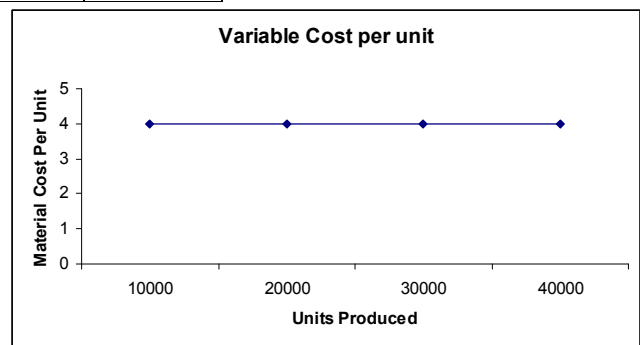
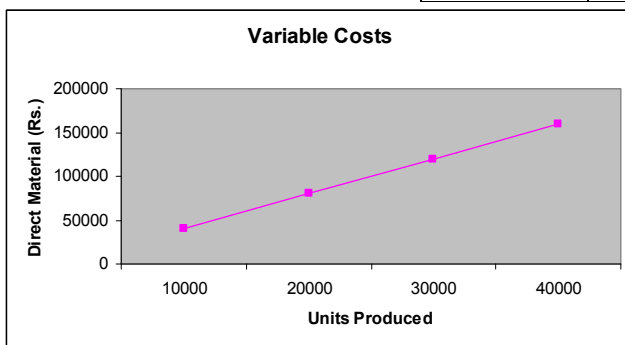


COST BEHAVIOR

THE NATURE OF COSTS: Before one can begin to understand how a business is going to perform over time and with shifts in volume, it is imperative to first consider the cost structure of the business. This requires drilling down into the specific types of costs that are to be incurred and trying to understand their unique attributes.

VARIABLE COSTS: Variable costs will vary in direct proportion to changes in the level of an activity. For example, direct material, direct labor, sales commissions, fuel cost for a trucking company, and so on, may be expected to increase with each additional unit of output.

<u>Units</u>	<u>Direct Material (Rs.)</u>	<u>Cost per unit(Rs.)</u>
10000	40000	4
20000	80000	4
30000	120000	4
40000	160000	4



FIXED COSTS: The opposite of variable costs are fixed costs. Fixed costs do not fluctuate with changes in the level of activity. Examples include administrative salaries, rents, property taxes, security, networking infrastructure support, and so forth. Observe that the fixed cost *per unit* will decline with increases in production. This attribute of fixed costs is important to consider in assessing the scalability of a business proposition.

Types of fixed costs: For planning purposes, fixed costs can be viewed as either committed or discretionary.

Committed fixed costs - Relate the investment in facilities, equipment & basic organizational structure. They have two key characteristics:

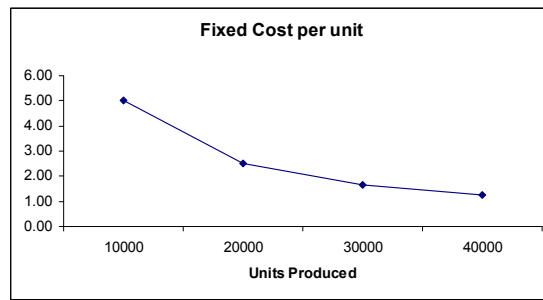
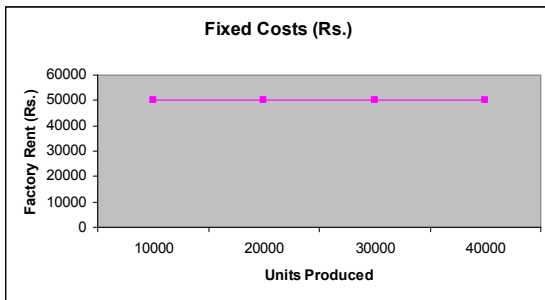
- ☐ They are long term
- ☐ They can't be significantly reduced even for short periods of time without seriously impairing the profitability or long run goals of the organization

Discretionary fixed costs - Usually arise from annual decisions by management to spend in certain fixed cost areas. Examples are: Advertising, R & D, Public relations, Management development programs, Internships for students.

Two key differences exist between discretionary & committed fixed costs:

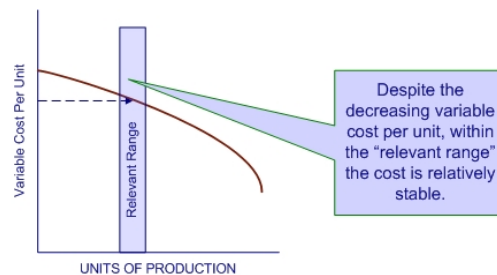
- ☐ The planning horizon for discretionary fixed costs is short term.
- ☐ Discretionary fixed costs can be cut for short periods of time with minimal damage to the long run goals or the organization.

<u>Units</u>	<u>Factory Rent (Rs.)</u>	<u>Rent per unit(Rs.)</u>
10000	50000	5.00
20000	50000	2.50
30000	50000	1.67
40000	50000	1.25



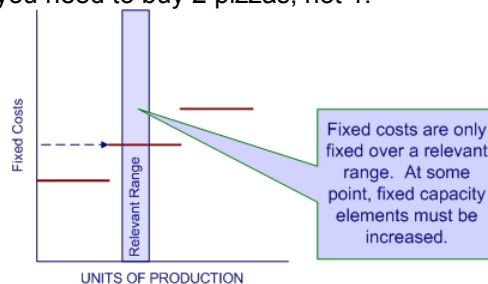
RELEVANT RANGE

The "relevant range" is the anticipated activity level at which you will perform. Any pricing data outside of this range is irrelevant and need not be considered. This enhanced concept of variable cost is portrayed in the following graphic:



Cost behavior often changes outside of the relevant range of activity due to a change in the fixed costs. When volume increases to a certain point, more fixed costs will have to be added. When volume shrinks significantly, some fixed costs could be eliminated. Fixed costs that behave in this fashion are also called **step costs**.

For example, you are buying frozen pizza in a box from the grocery store. One pizza can feed 3 guys. Step-fixed cost is the cost of the pizza, it is sold by the box, and there is no partial pizza to be sold. The relevant range is the 3 guys, once it's more than 3; it goes up to the next level->need another box of pizza. When you have 4 guys waiting to eat pizza, you need to buy 2 pizzas, not 1.



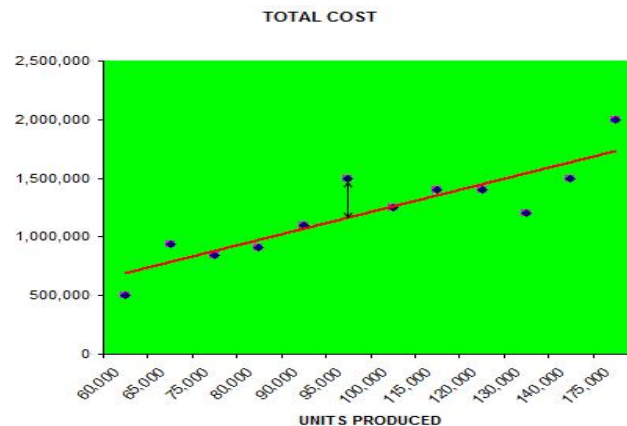
Note: Difference between Step fixed-cost function and Step variable-cost function is that the cost remains the same in step fixed-cost function over *wide* ranges of the activity in each relevant range though in step variable-cost function it remains same over *narrow* ranges of the level of activity in each relevant range.

MIXED COSTS: Many costs contain both variable and fixed components. These costs are called **mixed or semi-variable or semi-fixed costs**. If you have a phone, you probably know more than you wish about such items. Phone agreements usually provide for a monthly fee plus usage charges for excess minutes, internet expense and so forth. With a mixed cost, there is some fixed amount plus a variable component tied to an activity. Mixed costs are harder to evaluate, because they change in response to fluctuations in volume. But, the fixed cost element means the overall change is not directly proportional to the change in activity.

Methods for segregation of Mixed Cost:

1. Graphical Method (Scattered Graph) - The visual fit method or scatter-graph method requires that all recent, normal data observations be plotted on a cost (Y-axis) versus activity (X-axis) graph. A line is then drawn that is a best fit for the data points. When the line is extended to cross the Y-axis (at zero

units of activity), there is a "fairly accurate estimate of fixed costs for the period". The slope can also be calculated to give another reasonably accurate estimate of the variable cost per product. To compute the variable cost per unit, the slope of the line is determined by choosing two points and dividing the change in their cost by the change in the units of activity for the two points selected.



2. High-Low Method (Range Method) - uses the total costs incurred at the high and low levels of activity to classify mixed costs into fixed and variable components. The difference in costs between the high and low levels represents variable costs.

$$\text{Variable Cost per unit} = \frac{\text{Changes in Total Costs}}{\text{High Minus Low Activity Level}}$$

The fixed cost can be found by subtracting the total variable cost at either the high or the low activity level from the total cost at that activity level.

