CHAPTER 14

# MARGINAL COSTING

## LEARNING OUTCOMES

- Explain the meaning and characteristics of Marginal Costing.
- Describe the meaning of CVP Analysis and apply the same in making short-term managerial decisions.
- Describe the meaning and application of Break-even point, Margin of safety, Angle of incidence etc. and apply the same in making computations.
- Calculate and explain the various formulae used in CVP analysis.
- Apply the concepts of marginal costing and CVP analysis in short-term decision making.
- Differentiate between Marginal Costing and Absorption Costing.

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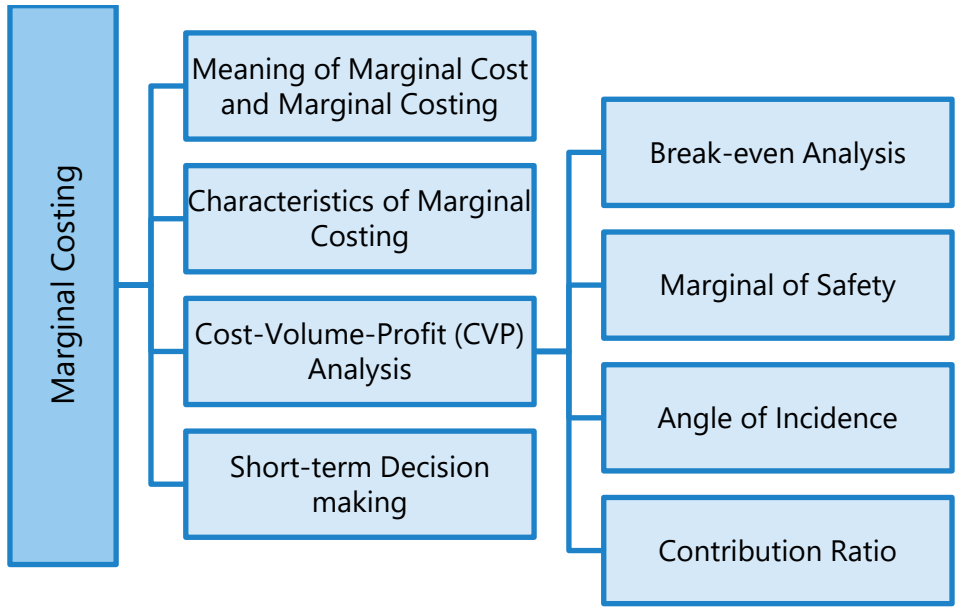
## CHAPTER OVERVIEW




## 1. INTRODUCTION

As discussed in the first chapter 'Introduction to Cost and Management Accounting', the cost and management accounting system by provision of information, enables management to take various decisions. Marginal Costing is a technique of cost and management accounting which is used to analyse relationship between cost, volume and profit.

In order to appreciate the concept of marginal costing, it is necessary to study the definition of marginal costing and certain other terms associated with this technique. The important terms have been defined as follows:

**1. Marginal Cost:** Marginal cost as understood in economics is **the incremental cost of production** for producing one additional unit of product. As we understood, variable costs have direct relationship with volume of output and fixed costs remains constant irrespective of volume of production. Hence, marginal cost is measured by the total variable cost attributable to one

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additional unit. For example, the total cost of producing 10 units and 11 units of a product is ₹10,000 and ₹10,500 respectively. The marginal cost for 11th unit i.e. 1 unit extra from 10 units is ₹500.

Marginal cost can precisely be the sum of prime cost and variable overhead.

**Example 1**: Arnav Ltd. produces 10,000 units of product Z by incurring a total cost of ₹ 3,50,000. Break-up of costs are as follows:

(i) Direct Material @ ₹ 10 per unit, ₹ 1,00,000,

(ii) Direct employee (labour) cost @ ₹ 8 per unit, ₹ 80,000

(iii) Variable overheads @ ₹2 per unit, ₹ 20,000

(iv) Fixed overheads ₹ 1,50,000 (upto a volume of 50,000 units)

In this example, if Arnav Ltd. wants to know marginal cost of producing one extra unit from the current production i.e. 10,001st unit. The marginal cost would be the change in the total cost due production of this 10,001st extra unit. The extra cost would be ₹20, as calculated below:

| | 10,000 units | 10,001 units | Change in Cost |
|---|---|---|---|
| | (A) | (B) | (c) = (B) - (A) |
| (i) Direct Material @ ₹10 per unit | 1,00,000 | 1,00,010 | 10 |
| (ii) Direct employee (labour) cost @ ₹8 per unit | 80,000 | 80,008 | 8 |
| (iii) Variable overheads @ ₹2 per unit | 20,000 | 20,002 | 2 |
| (iv) Fixed overheads | 1,50,000 | 1,50,000 | 0 |
| Total Cost | 3,50,000 | 3,50,020 | 20 |

**2. Marginal Costing: It is a costing system where products or services and inventories are valued at variable costs only**. It does not take consideration of fixed costs. This system of costing is also known as direct costing as only direct costs forms the part of product and inventory cost. Costs are classified on the basis of behavior of cost (i.e. fixed and variable) rather functions as done in absorption costing method.

**3. Direct Costing:** Direct costing and Marginal Costing is used synonymously at various places. But the relation of costs with respect to activity level must be

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understood. Some costs are variable at batch level but fixed for unit level whereas others are variable at production line level but fixed for batches and units.

**Example 2:** Arnav Ltd. produces 10,000 units of product Z by incurring a total cost of ₹4,80,000. Break-up of costs are as follows:

(i) Direct Material @ ₹10 per unit, ₹1,00,000,

(ii) Direct employee (labour) cost @ ₹8 per unit, `80,000

(iii) Variable overheads @ ₹ 2 per unit, ₹20,000

(iv) Machine set up cost @ ₹1,200 for a production run (100 units can be manufactured in a run)

(v) Depreciation of a machine specifically used for production of Z ₹10,000

(iv) Apportioned fixed overheads ₹ 1,50,000.

**Analysis of the costs:**

| | **10,000 units** | **10,001 units** | **Change in Cost** | **Direct Cost** |
|---|---|---|---|---|
| | **(A)** | **(B)** | **(c) = (B) - (A)** | |
| (i) Direct Material @ ₹ 10 per unit | 1,00,000 | 1,00,010 | 10 | Unit level Direct Cost. |
| (ii) Direct employee (labour) cost @ ₹ 8 per unit | 80,000 | 80,008 | 8 | Unit level Direct Cost. |
| (iii) Variable overheads @ ₹2 per unit | 20,000 | 20,002 | 2 | Unit level Direct Cost. |
| (iv) Machine set up cost | 1,20,000 | 1,21,200 | 1,200 | Batch level Direct Cost |
| (v) Depreciation of a machine | 10,000 | 10,000 | 0 | Product level Direct Cost. |
| (vi) Apportioned fixed overheads | 1,50,000 | 1,50,000 | 0 | Department level Direct Cost |
| Total Cost | 4,80,000 | 4,81,220 | 1,220 | |

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In the example, the direct cost of producing 10,001st unit is 1,220 but it is not the marginal cost of producing one extra unit rather marginal cost of running one extra production run (batch).

**4. Differential and Incremental Cost: Differential cost is difference between the costs of two different production levels.** It is a relative representation of costs for two different levels that results in the increase or decrease in cost. Incremental cost, on the other hand, is the increase in the costs due to change in the volume or process of production activities. Incremental costs are sometime compared with marginal cost but in reality, there is a thin line difference between the two. Marginal cost is the change in the total cost due to production of one extra unit while incremental cost can be both for increase in one unit or in total volume. In the Example 2 above, ₹ 1,220 is the incremental cost of producing one extra unit but not marginal cost for producing one extra unit.

## 2. CHARACTERISTICS OF MARGINAL COSTING

The technique of marginal costing is based on the distinction between product costs and period costs. Only the variables costs are treated as the costs of the products while the fixed costs are treated as period costs which will be incurred during the period regardless of the volume of output. The main characteristics of marginal costing are as follows:

1. **All elements of cost are classified into fixed and variable components**. Semi-variable costs are also analyzed into fixed and variable elements.
2. The marginal or **variable costs** (as direct material, direct labour and variable factory overheads) **are treated as the cost of product**.
3. Under marginal costing, **the value of finished goods and work–in–progress is also comprised only of marginal costs**. Variable selling and distribution are excluded for valuing these inventories. Fixed costs are not considered for valuation of closing stock of finished goods and closing WIP.
4. **Fixed costs are treated as period costs** and are charged to profit and loss account for the period for which they are incurred.
5. Prices are determined with reference to marginal costs and contribution margin.

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6. Profitability of departments and products is determined with reference to their contribution margin.

## 3. FACTS ABOUT MARGINAL COSTING

Some of the facts about marginal costing are depicted below:

**Not a distinct method:** Marginal costing is not a distinct method of costing like job costing, process costing, operating costing, etc., but a special technique used for managerial decision making. Marginal costing is used to provide a basis for the interpretation of cost data to measure the profitability of different products, processes and cost centres in the course of decision making. It can, therefore, be used in conjunction with the different methods of costing such as job costing, process costing, etc., or even with other techniques such as standard costing or budgetary control.

**Cost Ascertainment:** In marginal costing, cost ascertainment is made on the basis of the nature of cost. It gives consideration to behaviour of costs. In other words, the technique has developed from a particular conception and expression of the nature and behaviour of costs and their effect upon the profitability of an undertaking.

**Decision Making:** According to traditional or total cost method, as opposed to marginal costing, the classification of costs is based on functional basis. Under this method the total cost is the sum total of the cost of direct material, direct labour, direct expenses, manufacturing overheads, administration overheads, selling and distribution overheads. In this system, other things being equal, the total cost per unit will remain constant only when the level of output or mixture is the same from period to period. Since these factors are continually fluctuating, the actual total cost will vary from one period to another. Thus, it is possible for the costing department to say one day that an item cost ₹20 and the next day it costs ₹18. This situation arises because of changes in volume of output and the peculiar behavior of fixed expenses included in the total cost. Such fluctuating manufacturing activity, and consequently the variations in the total cost from period to period or even from day to day, poses a serious problem to the management in taking sound decisions. Hence, the application of marginal costing has been given wide recognition in the field of decision making.

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## 4. DETERMINATION OF COST AND PROFIT UNDER MARGINAL COSTING

For the determination of cost of a product or service under marginal costing, costs are classified into variable and fixed. All the variable costs are part of product and services while fixed costs are charged against contribution margin.

**Cost and Profit Statement under Marginal Costing**

| | | Amount (₹) | Amount (₹) |
|---|---|---|---|
| Revenue | (A) | | **xxx** |
| **Product Cost:** | | | |
| - Direct Materials | | xxx | |
| - Direct employee (labour) | | xxx | |
| - Direct expenses | | xxx | |
| - Variable manufacturing overheads | | xxx | |
| **Product (Inventoriable) Costs:** | (B) | xxx | **xxx** |
| Product Contribution Margin {A – B} | | | **xxx** |
| - Variable Administration overheads | | xxx | |
| - Variable Selling & Distribution overheads | | xxx | **xxx** |
| **Contribution Margin:** | (C) | | **xxx** |
| **Period Cost:** | (D) | | |
| Fixed Manufacturing expenses | | xxx | |
| Fixed non-manufacturing expenses | | xxx | **xxx** |
| Profit/ (loss) {C – D} | | | **xxx** |

**(i) Product (Inventoriable) Costs:** In the case of merchandise inventory, these are the costs which are associated with the purchase and sale of goods. In the production scenario, **such costs are associated with the acquisition and conversion of materials and all other manufacturing inputs into finished product for sale**. Hence, under marginal costing, variable manufacturing costs constitute inventoriable or product costs.

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Finished goods are measured at product cost. Work-in-process (WIP) inventories are also measured at product cost on the basis of percentage of completion (Please refer Process & Operation costing chapter)

**(ii) Contribution:** Contribution or contribution margin is the difference between sales revenue and total variable costs irrespective of manufacturing or non-manufacturing.

| Contribution (C) = Sales Revenue (S) – Total Variable Cost (V) |
|---|

It is obtained by subtracting variable costs from sales revenue. It can also be defined as excess of sales revenue over the variable costs. The contribution concept is based on the theory that the profit and fixed expenses of a business is a 'joint cost' which cannot be equitably apportioned to different segments of the business. In view of this difficulty the contribution serves as a measure of efficiency of operations of various segments of the business. The contribution forms a fund for fixed expenses and profit as illustrated below:

**Example:**

| | |
|---|---|
| Variable Cost | = ₹50,000, Fixed Cost = ₹ 20,000, |
| Selling Price | = ₹ 80,000 |
| Contribution | = Selling Price – Variable Cost |
| | = ₹ 80,000 – ₹ 50,000 = ₹ 30,000 |
| Profit | = Contribution – Fixed Cost |
| | = ₹ 30,000 – ₹ 20,000 = ₹10,000 |

Since, contribution exceeds fixed cost; the profit is of the magnitude of ₹ 10,000. Suppose the fixed cost is ₹ 40,000 then the position shall be:

Contribution – Fixed cost = Profit or,

= ₹ 30,000 – ₹ 40,000 = - ₹ 10,000

The amount of ₹ 10,000 represent extent of loss since the fixed costs are more than the contribution. At the level of fixed cost of ₹ 30,000, there shall be no profit and no loss.

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**(iii) Period Cost:** These are the **costs, which are not assigned to the products but are charged as expenses against the revenue of the period in which they are incurred.** All fixed costs either manufacturing or non-manufacturing are recognised as period costs in marginal costing.

## 5. ABSORPTION COSTING

**Absorption Costing is the practice of charging all costs, both variable and fixed to operations, processes or product.**

In absorption costing the classification of expenses is based on functional basis whereas in marginal costing it is based on the nature of expenses. In absorption costing, the fixed expenses are distributed over products on absorption costing basis that is, based on a pre-determined level of output. Since fixed expenses are constant, such a method of recovery will lead to over or under-recovery of expenses depending on the actual output being greater or lesser than the estimate used for recovery. This difficulty will not arise in marginal costing because the contribution is used as a fund for meeting fixed expenses.

**(For understanding the difference between marginal and absorption costing along with the presentation of information to management under the said two costing techniques, students are advised to refer Para 14.14)**

## 6. ADVANTAGES AND LIMITATIONS OF MARGINAL COSTING

### ADVANTAGES

1. ***Simplified Pricing Policy:*** *The marginal cost remains* constant per unit of output whereas the fixed cost remains constant in total. Since marginal cost per unit is constant from period to period within a short span of time, firm decisions on pricing policy can be taken. If fixed cost is included, the unit cost will change from day to day depending upon the volume of output. This will make decision making task difficult.

2. ***Proper recovery of Overheads:*** Overheads are recovered in costing on the basis of pre-determined rates. If fixed overheads are included on the basis of pre-determined rates, there will be under- recovery of overheads if

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production is less or if overheads are more. There will be over- recovery of overheads if production is more than the budget or actual expenses are less than the estimate. This creates the problem of treatment of such under or over-recovery of overheads. Marginal costing avoids such under or over recovery of overheads.

3. ***Shows Realistic Profit:*** Advocates of marginal costing argues that under the marginal costing technique, the stock of finished goods and work-in-progress are carried on marginal cost basis and the fixed expenses are written off to profit and loss account as period cost. This shows the true profit of the period.

4. ***How much to produce:*** Marginal costing helps in the preparation of break-even analysis which shows the effect of increasing or decreasing production activity on the profitability of the company.

5. ***More control over expenditure:*** Segregation of expenses as fixed and variable helps the management to exercise control over expenditure. The management can compare the actual variable expenses with the budgeted variable expenses and take corrective action through analysis of variances.

6. ***Helps in Decision Making:*** Marginal costing helps the management in taking a number of business decisions like make or buy, discontinuance of a particular product, replacement of machines, etc.

7. ***Short term profit planning:*** It helps in short term profit planning by B.E.P charts.

## LIMITATIONS

1. ***Difficulty in classifying fixed and variable elements*:** It is difficult to classify exactly the expenses into fixed and variable category. Most of the expenses are neither totally variable nor wholly fixed. For example, various amenities provided to workers may have no relation either to volume of production or time factor.

2. ***Dependence on key factors:*** Contribution of a product itself is not a guide for optimum profitability unless it is linked with the key factor.

3. ***Scope for Low Profitability:*** Sales staff may mistake marginal cost for total cost and sell at a price; which will result in loss or low profits. Hence, sales staff should be cautioned while giving marginal cost.

4. ***Faulty valuation:*** Overheads of fixed nature cannot altogether be excluded particularly in large contracts, while valuing the work-in- progress. In order

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to show the correct position, fixed overheads have to be included in work-in-progress.

5. ***Unpredictable nature of Cost:*** Some of the assumptions regarding the behaviour of various costs are not necessarily true in a realistic situation. For example, the assumption that fixed cost will remain static throughout is not correct. Fixed cost may change from one period to another. For example, salaries bill may go up because of annual increments or due to change in pay rate etc. The variable costs do not remain constant per unit of output. There may be changes in the prices of raw materials, wage rates etc. after a certain level of output has been reached due to shortage of material, shortage of skilled labour, concessions of bulk purchases etc.

