ltd. furnishes the following data relating to the year 2012 :

	First 6 months	Last 6 Months
	₹	₹
Sales	5,40,000	6,00,000
Total Cost	4,80,000	5,16,000

Calculate following for the year 2012 :

- (a) Profit Volume Ratio,
- (b) Fixed expenses,
- (c) Break Even sales, and,
- (d) Margin of safety and its ratio.

9. You are required to calculate (a) P/V ratio, (b) Sales required to earn a profit of ₹ 10,000, and (c) Profit when sales are ₹ 30,000 on the basis of following details :

Year	Sales (₹)	Profit (₹)
2011	35,000	3750
2012	40,000	5,000

10. The following information are given :

Fixed Cost	₹ 20,000
Selling Price per unit	₹ 20
Variable cost per unit	₹ 10

Calculate the impact of following on BEP :

- 20% increase in fixed costs,
 - 10% increase in variable costs,
 - 10% increase in fixed costs and 5% decrease in the variable costs,
 - 10% decrease in fixed costs and 20% increase in variable costs.
11. The following data are available from the cost records of Eggintan Private Ltd. :

Sales Price	₹ 20 per unit
Variable Manufacturing Cost	₹ 11 Per unit
Variable Selling Cost	₹ 3 per unit
Fixed Factory overhead	₹ 5,40,000 p.a.
Fixed selling overhead	₹ 2,52,000 p.a.

Find out—

- BEP in rupees of sales
- No. of units to be sold to earn a profit of ₹ 60,000 p.a.
- How many units must be sold to earn 10% Profit on Sales ?

ANSWERS TO NUMERICAL QUESTIONS

- BEP (in units) 2,000 units BEP (in ₹) Rs. 60,000, P/V Ratio = 33%
- BEP : ₹ 1,80,000, ₹ 3,00,000, P/V Ratio : 50% 40%, Margin of Safety : ₹ 1,20,000, ₹ 60,000 MOS Ratio : 40%, 16.67%
- P/V Ratio 40%, Fixed expenses ₹ 3,12,000, BE sales ₹ 7,80,000 MOS ₹ 3,60,000, MOS Ratio 31.581.
- P/V Ratio 25%, Sales ₹ 60,000. Profit ₹ 2,500
- Present BEP 5,000 Units (a) 6,000 Units (b) 8,333 Units (c) 4,583 Units (d) 22,500 units
- (a) ₹ 26,40,000 (b) 1,42,000 Units, (c) 1,98,000 Units

SHORT ANSWER TYPES QUESTION

- What are the assumptions of Break-Even analysis ?
- Briefly explain the graphic technique of Break-Even point calculation.
- What is Margin of Safety ?
- Point out the meaning and usefulness of P/V Ratio.
- Explain the statement that the assumptions of Break-Even analysis are the limitations of it.

VERY SHORT ANSWER TYPE QUESTIONS

- State the quantity of profit at BEP.
- Write the formula for computation of P/V Ratio.
- What is called Margin of Safety ?
- Calculate P/V Ratio :

Year	Sales ₹	Profit ₹
2013	5,00,000	1,00,000
2014	7,50,000	2,00,000

TEST QUESTIONS

A. Objective Type

1. State whether the following statements are True or False :

- (i) Contribution is the difference between the sales and the total cost of sales.
- (ii) At break-even point the company earns only a marginal profit.
- (iii) Contribution is also known as Gross Margin.
- (iv) P/V ratio can be improved by increasing the selling price.
- (v) P/V ratio can be improved by reducing the fixed costs.
- (vi) Margin of safety
$$\frac{\text{Fixed Expenses}}{\text{P/V ratio}}$$
- (vii) Margin of safety can be improved by reducing the fixed cost.
- (viii) Break-even analysis is fundamentally a static analysis.

[Ans. (i) False ; (ii) False ; (iii) True ; (iv) True ; (v) False ; (vi) False ; (vii) True ; (viii) False]