3. Comparison by period (Level of Activity Method) – This method is same as Range Method except high & low activities we arbitrarily choose any two activity levels.
4. Least Squares Method – This method uses mathematical approach to determine the components of variable & fixed expenses. The following regression equation for a straight line can be used to express the relationship between a mixed cost & the level of activity:

$$Y = a + bX$$

We will solve following equations to yield the values of parameters a and b of the above equation.

$$\begin{aligned}\Sigma Y &= Na + b \Sigma X \\ \Sigma XY &= a \Sigma X + b \Sigma X^2\end{aligned}$$

- ☐ Y = the total mixed cost
- ☐ a = the total fixed cost
- ☐ b = the variable cost per unit of activity
- ☐ X = the level of activity
- ☐ N = No. of activities

This equation makes it very easy to calculate what the total mixed cost would be for any level of activity within the relevant range.

5. Analytical Method (Accounting Method): Each account under consideration is classified as either variable or fixed based on the analyst's prior knowledge of how the cost behaves.

Question 1: Briefly explain the methods of separating semi-variable costs into their fixed and variable elements. (6 Marks) May/00

Question 2: Distinguish between 'committed fixed costs' and 'discretionary fixed cost' (5 Marks) May/96

Question 3: From the following information in respect of the semi - variable expenses obtain the fixed and variable elements using the following methods.

- a. Level of activity method.
- b. High low method.

d.	Scatter Graph method	e.	Least squares method
	Month	Machine Hours	Semi-variable maintenance expense (Rs.)
	January	400	2800
	February	300	2600
	March	200	2400
	April	600	3200
	May	500	3000
	June	800	3600

Marginal Costing: The accounting system in which variable cost are charged to cost units and fixed costs of the period are written off in full against the aggregate contribution. (CIMA's Official Terminology). Variable costing & Contribution Approach are other names of marginal costing.

It may be defined as the technique of presenting cost data wherein variable costs and fixed costs are shown separately for managerial decision-making. It should be clearly understood that marginal costing is not a method of costing like process costing or job costing. Rather it is simply a method or technique of the analysis of cost information for the guidance of management which tries to find out an effect on profit due to changes in the volume of output.

Product Cost : A product cost is the sum of the costs assigned to a product for a specific purpose. In Financial accounting courses, it is a concept used in applying the cost plus approach to product pricing in which only the costs of manufacturing the product are included in the cost amount to which the markup is added. The three components of manufacturing costs: direct materials, direct labor, and factory overhead costs. Generally, *inventoriable(manufacturing) costs* are called product costs.

Period Costs: These are all costs in the income statement other than cost of goods sold. Period costs are treated as expense of the A/cing period in which they are incurred because they are expected to benefit revenues in that period and are not expected to benefit revenues in future periods (or because there is not sufficient evidence to conclude that such benefits exists). R&D cost, Design costs, Marketing costs, distribution costs, customer-service costs are some examples of period costs.

Marginal Cost: The cost of one unit of product or service which would be avoided if that unit were not produced or provided. (CIMA's Official Terminology)

Note: In this context, a unit is usually either a single article or a standard measure such as the liter or kilogram, but in certain circumstances is an operation, process or part of an organization.

The marginal cost of a product –“is its variable cost”. This is normally taken to be; direct labour, direct material, direct expenses and the variable part of overheads.

Presentation of Cost Data under Marginal Costing and Absorption Costing

Following presentation of two Performa shows the difference between the presentation of information according to absorption and marginal costing techniques:

Absorption Costing

ABC Ltd. Income Statement For the year ended

	(Rs. '000) yyy
Sales	
Cost of Goods Sold:	
Direct material consumed	xxxx
Direct labour cost	xxxx
Variable manufacturing overhead	xxxx
Fixed manufacturing overhead	xxxx
Manufacturing Cost incurred during the year (a.k.a.Gross Factory Cost)	xxx
Opening Work-in-Progress	xxxx
Less: Closing Work-in-Progress	xxxx
Total cost of goods manufactured	xxxxx

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Add: Op. stock of finished goods (valued at total cost of previous year)	xxxx	
Less: Cl. stock of finished goods (valued at total cost of current year)	<u>xxxx</u>	<u>yyyy</u>
Gross profit/Margin (i.e. Sales-Cost of goods sold)		yyyyy
Less: Operating Costs:		
These are period costs → Selling and distribution costs (Both Fixed & Variable)	xxxx	
Administration costs, etc. (Both Fixed & Variable)	<u>xxxx</u>	<u>yyyy</u>
Operating Income before absorption adjustment		<u>zzzz</u>
Less: Under-absorption of Fixed factory overhead		<u>yyyy</u>
Add: Over-absorption of Fixed factory overhead		<u>yyyy</u>
Operating Income		<u>zzzzz</u>

Marginal Costing

ABC Ltd. Income Statement (a.k.a. *Contribution Income Statement*) For the year ended

		(Rs. '000)
Sales		yyy
Total variable cost:	xxxx	
Direct material consumed	xxxx	
Direct labour cost	xxxx	
Variable manufacturing overhead	<u>xxx</u>	
Variable cost of goods produced	xxxxx	
Add: Op. stock of finished goods (valued at Total Var. Cost of previous year)	xxxx	
Less: Cl. stock of finished goods (valued at Total Var. Cost of current year)	<u>xxx</u>	
Variable Cost of Goods Sold	<u>xxxx</u>	
Add: Variable administration, selling and dist. overhead	<u>xxxxx</u>	
Total variable cost		<u>yyyy</u>
Contribution Margin (Sales - Total variable cost)		yyyyy
Less: Fixed operating costs (Production, administration, selling and distribution)		<u>yyyy</u>
Operating Income		<u>zzzz</u>

1. Net Income/Profit = Operating Income – Non Operating Expenses (e.g. Income Taxes, Interest, etc.)
2. As Non Operating Expenses are generally not given in question, we take Operating Income as Net Profit

Question 4: State the distinction between Marginal Costing and Absorption Costing. (7 Marks) Nov/01

Absorption Costing

1. It is a total cost technique i.e. both variable and fixed costs are charged to products, processes or operations.
2. Fixed factory overheads are absorbed by the production units on the basis of a predetermined fixed factory overhead recovery rate based on normal capacity. Under/over absorbed overheads are adjusted before arriving at the figure of profit for a particular period.
3. Inspire of best possible forecast and equitable basis of apportionment/allocation of fixed costs, under or over recovery of fixed overheads generally arises.
4. Managerial decisions under this costing technique are based on profit i.e. excess of sales value over total costs, which may at times lead to erroneous decisions.

Marginal Costing

- Here only variable costs are charged to product, processes or operations. Fixed costs are charged as period costs to the profit statement of the same period in which they are incurred.
- The cost of production under this method does not include fixed factory overheads and therefore, the value of closing stock comprises of only variable costs. No part of the fixed expenses is included in the value of closing stock and carried over to the next period.
- Since fixed overheads are not included in the cost of production, therefore the question of their under/ over recovery does not arise.
- Here decisions are made on the basis of contribution i.e. excess of sales price over variable costs. This basis of decision making results in optimum profitability.

Reconciliation Statement for Marginal Costing and Absorption Costing Profit

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	Rs.
Absorption Costing Profit	xx
Less: Closing Stock(units) x OAR [i.e. overvaluation of Closing Stock in Absorption costing in comparison to Marginal Costing]	xx
Add: Opening Stock(units) x OAR [i.e. undervaluation of Closing Stock in Absorption costing in comparison to Marginal Costing]	xx
= Marginal Costing Profit	xx

Where OAR(overhead absorption rate) = $\frac{\text{Budgeted fixed production overhead}}{\text{Budgeted levels of activities}}$

Question 5: Following cost data is given for a product of NISHU and Co. Ltd.

	<u>Per Unit</u>
Selling Price	Rs. 10
Variable Cost	Rs. 6
Fixed Cost	Rs. 2
Normal Production	26000 units

Following additional data are given for four consecutive periods:

	Period I	Period II	Period III	Period IV	Total
	Units	Units	Units	Units	Units
Opening Stock	-	-	6000	2000	-
Production	26000	30000	24000	30000	110000
Sales	26000	24000	28000	32000	110000
Closing Stock	-	6000	2000	-	-

Prepare a statement showing the profit for the different periods under both marginal costing method and absorption costing method.

[Ans.: Profits under Marginal Costing are 52000, 44000, 60000, 76000 & 232000 & Profits under Absorption Costing are 52000, 56000, 52000 & 72000]

Question 6: PH Ltd. has a productive capacity 2,00,000 units of product BXE per annum . The company estimated its normal capacity utilization at 90% for 2003-04. The variable production costs are Rs. 22 per unit and the fixed factory overheads were budgeted at Rs. 7,20,000 per annum. The variable sell overheads amounted to Rs. 6 per unit and the fixed selling expenses were budgeted at Rs. 5,04,000. The operating data for 2003-04 are as under:

Production	1,60,000 units
Sales @ Rs. 40 per unit	1,50,000 units
Opening stock of finished goods	10,000 units

The cost analysis revealed an excess spending of variable factory overheads to the extent of Rs. 80,000. There are no variances in respect of other of cost.