6. ***Marginal costing ignores time factor and investment*:** The marginal cost of two jobs may be the same but the time taken for their completion and the cost of machines used may differ. The true cost of a job which takes longer time and uses costlier machine would be higher. This fact is not disclosed by marginal costing.

7. ***Understating of W-I-P:*** Under marginal costing stocks and work in progress are understated.

## 7. COST-VOLUME-PROFIT (CVP) ANALYSIS

**Meaning:** It is a managerial tool showing the relationship between various ingredients of profit planning viz., cost, selling price and volume of activity. As the name suggests, cost volume profit (CVP) analysis **is the analysis of three variables, cost, volume and profit.** Such an analysis explores the relationship between costs, revenue, activity levels and the resulting profit. It aims at measuring variations in cost and volume.

**Assumptions:**

1. **Changes in the levels of revenues and costs arise only because of changes in the number of product (or service) units produced and sold** – for example, the number of television sets produced and sold by Sony Corporation or the number of packages delivered by Overnight Express. The number of output units is the only revenue driver and the only cost driver.

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Just as a cost driver is any factor that affects costs, a revenue driver is a variable, such as volume, that causally affects revenues.

2. **Total costs can be separated into two components**; a fixed component that does not vary with output level and a variable component that changes with respect to output level. Furthermore, variable costs include both direct variable costs and indirect variable costs of a product. Similarly, fixed costs include both direct fixed costs and indirect fixed costs of a product

3. When represented graphically, **the behaviours of total revenues and total costs are linear** (meaning they can be represented as a straight line) in relation to output level within a relevant range (and time period).

4. **Selling price, variable cost per unit, and total fixed costs (within a relevant range and time period) are known and constant**.

5. The analysis either covers a single product or assumes that **the proportion of different products when multiple products are sold will remain constant** as the level of total units sold changes.

6. All revenues and costs can be added, subtracted, and compared **without taking into account the time value of money.** (Refer to the FM study material for a clear understanding of time value of money).

**Importance**

It provides the information about the following matters:

1. The behavior of cost in relation to volume.
2. Volume of production or sales, where the business will break-even.
3. Sensitivity of profits due to variation in output.
4. Amount of profit for a projected sales volume.
5. Quantity of production and sales for a target profit level.

**Impact of various changes on profit:**

An understanding of CVP analysis is extremely useful to management in budgeting and profit planning. It elucidates the impact of the following on the net profit:

(i) Changes in selling prices,

(ii) Changes in volume of sales,

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(iii) Changes in variable cost,

(iv) Changes in fixed cost.

## 7.1 Marginal Cost Equation

The contribution theory explains the relationship between the variable cost and selling price. It tells us that selling price minus variable cost of the units sold is the contribution towards fixed expenses and profit. If the contribution is equal to fixed expenses, there will be no profit or loss and if it is less than fixed expenses, loss is incurred. Since the variable cost varies in direct proportion to output, therefore if the firm does not produce any unit, the loss will be there to the extent of fixed expenses. These points can be described with the help of following marginal cost equation:

Marginal Cost Equation = S -V = C = F ± P

Where,

S = Sales value, V = Variable cost , C = Contribution, F = Fixed Cost,

**Marginal Cost Statement**

| | (₹) |
|---|---|
| Sales | xxxx |
| Less: Variable Cost | xxxx |
| Contribution | xxxx |
| Less: Fixed Cost | xxxx |
| Profit | xxxx |

## 7.2 Contribution to Sales Ratio (Profit Volume Ratio or P/V Ratio)

This ratio shows the **proportion of sales available to cover fixed costs and profit**. Contribution represents the sales revenue after deducting variable costs. This ratio is usually expressed in percentage.

$$P/V\ Ratio = \frac{Contribution}{Sales} \times 100 \text{ or, } P/V\ Ratio = \frac{Change\ in\ contribution\ /\ Profit}{Change\ in\ sales} \times 100$$

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A higher contribution to sales ratio implies that the rate of growth of contribution is faster than that of sales. This is because, once the breakeven point is reached, profits shall grow at a faster rate when compared to a product with a lesser contribution to sales ratio.

By transposition, we have derived the following equations:

(i) $C = S \times P/V \text{ ratio}$

(ii) $S = \frac{C}{P/V \text{Ratio}}$

### 7.3 Break-Even Analysis

Break-even analysis is a generally used method to study the CVP analysis. This technique can be explained in two ways:

(i) In narrow sense it is concerned with computing the break-even point. At this point of production level and sales there will be no profit and loss i.e. total cost is equal to total sales revenue.

(ii) In broad sense this technique is used to determine the possible profit/loss at any given level of production or sales.

## 8. METHODS OF BREAK-EVEN ANALYSIS

Break even analysis may be conducted by the following two methods:

(A) Algebraic computations

(B) Graphic presentations

**(A) ALGEBRAIC CALCULATIONS**

### 8.1 Break-even Point

The word contribution has been given its name because of the fact that it literally contributes towards the recovery of fixed costs and the making of profits. The contribution grows along with the sales revenue till the time it just covers the fixed cost. This is the point where neither profits nor losses have been made is known as a break-even point. This implies that in order to break even the amount of contribution generated should be exactly equal to the fixed costs incurred. Hence, if we know how much contribution is generated from each unit sold, we shall have sufficient information

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for computing the number of units to be sold in order to break even. Mathematically,

$$\text{Break-even point in units} = \frac{\text{Fixed costs}}{\text{Contribution per unit}}$$

**Example 3:** ABC Ltd. manufacturing a single product, incurring variable costs of ₹ 300 per unit and fixed costs of ₹ 2,00,000 per month. If the product sells for ₹ 500 per unit, the breakeven point shall be calculated as follows;

$$\text{Break- even point in units} = \frac{\text{Fixed costs}}{\text{Contribution per unit}} = \frac{₹2,00,000}{₹200} = 1{,}000 \text{ units}$$

$$\text{Break- even points (in Value)} = \frac{\text{Total fixed cost}}{\text{Contribution}} \times \text{Sales}$$

$$\text{Break- even point (in Value)} = \frac{\text{Total fixed cost}}{\text{P / V Ratio}}$$

## 8.2 Cash Break-even Point

When break-even point is calculated only with those fixed costs which are payable in cash, such a break-even point is known as cash break-even point. This means that depreciation and other non-cash fixed costs are excluded from the fixed costs in computing cash break-even point. Its formula is –

$$\text{Cash break- even point} = \frac{\text{Cash fixed costs}}{\text{Contribution per unit}}$$

### ILLUSTRATION 1

*MNP Ltd sold 2,75,000 units of its product at ₹ 37.50 per unit. Variable costs are ₹ 17.50 per unit (manufacturing costs of ₹ 14 and selling cost ₹ 3.50 per unit). Fixed costs are incurred uniformly throughout the year and amounting to ₹ 35,00,000 (including depreciation of ₹ 15,00,000). There is no beginning or ending inventories.*

*Required:*

*COMPUTE breakeven sales level quantity and cash breakeven sales level quantity.*

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**SOLUTION**

$$\text{Break even Sales Quantity} = \frac{\text{Fixed cost}}{\text{Contribution margin per unit}} = \frac{₹\,35,00,000}{₹20}$$

$$= 1,75,000 \text{ units}$$

$$\text{Cash Break-even Sales Quantity} = \frac{\text{Cash Fixed Cost}}{\text{Contribution margin per unit}} = \frac{₹\,20,00,000}{₹20}$$

$$= 1,00,000 \text{ units.}$$

## 8.3 Multi-Product Break-Even Analysis

In a multi-product environment, where more than one product is manufactured by using a common fixed cost, the break-even point formula needs some adjustments. **The contribution is calculated by taking weights for the products.** The weights may be of sales mix quantity or sales mix values. The calculation of Multi-Product Break-even analysis can be understood with the help of the following example.

**Example 4:** Arnav Ltd. sells two products, J and K. The sales mix is 4 units of J and 3 units of K. The contribution margins per unit are ₹ 40 for J and ₹ 20 for K. Fixed costs are ₹ 6,16,000 per month.

Sales mix (in quantity) is 4 units of Product- J and 3 units of Product- K

i.e. Sales ratio is 4 : 3

Composite contribution per unit by taking weights for the product sales quantity

$$= \text{Product J-}\ ₹40 \times \frac{4}{7} + \text{Product K-}\ ₹20 \times \frac{3}{7} = ₹22.86 + ₹8.57 = ₹31.43$$

$$\text{Composite Break-even point} = \frac{\text{Common Fixed Cost}}{\text{Composite Contribution per unit}} = \frac{₹6,16,000}{₹31.43}$$

$$= 19,600 \text{ units}$$

$$\text{Break-even units of Product-J} = 19,600 \times \frac{4}{7} = 11,200 \text{ units}$$

$$\text{Break-even units of Product- K} = 19,600 \times \frac{3}{7} = 8,400 \text{ units}$$

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## ILLUSTRATION 2

*You are given the following particulars*

*i. Fixed cost ₹ 1,50,000*

*ii. Variable cost ₹ 15 per unit*

*iii. Selling price is ₹ 30 per unit*

*CALCULATE:*

*(a) Break-even point*

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

## SOLUTION

**(a)** Break-even point (BEP) = $\frac{\text{Fixed cost}}{\text{Contribution per unit}^*} = \frac{₹1,50,000}{₹15}$ = 10,000 Units

* (Contribution per unit = Sales per unit – Variable cost per unit = ₹ 30 - ₹15)

**(b)** Sales to earn a Profit of ₹ 20,000:

$$= \frac{\text{Fixed cost} + \text{Desired profit}}{\text{Contribution per unit}} \times \text{Selling price per unit}$$

$$= \frac{₹1,50,000 + ₹20,000}{₹15} \times ₹30 = ₹\ 3,40,000$$

Or

$$\frac{\text{Fixed cost} + \text{Desired profit}}{\text{P/V Ratio}} = \frac{₹1,70,000}{\text{P/V Ratio}} = \frac{₹1,70,000}{50\%} = ₹3,40,000$$

$$\text{PV Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$$

## ILLUSTRATION 3

*A company has a P/V ratio of 40%. COMPUTE by what percentage must sales be increased to offset: 20% reduction in selling price?*

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**SOLUTION**

$$\text{Revised Sales Value} = \frac{\text{Desired Contribution}}{\text{Revised P/V Ratio}^*} = \frac{0.40}{0.25} = 1.6$$

This means sales value to be increased by 60% of the existing sales.

$$^*\text{Revised P/V Ratio} = \frac{\text{Revised Contribution}}{\text{Revised Selling Price}} = \frac{0.80 - 0.60}{0.80} = 0.25$$

$$\text{Required Sales Quantity} = \frac{\text{Desired Contribution}}{\text{Revised P/V Ratio}^* \times \text{Revised Selling Price}} = \frac{0.40}{0.25 \times 0.80} = 2$$

Therefore, Sales value to be increased by 60% and sales quantity to be doubled to offset the reduction in selling price.

***Proof:***

Let selling price per unit is ₹10 and sales quantity is 100 units.

**Data before change in selling price:**

| | (₹) |
|---|---|
| Sales (₹10 × 100 units) | 1,000 |
| Contribution (40% of 1,000) | 400 |
| Variable cost (balancing figure) | 600 |

**Data after the change in selling price:**

Selling price is reduced by 20% that means it became ₹8 per unit. Since, we have to maintain the earlier contribution margin i.e. ₹400 by increasing the sales quantity only. Therefore, the target contribution will be ₹400.

The new P/V Ratio will be

| | (₹) |
|---|---|
| Sales | 8.00 |
| Variable cost | 6.00 |
| Contribution per unit | 2.00 |
| P/V Ratio | 25% |

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$$\text{Sales Value} = \frac{\text{Desired Contribution}}{\text{Revised P/V Ratio}} = \frac{₹400}{0.25} = ₹1,600$$

$$\text{Sales quantity} = \frac{\text{Sales value}}{\text{Selling price per unit}} = \frac{₹1,600}{₹8} = 200 \text{ units}$$

**ILLUSTRATION 4**

*PQR Ltd. has furnished the following data for the two years:*

| | ***2021-22*** | ***2022-23*** |
|---|---|---|
| *Sales* | *₹ 8,00,000* | *?* |
| *Profit/Volume Ratio (P/V ratio)* | *50%* | *37.5%* |
| *Margin of Safety sales as a % of total sales* | *40%* | *21.875%* |

*There has been substantial savings in the fixed cost in the year 2022-23 due to the restructuring process. The company could maintain its sales quantity level of 2021-22 in 2022-23 by reducing selling price.*

*You are required to CALCULATE the following:*

*(i) Sales for 2022-23 in Value,*

*(ii) Fixed cost for 2022-23 in Value,*

*(iii) Break-even sales for 2022-23 in Value.*

**SOLUTION**

In 2021-22, PV ratio = 50%

Variable cost ratio = 100% - 50% = 50%

Variable cost in 2021-22 = ₹ 8,00,000 × 50% = ₹ 4,00,000

In 2022-23, sales quantity has not changed. Thus, variable cost in 2022-23 is ₹ 4,00,000.

In 2022-23, P/V ratio = 37.50%

Thus, Variable cost ratio = 100% – 37.5% = 62.5%

(i) Thus, sales in 2022-23 $= \frac{4,00,000}{62.5\%} = ₹6,40,000$

In 2022-23, Break-even sales = 100% – 21.875% (Margin of safety) = 78.125%

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(ii) Break-even sales = 6,40,000 × 78.125% = ₹ 5,00,000

(iii) Fixed cost = B.E. sales × P/V ratio

= 5,00,000 × 37.50% = ₹1,87,500.

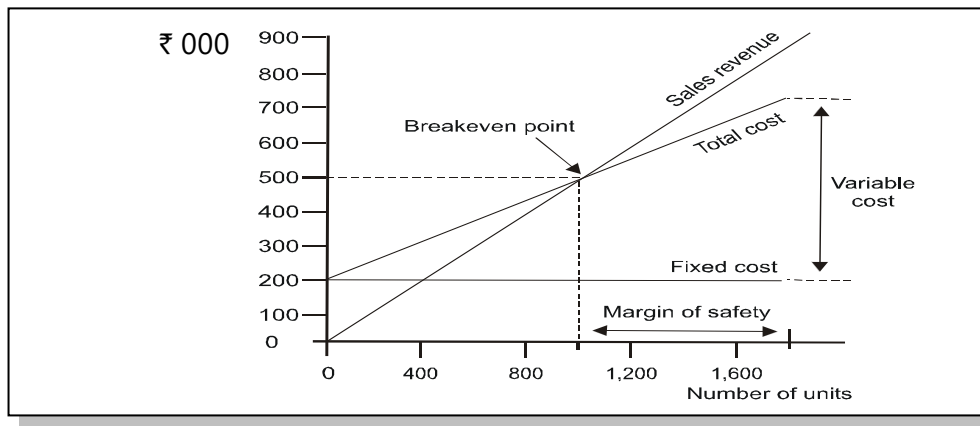
**(B) GRAPHICAL PRESENTATION OF BREAK-EVEN CHART**

## 8.4 Break-even Chart

A breakeven chart records costs and revenues on the vertical axis and the level of activity on the horizontal axis. The making of the breakeven chart would require you to select appropriate axes. Subsequently, you will need to mark costs/revenues on the Y axis whereas the level of activity shall be traced on the X axis. Lines representing (i) Fixed costs (horizontal line at ₹ 2,00,000 for ABC Ltd), (ii) Total costs at maximum level of activity (joined to the Y-axis where the Fixed cost of ₹ 2,00,000 is marked) and (iii) Revenue at maximum level of activity (joined to the origin) shall be drawn next.

The breakeven point is that point where the sales revenue line intersects the total cost line. Other measures like the margin of safety and profit can also be measured from the chart.

The breakeven chart for ABC Ltd (Example-3) is drawn below.




## 8.5 Contribution Breakeven Chart

It is not possible to use a breakeven chart as described above to measure contribution. This is one of its major limitations especially so because contribution analysis is literally the backbone of marginal costing. To overcome such a limitation, accountants frequently resort to the making of a contribution breakeven chart which is based on the same principles as a conventional breakeven chart except for

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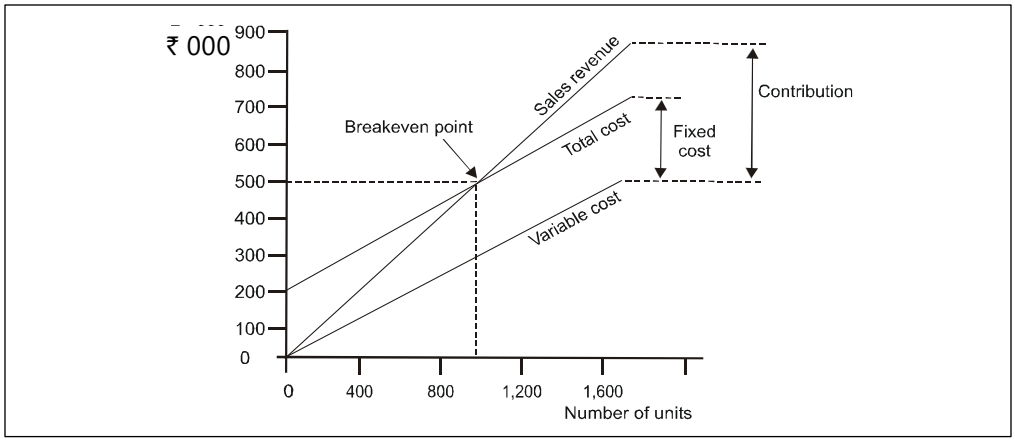
that it shows the variable cost line instead of the fixed cost line. Lines for Total cost and Sales revenue remain the same. The breakeven point and profit can be read off in the same way as with a conventional chart. However, it is also possible to read the contribution for any level of activity.

Using the same example of ABC Ltd as for the conventional chart, the total variable cost for an output of 1,700 units is 1,700 × ₹300 = ₹5,10,000. This point can be joined to the origin since the variable cost is nil at zero activity.

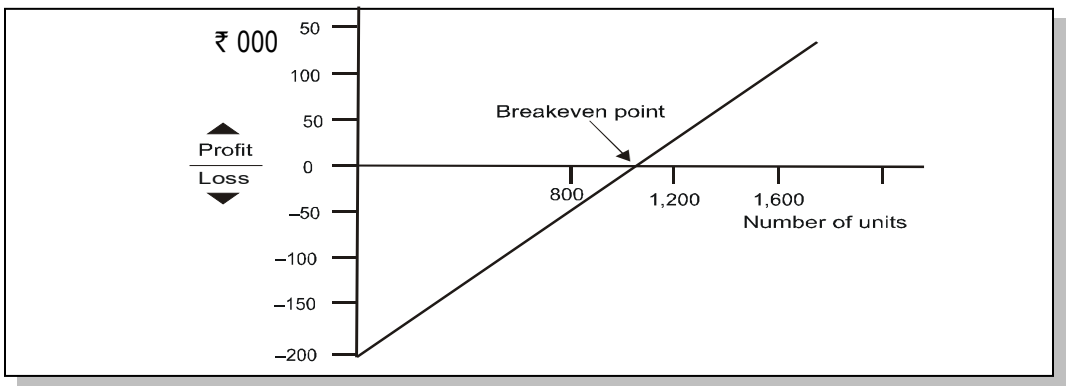



The contribution can be read as the difference between the sales revenue line and the variable cost line.

## 8.6 Profit-Volume Chart

This is also very similar to a breakeven chart. In this chart the vertical axis represents profits and losses, and the horizontal axis is drawn at zero profit or loss.

In this chart each level of activity is taken into account and profits marked accordingly. The breakeven point is where this line interacts the horizontal axis. A profit-volume graph for our example (ABC Ltd) will be as follows,

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The loss at a nil activity level is equal to ₹ 2,00,000, i.e. the amount of fixed costs. The second point used to draw the line could be the calculated breakeven point or the calculated profit for sales of 1,700 units.

**Advantages of the profit-volume chart**

1. The biggest advantage of the profit-volume chart is its capability of depicting clearly the effect on profit and breakeven point of any changes in the variables. The following example illustrates this characteristic,

**Example 5**

A manufacturing company incurs fixed costs of ₹3,00,000 per annum. It is a single product company with annual sales budgeted to be 70,000 units at a sales price of ₹300 per unit. Variable costs are ₹ 285 per unit.

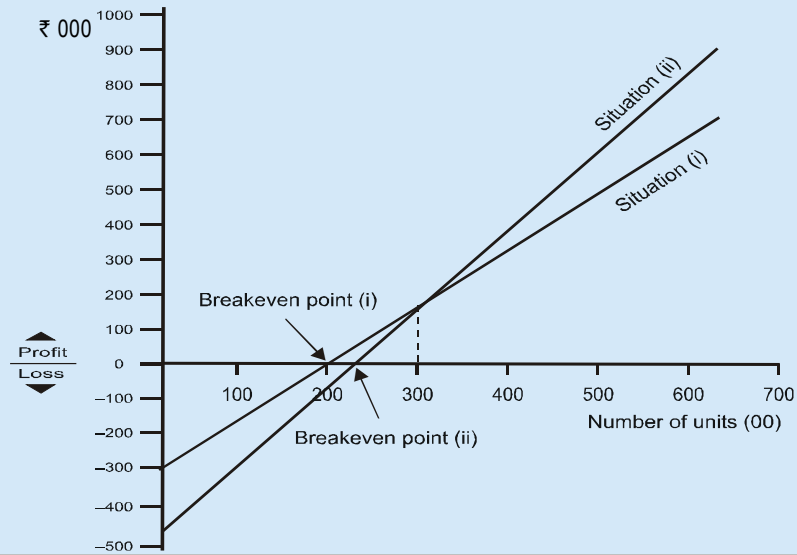
(i) Draw a profit volume graph, and use it to determine the breakeven point.

The company is deliberating upon an increase in the selling price of the product to ₹ 350 per unit. This shall be required in order to improve the quality of the product. It is anticipated that despite increase in the selling price the sales volume shall remain unaffected, however, the fixed costs shall increase to ₹ 4,50,000 per annum and the variable costs to ₹ 330 per unit.

(ii) Draw on the same graph as for part (a) a second profit volume graph and give your comments.

**Solution**

**Figure showing changes with a profit-volume chart**

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**Working notes (i)**

The profit for sales of 70,000 units is ₹ 7,50,000.

| | (₹'000) |
|---|---|
| Contribution 70,000 × (₹300 – ₹285) | 1050 |
| Fixed costs | 300 |
| Profit | 750 |

This point is joined to the loss at zero activity, ₹ 3,00,000 i.e., the fixed costs.

**Working notes (ii)**

The profit for sales of 70,000 units is ₹ 9,50,000.

| | (₹'000) |
|---|---|
| Contribution 70,000 × (₹350 – ₹330) | 1400 |
| Fixed costs | 450 |
| Profit | 950 |

This point is joined to the loss at zero activity, ₹ 4,50,000 i.e., the fixed costs.

**Comments:**

It is clear from the graph that there are larger profits available from option (ii). It also shows an increase in the break-even point from 20,000 units to 22,500 units, however, the increase of 2,500 units may not be considered large in view of the projected sales volume. It is also possible to see that for sales volumes above 30,000 units the profit achieved will be higher with option (ii). For sales volumes below 30,000 units option (i) will yield higher profits (or lower losses).

## ILLUSTRATION 5

*You are given the following data for the current financial year of Rio Co. Ltd:*

| | | |
|---|---|---|
| *Variable cost* | *60,000* | *60%* |
| *Fixed cost* | *30,000* | *30%* |
| *Net profit* | *10,000* | *10%* |
| *Sales* | *1,00,000* | *100%* |

*FIND OUT (a) Break-even point, (b) P/V ratio, and (c) Margin of safety. Also DRAW a break-even chart showing contribution and profit.*

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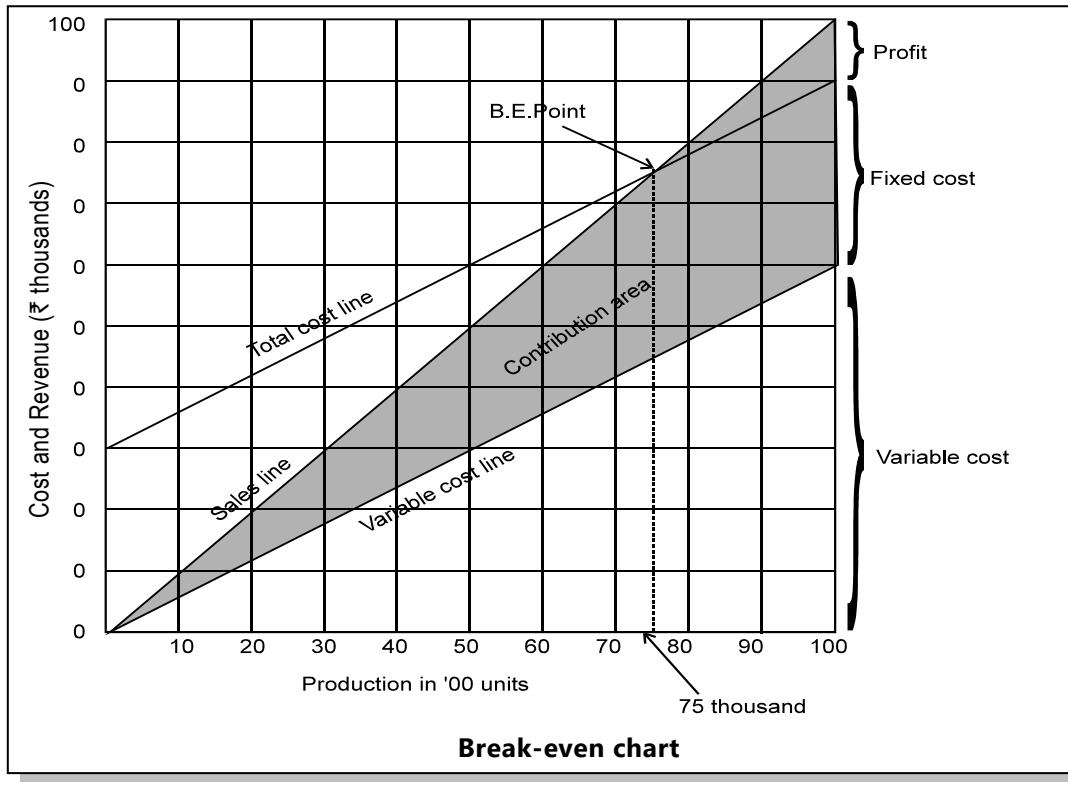
## SOLUTION

$$P/V\ ratio = \frac{Sales - Variable\ Cost}{Sales} = \frac{1,00,000 - 60,000}{1,00,000} = 40\%$$

$$Break\ Even\ Point = \frac{Fixed\ Cost}{P/V\ ratio} = \frac{30,000}{40\%} = ₹\ 75,000$$

Margin of safety = Actual Sales – BE point = 1,00,000 – 75,000 = ₹ 25,000

Break even chart showing contribution is shown below:




**Break-even chart**

## ILLUSTRATION 6

*PREPARE a profit graph for products A, B and C and find break-even point from the following data:*

| Products | A | B | C | Total |
|---|---|---|---|---|
| Sales (₹) | 7,500 | 7,500 | 3,750 | 18,750 |
| Variable cost (₹) | 1,500 | 5,250 | 4,500 | 11,250 |
| Fixed cost (₹) | --- | --- | --- | 5,000 |

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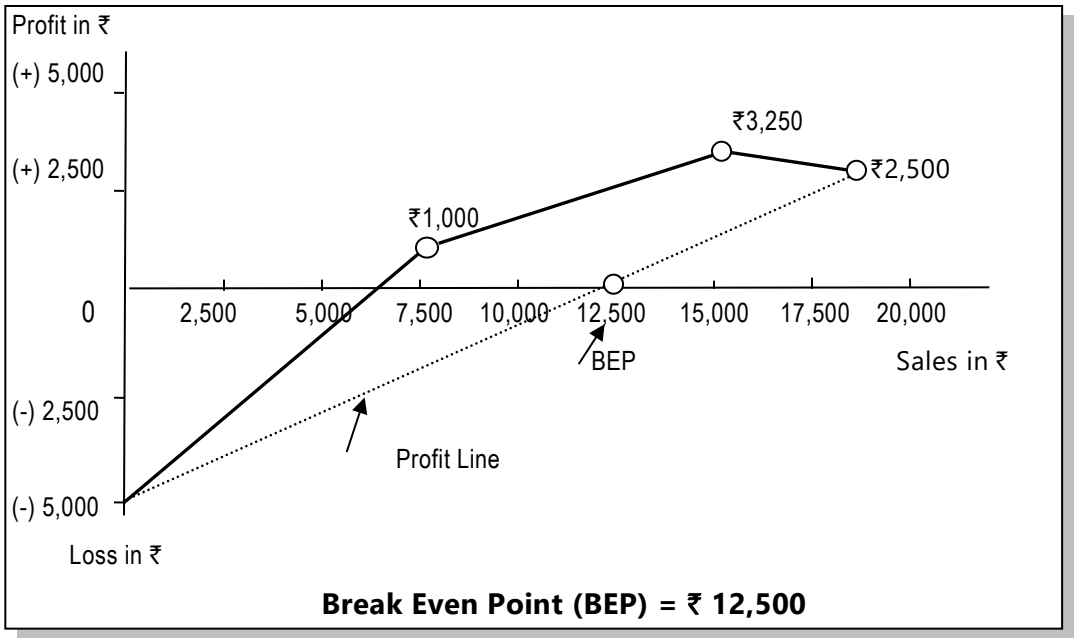
**SOLUTION**

**Statement Showing Cumulative Sales & Profit**

| Sales | Cumulative Sales | | Variable Cost | Contribution | Cumulative Contribution | Cumulative Profit |
|---|---|---|---|---|---|---|
| | (₹) | (₹) | (₹) | (₹) | (₹) | (₹) |
| A | 7,500 | 7,500 | 1,500 | 6,000 | 6,000 | 1,000 |
| B | 7,500 | 15,000 | 5,250 | 2,250 | 8,250 | 3,250 |
| C | 3,750 | 18,750 | 4,500 | (750) | 7,500 | 2,500 |




**Break Even Point (BEP) = ₹ 12,500**

## 9. LIMITATIONS OF BREAK-EVEN ANALYSIS

The limitations of the **practical applicability of breakeven analysis and breakeven charts stem mostly from the assumptions underlying CVP** which have been mentioned above. Assumptions like costs behaving in a linear fashion or sales revenue remain constant at different sales levels or the stocks shall remain constant period after period are unrealistic. Similarly, the assumption that the only factor which influences costs is the 'activity level achieved' is erroneous because other factors like inflation also have a bearing on costs.

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## 10. MARGIN OF SAFETY

The margin of safety can be defined as **the difference between the expected level of sale and the breakeven sales**. The larger the margin of safety, the higher is the chances of making profits. In the Example-3 if the forecast sale is 1,700 units per month, the margin of safety can be calculated as follows,

Margin of Safety = Projected sales – Breakeven sales

= 1,700 units – 1,000 units

= 700 units or 41% of sales.

The Margin of Safety can also be calculated by identifying the difference between the projected sales and breakeven sales in units multiplied by the contribution per unit. This is possible because, at the breakeven point all the fixed costs are recovered and any further contribution goes into the making of profits. It also can be calculated as:

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

### ILLUSTRATION 7

*A company earned a profit of ₹ 30,000 during the year. If the marginal cost and selling price of the product are ₹ 8 and ₹ 10 per unit respectively, FIND OUT the amount of margin of safety.*

### SOLUTION

$$\text{P/V ratio} = \frac{\text{Selling price - Variable cost per unit}}{\text{Selling price}} = \frac{₹10 - ₹8}{₹10} = 20\%$$

$$\text{Margin of safety} = \frac{\text{Profit}}{\text{P/V ratio}} = \frac{30,000}{20\%} = ₹\ 1,50,000$$

### ILLUSTRATION 8

*A Ltd. Maintains margin of safety of 37.5% with an overall contribution to sales ratio of 40%. Its fixed costs amount to ₹ 5 lakhs.*

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*CALCULATE the following:*

*i. Break-even sales*

*ii. Total sales*

*iii. Total variable cost*

*iv. Current profit*

*v. New 'margin of safety' if the sales volume is increased by 7 ½ %.*

**SOLUTION**

**(i)** We know that: Break- even Sales (BES) × P/V Ratio = Fixed Cost

Break-even Sales (BES) × 40% = ₹ 5,00,000

Break- even Sales (BES) = ₹ 12,50,000

**(ii)** Total Sales (S) = Break Even Sales + Margin of Safety

S = ₹ 12,50,000 + 0.375S

Or, S – 0.375S = ₹ 12,50,000

Or, S = ₹ 20,00,000

**(iii)** Contribution to Sales Ratio = 40%

Therefore, Variable cost to Sales Ratio = 60%

Variable cost = 60% of sales = 60% of 20,00,000

Variable cost = 12,00,000

**(iv)** Current Profit = Sales – (Variable Cost + Fixed Cost)

= ₹ 20,00,000 – (12,00,000 + 5,00,000) = ₹ 3,00,000

**(v)** If sales value is increased by 7 ½ %

New Sales value = ₹ 20,00,000 × 1.075 = ₹ 21,50,000

New Margin of Safety = New Sales value – BES

= ₹ 21,50,000 – ₹ 12,50,000 = ₹ 9,00,000

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# 11. VARIATIONS OF BASIC MARGINAL COST EQUATION AND OTHER FORMULAE

. Sales – Variable cost = Fixed cost ± Profit/ Loss

By multiplying and dividing L.H.S. by S

ii. $\frac{S(S-V)}{S} = F + P$

iii. S × P/V Ratio = F + P or Contribution $\left(\because \text{P/V Ratio} = \frac{S-V}{S}\right)$

iv BES × P/V Ratio = F (∵ at BEP profit is zero)

v $\text{BES} = \frac{\text{Fixed Cost}}{\text{P/V Ratio}}$

vi $\text{P/V Ratio} = \frac{\text{Fixed Cost}}{\text{BES}}$

vii S × P/V Ratio = Contribution (Refer to iii)

viii $\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}}$

ix (BES + MS) × P/V Ratio = Contribution (Total sales = BES + MS)

x (BES × P/V Ratio) + (MS × P/V Ratio) = F + P

By deducting (BES × P/V Ratio) from L.H.S. and F from R.H.S. in (x) above, we get:

xi M.S. × P/V Ratio = P

xii $\text{P/V Ratio} = \frac{\text{Change in profit}}{\text{Change in sales}}$

xiii $\text{P/V Ratio} = \frac{\text{Change in contribution}}{\text{Change in sales}}$

xiv $\text{Profitability} = \frac{\text{Contribution}}{\text{Key factor}}$

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xv Margin of Safety = Total Sales – BES or $\frac{\text{Profit}}{\text{P/V ratio}}$.