Required:

- Determine the budgeted break-even point for 2003-04.
- What increase in price would have been necessary to achieve the budgeted profit.
- Present statement of profitability for 2003-04 using :
 - Marginal costing basis.
 - Absorption costing basis.
- Explain the reason for the difference in profits under the two methods stated in (iii) above.

[Ans.: (i) 102000 units; (ii) Rs. 2.86 (iii) Profit under Marginal Costing is Rs. 506000 & Profit under Absorption Costing is 546000]

Question 7: The following information relates to the first two years of operation for a newly created division of a manufacturing company:

Standard Manufacturing Costs	(Unit costs Rs.)
Direct Material	4.00
Direct Labour	4.00
Variable Manufacturing Overhead	2.00
Total Manufacturing Overhead	10.00

Fixed Manufacturing Cost	<u>4.00</u>
Total Manufacturing Cost	<u>14.00</u>

Standard Capacity	200000 units
Selling price	Rs. 25 per unit
Selling and administration expenses:	
Variable	Rs. 2.00 per unit of output
Fixed	Rs. 300000

Production and Sales Statistics:

<u>Particulars</u>	<u>Year 1</u>	<u>Year 2</u>
Units Produced	220000	170000
Units Sold	<u>180000</u>	<u>200000</u>
Inventory change	(+) <u>40000</u>	(-) <u>30000</u>

Required:

Prepare Comparative Income Statement, for the first two years of operations, using both Absorption costing and Marginal Costing. Also prepare a statement reconciling the difference between profits, if any between the two methods. Nov./1989

[Ans.: Profit under Absorption Costing is 1400000 & 1380000; Profit under Marginal Costing is 1240000 & 1500000]

Question 8: A single product company recovers its fixed factory overheads of Rs. 80000 on the basis of normal output of 160000 units. The actual fixed overheads are same as budgeted fixed overheads. The management accountant presented the following statement of profit for 3 years on absorption costing basis:

Particulars	2002	2003	2004
Production (units)	176000	192000	128000
Sales (units)	160000	128000	160000
	Rs.	Rs.	Rs.
Cost of sales at standard	384000	307200	384000
Production cost variance	1760A	1920A	1280A
Volume variance	8000F	16000F	16000F
Sales	480000	384000	480000
S/Adm. Cost (fixed)	48000	48000	48000
Closing Stock	38400	192000	115200
Profit	54240	42880	30720

A means adverse and F means Favourable

Required:

- Redraft the statement on marginal costing basis to show the closing stock, contribution and profit.
- Prepare a statement reconciling the profits arrived at by you with the profits given above.

[Ans.: Profit under Marginal Costing is 46400, 11520 & 46400] (ICWA June/00)

Under-absorption = Adverse Variance & Over-absorption = Favourable Variance
It is advisable to revise Question 7 after going through concepts of Variance Analysis

Cost-Volume-Profit Analysis

Cost-volume-profit (CVP) analysis is used to determine how changes in costs and volume affect a company's operating income and net income. In performing this analysis, there are several assumptions made, including:

- ☐ Sales price per unit, Variable costs per unit & total fixed costs are known & constant (Within relevant range & time period) & if represented graphically they are linear in behavior (representing straight lines).
- ☐ Other variables like production efficiency, production methods, and price levels remain constant.
- ☐ Everything produced is sold.
- ☐ All the company's costs, including manufacturing, selling, and administrative costs, be identified as variable or fixed
- ☐ Revenue & Costs are only affected because activity changes.
- ☐ If a company sells more than one product, they are sold in the same mix (i.e. **constant sales mix**).

- All revenues & costs can be added, subtracted & compared without taking into account time value of money.

Contribution margin and contribution margin ratio

Key calculations when using CVP analysis are the **contribution margin** and the **contribution margin ratio**. The contribution margin represents the amount of income or profit the company made before deducting its fixed costs. Said another way, it is the amount of sales available to cover (or contribute to) fixed costs. When calculated as a ratio, it is the percent of sales available to cover fixed costs. Once fixed costs are covered, the next rupee of sales results in the company having income. The contribution margin (a.k.a. contribution) is sales revenue minus all variable costs. To calculate the contribution margin ratio, the contribution margin is divided by the sales or revenues amount. **Contribution Margin Ratio is also popularly known as Profit Volume Ratio (P/V Ratio) & Contribution Sales Ratio (C/S Ratio).**

Single product contribution income statement

Units	XXXX
	(Rs. '000)
Sales	XXX
Less: Variable cost	XXX
Contribution	XXX
Less: Fixed cost	XXX
Profit	XXX

Multi-product contribution income statement

Particulars	A	B	C	Total
Sales	XXX	XXX	XXX	XXX
Less: Variable cost	XXX	XXX	XXX	XXX
Contribution	XXX	XXX	XXX	XXX
Less: Specific Fixed cost	XXX	XXX	XXX	XXX
Total	XXX	XXX	XXX	XXX
Less: General/Common fixed cost				XXX
Profit				XXX

Formulae for Calculation:

- Profit (Operating Income) = Sales – Variable Costs – Fixed Costs
- Contribution = Sales – Variable costs
- Contribution = Fixed Cost + Profit
- Sales – Variable cost = Fixed cost + Profit
- P/V ratio (or C/S ratio) = Contribution ÷ Sales
 - = Contribution per unit ÷ Selling price per unit
 - = Change in Contribution ÷ Change in Sales
 - = Change in Profit ÷ Change in Sales
 - = Profit ÷ Margin of Safety Sales
 - = 1 – Variable Cost Ratio
- Profit = (Sales × P/V ratio) - Fixed Cost = P/V ratio × Margin of Safety sales(Rs.)
 - = Contribution p.u. × Margin of safety (in units)

Break-even point

The break-even point represents the level of sales where net income equals zero. In other words, the point where sales revenue equals total variable costs plus total fixed costs, and contribution margin equals fixed costs. Variable costs represent all variable costs including costs classified as manufacturing costs, selling expenses, and administrative expenses. Similarly, the fixed costs represent total manufacturing, selling, and administrative fixed costs.

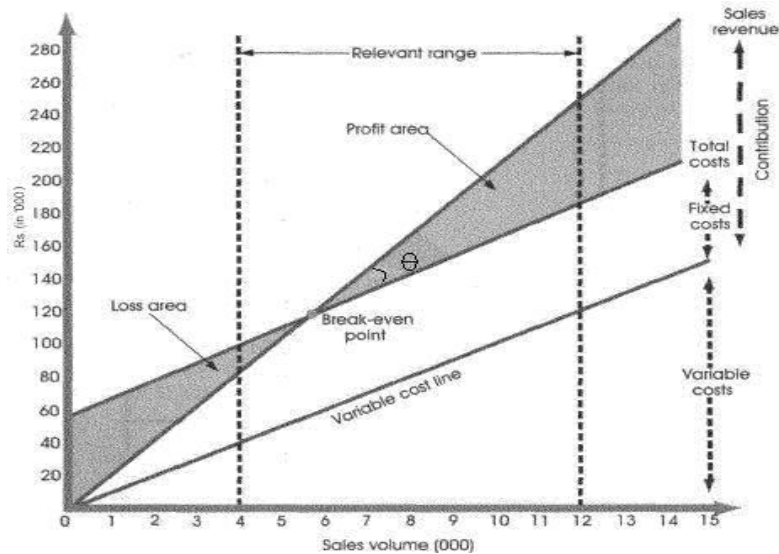
- Break Even point (in units) = Fixed Cost ÷ Contribution *per unit*

Break-even point (in rupees): The break-even point in sales rupees is calculated by dividing total fixed costs by the contribution margin ratio.

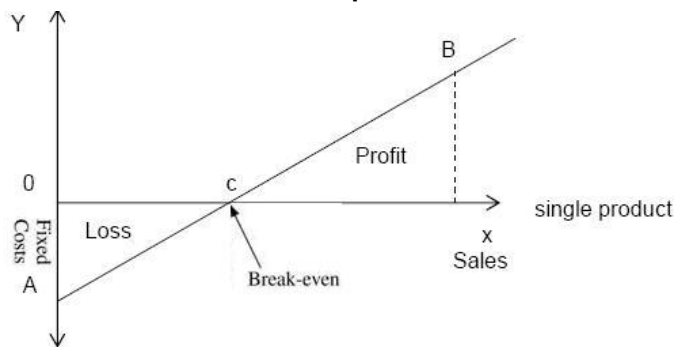
- Break Even Sales (in sales value) = Fixed Cost ÷ P/V ratio
- Break Even Sales (in sales value) = Variable Costs + Fixed Costs

Once the break-even point in units has been calculated, the break-even point in sales rupees may be calculated by multiplying the number of break-even units by the selling price per unit. This also works in reverse. If the break-even point in sales rupees is known, it can be divided by the selling price per unit to determine the break-even point in units.