xvi BES = Total Sales – MS

Margin of Safety Ratio = $\frac{\text{Total sales - BES}}{\text{Total sales}}$

## ILLUSTRATION 9

*By noting "P/V will increase or P/V will decrease or P/V will not change", as the case may be, STATE how the following independent situations will affect the P/V ratio:*

*(i) An increase in the physical sales volume;*

*(ii) An increase in the fixed cost;*

*(iii) A decrease in the variable cost per unit;*

*(iv) A decrease in the contribution margin;*

*(v) An increase in selling price per unit;*

*(vi) A decrease in the fixed cost;*

*(vii) A 10% increase in both selling price and variable cost per unit;*

*(viii) A 10% increase in the selling price per unit and 10% decrease in the physical sales volume;*

*(ix) A 50% increase in the variable cost per unit and 50% decrease in the fixed cost.*

*(x) An increase in the angle of incidence.*

## SOLUTION

| Item no. | P/V Ratio | Reason |
|---|---|---|
| (i) | Will not change | The ratio of sales value and variable cost will remain same irrespective of change in sales volume. |
| (ii) | Will not change | Fixed cost is not considered in calculation of P/V ratio. |
| (iii) | Will increase | Decrease in variable cost increases contribution |

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| | | |
|---|---|---|
| | | margin so does the P/V ratio. |
| (iv) | Will decrease | Decrease in contribution margin decreases the P/V ratio. |
| (v) | Will increase | Increase in selling price per unit increases the contribution margin per unit and the P/V ratio. |
| (vi) | Will not change | Fixed cost is not considered in calculation of P/V ratio. |
| (vii) | Will not change | The increase in selling price and variable cost by the same ratio will not change the P/V ratio. Please refer the example note- 1 below. |
| (viii) | Will increase | The increase in selling price will increase the contribution margin but the change in sales volume in any direction will not affect P/V ratio. Thus, increase in selling price with decrease in sales volume will increase the P/V ratio. |
| (ix) | Will decrease | The increase in variable cost reduces the contribution margin thus decreases the PV ratio. Increase or decrease in fixed cost will not affect the P/V ratio. |
| (x) | Will increase | Angle of incidence represents the rate of profit earning, after reaching the break-even point. Increase in angle of incidence means increase in rate of profit earning which is nothing but the P/V ratio that contributes towards the profitability after recovering the fixed cost. (Please also refer para 14.12) |

A 10% increase in both selling price and variable cost per unit.

Example note-1:

Assumptions:

a) Variable cost is less than selling price.

b) Selling price ₹100 variable cost ₹ 90 per unit.

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c) P/V ratio $= \frac{100-90}{100} = 10\%$

10% increase in S.P. = ₹110

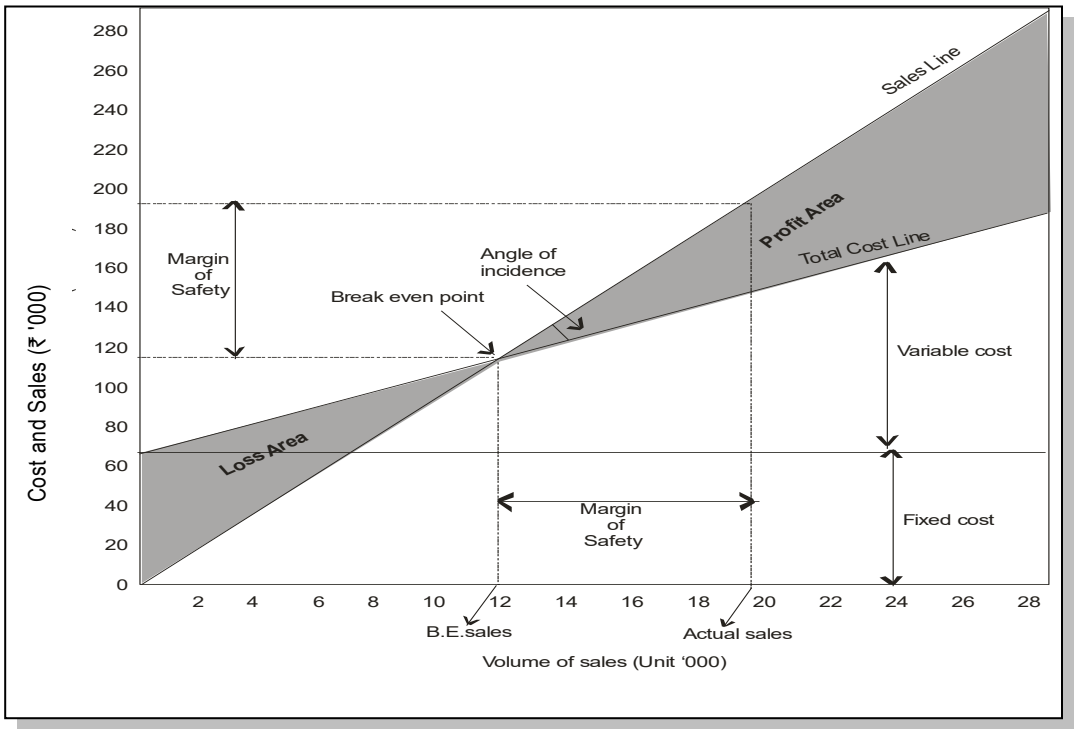
10% increase in variable cost = ₹99

P/V ratio $= \frac{110-99}{10} = 10\%$ i.e. P/V ratio will not change

## 12. ANGLE OF INCIDENCE

This angle is formed by the intersection of sales line and total cost line at the break-even point. **This angle shows the rate at which profit is earned once the break-even point is reached.** The wider the angle the greater is the rate of earning profits. A large angle of incidence with a high margin of safety indicates extremely favourable position.

The shaded area in the graph given below is representing the angle of incidence. The angle above and below the break-even point shows the rate of earning profitability (loss). Wider angle denotes higher rate of earnings and vice-versa.

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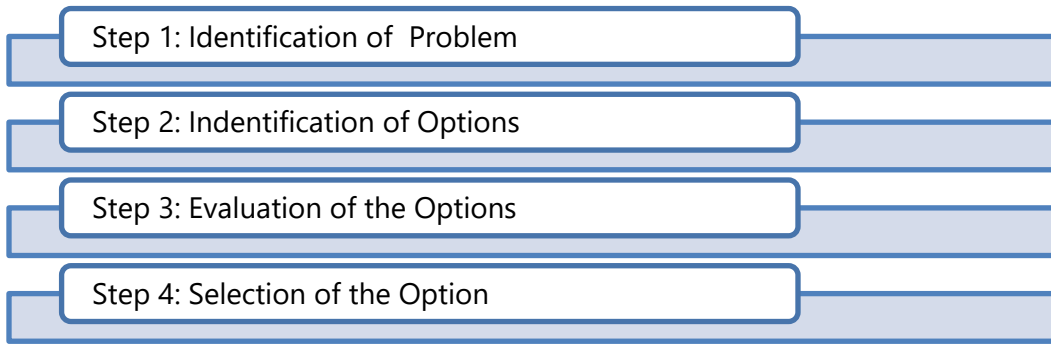
# 13. APPLICATION OF CVP ANALYSIS IN DECISION MAKING

As discussed earlier CVP analysis is used as an evaluation tool for managerial decisions. In this chapter we will discuss the use of CVP Analysis for short term decision making. Before going into illustration, let us discuss the decision making framework.

## 13.1 Framework for Decision Making




**Step-1: Identification of Problem**

Every organisation has its own objectives, and goals are set to achieve these objectives. To reach at the goal, actions are to be taken. For example, if an organisation wants to be a cost leader in the industry it operates in, it has to achieve 3Es in its all activities. 3Es means economy in inputs, efficiency in process and operations and effectiveness in output. An entity that exists for profit may identify few areas (problem areas) which if worked on can add to the profit or wealth maximisation. For example, Arnav Ltd. a manufacturer of Steel products, has identified that it can be leader in the industry if it can produce steel products at lower cost than its rival. Here the goal should be (problem area) low-cost production.

**Step- 2: Identification of Options**

After identification of problem(s), the next step is identification of options to achieve the goal (to answer the problem). All possible options need to be explored. In the above example, the Arnav Ltd. may have the following options for low-cost production:

(a) Purchase of inputs from specialised market- Local vs Import

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(b) Make the input in its own factory- Make or Buy

(c) Bulk purchase to avail discount offer- How much to purchase

(d) Make in-house- Make vs Outsource

(e) Bulk processing- How much to produce

(f) Using efficient machine for manufacturing- Old machine vs New machine

(g) Optimisation of key resources- Product mix decisions etc.

**Step- 3: Evaluation of the Options**

After identification of options, each option is to be evaluated against the objective criteria. An entity with objective of making profit may evaluate options on the basis of financial measures like impact of profit or loss, market share, overall impact on profitability, return on investment etc. Non-financial factors like customer satisfaction, impact on existing market/ customer, ethics of decision are also evaluated.

This step is a very important and may be grouped into two tasks

(i) Identification of Cost and Benefits of each option

(ii) Estimation of amount of each option

**Step-4: Selection of option:**

After evaluation of the options, the best option is selected and implemented.

## 13.2 Principles for Identification of Cost and Benefits for Measurement

The cost and benefit of an option is identified for measurement if it passes the principles of Controllability and Relevance.

**(i) Controllability:** Those cost and benefits which arise due to choice of an option. In other words, benefits received, and cost incurred are directly related with the choice of the option. Thus, the costs and benefits which are controllable are considered for measurement for making decision.

**(ii) Relevance:** The costs which are controllable need to be relevant for decision making. This means all controllable costs are not relevant for decision making unless it differs under the two options. Thus, **a cost is treated is relevant only if (a) it is a future cost and (b) it differs under two options under consideration**.

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For Example, Arnav Ltd. wants to manufacture 1,000 additional units of Product X. It is considering either to manufacture in its own factory or to outsource to job workers. In this example cost of raw materials to manufacture additional 1,000 units is controllable as it arises due to management's decision to make additional units. But it is not relevant for making choice between manufacturing in-house and outsource to job workers, as under the both options, the raw materials cost would be same.

Hence, for decision making purpose only those cost and benefits are identified for measurement which are both Controllable and Relevant.

**Below is an analysis of few costs for its relevance:**

| Cost | Relevance | Reason |
|---|---|---|
| (i) Historical Cost | Irrelevant | The cost has already been incurred and do not affect the decision. Example: Book value of machinery etc. |
| (ii) Sunk Cost | Irrelevant | The cost which are already paid either for goods or services availed or to be availed. Example: Raw material purchased and held in store without having replacement cost, Cost of drawing, blueprint etc. |
| (iii) Committed Cost | Irrelevant | The committed costs are the pre-agreed cost which cannot be revoked under the normal circumstances. This is also a sunk cost. Examples: Cost of materials as per rate agreement, Salary cost to employees etc. |
| (iv) Opportunity Cost | Relevant | The opportunity cost is represented by the forgone potential benefit from the best rejected course of action. Had the option under consideration not chosen, the benefit would come to the organisation. |
| (v) Notional or Imputed Cost | Relevant | Notional costs are relevant for the decision making only if company is actually forgoing benefits by employing its resources to alternative course of action. For example, notional interest on internally generated |

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| | | |
|---|---|---|
| | | fund is treated as relevant notional cost only if company could earn interest from it. |
| (vi) Shut-down Cost | Relevant | When an organization suspends its manufacturing operations, certain fixed expenses can be avoided and certain extra fixed expenses may be incurred depending upon the nature of the industry. By closing down the manufacturing, the organization will save variable cost of production as well as some discretionary fixed costs. This particular discretionary cost is known as shut-down cost. |

## 13.3 Principles of Estimation of Costs and Benefits

After identification of the costs and benefits, it is now required to be quantified i.e., the cost and benefit should be measured and estimated. The estimation is done by following the two principles as discusses below:

**(i) Variability:** Variability means by how much a cost or benefit increased or decreased due to the choice of the option. Variable costs are the cost which differs under the different volume or activities. On the other hand, fixed costs remain same irrespective of volume and activities.

**(ii) Traceability:** Traceability of cost means degree of relationship between the cost and the choice of the option. Direct costs are directly assigned to the option on the other hand indirect costs needs to be apportioned to the option on some reasonable basis.

For Example, Arnav Ltd. wants to manufacture 1,000 units of Product X. It is considering to manufacture the same in its own factory. To manufacture in its own factory, it requires 1,000 hours of employees and a specialised machine. In this example, employee cost for labour of 1,000 hours is variable cost for in-house manufacturing and it is directly traceable. Cost of machinery is also direct cost but so far as traceability of the machinery cost is concerned it is direct cost for 1,000 units as a whole but indirect cost for a unit.

Hence, the cost and benefits of an option is measured at directly traceable and variable costs.

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## 13.4 Short-term Decision-Making using concepts of CVP Analysis

Management uses marginal costing and CVP concepts for making various decisions. In this chapter we will learn how the concepts of marginal costing and CVP is applied for analysis of identified options for short-term decision making. Generally, short-term decisions are related with temporary gaps between demand and supply for available resources. The areas of short term decision may be classified into two broad categories:

**(i) Decisions related with excess supply, such as:**

(a) Processing of Special Order

(b) Determination of price for stimulating demand

(c) Local vs Export sale

(d) Determination of minimum price for price quotations

(e) Shut-down or continue decision etc.

**(ii) Decisions related with excess demand, such as:**

(a) Make or Buy/ In-house-processing vs Outsourcing

(b) Product mix decision under resource constraints (limiting factors)

(c) Sales mix decisions

(d) Sale or further processing etc.

**What is a Limiting Factor?** Limiting factor is anything which limits the activity of an entity. The factor is a key to determine the level of sale and production, thus it is also known as Key factor. From the supply side the limiting factor may either be Men (employees), Materials (raw material or supplies), Machine (capacity), or Money (availability of fund or budget) and from demand side it may be demand for the product, other factors like nature of product, regulatory and environmental requirement etc. The management, while making decisions, has objective to optimise the key resources upto maximum possible extent.

### ILLUSTRATION 10

*A company can make any one of the 3 products X, Y or Z in a year. It can exercise its option only at the beginning of each year.*

*Relevant information about the products for the next year is given below.*

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| | X | Y | Z |
|---|---|---|---|
| *Selling Price (₹ / unit)* | *10* | *12* | *12* |
| *Variable Costs (₹ / unit)* | *6* | *9* | *7* |
| *Market Demand (unit)* | *3,000* | *2,000* | *1,000* |
| *Production Capacity (unit)* | *2,000* | *3,000* | *900* |
| *Fixed Costs (₹)* | *30,000* | | |

***Required***

*COMPUTE the opportunity costs for each of the products.*

**SOLUTION**

| | X | Y | Z |
|---|---|---|---|
| I. Contribution *per unit* (₹) | 4 | 3 | 5 |
| II. Units (Lower of Production / Market Demand) | 2,000 | 2,000 | 900 |
| III. Possible Contribution (₹) [ I × II ] | 8,000 | 6,000 | 4,500 |
| IV. Opportunity Cost* (₹) | 6,000 | 8,000 | 8,000 |

(*) Opportunity cost is the maximum possible contribution forgone by not producing alternative product i.e. if Product X is produced then opportunity cost will be maximum of (₹ 6,000 from Y, ₹ 4,500 from Z).

**ILLUSTRATION 11**

*M.K. Ltd. manufactures and sells a single product X whose selling price is ₹ 40 per unit and the variable cost is ₹ 16 per unit.*

*(i) If the Fixed Costs for this year are ₹ 4,80,000 and the annual sales are at 60% margin of safety, CALCULATE the rate of net return on sales, assuming an income tax level of 40%*

*(ii) For the next year, it is proposed to add another product line Y whose selling price would be ₹ 50 per unit and the variable cost ₹ 10 per unit. The total fixed costs are estimated at ₹ 6,66,600. The sales mix values of X : Y would be 7 : 3. DETERMINE at what level of sales next year, would M.K. Ltd. break even? Give separately for both X and Y the break-even sales in rupee and quantities.*

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## SOLUTION

**(i)** Contribution *per unit* = Selling price – Variable cost

= ₹40 – ₹16 = ₹24

Break-even Point = $\frac{₹4,80,000}{₹24}$ = 20,000 units

Percentage Margin of Safety = $\frac{\text{Actual Sales} - \text{Break-even Sales}}{\text{Actual Sales}}$

*Or,* 60% = $\frac{\text{Actual Sales} - 20,000 \text{ units}}{\text{Actual Sales}}$

∴ Actual Sales = 50,000 units

| | (₹) |
|---|---|
| Sales Value (50,000 units × ₹40) | 20,00,000 |
| *Less:* Variable Cost (50,000 units × ₹16) | 8,00,000 |
| Contribution | 12,00,000 |
| *Less:* Fixed Cost | 4,80,000 |
| Profit | 7,20,000 |
| *Less:* Income Tax @ 40% | 2,88,000 |
| Net Return | 4,32,000 |

Rate of Net Return on Sales = 21.6% $\left(\frac{₹4,32,000}{₹20,00,000} \times 100\right)$

**(ii)** Products

| | X | Y |
|---|---|---|
| | (₹) | (₹) |
| Selling Price | 40 | 50 |
| Less: Variable Cost | 16 | 10 |
| Contribution per unit | 24 | 40 |
| Sales Ratio | 7 | 3 |
| Contribution in sales Ratio | 168 | 120 |

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**Based on Weighted Contribution**

$$\text{Weighted Contribution} = \frac{24 \times 7 + 40 \times 3}{10} = ₹\ 28.8 \text{ per unit}$$

$$\text{Total Break-even Point} = \frac{\text{Total Fixed Cost}}{\text{Weighted Contribution}} = \frac{6,66,600}{28.80} = 23,145.80 \text{ units}$$

Break-even Point

$$X = \frac{7}{10} \times 23,145.80 = 16,202 \text{ units}$$

or 16,202 × ₹ 40 = ₹ 6,48,080

$$Y = \frac{3}{10} \times 23,145.80 = 6,944 \text{ units or } 6,944 \times ₹\ 50 = ₹\ 3,47,200$$

**Based on distributing fixed cost in the weighted Contribution Ratio**

Fixed Cost

$$X = \frac{168}{288} \times 6,66,600 = ₹\ 3,88,850$$

$$Y = \frac{120}{288} \times 6,66,600 = ₹\ 2,77,750$$

Break-even Point

$$X = \frac{\text{Fixed Cost}}{\text{Contribution per unit}} = \frac{3,88,850}{24} = 16,202 \text{ units or } ₹\ 6,48,000$$

$$Y = \frac{\text{Fixed Cost}}{\text{Contribution per unit}} = \frac{2,77,750}{40} = 6,944 \text{ units or } ₹\ 3,47,200$$

## ILLUSTRATION 12

*X Ltd. supplies spare parts to an air craft company Y Ltd. The production capacity of X Ltd. facilitates production of any one spare part for a particular period of time. The following are the cost and other information for the production of the two different spare parts A and B:*

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| | | *Part A* | *Part B* |
|---|---|---|---|
| *Per unit* | | | |
| *Alloy usage* | | *1.6 kgs.* | *1.6 kgs.* |
| *Machine Time: Machine P* | | *0.6 hrs* | *0.25 hrs.* |
| *Machine Time: Machine Q* | | *0.5 hrs.* | *0.55 hrs.* |
| *Target Price (₹)* | | *145* | *115* |
| *Total hours available* | *Machine P 4,000 hours* | | |
| | *Machine Q 4,500 hours* | | |

Alloy available is 13,000 kgs. @ ₹ 12.50 per kg.

Variable overheads per machine hours — Machine P: ₹ 80

Machine Q: ₹ 100

***Required***

*(i) IDENTIFY the spare part which will optimize contribution at the offered price.*

*(ii) If Y Ltd. reduces target price by 10% and offers ₹ 60 per hour of unutilized machine hour, CALCULATE the total contribution from the spare part identified above?*

**SOLUTION**

(i)

| | **Part A** | **Part B** |
|---|---|---|
| Machine "P" (4,000 hrs) | 6,666 | 16,000 |
| Machine "Q" (4,500 hrs) | 9,000 | 8,181 |
| Alloy Available (13,000 kg.) | 8,125 | 8,125 |
| Maximum Number of Parts *to be manufactured (Minimum of the above three)* | 6,666 | 8,125 |

| | **(₹)** | **(₹)** |
|---|---|---|
| Material (₹12.5 × 1.6 kg.) | 20.00 | 20.00 |
| Variable Overhead: Machine "P" | 48.00 | 20.00 |
| Variable Overhead: Machine "Q" | 50.00 | 55.00 |

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| | | | |
|---|---|---|---|
| Total Variable Cost *per unit* | | 118.00 | 95.00 |
| Price Offered | | 145.00 | 115.00 |
| Contribution *per unit* | | 27.00 | 20.00 |
| Total Contribution *for units produced* | (I) | 1,79,982 | 1,62,500 |

Spare Part A will optimize the contribution.

(ii)

| | | **Part A** |
|---|---|---|
| Parts to be manufactured numbers | | 6,666 |
| Machine P : to be used | | 4,000 |
| Machine Q : to be used | | 3,333 |
| Underutilized Machine Hours (4,500 hrs. – 3,333 hrs.) | | 1,167 |
| Compensation for unutilized machine hours (1,167hrs. × ₹60) | (II) | 70,020 |
| Reduction in Price by 10%, Causing fall in Contribution of ₹14.50 *per unit* (6,666 units × ₹14.5) | (III) | 96,657 |
| Total Contribution | (I + II – III) | 1,53,345 |

## ILLUSTRATION 13

*The profit for the year of R.J. Ltd. works out to 12.5% of the capital employed and the relevant figures are as under:*

*Sales..... ₹ 5,00,000*

*Direct Materials..... ₹ 2,50,000*

*Direct Labour..... ₹ 1,00,000*

*Variable Overheads..... ₹ 40,000*

*Capital Employed..... ₹ 4,00,000*

*The new Sales Manager who has joined the company recently estimates for next year a profit of about 23% on capital employed, provided the volume of sales is increased by 10% and simultaneously there is an increase in Selling Price of 4% and an overall cost reduction in all the elements of cost by 2%.*

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***Required***

*FIND OUT by computing in detail the cost and profit for next year, whether the proposal of Sales Manager can be adopted.*

**SOLUTION**

**Statement Showing "Cost and Profit for the Next Year"**

| **Particulars** | **Existing Volume, etc.** | **Volume, Costs, etc. after 10% Increase** | **Estimated Sale, Cost, Profit, etc.*** |
|---|---|---|---|
| | (₹) | (₹) | (₹) |
| Sales | 5,00,000 | 5,50,000 | 5,72,000 |
| *Less:* Direct Materials | 2,50,000 | 2,75,000 | 2,69,500 |
| Direct Labour | 1,00,000 | 1,10,000 | 1,07,800 |
| Variable Overheads | 40,000 | 44,000 | 43,120 |
| Contribution | 1,10,000 | 1,21,000 | 1,51,580 |
| *Less:* Fixed Cost# | 60,000 | 60,000 | 58,800 |
| Profit | 50,000 | 61,000 | 92,780 |

(*) for the next year after increase in selling price @ 4% and overall cost reduction by 2%.

(#) Fixed Cost = Existing Sales – Existing Marginal Cost – 12.5% on ₹4,00,000

= ₹5,00,000 – ₹3,90,000 – ₹50,000 = ₹60,000

Percentage Profit on Capital Employed equals to 23.19% $\left(\frac{₹92,780}{₹4,00,000} \times 100\right)$

Since the Profit of ₹92,780 is more than 23% of capital employed, the proposal of the Sales Manager can be adopted.

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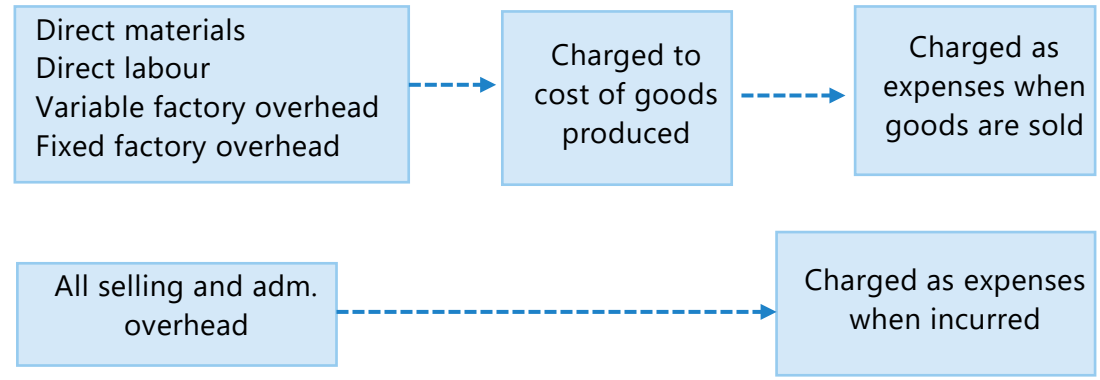
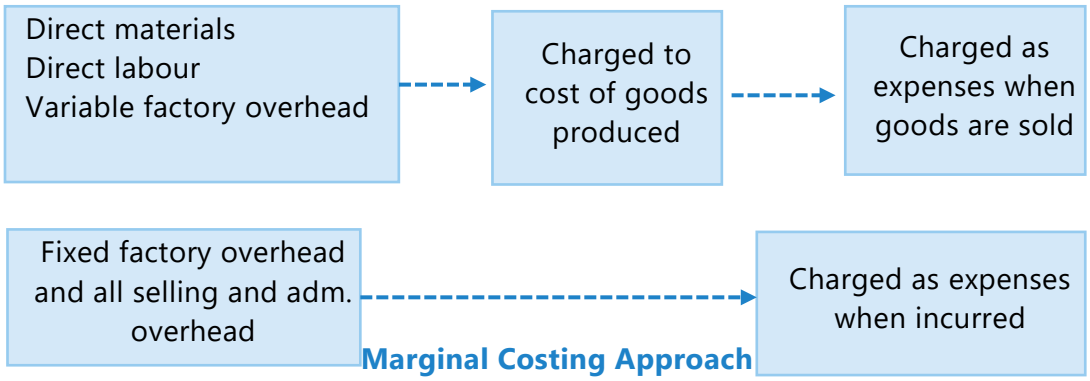
# 14. DISTINCTION BETWEEN MARGINAL AND ABSORPTION COSTING

The distinctions in these two techniques are illustrated by the following diagrams:




**Absorption Costing Approach**




**Marginal Costing Approach**

## 14.1 Main Points of distinction between Marginal Costing and Absorption Costing

| | Marginal costing | Absorption costing |
|---|---|---|
| 1. | Only variable costs are considered for product costing and inventory valuation. | Both fixed and variable costs are considered for product costing and inventory valuation. |
| 2. | Fixed costs are regarded as period costs. The Profitability | Fixed costs are charged to the cost of production. Each product bears a reasonable share of fixed cost and thus the |

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| | | |
|---|---|---|
| | of different products is judged by their P/V ratio. | profitability of a product is influenced by the apportionment of fixed costs. |
| 3. | Cost data presented highlight the total contribution of each product. | Cost data are presented in conventional pattern. Net profit of each product is determined after subtracting fixed cost along with their variable costs. |
| 4. | The difference in the magnitude of opening stock and closing stock does not affect the unit cost of production. | The difference in the magnitude of opening stock and closing stock affects the unit cost of production due to the impact of related fixed cost. |
| 5. | In case of marginal costing the cost per unit remains the same, irrespective of the production as it is valued at variable cost | In case of absorption costing the cost per unit reduces, as the production increases as it is fixed cost which reduces, whereas, the variable cost remains the same per unit. |

## 14.2 Difference in Profit under Marginal and Absorption costing

The above two approaches will compute the different profit because of the difference in the stock valuation. This difference is explained as follows in different circumstances.

1. **No opening and closing stock:** In this case, profit / loss under absorption and marginal costing will be equal.

2. **When opening stock is equal to closing stock:** In this case, profit / loss under two approaches will be equal provided the fixed cost element in both the stocks is same amount.

3. **When closing stock is more than opening stock:** In other words, when production during a period is more than sales, then **profit as per absorption approach will be more** than that by marginal approach. The reason behind this difference is that a part of fixed overhead included in closing stock value is carried forward to next accounting period.

4. **When opening stock is more than the closing stock:** In other words, when production is less than the sales, **profit shown by marginal costing will be more** than that shown by absorption costing. This is because a part of fixed cost from the preceding period is added to the current year's cost of goods sold in the form of opening stock.

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The presentation of information to management under the two costing techniques is as under:

**Income Statement (Absorption costing)**

| | | | (₹) |
|---|---|---|---|
| *Sales* | | | *XXXXX* |
| *Production Costs:* | | | |
| | *Direct material consumed* | | *XXXXX* |
| | *Direct labour cost* | | *XXXXX* |
| | *Variable manufacturing overhead* | | *XXXXX* |
| | *Fixed manufacturing overhead* | | *XXXXX* |
| | ***Cost of Production*** | | *XXXXX* |
| *Add:* | *Opening stock of finished goods* | | *XXXXX* |
| | *(Value at cost of previous period's production)* | | |
| | | | *XXXXX* |
| *Less:* | *Closing stock of finished goods* | | *XXXXX* |
| | *(Value at production cost of current period)* | | . |
| | *Cost of Goods Sold* | | *XXXXX* |
| *Add:* | *(or less) Under (or over) absorption of fixed* | | |
| | *Manufacturing overhead* | | *XXXXX* |
| *Add:* | *Administration costs* | *XXXXX* | |
| | *Selling and distribution costs* | *XXXXX* | *XXXXX* |
| | ***Total Cost*** | | *XXXXX* |
| | *Profit (Sales – Total cost)* | | *XXXXX* |

**Income Statement (Marginal costing)**

| | (₹) |
|---|---|
| *Sales* | *XXXXX* |
| *Variable manufacturing costs:* | |
| *– Direct material consumed* | *XXXXX* |
| *– Direct labour* | *XXXXX* |
| *– Variable manufacturing overhead* | *XXXXX* |

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| | | |
|---|---|---|
| | *Cost of Goods Produced* | *XXXXX* |
| *Add:* | *Opening stock of finished goods* | *XXXXX* |
| | *(Value at cost of previous period)* | |
| *Less:* | *Closing stock of finished goods (Value at current variable cost)* | |
| | ***Cost of Goods Sold*** | *XXXXX* |
| *Add:* | *Variable administration, selling and dist. overhead* | *XXXXX* |
| | *Total Variable Cost* | *XXXXX* |
| *Add:* | *Selling and distribution costs* | |
| | ***Contribution (Sales – Total variable costs)*** | *XXXXX* |
| *Less:* | *Fixed costs (Production, admin., selling and dist.)* | *XXXXX* |
| | *Net Profit* | *XXXXX* |

It is evident from the above that under marginal costing technique the contributions of various products are pooled together and the fixed overheads are met out of such total contribution. The total contribution is also known as gross margin. The contribution minus fixed expenses yields net profit. In absorption costing technique cost includes fixed overheads as well.