Contribution Break Even Chart



Profit Graph



Question 9: A company manufactures a single product having a marginal cost of Rs. 0.75 per unit. Fixed Cost is Rs. 15000 per annum. The market is such that up to 40000 units can be sold at a price of Rs. 1.50 per unit, but any additional sale must be made at Re. 1 per unit. Company has a planned profit of Rs. 25000. How many units must be made and sold.

[Ans.: 80000]

Question 10(Sensitivity analysis): The Super co. owns and operates six outlets in and around Kansas City. You are given the following corporate budget data for next year:

	(Rs.)
Revenue	1,00,00,000
Fixed Costs	17,00,000
Variable Costs	82,00,000

Variable costs change with respect to the number of units sold.

Required:

Compute the budget operating income for each of the following deviations from the original budget data. (Consider each case independently.)

- a. A 10% increase in contribution margin, holding revenues constant.
- b. A 10% decrease in contribution margin, holding revenues constant.
- c. A 5% increase in fixed costs.
- d. A 5% decrease in fixed costs.
- e. An 8% increase in units sold.
- f. An 8% decrease in units sold.
- g. A 10% increase in fixed costs and 10% increase in units sold.
- h. A 5% increase in fixed costs and 5% decrease in variable costs.

[Ans.: 280000, (80000), 15000, 185000, 244000, (44000), 110000, 425000]

Question 11 (Sensitivity analysis): If labour costs and material cost are likely to go up by 10% and 5% respectively per unit, what is the percentage increase necessary in selling price to keep the P/V of 20% as before, assuming that the ratio between material and labour is 3:2, and variable overheads is nil.

[Ans.: 7%]

Question 12: H Ltd. produces Pens and Pencils. The company's budget for 2008 includes the following data:

	Pens	Pencils
Unit Selling Price (Rs.)	10	5
Contribution Margin ratio (%)	40	60

The budget is designed to show a figure of profit or loss for each product, after apportioning joint fixed costs of Rs. 100000 in proportion to the number of units of each product sold.

For 2008, Pens are budgeted to show a profit of Rs. 14000, and pencils a loss of Rs. 2000. The number of units of each product sold is expected to be equal.

You are required to write a report to the managing director of H Ltd. advising him on the basis of the information given whether to implement any of the following three proposals:

- (i) to increase the price the pencil by 25%, in the expectation that the price elasticity of demand over this range of prices will be unity;
- (ii) to make changes to the production process that would reduce the joint fixed costs by 12.5% and increase the variable costs of each product by 10%;
- (iii) to introduce both the above changes.

[Ans.: (i) Increase in contribution = Rs. 6400; (ii) Decline in profit = Rs. 300; (iii) Increase in profit = Rs. 6740]

Targeted income

CVP analysis is also used when a company is trying to determine what level of sales is necessary to reach a specific level of income, also called **targeted income**. To calculate the required sales level, the targeted income is added to fixed costs, and the total is divided by the P/V Ratio to determine required sales rupees, or the total is divided by contribution per unit to determine the required sales level in units.

$$\text{Required Sales Revenue in Rupees} = \frac{\text{Fixed Costs} + \text{Target Operating Income}}{\text{P/V Ratio}}$$

$$\text{Required Sales in Units} = \frac{\text{Fixed Costs} + \text{Target Operating Income}}{\text{Contribution Margin per unit}}$$

This calculation of targeted income assumes it is being calculated for a division as it ignores income taxes. If a targeted net income (income after taxes) is being calculated, then income taxes would also be added to fixed costs along with targeted net income.

$$\text{Required Sales Revenue in Rupees} = \frac{\text{Fixed Costs} + \text{Target Net Income} + \text{Income Tax}}{\text{P/V Ratio}}$$

$$\text{Required Sales in Units} = \frac{\text{Fixed Costs} + \text{Target Net Income} + \text{Income Tax}}{\text{Contribution Margin per unit}}$$

Where, **Target Operating Income = Target Net Income + Income Taxes**

If Rate of Income Tax is known & Value of Income Tax not known then,

$$\text{Target Operating Income} = \frac{\text{Target Net Income}}{1 - \text{Tax Rate}}$$

Question 13: X Ltd. is a recently formed company, manufacturing vehicles. Its cost structure is such that on sale of every Rs.2,000, it spends Rs.1400/-.In 2002, when the total sales revenue was Rs.10,00,000/-, it sustained loss of Rs. 2,00,000/- You are required to compute the break even point. If the minimum net profit to be earned is Rs.2,00,000/- in order to justify the survival, what must be sales revenue?

[Ans.:1666667 & 2333333]

Question 14(Volume analysis): The following figures for profit & sales are obtained from the accounts of X Co. Ltd.

Year	Sales	Profit
	Rs.	Rs.
2002	20,000	2,000
2003	30,000	4,000

- Find out Contribution Sales Ratio.
- What is Break Even Sales
- Find out the sales to earn a profit of Rs.6000 in 2004.
- What is the profit when sales are Rs.12000 in 2004?

[Ans.:0.2,10000,40000,(400)]

Margin of Safety:

Margin of safety is the difference between the sales or productions at a particular level of activity and the break even sales a production. A large margin of safety indicates the soundness of the business and correspondingly a small margin of business indicates a not too-sound position.

Margin of safety can be improved by lowering the fixed cost and variable costs, increasing the volumes of sales and production, increasing the selling prices or changing the product mix resulting into a better overall Profit/Volume ratio.

- Margin of safety Sales = Sales at selected activity – BEP Sales
- Margin of safety Sales = Profit at selected activity ÷ P/V ratio
- Margin of safety (%) = Margin of Safety Sales X 100 ÷ Sales at selected activity
- Margin of safety (%) = 1 – BEP (%)

Question 15(Single product marginal cost sheet): A company producing a single article sells it at Rs.10 each. The marginal cost of production is Rs.6 each and fixed cost is Rs.400 per annum.

Calculate

- The P/V ratio;
- The break-even sales;
- The sales to earn a profit Rs.500;
- Profit at sales Rs.3, 000;
- New break-even point if sales price is reduced by 10%.
- MOS when the profit earned in Rs.200 and PVR – 40%.

[Ans.: 0.4, 1000, 2250, 800, 1200, 500]

Question 16: From the following particulars, you are required to calculate:

- P/V Ratio
- BEP for sales;
- Margin of Safety;
- Profit when sales are Rs.2,00,000/-
- Sales required to earn a profit of Rs.40,000/-

Year	Sales	Profit
I	Rs. 2,40,000	18,000
II	Rs. 2,80,000	26,000

You may make plausible assumptions. Also evaluate the effect on II year's profit of

- 20% decrease in sales quantity.
- 20% decrease in sales quantity accompanied by 10% increase in sales price and reduction of Rs. 3,500/- in fixed costs.

[Ans.: 0.20, 150000, 130000, 10000, 350000, (a) Increase in profit 14700; (b)Increase in profit 14700]

Question 17: A single product company furnishes the following data:

Year 2007

Year 2008

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Sales	24,00,000	?
P/V Ratio	33-1/3 %	30%
Margin of Safety	25%	40%

While there was no change in volume of sales in year 2008, the selling price was reduced. Calculate sales, fixed cost and profit for year 2008.

[Ans.: Sales: 2285714, Fixed Cost: 411429, Profit: 274285]

Composite BEP i.e. more than one product with common fixed costs

(i) With out limiting factor (Multi Products)

BEP (in units) = Fixed cost ÷ Weighted Average contribution p.u.

Where, Weighted Av. Contribution p.u. = $\sum [\text{Sales Mix}(\%) \times \text{Contribution p.u.}]$

Also, BEP (in Rs.) = Fixed cost ÷ composite P/V ratio

Where, composite P/V ratio = Cumulative Contribution ÷ Cumulative Revenue

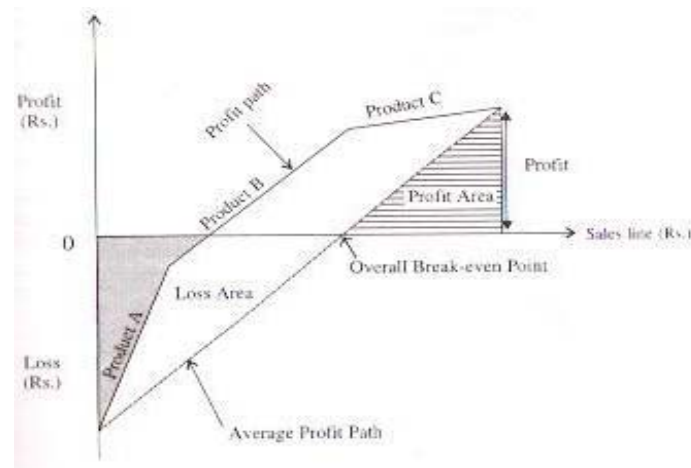
But, when sales mix in rupee is given

BEP (in Rs.) = Fixed cost ÷ composite P/V ratio

Where, composite P/V ratio = $\sum [\text{Sales Mix} \times \text{P/V Ratio}]$

(ii) With limiting factor:

Find contribution per limiting factor & give rank. Find total contribution from 1st rank product. Calculate the amount of fixed cost still to recover. Whether it can be recovered by 2nd rank product or not?