## ILLUSTRATION 14

*Wonder Ltd. manufactures a single product, ZEST. The following figures relate to ZEST for a one-year period:*

| ***Activity Level*** | ***50%*** | ***100%*** |
|---|---|---|
| *Sales and production (units)* | *400* | *800* |
| | *(₹)* | *(₹)* |
| *Sales* | *8,00,000* | *16,00,000* |
| *Production costs:* | | |
| *- Variable* | *3,20,000* | *6,40,000* |
| *- Fixed* | *1,60,000* | *1,60,000* |
| *Selling and distribution costs:* | | |
| *- Variable* | *1,60,000* | *3,20,000* |
| *- Fixed* | *2,40,000* | *2,40,000* |

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*The normal level of activity for the year is 800 units. Fixed costs are incurred evenly throughout the year, and actual fixed costs are the same as budgeted. There were no stocks of ZEST at the beginning of the year.*

*In the first quarter, 220 units were produced and 160 units were sold.*

*Required:*

*(a) COMPUTE the fixed production costs absorbed by ZEST if absorption costing is used?*

*(b) CALCULATE the under/over-recovery of overheads during the period?*

*(c) CALCULATE the profit using absorption costing?*

*(d) CALCULATE the profit using marginal costing?*

**SOLUTION**

**(a) *Fixed production costs absorbed:*** ***(₹)***

| | |
|---|---|
| Budgeted fixed production costs | 1,60,000 |
| Budgeted output (normal level of activity 800 units) | |
| Therefore, the absorption rate: 1,60,000/800 = ₹ 200 per unit | |
| During the first quarter, the fixed production | |
| cost absorbed by ZEST would be (220 units × ₹ 200) | 44,000 |

**(b) *Under /over-recovery of overheads during the period:*** ***(₹)***

| | |
|---|---|
| Actual fixed production overhead | 40,000 |
| (1/4 of ₹ 1,60,000) | |
| Absorbed fixed production overhead | 44,000 |
| Over-recovery of overheads | 4,000 |

**(c) *Profit for the Quarter (Absorption Costing)***

| | (₹) | (₹) |
|---|---|---|
| Sales revenue (160 units × ₹ 2,000): (A) | | 3,20,000 |
| *Less:* Production costs: | | |
| - Variable cost (220 units × ₹ 800) | 1,76,000 | |

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| | | |
|---|---|---|
| - Fixed overheads absorbed (220 units × ₹ 200) | 44,000 | 2,20,000 |
| Add: Opening stock | | -- |
| Less: Closing Stock $\left(\frac{₹2,20,000}{220 units} \times 60 units\right)$ | | (60,000) |
| Cost of Goods sold | | 1,60,000 |
| Less: Adjustment for over-absorption of fixed production overheads | | (4,000) |
| Add: Selling & Distribution Overheads: | | |
| - Variable (160 units × ₹400) | 64,000 | |
| - Fixed (1/4$^{th}$ of ₹ 2,40,000) | 60,000 | 1,24,000 |
| **Cost of Sales (B)** | | 2,80,000 |
| Profit {(A) – (B)} | | 40,000 |

**(d)** ***Profit for the Quarter (Marginal Costing)***

| | (₹) | (₹) |
|---|---|---|
| Sales revenue (160 units × ₹ 2,000): (A) | | 3,20,000 |
| *Less:* Production costs: | | |
| - Variable cost (220 units × ₹ 800) | | 1,76,000 |
| Add: Opening stock | | -- |
| Less: Closing Stock $\left(\frac{₹1,76,000}{220 units} \times 60 units\right)$ | | (48,000) |
| Variable cost of goods sold | | 1,28,000 |
| Add: Selling & Distribution Overheads: | | |
| - Variable (160 units × ₹400) | | 64,000 |
| Cost of Sales (B) | | 1,92,000 |
| **Contribution {(C) = (A) – (B)}** | | **1,28,000** |
| Less: Fixed Costs: | | |
| - Production cost | (40,000) | |
| - Selling & distribution cost | (60,000) | (1,00,000) |
| Profit | | 28,000 |

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# SUMMARY

- **Marginal Cost:** Marginal cost as understood in economics is the incremental cost of production which arises due to one-unit increase in the production quantity. Marginal cost is measured by the total variable cost attributable to one unit.
- **Marginal Costing:** It is a costing system where products or services and inventories are valued at variable costs only. It does not take consideration of fixed costs.
- **Absorption Costing:** A method of costing by which all direct cost and applicable overheads are charged to products or cost centers for finding out the total cost of production. Absorbed cost includes production cost as well as administrative and other cost.
- **Contribution:** Contribution or contribution margin is the difference between sales revenue and total variable costs irrespective of manufacturing or non-manufacturing.
- **Cost-Volume-Profit (CVP) Analysis:** It is an analysis of reciprocal effect of changes in cost, volume and profitability. Such an analysis explores the relationship between costs, revenue, activity levels and the resulting profit. It aims at measuring variations in cost and volume.
- **Contribution to Sales Ratio (Profit Volume Ratio or P/V ratio):** This ratio shows the proportion of sales available to cover fixed costs and profit. Contribution represents the sales revenue after deducting variable costs.
- **Break-even Point (BEP):** The level of sales where an entity neither earns profit nor incurs loss. BEP is indicated in both quantity and monetary value terms.
- **Margin of Safety (MOS):** The margin between sales and the break-even sales is known as margin of safety. It can either be indicated in quantitative or monetary terms.
- **Angle of Incidence:** This angle is formed by the intersection of sales line and total cost line at the break-even point. This angle shows the rate at which profits is earned once the break-even point is reached.
- **Limiting (Key) factor:** Limiting factor is anything which limits the activity of an entity. The factor is a key to determine the level of sale and production, thus it is also known as Key factor.

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# TEST YOUR KNOWLEDGE

## Multiple Choice Questions (MCQs)

1. *Under marginal costing the cost of product includes:*
   - *(a) Prime costs only.*
   - *(b) Prime costs and variable overheads.*
   - *(c) Prime costs and fixed overheads.*
   - *(d) Prime costs and factory overheads.*
2. *Reporting under marginal costing is accomplished by:*
   - *(a) Treating all costs as period costs.*
   - *(b) Eliminating the work-in-progress inventory account.*
   - *(c) Matching variable costs against revenue and treating fixed costs as period costs.*
   - *(d) Including only variable costs in income statement.*
3. *Period costs are:*
   - *(a) Variable costs.*
   - *(b) Fixed costs.*
   - *(c) Prime costs.*
   - *(d) Overheads costs.*
4. *When sales and production (in units) are same then profit under:*
   - *(a) Marginal costing is higher than that of absorption costing.*
   - *(b) Marginal costing is lower than that of absorption costing.*
   - *(c) Marginal costing is equal to that of absorption costing.*
   - *(d) None of the above.*
5. *When sales exceed production (in units) then profit under:*
   - *(a) Marginal costing is higher than that of absorption costing.*
   - *(b) Marginal costing is lower than that of absorption costing.*

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(c) *Marginal costing is equal than that of absorption costing.*

(d) *None of above.*

6. *The main difference between marginal costing and absorption costing is regarding the treatment of:*

(a) *Prime cost.*

(b) *Fixed overheads.*

(c) *Direct materials.*

(d) *Variable overheads.*

7. *Under profit volume ratio, the term profit:*

(a) *Means the sales proceeds in excess of total costs.*

(b) *Means the same thing as is generally understood.*

(c) *Is a misnomer, it in fact refers to contribution i.e. (sales revenue-variable costs).*

(d) *None of the above.*

8. *Factors which can change the break-even point:*

(a) *Change in fixed costs.*

(b) *Change in variable costs.*

(c) *Change in the selling price.*

(d) *All of the above.*

9. *If P/V ratio is 40% of sales then what about the remaining 60% of sales:*

(a) *Profit.*

(b) *Fixed cost.*

(c) *Variable cost.*

(d) *Margin of safety.*

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10. *The P/V ratio of a product is 0.6 and profit is ₹ 9,000. The margin of safety is:*

    *(a) ₹ 5,400*

    *(b) ₹ 15,000*

    *(c) ₹ 22,500*

    *(d) ₹ 3,600*

## Theoretical Questions

1. *EXPLAIN and ILLUSTRATE break-even point with the help of break-even chart.*
2. *WRITE a short note on Angle of Incidence.*
3. *DISCUSS basic assumptions of Cost Volume Profit analysis.*
4. *DISCUSS the practical application of Marginal Costing.*
5. *DISCUSS the points of difference between Absorption Costing and Marginal Costing.*
6. *WRITE a short note on Margin of Safety.*

## Practical Problems

1. *If P/V ratio is 60% and the Marginal cost of the product is ₹ 20. CALCULATE the selling price?*
2. *The ratio of variable cost to sales is 70%. The break-even point occurs at 60% of the capacity sales. Find the capacity sales when fixed costs are ₹ 90,000. Also COMPUTE profit at 75% of the capacity sales.*
3. *You are required to-*

| | | | (₹) |
|---|---|---|---|
| (i) | DETERMINE profit, when sales | = | 2,00,000 |
| | Fixed Cost | = | 40,000 |
| | BEP | = | 1,60,000 |
| (ii) | DETERMINE sales, when fixed cost | = | 20,000 |
| | Profit | = | 10,000 |
| | BEP | = | 40,000 |

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4. *A company has made a profit of ₹ 50,000 during the year. If the selling price and marginal cost of the product are ₹ 15 and ₹ 12 per unit respectively, FIND OUT the amount of margin of safety.*

5. *(a) If margin of safety is ₹ 2,40,000 (40% of sales) and P/V ratio is 30% of AB Ltd, CALCULATE its (1) Break even sales, and (2) Amount of profit on sales of ₹ 9,00,000.*

   *(b) X Ltd. has earned a contribution of ₹ 2,00,000 and net profit of ₹1,50,000 of sales of ₹ 8,00,000. What is its margin of safety?*

6. *A company sells its product at ₹ 15 per unit. In a period, if it produces and sells 8,000 units, it incurs a loss of ₹ 5 per unit. If the volume is raised to 20,000 units, it earns a profit of ₹ 4 per unit. CALCULATE break-even point both in terms of Value as well as in units.*

7. *You are given the following data:*

| | **Sales** | **Profit** |
|---|---|---|
| *Year 2021-22* | *₹ 1,20,000* | *8,000* |
| *Year 2022-23* | *₹ 1,40,000* | *13,000* |

*FIND OUT –*

*(i) P/V ratio,*

*(ii) B.E. Point,*

*(iii) Profit when sales are ₹ 1,80,000,*

*(iv) Sales required earn a profit of ₹ 12,000,*

*(v) Margin of safety in year 2022-23.*

8. *The product mix of a Gama Ltd. is as under:*

| | **Products** | |
|---|---|---|
| | **M** | **N** |
| *Units* | *54,000* | *18,000* |
| *Selling price* | *₹ 7.50* | *₹ 15.00* |
| *Variable cost* | *₹ 6.00* | *₹ 4.50* |

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*FIND the break-even points in units, if the company discontinues product 'M' and replace with product 'O'. The quantity of product 'O' is 9,000 units and its selling price and variable costs respectively are ₹ 18 and ₹ 9. Fixed Cost is ₹ 15,000.*

9. *Mr. X has ₹ 2,00,000 investments in his business firm. He wants a 15 per cent return on his money. From an analysis of recent cost figures, he finds that his variable cost of operating is 60 per cent of sales, his fixed costs are ₹ 80,000 per year. Show COMPUTATIONS to answer the following questions:*

   *(i) What sales volume must be obtained to break even?*

   *(ii) What sales volume must be obtained to get 15 per cent return on investment?*

   *(iii) Mr. X estimates that even if he closed the doors of his business, he would incur ₹ 25,000 as expenses per year. At what sales would he be better off by locking his business up?*

10. *A company had incurred fixed expenses of ₹ 4,50,000, with sales of ₹ 15,00,000 and earned a profit of ₹ 3,00,000 during the first half year. In the second half, it suffered a loss of ₹ 1,50,000.*

    *CALCULATE:*

   *(i) The profit-volume ratio, break-even point and margin of safety for the first half year.*

   *(ii) Expected sales volume for the second half year assuming that selling price and fixed expenses remained unchanged during the second half year.*

   *(iii) The break-even point and margin of safety for the whole year.*

11. *The following information is given by Star Ltd.:*

| | |
|---|---|
| *Margin of Safety* | *₹ 1,87,500* |
| *Total Cost* | *₹ 1,93,750* |
| *Margin of Safety* | *3,750 units* |
| *Break-even Sales* | *1,250 units* |

*Required:*

*CALCULATE Profit, P/V Ratio, BEP Sales (in ₹) and Fixed Cost.*

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12. *A single product company sells its product at ₹ 60 per unit. In 2021-22, the company operated at a margin of safety of 40%. The fixed costs amounted to ₹ 3,60,000 and the variable cost ratio to sales was 80%.*

*In 2022-23, it is estimated that the variable cost will go up by 10% and the fixed cost will increase by 5%.*

*(i) FIND the selling price required to be fixed in 2022-23 to earn the same P/V ratio as in 2021-22.*

*(ii) Assuming the same selling price of ₹ 60 per unit in 2022-23, FIND the number of units required to be produced and sold to earn the same profit as in 2021-22.*

13. *(a) You are given the following data for the coming year for a factory.*

| | |
|---|---|
| *Budgeted output* | *8,00,000 units* |
| *Fixed expenses* | *₹ 40,00,000* |
| *Variable expenses per unit* | *₹ 100* |
| *Selling price per unit* | *₹ 200* |

*DRAW a break-even chart showing the break-even point.*

*(b) If price is reduced to ₹ 180, what will be the new break-even point?*

14. *A company has three factories situated in north, east and south with its Head Office in Mumbai. The management has received the following summary report on the operations of each factory for a period:*

*(₹ in '000)*

| | Sales | | Profit | |
|---|---|---|---|---|
| | **Actual** | **Over/(Under) Budget** | **Actual** | **Over/(Under) Budget** |
| *North* | *1,100* | *(400)* | *135* | *(180)* |
| *East* | *1,450* | *150* | *210* | *90* |
| *South* | *1,200* | *(200)* | *330* | *(110)* |

*CALCULATE for each factory and for the company as a whole for the period:*

*(i) the fixed costs.* *(ii) break-even sales.*

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15. *An automobile manufacturing company produces different models of Cars. The budget in respect of model 007 for the month of March is as under:*

| ***Budgeted Output*** | | | ***40,000 Units*** |
|---|---|---|---|
| | | ***₹ In lakhs*** | ***₹ In lakhs*** |
| *Net Realisation* | | | *2,10,000* |
| *Variable Costs:* | | | |
| *Materials* | | *79,200* | |
| *Labour* | | *15,600* | |
| *Direct expenses* | | *37,200* | *1,32,000* |
| *Specific Fixed Costs* | | *27,000* | |
| *Allocated Fixed Costs* | | *33,750* | *60,750* |
| | *Total Costs* | | *1,92,750* |
| | *Profit* | | *17,250* |
| | *Sales* | | *2,10,000* |

*CALCULATE:*

*(i) Profit with 10 percent increase in selling price with a 10 percent reduction in sales volume.*

*(ii) Volume to be achieved to maintain the original profit after a 10 percent rise in material costs, at the originally budgeted selling price per unit.*

16. *An Indian soft drink company is planning to establish a subsidiary company in Bhutan to produce mineral water. Based on the estimated annual sales of 40,000 bottles of the mineral water, cost studies produced the following estimates for the Bhutanese subsidiary:*

| | ***Total annual costs*** | ***Percent of Total Annual Cost which is variable*** |
|---|---|---|
| *Material* | *2,10,000* | *100%* |
| *Labour* | *1,50,000* | *80%* |
| *Factory Overheads* | *92,000* | *60%* |
| *Administration Expenses* | *40,000* | *35%* |

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*The Bhutanese production will be sold by manufacturer's representatives who will receive a commission of 8% of the sale price. No portion of the Indian office expenses is to be allocated to the Bhutanese subsidiary. You are required to*

*(i) COMPUTE the sale price per bottle to enable the management to realize an estimated 10% profit on sale proceeds in Bhutan.*

*(ii) CALCULATE the break-even point in rupees sales as also in number of bottles for the Bhutanese subsidiary on the assumption that the sale price is ₹ 14 per bottle.*

17. *XYZ Ltd. has a production capacity of 2,00,000 units per year. Normal capacity utilisation is reckoned as 90%. Standard variable production costs are ₹ 11 per unit. The fixed costs are ₹3,60,000 per year. Variable selling costs are ₹ 3 per unit and fixed selling costs are ₹2,70,000 per year. The unit selling price is ₹ 20.*

*In the year just ended on 31st March, the production was 1,60,000 units and sales were 1,50,000 units. The closing inventory on 31st March was 20,000 units. The actual variable production costs for the year were ₹ 35,000 higher than the standard.*

*(i) CALCULATE the profit for the year*

(a) by absorption costing method and

(b) by marginal costing method.