MULTI PRODUCT PROFIT PATH CHART

Multi Product Profit Path Chart (Sequential Graph)

Steps:

1. First prepare marginal cost statement to know P/V ratios.
2. Align products in descending sequence of P/V ratios.
3. Prepare a statement to find cumulative sale, cumulative contribution & cumulative profit.
4. Draw a profit path with the help of columns, cumulative sale & cumulative profit.
5. Draw Average Profit path line for the group of products.

Question 18(Sales mix and BEP): Aravind Ltd. manufactures and sells four products under the brand names A, B, C & D. the following details are provided in respect of the products.

Product	A	B	C	D
% in Sales Value	30	40	20	10
% of Variable cost to selling price	60	70	80	30

The total budgetary sales (100%) are Rs.10, 00,000 p.m. fixed costs are Rs.2, 50,000 p.m.

The company's new sales manager, Aravind has suggested a change in sales mix keeping the total sales at Rs.10, 00,000 per month. His suggestion is as under:

Product	A	B	C	D
% in Sales Value	25	40	30	5

- (1) Calculate the break-even point for the Company, under the existing sales mix.
- (2) Compute the effect of implementing the suggested change in sales mix.

- (3) Explain the reasons for the effect of change in sales mix despite total sales and fixed cost being the same.

[Ans.: 714286, BEP will change to 793651]

Question 19(Sales mix and BEP): The budgeted results of A Co. Ltd. include:

Product	Sales value (Rs.)	P/V ratio
A	50,000	50%
C	80,000	40%
O	1,20,000	30%

Fixed overhead for the period Rs.1,00,000.

The directors are worried about the results of the company. They have requested you to prepare a statement showing the amount of loss of expected and recommend a change in the sales of each product or in total mix which will eliminate the expected loss.

[Ans.: 7000, New BEP Sales 85000, 80000, 85000]

Question 20: A multi-product company has the following costs and output data for the last year

	Product		
	X	Y	Z
Sales mix (in value)	40%	35%	25%
Selling price	Rs. 20	Rs. 25	Rs. 30
Variable cost per unit	Rs. 10	Rs. 15	Rs. 18
Total fixed costs	Rs.1,50,000		
Total sales	Rs.5,00,000		

The company proposes to replace product Z with product S.

Estimated cost and output data are:

	Product		
	X	Y	Z
Sales mix (in value)	50 %	30%	20%
Selling price	Rs. 20	Rs. 25	Rs. 28
Variable cost per unit	Rs. 10	Rs. 15	Rs. 14
Total fixed costs	Rs.1,60,000		
Total sales	Rs.4,50,000		

Analyze the proposed change and suggest what decision the company should take.

Also state the break even point for the company as a whole in the two situations.

[Ans.: Continue Product Z; 340909 & 340426]

Question 21: XYZ Ltd. sells three Products A,B & C. The following information is provided:

Particulars	A	B	C
Sales Volume (units)	7000	5000	6000
Selling Price per unit (Rs.)	10	8	5
Variable Cost per unit (Rs.)	5	6	2.50

Fixed Cost p.a. Rs. 40000. Construct a multi product P.V. Chart

[Ans.: BES 93334]

Break-even point in case of step cost: In some cases, some costs tend to behave as fixed for production within batches though are variable with quantity of batches, in such cases we will calculate Break-even level of units on batches of production.

Question 22(Multiple break even points): A firm sells its product at Rs.25 per unit. Its Cost behavior for various production ranges is:

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Units of production	Cumulative fixed Cost	Variable Cost per Unit
0 –16,000	2,50,000	16.00
16,001 – 60,000	3,50,000	17.00
60,001 and above	5,00,000	20.00

Identify the break- even point(s) in units.

[Ans.: 43750 & 100000]

Question 23(Multiple Break even points): Kalyan University conducts a special course on 'Computer Applications' during summer. For this purpose, it invites applications from graduates. An entrance test is given to the candidates and based on the same, a final selection of a hundred candidates is made. The entrance test consists of four objective type of Examination and is spread over four days, one examination per day. Each candidate is charged a fee of Rs.50 for taking up the entrance test. The following data was gathered for the past two years:

Statement of Net Revenue from the Entrance Test for the course on "Computer Application"		
	Year 1 (Rs.)	Year 2 (Rs.)
Gross Revenue (Fees collected)	1,00,000	1,50,000
Costs		
Valuation	40,000	60,000
Question booklets	20,000	30,000
Hall rent at Rs.2, 000 per day	8,000	8,000
Honorarium to Chief Administrator	6,000	6,000
Supervision charges (1 supervisor for every 100 candidates at Rs.50/- per day)	4,000	6,000
General Administration Expenses	6,000	6,000
Total Cost	84,000	1,16,000
Net revenue	16,000	34,000

Required to compute:

- The budgeted net revenue if 4,000 candidates take up the entrance test in Year 3.
- The break even number of candidates.
- The number of candidates to be enrolled if the net income desired is Rs.20,000/-.

[Ans.: 52000, 1120, 2230]

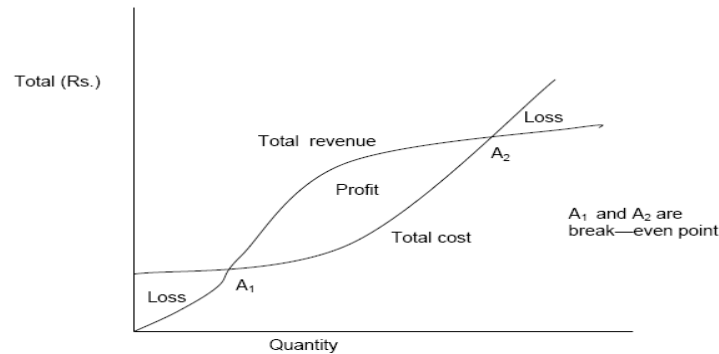
Angle of Incidence:

It is the angle of intersection (θ) between the sales & the total cost lines. It indicates the profit earning capacity of the concern at a certain level of sales production. The larger the angle of incidence the more is the profit earning capacity & vice versa. It also provides an indication as to what extent the output & sales price may be varied to attain a desire level of profit. It gives an easy & clear idea to the profitability under different levels of activities & also for different product mix & is a simple visual aid to find out profit earning capacity without going in for any calculation.

Curvilinear CVP analysis

In CVP analysis, the usual assumption is that the total sales line and variable cost line will have linear relationship, i.e. these lines will be straight lines, and however, in actual practice it is unlikely to have a linear relationship for two reasons, namely:

- After the saturation point of existing demand the sales value may show a downward trend.
 - The average unit variable cost declines initially, reflecting the fact that, as output increases the firm will be able to obtain bulk discounts on the purchase of raw materials and can also benefit from division of labour. When the plant is operated at further higher levels of output, due to bottlenecks and breakdowns the variable costs per unit will tend to increase. Thus the law of increasing costs may operate and the variable cost per unit may increase after reaching a particular level of output.
- In such cases, the contribution will not increase in linear proportion on the phenomenon of diminishing marginal productivity; the total cost line will not be straight, as assumed but will be of curvilinear shape. This situation will give rise to two break even points. The optimum profit is earned at the point where the distance between sales and total cost is the greatest.



Key Factor/Limiting Factor

A key factor is defined as the factor in the activities of an undertaking which, at a particular point of time or over a period, will limit the volume of output. Other variant terms are limiting factor, Principal Budget Factor & scarce factor. Limiting factors are governed by both internal & external factors. It may be actual or potential. If a factor of production is in short supply, then the best-paying product becomes that which yields the highest contribution per unit of limiting factor.

$$\text{Profitability} = \frac{\text{Contribution}}{\text{Key Factor}}$$

Thus, Contribution per unit of key factor may be ascertained & maximized according to priority (ranking).

Some examples of key factors are:

- 1) Materials-Scarce Raw Material; Restrictions by licenses, etc.
- 2) Labour-General Shortage; Shortage of a particular type of labour.
- 3) Plant-Imbalance; Insufficient capacity due to shortage of capital, supply, etc.
- 4) Management-Shortage of efficient staff; policy decisions.
- 5) Capital-Shortage of capital; insufficient research activity
- 6) Sales-Market demand; insufficient advertisement.

Question 24(Limiting Factor): Mega Corporation manufactures and sells three products to the automobile industry. All the products must pass through a matching process, the capacity of which is limited to 20,000 hours per annum, both by equipment design and government regulation. The following additional information is available:

	Product - X	Product - Y	Product - Z
Selling price Rs/unit	1,900	2,400	4,000
Variable cost Rs/unit	700	1,200	2,800
Machining requirement hrs/units	3	2	1
Maximum possible sales – units	10,000	2,000	1,000

Required : statement showing the best possible production mix which would provide the maximum profit for Mega Corporation together with supporting workings.