*(ii) EXPLAIN the difference in the profits.*

18. *The following are cost data for three alternative ways of processing the clerical work for cases brought before the LC Court System:*

| | ***A Manual (₹)*** | ***B Semi-Automatic (₹)*** | ***C Fully-Automatic (₹)*** |
|---|---|---|---|
| *Monthly fixed costs:* | | | |
| *Occupancy* | *15,000* | *15,000* | *15,000* |
| *Maintenance contract* | *---* | *5,000* | *10,000* |
| *Equipment lease* | *---* | *25,000* | *1,00,000* |

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| | | | |
|---|---|---|---|
| *Unit variable costs (per report):* | | | |
| *Supplies* | *40* | *80* | *20* |
| *Labour* | *₹200 (5 hrs × ₹40)* | *₹60 (1 hr × ₹60)* | *₹20 (0.25 hr × ₹80)* |

*Required:*

*(i) CALCULATE cost indifference points. Interpret your results.*

*(ii) If the present case load is 600 cases and it is expected to go up to 850 cases in near future, SELECT most appropriate on cost considerations?*

19. *XY Ltd. makes two products X and Y, whose respective fixed costs are $F_1$ and $F_2$. You are given that the unit contribution of Y is one fifth less than the unit contribution of X, that the total of $F_1$ and $F_2$ is ₹ 1,50,000, that the BEP of X is 1,800 units (for BEP of X, $F_2$ is not considered) and that 3,000 units is the indifference point between X and Y.(i.e. X and Y make equal profits at 3,000 unit volume, considering their respective fixed costs). There is no inventory buildup as whatever is produced is sold.*

***Required***

*FIND OUT the values $F_1$ and $F_2$ and units contributions of X and Y.*

20. *Prisha Limited manufactures three different products and the following information has been collected from the books of accounts:*

| | **Products** | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| *Sales Mix* | *40%* | *35%* | *25%* |
| *Selling Price* | *₹ 300* | *₹ 400* | *₹ 200* |
| *Variable Cost* | *₹ 150* | *₹ 200* | *₹ 120* |
| *Total Fixed Costs* | | | *₹ 18,00,000* |
| *Total Sales* | | | *₹ 60,00,000* |

*The company has currently under discussion, a proposal to discontinue the manufacture of Product C and replace it with Product E, when the following results are anticipated:*

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| | Products | | |
|---|---|---|---|
| | **A** | **B** | **E** |
| *Sales Mix* | *45%* | *30%* | *25%* |
| *Selling Price* | *₹ 300* | *₹400* | *₹ 300* |
| *Variable Cost* | *₹ 150* | *₹200* | *₹ 150* |
| *Total Fixed Costs* | | | *₹ 18,00,000* |
| *Total Sales* | | | *₹ 64,00,000* |

*Required:*

*(i) CALCULATE the total contribution to sales ratio and present break-even sales at existing sales mix.*

*(ii) CALCULATE the total contribution to sales ratio and present break-even sales at proposed sales mix.*

*(iii) STATE whether the proposed sales mix is accepted or not?*

## Case Scenarios

1. *A meeting of the heads of departments of the Arnav Ltd. has been called to review the operating performance of the company in the last financial year. The head of the production department appraised that during the last year the company could operate at 70% capacity level but in the coming financial year 95% capacity level can be achieved if an additional amount of ₹100 Crore on capex and working capital is incurred.*

   *The head of the finance department has presented that during the last financial year the company had a P/V ratio of 40%, margin of safety and the break-even were ₹50 crore and ₹200 crore respectively.*

   *To the reply to the proposal of increasing the production capacity level to 95%, the head of the finance department has informed that this could be achieved if the selling price and variable cost are reduced by 8% and 5% of sales respectively. Fixed cost will also increase by ₹20 crore due to increased depreciation on additional assets. The additional capital will be arranged at a cost of 15% p.a. from a bank.*

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*In the coming financial year, it has been aimed to achieve an additional profit of ₹10 crore over and above the last year's profit after adjusting the interest cost on the additional capital.*

*The following points is required to be calculated on urgent basis to put the same in the meeting. You being an assistant to the head of finance, has been asked the followings:*

*i. What will be the revised sales for the coming financial year?*

(a) *₹322.22 Crore*

(b) *₹311.11 Crore*

(c) *₹300.00 Crore*

(d) *₹324.24 Crore*

*ii. What will be the revised break-even point for the coming financial year?*

*(a) ₹222.22 Crore*

*(b) ₹252.22 Crore*

*(c) ₹244.44 Crore*

*(d) ₹255.56 Crore*

*iii. What will be the revised margin of safety for the coming financial year?*

*(a) ₹100 Crore*

*(b) ₹58.89 Crore*

*(c) ₹55.56 Crore*

*(d) ₹66.66 Crore*

*iv. The profit of the last year and for the coming year are:*

*(a) ₹50 Crore & ₹95 Crore respectively*

*(b) ₹20 Crore & ₹65 Crore respectively*

*(c) ₹20 Crore & ₹30 Crore respectively*

*(d) ₹45 Crore & ₹66.66 Crore respectively*

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*v. The total cost of the last year and for the coming year are:*

(a) *₹ 230 Crore & ₹292.22*

(b) *₹ 230 Crore & ₹275 Crore*

(c) *₹ 220 Crore & ₹282.22 Crore*

(d) *₹ 220 Crore & ₹292.22 Crore*

# ANSWERS/ SOLUTIONS

## Answers to the MCQs

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | **(b)** | 2. | **(c)** | 3. | **(b)** | 4. | **(c)** | 5. | **(a)** | 6. | **(b)** |
| 7. | **(c)** | 8. | **(d)** | 9. | **(c)** | 10. | **(b)** | | | | |

## Answers to the Theoretical Questions

**1.** Please refer paragraph 8

**2.** Please refer paragraph 12

**3.** Please refer paragraph 7

**4.** Please refer paragraph 3

**5.** Please refer paragraph 5

**6.** Please refer paragraph 10

## Answers to the Practical Problems

**1.** Variable Cost = 100 – P/V Ratio

= 100 – 60 = 40

If Variable cost is 40, then selling price = 100

If Variable cost is 20, then selling price = (100/40) × 20 = ₹ 50

**2.** Variable cost to sales = 70%, Contribution to sales = 30%,

Or P/V Ratio 30%

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We know that: BES × P/V Ratio = Fixed Cost

BES × 0.30 = ₹ 90,000

Or BES = ₹ 3,00,000

It is given that break-even occurs at 60% capacity.

Capacity sales = ₹ 3,00,000 ÷ 0.60 = ₹ 5,00,000

Computation of profit of 75% Capacity

| | |
|---|---|
| 75% of capacity sales (i.e. ₹ 5,00,000 × 0.75) | = ₹ 3,75,000 |
| Less: Variable cost (i.e. ₹ 3,75,000 × 0.70) | = ₹ 2,62,500 |
| | = ₹ 1,12,500 |
| Less: Fixed Cost | = ₹ 90,000 |
| Profit | = ₹ 22,500 |

**3.** (i) We know that: B.E. Sales × P/V Ratio = Fixed Cost

or ₹ 1,60,000 × P/V ratio = ₹ 40,000

P/V ratio = 25%

We also know that Sales × P/V Ratio = Fixed Cost + Profit

or ₹ 2,00,000 × 0.25 = ₹ 40,000 + Profit

or Profit = ₹ 10,000

(ii) Again B.E. Sales × P/V ratio = Fixed Cost

or ₹ 40,000 × P/V Ratio = ₹ 20,000

or P/V ratio = 50%

We also know that: Sales × P/V ratio = Fixed Cost + Profit

or Sales × 0.50 = ₹ 20,000 + ₹ 10,000

or Sales = ₹ 60,000.

**4.** P/V Ratio $= \frac{\text{Contribution}}{\text{Sales}} \times 100$

$= [(15 - 12)/15] \times 100$

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= (3/15) x 100 = 20%

Marginal of Safety = Profit ÷ P/V Ratio

= 50,000 ÷ 20% = ₹ 2,50,000

**5.** **(a)** Total Sales = $2,40,000 \times \frac{100}{40}$ = ₹ 6,00,000

Contribution = 6,00,000 × 30% = ₹ 1,80,000

Profit = M/S × P/V ratio = 2,40,000 × 30% = ₹ 72,000

Fixed cost = Contribution – Profit

= 1,80,000 – 72,000 = ₹ 1,08,000

(1) Break-even Sales = $\frac{\text{Fixed Cost}}{\text{P/V ratio}} = \frac{1,08,000}{30\%}$ = ₹ 3,60,000

(2) Profit = (Sales × P/V ratio) – Fixed cost

= (9,00,000 × 30%) – 1,08,000 = ₹ 1,62,000

**(b)** P/V ratio = $\frac{\text{Contribution}}{\text{Sales}} = \frac{2,00,000}{8,00,000}$ = 25%

Margin of safety = $\frac{\text{Profit}}{\text{P/V ratio}} = \frac{1,50,000}{25\%}$ = ₹ 6,00,000

*Alternatively:*

Fixed cost = Contribution – Profit

= ₹ 2,00,000 – ₹1,50,000 = ₹ 50,000

B.E. Point = ₹ 50,000 ÷ 25% = ₹ 2,00,000

Margin of Safety = Actual sales – B.E. sales

= 8,00,000 – 2,00,000 = 6,00,000

**6.** We know that S – V = F + P

∴ Suppose variable cost = *x,* Fixed Cost = y

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In first situation:

$15 \times 8{,}000 - 8{,}000\,x = y - 40{,}000$ (1)

In second situation:

$15 \times 20{,}000 - 20{,}000\,x = y + 80{,}000$ (2)

or, $1{,}20{,}000 - 8{,}000\,x = y - 40{,}000$ (3)

$3{,}00{,}000 - 20{,}000\,x = y + 80{,}000$ (4)

From (3) & (4) we get $x$ = ₹ 5, Variable cost per unit = ₹ 5

Putting this value in 3rd equation:

$1{,}20{,}000 - (8{,}000 \times 5) = y - 40{,}000$

or, y = ₹ 1,20,000

Fixed Cost = ₹ 1,20,000

$$\text{P/V ratio} = \frac{S-V}{S} = \frac{15-5}{15} \times 100 = \frac{200}{3} = 66\frac{2}{3}\%.$$

Suppose break-even sales = $x$

$15x - 5x = 1{,}20{,}000$ (at BEP, contribution will be equal to fixed cost)

$x$ = 12,000 units.

or, Break-even sales in units = 12,000, Break-even sales in Value

= 12,000 × 15 = ₹1,80,000.

**7.**

| | Sales | Profit |
|---|---|---|
| Year 2021-22 | ₹ 1,20,000 | 8,000 |
| Year 2022-23 | ₹ 1,40,000 | 13,000 |
| Difference | ₹ 20,000 | 5,000 |

**(i)** $\text{P/V Ratio} = \frac{\text{Difference in profit}}{\text{Difference in Sales}} \times 100 = \frac{5{,}000}{20{,}000} \times 100 = 25\%$

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| | (₹) |
|---|---|
| Contribution in 2021-22 (1,20,000 × 25%) | 30,000 |
| Less: Profit | 8,000 |
| Fixed Cost* | 22,000 |

*Contribution = Fixed cost + Profit

∴ Fixed cost = Contribution - Profit

**(ii)** Break-even point = $\frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{22,000}{25\%}$ = ₹ 88,000

**(iii)** Profit when sales are ₹1,80,000

| | (₹) |
|---|---|
| Contribution (₹1,80,000 × 25%) | 45,000 |
| Less: Fixed cost | 22,000 |
| Profit | 23,000 |

**(iv)** Sales to earn a profit of ₹12,000

$$\frac{\text{Fixed cost} + \text{Desired profit}}{\text{P/V ratio}} = \frac{22,000 + 12,000}{25\%} = ₹1,36,000$$

**(v)** Margin of safety in 2022-23 –

Margin of safety = Actual sales – Break-even sales

= 1,40,000 – 88,000 = ₹ 52,000.

**8.**

| | |
|---|---|
| N | = 18,000 units |
| O | = 9,000 units |
| Ratio (N : O) | = 2:1 |
| Let | |
| t | = No. of units of 'O' for BEP |
| 2t | = No. of units of 'N' for BEP |
| Contribution of 'N' | = ₹ 10.5 per unit |
| Contribution of 'O' | = ₹ 9 per unit |

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At Break Even Point:

$\Rightarrow$10.5 x (2t) + 9 x t -15,000 = 0

$\Rightarrow$30t = 15,000

$\Rightarrow$t = 500 units

BEP of 'N' = 2t

= 1,000 units

BEP of 'O' = t = 500 units

**9.**

| **Particulars** | | **(₹)** |
|---|---|---|
| Suppose sales | | 100 |
| Variable cost | | 60 |
| Contribution | | 40 |
| P/V ratio | | 40% |
| Fixed cost | | = ₹ 80,000 |
| (i) | Break-even point = Fixed Cost ÷ P/V ratio =80,000 ÷ 40% or ₹ 2,00,000 | |
| (ii) | 15% return on ₹ 2,00,000 | 30,000 |
| | Fixed Cost | 80,000 |
| | Contribution required | 1,10,000 |
| | Sales volume required = ₹ 1,10,000 ÷ 40% or ₹ 2,75,000 | |
| (iii) | Avoidable fixed cost if business is locked up = ₹ 80,000 - ₹ 25,000 = ₹ 55,000 | |
| | Minimum sales required to meet this cost: ₹ 55,000 ÷ 40% or ₹ 1,37,500 | |

Mr. X will be better off by locking his business up, if the sale is less than ₹ 1,37,500

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**10.** **(i)** In the First half year:

Contribution = Fixed cost + Profit

= 4,50,000 + 3,00,000 = ₹ 7,50,000

P/V ratio $= \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{7,50,000}{15,00,000} \times 100 = 50\%$

Break-even point $= \frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{4,50,000}{50\%} \times 100 = ₹\ 9,00,000$

Margin of safety = Actual sales – Break-even point

= 15,00,000 – 9,00,000 = ₹ 6,00,000

**(ii)** In the second half year:

Contribution = Fixed cost – Loss

= 4,50,000 – 1,50,000 = ₹ 3,00,000

Expected sales volume $= \frac{\text{Fixed cost - Loss}}{\text{P / V ratio}} = \frac{3,00,000}{50\%} = ₹\ 6,00,000$

**(iii)** For the whole year:

B.E. point $= \frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{4,50,000 \times 2}{50\%} = ₹18,00,000$

Margin of safety $= \frac{\text{Profit}}{\text{P/V ratio}} = \frac{3,00,000 - 1,50,000}{50\%} = ₹\ 3,00,000.$

**11.** Margin of Safety (%) $= \frac{3,750\text{units}}{3,750\text{units} + 1,250\text{units}}$

$= 75\%$

Total Sales $= \frac{₹1,87,500}{0.75} = ₹\ 2,50,000$

Profit = Total Sales – Total Cost

= ₹ 2,50,000 – ₹ 1,93,750 = ₹ 56,250

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P/V Ratio = $\frac{\text{Profit}}{\text{Margin of Safety (₹)}} \times 100$

= $\frac{₹56,250}{₹1,87,500} \times 100 = 30\%$

Break-even Sales = Total Sales × [100 – Margin of Safety %]

= ₹ 2,50,000 × 0.25 = ₹ 62,500

Fixed Cost = Sales × P/V Ratio – Profit

= ₹ 2,50,000 × 0.30 – ₹ 56,250 = ₹ 18,750

**12. (i) Profit earned in 2021-22:**

| **Particulars** | **(₹)** |
|---|---|
| Total contribution (50,000 × ₹ 12) | 6,00,000 |
| Less: Fixed cost | 3,60,000 |
| Profit | 2,40,000 |
| **Selling price to be fixed in 2022-23:** | |
| Revised variable cost (₹ 48 × 1.10) | 52.80 |
| Revised fixed cost (3,60,000 × 1.05) | 3,78,000 |
| P/V Ratio (Same as of 2021-22) | 20% |
| Variable cost ratio to selling price | 80% |

Therefore, revised selling price per unit = ₹ 52.80 ÷ 80% = ₹ 66

**(ii) No. of units to be produced and sold in 2022-23 to earn the same profit:**

| We know that Fixed Cost plus profit = | Contribution (₹) |
|---|---|
| Profit in 2021-22 | 2,40,000 |
| Fixed cost in 2022-23 | 3,78,000 |
| Desired contribution in 2022-23 | 6,18,000 |

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Contribution per unit = Selling price per unit – Variable cost per unit.

= ₹ 60 – ₹ 52.80 = ₹ 7.20.

No. of units to be produced in 2022-23 = ₹ 6,18,000 ÷ ₹ 7.20 = 85,834 units.

**Workings:**

1. PV Ratio in 2021-22

| | (₹) |
|---|---|
| Selling price per unit | 60 |
| Variable cost (80% of Selling Price) | 48 |
| Contribution | 12 |
| P/V Ratio | 20% |

2. No. of units sold in 2021-22

Break-even point = Fixed cost ÷ Contribution per unit

= ₹ 3,60,000 ÷ ₹ 12 = 30,000 units.

Margin of safety is 40%. Therefore, break-even sales will be 60% of units sold.

No. of units sold = Break-even point in units ÷ 60%

= 30,000 ÷ 60% = 50,000 units.