[Ans.: X :5000; Y: 2000; Z: 1000]

Question 25: A firm can produce three different products from the same raw material using the same production facilities. The requisite labour is available in plenty at Rs.8 per hour for all products. The supply of raw materials, which is imported at Rs.8 per kg. is limited to 10,400 kgs. for the budget period. The variable overheads are Rs.5.60 per hour. The fixed overheads are Rs.50,000. The selling commission is 10 per cent on sales.

a. From the following information, you are required to suggest the most suitable sales mix, which will maximize the firms profits. Also determine the profit that will be earned at that level:

Product	Market demand (units)	Selling price per Unit	Labour hours required per Unit	Raw Material required per Unit (Kgs)
---------	-----------------------	------------------------	--------------------------------	--------------------------------------

X	8,000	30	1	0.7
Y	6,000	40	2	0.4
Z	5,000	50	1.5	1.5

b. Assume, in above situation, if additional 4,500 kgs of raw materials is made for production, should the firm go in for further production, if it will result in additional fixed overheads of Rs.20,000 and 25% increase in the rates per hour for labour and variable overheads ?

[Ans.: X : 6000, Y : 8000, Z : 1600 with Profit = 66160; Additional Net Profit = 2500]

Question 26: Super Forging Ltd. is manufacturing three household products A, B and C and selling them in competitive market. Details of current demand, selling price and cost structure are given below:

Particulars	A	B	C
Expected demand (units)	10000	12000	20000
Selling price per unit (Rs.)	20	16	10
Variable cost per unit (Rs.)			
Direct Materials (Rs. 10/kg)	6	4	2
Direct Labour (Rs. 15/hr.)	3	3	1.50
Variable Overheads	2	1	1
Fixed Overhead per unit (Rs.)	5	4	2

The company is frequently affected by acute scarcity of raw material and high labour turnover. During the next period it is expected to have one of the following situations:

- Raw materials available will be only 12100 kg.
- Direct labour hours available will be only 5000 hrs.
- It may be possible to increase sales of any one product by 25% without any additional fixed costs but by spending Rs.20000 on advertisement. There will be no shortage of materials or labour.

Suggest the best production plan in each case and the resultant profit that the company would earn according to your suggestion.

[Ans.: Net Profit (a) 117500 (b) 102000 (c) 165500]

TYPICAL QUESTIONS

Question 1: Your company has a production capacity of 2,00,000 units per year. Normal capacity utilization is reckoned as 90%. Standard variable production costs are Rs.11 per unit. The Fixed costs are budgeted at Rs 3,60,000/- per year. Variable selling costs are Rs.3 per unit and fixed selling costs are Rs.2,70,000 per year. The unit selling price is Rs.20. In the year just ended on 30th June, 2002, the production was 1,60,000 units and sales were 1,50,000 units. The closing inventory on 30.6.2002 was 20,000 units. The actual variable production costs for the year were Rs.35,000 higher than the standard. The actual fixed production overheads incurred were Rs.3,80,000/- for the year.

- Calculate the profit for the year
 - by absorption costing method, and
 - by marginal costing method.
- Explain the difference in the profits

[Ans.: Absorption Profit: Rs. 246875; Marginal Profit: Rs. 219375]

Question 2: A single product manufacturing has an installed capacity of 300000 units per annum. The normal capacity utilization of the company is 90%. The company has prepared the following budget for a year:

Variable costs:		
Factory costs		Rs. 33 per unit
Selling and Administration costs		Rs. 9 per unit
Fixed costs:		
Factory costs		Rs. 2160000
Selling and Administration costs		Rs. 756000
Selling Price		
Selling price per unit		Rs. 60

The actual production, sales, price and cost data relating to the year under review are as given below:

Production	240000 units
Sales	225000 units
Finished goods stock in the beginning of the year:	15000 units
Actual factory variable costs exceeded the budget by	Rs. 120000

Required:

- (i) Calculate the budgeted profit and break-even point in units.
- (ii) What increase in selling price was necessary during the year under review to maintain the budgeted profit?

Prepare statements showing the actual profit during the year under review by using (1) absorption costing method and (2) marginal costing method. (11 Marks) Nov/08-Old Course

[Ans.: (i) Rs. 1944000; 162000 units (ii) Rs. 4.07 (iii) Profit under Absorption Costing is Rs. 1149000 & Profit under Marginal Costing is Rs. 1029000]

Question 3: A Ltd. makes and sells a single product. The company's trading results for the year 2007 are:
Figs-Rs.'000 (Year 2007)

Sales		3000
Direct Materials	900	
Direct Labour	600	
Overheads	<u>900</u>	<u>2400</u>
Profits		<u>600</u>

For the year 2008, the following are expected:

- (i) Reduction in selling price by 10%.
- (ii) Increase in quantity sold by 50%.
- (iii) Inflation of direct material cost by 8%.
- (iv) Price Inflation in variable overhead by 6%.
- (v) Reduction of fixed overhead expenses by 25%.

It is also known that:

- (a) In 2006, overhead expenditure totaled to Rs. 8,00,000.
- (b) Total overhead cost inflation for 2007 has been 5% more than 2006.
- (c) Production and sales volumes have been 25% higher in 2007 than in 2006.

The high low method is being used by the company to estimate overhead expenditure.

You are required to:

- (i) Prepare a statement showing the estimated trading results for 2008.
- (ii) Calculate the Break-even point for 2007 and 2008.
- (iii) Comment on the BEP and profits of the years 2007 and 2008.

(12 Marks) May/08

[Ans.: (a) Profit: 981000 (b) 2007: 1500000 & 2008: 1500000]

Question 4: A Japanese soft drink company is planning to establish a subsidiary company in India to produce mineral water. Based on the estimated annual sales of 40,000 bottles of the minerals water, cost studies .Produced the following estimates for the Indian subsidiary.

	Total Annual Cost	Percentage of Total Annual Cost which is variable
	Rupees	
Material	2,10,000	100%
Labour	1,50,000	80%
Factory overheads	92,000	60%
Administration expenses	40,000	35%

The Indian Production will be sold by the manufacturer's representatives who will receive a commission of 8% of the sales price. No portion of the Japanese office expenses is to be allocated to the Indian subsidiary.

Required :

1. Compute the sales price per bottle to enable the management to realize an estimated 10% profit on sale proceeds in India.
2. Calculate the Break-even point in Rupee sales as also in number of bottles for the Indian subsidiary on the assumption that the sales price is Rs.14/- per bottle.

[Ans.: 15, 32000]

Question 5: An Umbrella manufacturer makes an average net profit of Rs.2.50 per piece on a selling price of Rs.14.30 by producing and selling 60,000 pieces or 60% of the potential capacity. His cost of sales is

Direct Material	3.5
Direct Wages	1.25

Work Overhead	6.25 (50% fixed)
Sales Overhead	0.80 (25% variable)

During the current year, he intends to produce the same number of units but anticipates that his fixed charges will go up by 10% while the direct labour and direct materials will go up by 8% and 6% respectively. But he has no option of increasing the selling price. Under this situation he obtains an offer for further 20% of his capacity.

What minimum price will you recommend for acceptance of offer to ensure the Manufacturer an overall profit of Rs.1,67,300/- ?

[Ans.: 11.30]

Question 6: Ever Forward Ltd is manufacturing and selling two products, Splash and Flash at selling prices of Rs.3 and Rs.4 respectively. The following sales strategy has been outlined for the year 2003 :

- Sales planned for the year will be Rs.7.20 lakhs in the case of Splash and Rs.3.50 Lakhs in the case of Flash
- To meet the competition, the selling price of Splash will be reduced by 20% and that of Flash by 12.5%
- Break-even is planned at 60% of the total sales of each product
- Profit for the year to be achieved is planned as Rs.69,120 in the case of Splash and Rs.17,500 in the case of Flash. This would be possible by launching a cost reduction programme and reducing the present annual fixed expenses of Rs.1,35,000 allocated at Rs.1,08,000 to Splash and Rs.27,000 to Flash.

You are required to present the proposal in financial terms giving clearly the following information:

- Number of units to be sold of Splash and Flash to break even as well as the total number of units of Splash and Flash to be sold during the year.
- Reduction in fixed expenses, product wise, that is envisaged by the Cost Reduction Programme.

[Ans.: 300000 & 100000; 4320 & 750]

Question 7: A hospital operates a 40 bed capacity special health care April 7, 2003 department. The said department levies a charge of Rs. 425 per bed day from the patient using its services. The data relating to fees collected and costs for the year 2001 are as under:

	Rs.
Fees collected during the year	3495625
Variable costs based on patient days	1357125
Departmental fixed costs	622500
Apportioned costs of the hospital administration charges	1000000

Based the above, nursing staff were employed as per the following scale at Rs. 48000 per annum per nurse.

Annual Patient days	No. of Nurses required
Less than 5000	3
5000-7000	4
7000-9000	4
Above 9000	8

The projections for the year 2002 are as under:

- The costs other than apportioned overheads will go up to 10%.
- The apportioned overheads will increase by Rs. 250000 per annum.
- The salary of the nursing staff will increase to Rs. 54000 per annum per nurse.

The occupancy of the bed capacity is not likely to increase in 2002 and consequently the management is actively considering a proposal to close down the department. In that event, the departmental fixed costs can be avoided.

Required:

- Present situation to show the profitability of the department for the years 2001 and 2002.
- Calculate the:
 - Break even bed capacity for the year 2002.
 - Increase in fee per bed day required to justify continuance of the department. (12 Marks) Nov/02

[Ans.: (i) Profit for 2001 is Rs. 2,28,000, For 2002 loss is Rs. 255962; (ii) BEP is 9720 bed days, Increase in fee per bed days Rs. 31.12]

Question 8: Jay Kay Ltd. is a single product manufacturing company. The following information relates to the month of May and June 2003:

	May Rs.	June Rs.
(i) Budgeted Costs and Selling Prices:		
Variable manufacturing cost per unit	2.00	2.20

Total Fixed manufacturing cost (based on budgeted output of 25000 units per month)				40000	44000
Total Fixed marketing cost				14000	15400
Selling price per unit				5.00	5.50
(ii)	Actual production and sales:				
				Units	Units
	Production			24000	24000
	Sales			21000	26500
(iii)	There was no stock of finished goods at the beginning of May 2003. There was no wastage or loss of finished goods during May or June 2003.				
(iv)	Actual costs incurred corresponded to those budgeted for each month.				

You are requested to calculate the relative effects on the month operating profits of applying: (a) Absorption Costing and (b) Marginal costing (11 Marks) May/06

[Ans.: Net Profit (a) May Rs.13800, June Rs. 24730 (b) May Rs. 9000, June Rs. 28650]

Question 9: PQ Ltd has been offered a choice to buy a machine between A and B

You are required to compute:

- Break even point for each of the machines
- The level of sales at which both machines earn equal profits
- The range of sales at which one is more profitable than the other

The other relevant data is as given below:

	Machine A	Machine B
Annual output in units	10,000	10,000
Fixed cost	30,000	16,000
Profit at above level of production	30,000	24,000

The market price of the product is expected to be Rs.10 per unit.

[Ans.: 5000 & 40000; 7000]

Question 10: Satish Enterprises are leading exporters of Kid's Toys. J Ltd. of USA have approached Satish Enterprises for exporting a special toy named "Jumping Monkey". The order will be valid for next three years at 3000 toys per month. The export price of the toy will be \$4.

Cost data per toy is as follows:

	Rs.
Material	60
Labour	25
Variable Overheads	20
Primary packing per toy	15

The toys will be packed in lots of 50 each. For this purpose a special box, which contain the 50 toys will have to be purchased, cost being Rs. 400 per box.

Satish Enterprises will also have to import a special machine for making the toys. The cost of the machine is Rs. 2400000 and duty thereon will be at 12%. The machine will have an effective life of 3 years and depreciation is to be charged on straight line method. Apart from depreciation, annual fixed overheads are estimated at Rs. 400000 for the first year with 6% increase in the second year. Fixed overheads are incurred uniformly over the year.

Assuming the average contribution rate to be Rs. 50 per \$, you are required to:

- Prepare monthly and yearly profitability statements for the first year and second year assuming the production at 3000 toys per month.
- Compute monthly and yearly break-even units in respect of the first year.
- In what contingency can there be a second break-even point for the month and for the year as a whole?
- Have you any comments to offer on the above? (Nov./99)

[Ans.: (i) 108000, 1296000, 106000, 1272000 (ii) 1500 & 18000 (iii) 1505 & 18005]

Question 11: Veejay Ltd. makes and sells two products, Vee and Jay. The budgeted selling price of Vee is Rs. 1800 and that of Jay is Rs. 2160. Variable costs associated with producing and selling the Vee are Rs. 900 and with Jay Rs. 1800. Annual fixed production and selling costs of Veejay Ltd. are Rs. 88000.

The company has two production/sales options. The Vee and Jay can be sold either in the ratio of two Vees to three jays or in the ratio of one Vee to two Jays.

What will be the optimal mix and why?

(Nov./99)

[Ans.: Option 1- BEP is 30.56 Batches & Option 2- BEP is 54.32 Batches; Optimal Mix is Option 1]

Question 12: ACE Office Supplies Corporation retails two products- Standard and a deluxe version of a designer ball point pen. The budgeted income statement is as under:

	Standard	Deluxe	Total
Sales (in units)	150000	50000	200000
Sales : at Rs. 20 per unit	Rs. 3000000	-	
At Rs. 30 per unit	-	Rs. 1500000	Rs. 4500000
Variable costs:			
At Rs. 14 per unit	Rs. 2100000	-	
At Rs. 18 per unit	-	Rs. 900000	Rs. 3000000
Contribution	Rs. 900000	Rs. 600000	Rs. 1500000
Fixed Cost			Rs. 1200000
Profit			Rs. 300000

Required:

- Calculate the break-even point in units assuming that the planned sales mix is maintained.
- Calculate the break-even point in units:
 - if only standard version is sold, and
 - if only deluxe version is sold.
- Suppose 200000 units are sold, but only 20000 units are of deluxe quality. Calculate the profit. Calculate the break-even points if these relationships persist in the next accounting period. Compare your answer with the original plan and the answer in requirement (b). What is your major finding?

(May/98)

[Ans.: (i) 120000 & 40000 (ii) 200000 & 100000 (iii) 300000 & 120000]

Question 13: Navbharat Commerce College, Bombay has six sections of B.Com and two sections of M.Com with 40 and 30 students per sections respectively. The college plans one day pleasure trip around the city for the students once in an academic session during break to visit park, zoo, planetarium and aquarium.

A transporter used to provide the required number of buses at a flat rate of Rs. 700 per bus for the aforesaid purpose. In addition, a special permit fee of Rs. 50 per bus is required to be deposited with city Municipal Corporation. Each bus is 52 seater. Two seats are reserved for teachers who accompany each bus. Each teacher is paid daily allowance of Rs. 100 for the day. No other costs in respect of teachers are relevant to the trip.

The approved caterers of the college supply breakfast, lunch and afternoon tea respectively at Rs. 7, Rs. 30 and Rs. 3 per student.

No entrance fee is charged at the park. Entrance fees come to Rs. 5 per student both for the zoo and the aquarium. As regards planetarium, the authorities charges block entrance fees as under for group of students of educational institutions depending upon the number of students in a group:

Number of students in a group	Block Entrance Fee
Upto 100	Rs. 200
101-200	Rs. 300
201 & above	Rs. 450

Cost of prizes to be awarded to the winners in different games being arranged in the park depend upon the strength of students in a trip. Cost of prizes to be distributed are;

Number of students in a Trip	Cost of Prizes
Upto 50	Rs. 900
51 – 125	Rs. 1050
126 – 150	Rs. 1200
151 – 200	Rs. 1300
201 – 250	Rs. 1400
251 and above	Rs. 1500

To meet the above costs the college collects Rs. 65 from each student who wish to join the trip. The college releases subsidy of Rs. 10 per student in the trip towards it.

You are required to :

- Prepare a tabulated statement showing total costs at the levels of 60, 120, 180, 240, and 300 students indicating each item of cost.
- Compute average cost per student at each of the above levels.
- Calculate the number of students to break even for the trip as the college suffered loss during the previous year despite 72% of the total students having joined the trip.

(May/97)

[Ans.: (a) 5850, 9600, 13500, 17400, 21150 (b) 97.50, 80, 75, 72.50, 70.50 (c) BEPs :145, 180, 220, 255]

Question 14: Paramount Food Products is a new entrant in the market for chocolates. It has introduced a new product 'Sweets'. This is a small rectangular chocolate bar. The bars are wrapped in aluminum foil and packed in attractive cartons containing 50 bars. A carton is, therefore, considered the basic sales unit. Although management had made detailed estimates of costs and volumes prior to undertaking the venture, new projections based on actual cost experience are now required.

Income Statements for the last two quarters are each thought to be representative of the costs and productive efficiency we can expect in the next few quarters. There were virtually no inventories on hand at the end of each quarter. The income statements reveal the following:

	First Quarter	Second Quarter
	Rs.	Rs.
Sales		
50000 × Rs. 24	1200000	-
70000 × Rs. 24	-	1680000
Less: Cost of Goods sold	700000	880000
Gross Margin	500000	800000
Less: Selling & Administration	650000	690000
Net Income (Loss) before taxation	(150000)	110000
Less: Tax (negative)	60000	44000
Net Income (Loss)	(90000)	66000

The firm's overall marginal and average income tax rate is 40%. This 40% figure has been used to estimate the tax liability arising from the chocolate operations.