**13. (a)** Contribution = S – V = ₹ 200 – ₹ 100 = ₹ 100 per unit.

$$\text{B.E. Point} = \frac{\text{Fixed cost}}{\text{Contribution per unit}} = \frac{40,00,000}{₹100} = 40,000 \text{ unit}$$

**(b)** When selling price is reduced

New selling price = ₹ 180

New Contribution = ₹ 180 – ₹ 100 = ₹ 80 per unit.

$$\text{New B.E. Point} = \frac{₹40,00,000}{₹\,80} = 50,000 \text{ units.}$$

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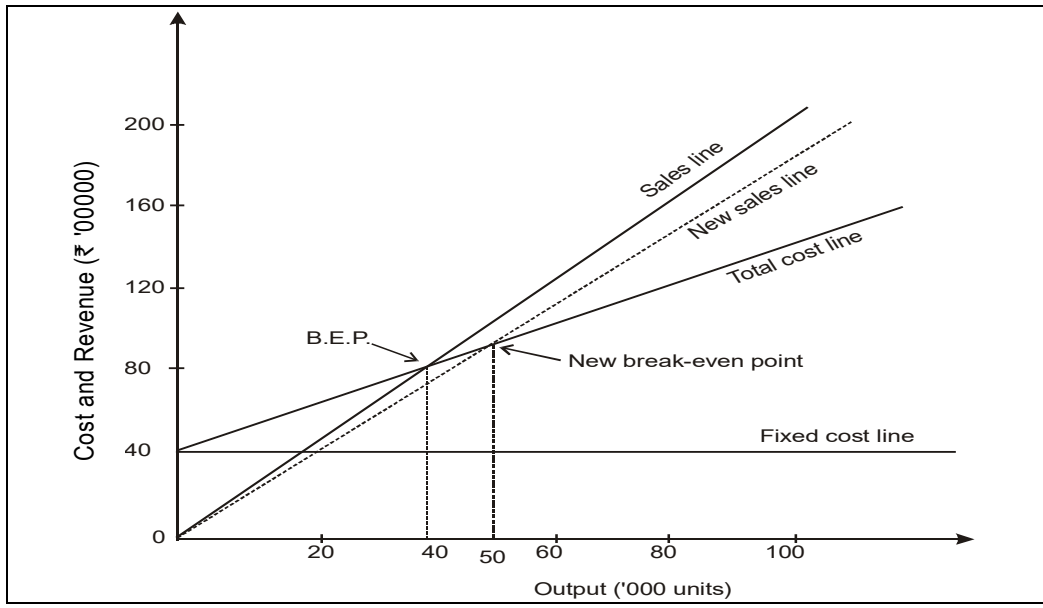
The break-even chart is shown below:




**14. Calculation of P/V Ratio** (₹' 000)

| | Sales | Profit |
|---|---|---|
| **North** : Actual | 1,100 | 135 |
| *Add* : Under budgeted | 400 | 180 |
| Budgeted | 1,500 | 315 |

$$\text{P/V ratio} = \frac{\text{Diferenece in Profit}}{\text{Difference in Sales}} = \frac{315 - 135}{1{,}500 - 1{,}100} = \times 100 = \frac{180}{400} \times 100 = 45\%$$

(₹ '000)

| | Sales | Profit |
|---|---|---|
| **East** : Actual | 1,450 | 210 |
| *Less* : Over budgeted | (150) | (90) |
| Budgeted | 1,300 | 120 |

$$\text{P/V ratio} = \frac{90}{150} \times 100 = 60\%$$

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(₹' 000)

| | Sales | Profit |
|---|---|---|
| **South :** Actual | 1,200 | 330 |
| *Add*: Under budgeted | 200 | 110 |
| Budgeted | 1,400 | 440 |

$$\text{P/V ratio} = \frac{110}{200} \times 100 = 55\%$$

**(i) Calculation of fixed cost**

Fixed Cost = (Actual sales × P/V ratio) – Profit

North = (1,100 × 45%) – 135 = 360

East = (1,450 × 60%) – 210 = 660

South = (1,200 × 55%) – 330 = 330

Total Fixed Cost 1,350

**(ii) Calculation of break-even sales (in ₹' 000)**

$$\text{B.E. Sales} = \frac{\text{Fixed Cost}}{\text{P/V ratio}}$$

$$\text{North} = \frac{360}{45\%} = 800$$

$$\text{East} = \frac{660}{60\%} = 1,100$$

$$\text{South} = \frac{330}{55\%} = 600$$

Total 2,500

**15. (i)** Budgeted selling price = 2,10,000 lakhs/ 40,000 units = ₹5,25,000 per unit.

Budgeted variable cost = 1,32,000 lakhs/ 40,000 units = ₹ 3,30,000 per unit.

Increased selling price = ₹5,25,000 + 10% = ₹ 5,77,500 per unit

New volume 40,000 – 10% = 36,000 units

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**Statement of Calculation of Profit:**

| | (₹ In lakhs) |
|---|---|
| Sales 36,000 units at ₹ 5,77,500 = | 2,07,900 |
| Less: Variable cost: 36,000 × ₹3,30,000 = | 1,18,800 |
| Contribution | 89,100 |
| Less: fixed costs | 60,750 |
| Profit | 28,350 |

(ii) Budgeted Material Cost = 79,200 Lakhs/ 40,000 Units = ₹1,98,000 per Unit

| | |
|---|---|
| Increased material cost = ₹1,98,000×110% = | 2,17,800 |
| Labour cost 15,600 lakhs/ 40,000 units = | 39,000 |
| Direct expenses, 37,200 lakhs/ 40,000 units = | 93,000 |
| Variable cost per unit | 3,49,800 |
| Budgeted selling price per unit | 5,25,000 |
| Contribution per unit (5,25,000 – 3,49,800) | 1,75,200 |

$$\text{Sales volume} = \frac{\text{Fixed costs} + \text{Profit}}{\text{Contribution Per Unit}} = \frac{60{,}750 \text{ lakhs} + 17{,}250 \text{ lakhs}}{₹1.752 \text{ lakhs}}$$

= 44,521 units are to be sold to maintain the original profit of ₹ 17,250 lakhs.

**16. (i) Computation of Sale Price *Per Bottle***

Output: 40,000 Bottles

| **Particulars** | **(₹)** |
|---|---|
| Variable Cost: | |
| Material | 2,10,000 |
| Labour (₹1,50,000 × 80%) | 1,20,000 |
| Factory Overheads (₹92,000 × 60%) | 55,200 |
| Administrative Overheads (₹40,000 × 35%) | 14,000 |

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| | |
|---|---|
| Commission (8% on ₹6,00,000) (W.N.-1) | 48,000 |
| Fixed Cost: | |
| Labour (₹1,50,000 × 20%) | 30,000 |
| Factory Overheads (₹92,000 × 40%) | 36,800 |
| Administrative Overheads (₹40,000 × 65%) | 26,000 |
| Total Cost | 5,40,000 |
| Profit (W.N.-1) | 60,000 |
| Sales Proceeds (W.N.-1) | 6,00,000 |
| Sales Price *per bottle* $\left(\frac{₹6,00,000}{40,000 \text{ Bottles}}\right)$ | 15 |

**(ii) Calculation of Break-even Point**

Sales Price per Bottle = ₹14

Variable Cost per Bottle = $\frac{₹4,44,000 \text{ (W.N.-2)}}{40,000 \text{ Bottles}}$ = ₹11.10

Contribution per Bottle = ₹14 – ₹11.10 = ₹2.90

Break -even Point:

(in number of Bottles) = $\frac{\text{Fixed Costs}}{\text{Contribution per Bottle}}$

= $\frac{₹92,800}{₹2.90} = 32,000 \text{ Bottles}$

(in Sales Value) = 32,000 Bottles × ₹14

= ₹4,48,000

**Working Note**

**W.N.-1**

Let the Sales Price be 'x'

Commission = $\frac{8x}{100}$

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$$\text{Profit} = \frac{10x}{100}$$

$$x = 4{,}92{,}000 + \frac{8x}{100} + \frac{10x}{100}$$

$$100x - 8x - 10x = 4{,}92{,}00{,}000$$

$$82x = 4{,}92{,}00{,}000$$

$$x = 4{,}92{,}00{,}000 / 82 = ₹6{,}00{,}000$$

**W.N.-2**

| **Total Variable Cost** | **(₹)** |
|---|---|
| Material | 2,10,000 |
| Labour | 1,20,000 |
| Factory Overheads | 55,200 |
| Administrative Overheads | 14,000 |
| Commission [(40,000 Bottles × ₹14) × 8%] | 44,800 |
| | 4,44,000 |

**17. Income Statement (Absorption Costing) for the year ending 31st March**

| | **(₹)** | **(₹)** |
|---|---|---|
| Sales (1,50,000 units @ ₹20) | | 30,00,000 |
| Production Costs: | | |
| Variable (1,60,000 units @ ₹11) | 17,60,000 | |
| *Add: Increase* | 35,000 | 17,95,000 |
| Fixed (1,60,000 units @ ₹2*) | | 3,20,000 |
| Cost of Goods Produced | | 21,15,000 |
| *Add*: Opening stock (10,000 units @ ₹13)* | | 1,30,000 |
| | | 22,45,000 |

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| | | |
|---|---|---|
| *Less*: Closing stock $\left(\frac{₹\,21,15,000}{1,60,000\ \text{units}} \times 20,000\ \text{units}\right)$ | | 2,64,375 |
| Cost of Goods Sold | | 19,80,625 |
| *Add*: Under absorbed fixed production overhead (3,60,000 – 3,20,000) | | 40,000 |
| | | 20,20,625 |
| *Add: Non*-production costs: | | |
| Variable selling costs (1,50,000 units @ ₹3) | | 4,50,000 |
| Fixed selling costs | | 2,70,000 |
| Total cost | | 27,40,625 |
| Profit (Sales – Total Cost) | | 2,59,375 |

*** Working Notes:**

1. Fixed production overhead is absorbed at a pre-determined rate based on normal capacity, i.e. ₹3,60,000 ÷ 1,80,000 units = ₹ 2.

2. Opening stock is 10,000 units, i.e., 1,50,000 units + 20,000 units – 1,60,000 units. It is valued at ₹13 per unit, i.e., ₹11 + ₹2 (Variable + fixed).

**Income Statement (Marginal Costing) for the year ended 31st March**

| | (₹) | (₹) |
|---|---|---|
| Sales (1,50,000 units @ ₹20) | | 30,00,000 |
| Variable production cost (1,60,000 units @ ₹11 + ₹35,000) | | 17,95,000 |
| Variable selling cost (1,50,000 units @ ₹3) | | 4,50,000 |
| | | 22,45,000 |
| *Add*: Opening Stock (10,000 units @ ₹11) | | 1,10,000 |
| | | 23,55,000 |
| *Less*: Closing stock $\left(\frac{₹17,95,000}{1,60,000\ \text{units}} \times 20,000\ \text{units}\right)$ | | 2,24,375 |

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| | | |
|---|---|---|
| Variable cost of goods sold | | 21,30,625 |
| Contribution (Sales – Variable cost of goods sold) | | 8,69,375 |
| *Less*: Fixed cost – Production | 3,60,000 | |
| – Selling | 2,70,000 | 6,30,000 |
| Profit | | 2,39,375 |

| **Reasons for Difference in Profit:** | **(₹)** |
|---|---|
| Profit as per absorption costing | 2,59,375 |
| *Add*: Op. stock under –valued in marginal costing (₹1,30,000 – 1,10,000) | 20,000 |
| | 2,79,375 |
| *Less*: Cl. Stock under –valued in marginal closing (₹2,64,375 – 2,24,375) | 40,000 |
| Profit as per marginal costing | 2,39,375 |

**18. (i) Cost Indifference Point**

| | | **A and B** | **A and C** | **B and C** |
|---|---|---|---|---|
| | | **(₹)** | **(₹)** | **(₹)** |
| Differential Fixed Cost | (I) | ₹30,000 | ₹1,10,000 | ₹80,000 |
| | | (₹45,000 – ₹15,000) | (₹1,25,000 – ₹15,000) | (₹1,25,000 – ₹45,000) |
| Differential Variable Costs | (II) | ₹100 | ₹200 | ₹100 |
| | | (₹240 – ₹140) | (₹240 – ₹40) | (₹140 – ₹40) |
| Cost Indifference Point | (I/II) | 300 | 550 | 800 |
| (Differential Fixed Cost / Differential Variable Costs *per case*) | | Cases | Cases | Cases |

**Interpretation of Results**

At activity level below the indifference points, the alternative with lower fixed costs and higher variable costs should be used. At activity level

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above the indifference point alternative with higher fixed costs and lower variable costs should be used.

| No. of Cases | Alternative to be Chosen |
|---|---|
| Cases ≤ 300 | Alternative 'A' |
| 300 ≥ Cases ≤ 800 | Alternative 'B' |
| Cases ≥ 800 | Alternative 'C' |

**(ii)** Present case load is 600. Therefore, alternative B is suitable. As the number of cases is expected to go upto 850 cases, alternative C is most appropriate.

**19.** Let $C_x$ be the Contribution per unit of Product X.

Therefore, Contribution per unit of Product Y $=C_y=4/5C_x = 0.8C_x$

Given $F_1 + F_2 = 1,50,000$,

$F_1 = 1,800C_x$ (Break even Volume × Contribution per unit)

Therefore, $F_2 = 1,50,000 – 1,800C_x$.

$3,000C_x – F_1 = 3,000 \times 0.8C_x – F_2$ or $3,000C_x – F_1 = 2,400\ C_x - F_2$ (Indifference Point)

i.e., $3,000C_x – 1,800C_x = 2,400C_x – 1,50,000 + 1,800C_x$

i.e., $3,000C_x = 1,50,000$, Therefore, $C_x$ = ₹ 50/- (1,50,000 / 3,000)

Therefore, Contribution per unit of X = ₹ 50

Fixed Cost of X = $F_1$ = ₹ 90,000 (1,800 × 50)

Therefore, Contribution per unit of Y is ₹ 50 × 0.8 = ₹ 40 and

Fixed Cost of Y = $F_2$ = ₹ 60,000 (1,50,000 – 90,000)

The Value of $F_1$ = ₹ 90,000, $F_2$ = ₹ 60,000 and X = ₹ 50 and Y = ₹ 40

**20. (i) Calculation of Contribution to sales ratio at existing sales mix:**

| | Products | | | Total |
|---|---|---|---|---|
| | A | B | C | |
| Selling Price (₹) | 300 | 400 | 200 | |
| Less: Variable Cost (₹) | 150 | 200 | 120 | |

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| | | | | |
|---|---|---|---|---|
| Contribution per unit (₹) | 150 | 200 | 80 | |
| P/V Ratio | 50% | 50% | 40% | |
| Sales Mix | 40% | 35% | 25% | |
| Contribution per rupee of sales (P/V Ratio × Sales Mix) | 20% | 17.5% | 10% | 47.5% |
| Present Total Contribution (₹ 60,00,000 × 47.5%) | | | | ₹ 28,50,000 |
| Less: Fixed Costs | | | | ₹ 18,00,000 |
| Present Profit | | | | ₹ 10,50,000 |
| Present Break-Even Sales (₹ 18,00,000/0.475) | | | | ₹ 37,89,473.68 |

**(ii) Calculation of Contribution to sales ratio at proposed sales mix:**

| | Products | | | |
|---|---|---|---|---|
| | **A** | **B** | **E** | **Total** |
| Selling Price (₹) | 300 | 400 | 300 | |
| Less: Variable Cost (₹) | 150 | 200 | 150 | |
| Contribution per unit (₹) | 150 | 200 | 150 | |
| P/V Ratio | 50% | 50% | 50% | |
| Sales Mix | 45% | 30% | 25% | |
| Contribution per rupee of sales (P/V Ratio x Sales Mix) | 22.5% | 15% | 12.5% | 50% |
| Proposed Total Contribution (₹ 64,00,000 × 50%) | | | | ₹ 32,00,000 |
| Less: Fixed Costs | | | | ₹ 18,00,000 |
| Proposed Profit | | | | ₹ 14,00,000 |
| Proposed Break-Even Sales (₹ 18,00,000/0.50) | | | | ₹ 36,00,000 |

**(iii)** The proposed sales mix increases the total contribution to sales ratio from 47.5% to 50% and the total profit from ₹ 10,50,000 to ₹ 14,00,000. Thus, the proposed sales mix should be accepted.

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## Answers To The Case Scenarios

**1.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **i.** | (a) | **ii.** | (d) | **iii.** | (d) | **iv.** | (c) | **v.** | (a) |

**i.** **a** Revised Sale $= \frac{\text{Revised Fixed Cost + Expected Profit}}{\text{P / V Ratio}}$

= {₹115 + (20+10)} ÷ 45% = ₹ 322.22 crores

**ii.** **d** Revised Break – even Point $= \frac{\text{Fixed Cost}}{\text{P / V Ratio}}$

= ₹115 Crore ÷ 45% = ₹255.56 Crore (Refer working notes)

**iii.** **d** Revised Margin of Safety = Revised Sales – Revised Break–even Sales

= ₹ 322.22Crores – ₹ 255.56Crores = ₹ 66.66 Crores.

**iv.** **c** ₹ 20 Crore & ₹30 Crore respectively (Refer working note)

**v.** **a** Total cost in last year = ₹230 Crore

Total cost in coming year = Variable Cost + Fixed Cost

Revised sales × 55% + 115 Crore

= ₹ 322.22 Crore × 55% + ₹ 115 Crore = ₹ 292.22 Crore

**Working Note**

**Present Sales and Profit**

| | | |
|---|---|---|
| Total Sales | = | Break – even Sales + Margin of Safety |
| | = | ₹ 200 Crores + ₹ 50 Crores |
| | = | ₹ 250 Crores |
| P/V Ratio | = | 40% |
| Variable Cost | = | 60% of Sales |
| | = | ₹ 250 Crores × 60% |
| | = | ₹ 150 Crores |

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Fixed Cost = Break – even Sales × P/V Ratio

= ₹ 200 Crores × 40%

= ₹ 80 Crores

Total Cost = ₹ 150 Crores + ₹ 80 Crores

= ₹ 230 Crores

Profit = Total Sales – Total Cost

= ₹ 250 Crores – ₹ 230 Crores

= ₹ 20 Cores

| **Revised Sales** | **(₹ in Crores)** |
|---|---|
| Present Fixed Cost | 80.00 |
| Increase in Fixed Cost | 20.00 |
| Interest at 15 *per cent* on Additional Capital (₹100Crores × 15%) | 15.00 |
| Total Revised Fixed Cost (in crore) | 115.00 |
| Assuming that the Present Selling Price is ₹ 100 | |
| Revised Selling Price will be (8% Less) | 92.00 |
| New Variable Cost (Reduced from 60% to 55%) of Sales (₹ 92 × 55%) | 50.60 |
| Contribution (₹ 92.00 – ₹ 50.60) | 41.40 |

New P / V Ratio $= \frac{₹\ 41.40}{₹\ 92.00} \times 100$

= 45%

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