Required:

- Management would like to know the break-even point in terms of quarterly carton sales for the chocolates.
- Management estimates that there is an investment of Rs. 3000000 in this product line. What quarterly carton sales and total revenue are required in each quarter to earn an after-tax return of 20% per annum on investment?
- The firm's marketing people predict that if the selling price is reduced by Rs. 1.50 per carton (Rs. 0.03 off per chocolate bar) and a Rs. 150000 advertising campaign among school children is mounted, sales will increase by 20% over the second quarter sales. Should the plan be implemented? (Nov./90)

[Ans.: (a) BES=Rs. 61539 cartons, (b) Required sales=80769 cartons (c) Profit as per proposed plan:Rs. 9600]

Question 15: Sturdy Ltd. a cycle manufacturing company has drawn up a programme for the manufacture of a new product for the purpose of fuller utilization of its capacity. The scheme envisages the manufacture of baby tricycle fitted with a bell. The company estimates the sales of tricycles at 10000 during the first year and expects that from the second year onwards the sales estimates will stabilize at 20000 tricycles. Since the company has no provision for the manufacture of the small bells specially required for the tricycles, the requirement of the bells is initially proposed to be met by way of purchase from the market at Rs. 8 each. However, if the company desires to manufacture the bell in its factory by installation of new equipment, it has two alternative proposals as under:

	Installation of Super X Machine	Installation of Janta Machine
Initial cost of Machine	Rs. 300000	Rs. 200000
Life	10 years	10 years
Fixed Overheads other than depreciation on machine (per annum)	Rs. 54000	Rs. 28000
Variable expense per bell	Rs. 4.00	Rs. 5.00

Depreciation on machine should be charged on straight line basis.

Required:

- For each of the two levels of output namely 10000 and 20000 bells state with suitable workings whether the company should purchase the bells from market or install new equipment of the two new machines should be installed?
- What would be your decision in case the forecast of requirement from the second year onwards is estimated at 40000 bells instead of 20000 bells.
- At what volume of bells will the installation of the machines break even.

[Ans.: (i) At 10000 units: Buy from market, At 20000 units: Install Janta Machine (ii) Install Super X Machine (iii) 36000 units]

Question 16: The operating data relating to two quarters as under:

	Quarters	
	I	II
Sales units	200	240
Sales value	Rs. 8000	?
Prime Cost	Rs. 3000	?
Overheads	Rs. 4000	Rs. 3900

There is a reduction in fixed overheads by Rs. 500 in the second quarter. If the variable costs increase by 20% in the second quarter, what should be the quantity to be sold in the second quarter to earn the same profit per unit as in quarter?

[Ans.: 300 units]

Question 17: Following is the data taken from records of a concern manufacturing a special part ZED

	Rupees
Selling price per unit	20
Direct Material cost per unit	5
Direct labour cost per unit	3
Variable overhead cost per unit	2
Budgeted level of output and sales	80,000 (Units)
Budgeted recovery rate of fixed overheads cost per unit	5

You are required to:

- Draw a break even chart showing the break even point
- In the same chart show the impact of break even point
 - if selling price per unit is increased by 30% and
 - if selling price per unit is decreased by 10%

Note : Assume a scale of 1" = 20,000 units of "X" axis and 1" Rs.4,00,000 for "Y" axis. Working should form part of the answer.

[Ans.: BEP (a) 40000 (b) 25000 (c) 50000]

Question 18: R Ltd. has spare capacity in two of its manufacturing departments – Department 4 and Department 5. A five-day week of 40 hours is worked, but there is only enough internal work for 3 days per week so that 2 days per week (16 hours) could be available in each department. R Ltd. has sold this time to another manufacturer, but there is some concern about the profitability of this work.

The accountant has prepared a table giving the hourly operating cost in each department. The summarised figures are as follows:

	Department 4	Department 5
	Rs.	Rs.
Power costs	40	60
Labour costs	40	20
Overhead costs	40	40
	<u>120</u>	<u>120</u>

The labour is paid on a time basis and there is no charge in the weekly wage bill whether or not the plant is working at full capacity. The overhead figures are based on firm's current overhead absorption rates (fixed and variable) when the departments are operating at 90% of full capacity (assume a 50 week year). The budgeted fixed overhead attributed to department 4 is Rs. 36,000 p.a. and that for Deptt. 5 Rs. 50,400 p.a.

As a short term measure the company has been selling processing time to another manufacturer @ Rs. 70 per hour in either departments. The customer is willing to continue this arrangement and to purchase any spare time available, but R Ltd. is considering the introduction of a new product on a minor scale to absorb the spare capacity.

Each unit of the new product would require 45 minutes in Deptt. 4 and 20 minutes in Deptt. 5. The variable cost of the required input material is Rs. 10 per unit. The market study indicated as follows:

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- (i) with a selling price of Rs. 100, the demand would be 1,500 units p.a.
- (ii) with a selling price of Rs. 110, the demand would be 1,000 units p.a.
- (iii) with a selling price of Rs. 120, the demand would be 500 units p.a.

You are required to calculate the best weekly programme for the spare time in the two manufacturing departments, to determine the best price to charge for the new product and to quantity the weekly gain that this programme and price should yield. (11 Marks) May/05

[Ans.: Selling 1000 units @ Rs. 110 per unit will achieve optimum contribution, Additional gain for introducing the new product 450]

Question 19: A company following standard marginal costing system has the following interim trading statement for the quarter ending 30th June, 2005, which reveals a loss of Rs. 17,000, detailed below:

Sales		Rs.
		4,99,200
Closing stock (at prime cost)		<u>18,000</u>
		5,17,200
Costs:		
Direct material	1,68,000	
Direct labour	1,05,000	
Variable overhead	<u>42,000</u>	
	3,15,000	
Fixed overhead	1,20,000	
Fixed Admn OH	40,000	
Variable distribution OH	19,200	
Fixed selling OF	<u>40,000</u>	
	2,19,200	
Total costs		<u>5,34,000</u>
Loss		<u>17,000</u>

Additional information is as follows:

- (i) Sales for the quarter were 1,200 units. Production was 1,400 units, of which 100 units were scrapped after complete manufacture. The factory capacity is estimated at 2,000 units.
- (ii) Because of low production, labour efficiency during the quarter is estimated to be 20% below normal level.

You are required to analyse the above and report to the management giving the reasons for the loss.

(13 Marks) Nov/06

[Ans.: Factors causing loss:- Labour inefficiency Rs. 21000 units scrapped Rs. 21000, Undervaluation of closing stock Rs. 3000, Standard profit Rs. 28000, Actual Profit (-) Rs. 17000. (28000-21000-21000-3000)]

Question 20(Merger of plants): A, B and C are three similar plants under the same management who want them to be merged for better operation. The details are as under:-

Plant	A	B	C
Capacity Operated %	100	70	50
	Rs.	Rs.	Rs.
	(in lakhs)	(in lakhs)	(in lakhs)
Turnover	300	280	150
Variable cost	200	210	75
Fixed costs	70	50	62

Find out:

- a. The capacity of the merged plant for break-even.
- b. The profit at 75% capacity of the merged plant.
- c. The turnover from the merged plant to give a profit of Rs.28 lakhs.

[Ans.: 52%,80.5,600]

Question 21(Uncertainty):Nuksan Ltd. which makes only one product, sells 10,000 units of its product making a loss of Rs.10,000/-. The variable cost per unit of the product is Rs.8/- and the fixed cost is Rs.30,000/-

Sales units	Probability
10,000	0.10
12,000	0.15
14,000	0.20
16,000	0.30
18,000	0.25

- (i) What is the probability that the company will continue to make losses?
(ii) What is the probability that the company will make a profit of Rs.6,000?
(iii) What is the probability that the profit will be at the most Rs.2,000?

[Ans.: 0.45, 0.25, 0.75]

Question 22: A sports goods manufacturer, in conjunction with a software house, is considering the launch of a new sporting simulator based on videotapes linked to a personal computer enabling much greater realism to these are limited, only the product can be launched.

The following data are the best estimates the firm has been able to obtain:

	Football Simulator	Cricket simulator
Annual Volume (units)	40000	30000
Selling Price	Rs. 130 per unit	Rs. 200 per unit
Variable Production costs	Rs. 80 per unit	Rs. 100 per unit
Fixed Production costs	Rs. 600000	Rs. 600000
Fixed Selling & administrative costs	Rs. 450000	Rs. 1350000

The higher selling & administration costs for the cricket simulator reflect the additional advertising and promotion cost expected to be necessary to sell the more expensive cricket system.

The firm has a minimum target of Rs. 200000 profit per year for new products. The management recognizes the uncertainty in the above estimates and wishes to explore the sensitivity of the profit on each product to changes in the value of the variable (volume, price, variable cost per unit, fixed costs).

You are required:

- (a) to calculate the expected profit from each product;
(b) to calculate the critical value for each variable (i.e. the value at which the firm will earn Rs. 200000), assuming that all other variables are as expected (express this as an absolute value and as percentage change from expected value).

[Ans.: (a) Football Simulator: Rs. 950000 Cricket Simulator: Rs. 1050000 (b) Sensitivity due to change in volume: Football: 37.5%; Cricket: 28.3%; Sensitivity due to change in variable cost per unit: Football: 23.4%; Cricket: 28.3%; Sensitivity due to change in fixed costs: Football: 71.4%; Cricket: 43.6%] (1992)ICWA