CHAPTER 7

Solved Problems

P.7.7 On investigation it was found that variable cost in *XYZ* Ltd is 80 per cent of the selling price. If the fixed expenses are Rs 10,000, calculate the break-even sales of the company.

Another firm, IMN Company Ltd, having the same amount of fixed expenses, has its break-even point at a lower figure than that of *XYZ* Ltd. Comment on the causes.

*S*olution

BEP (amount) = Rs 10,000/ P/V ratio (100 per cent-Variable cost to volume ratio = 0.80)
= Rs 10,000/0.20 = Rs 50,000 (*XYZ* Ltd)

The lower break-even point of IMN Ltd *vis-à-vis XYZ* Ltd is due to its lower variable expenses to volume ratio, which in turn may be either due to its lower VC per unit or higher *SP* per unit, eventually yielding higher contribution margin and, hence, higher P/V ratio and lower BEP.

P.7.8 Calculate from the following data (i) the value of output at which the business breaks even; and (ii) the percentage of capacity at which it breaks even:

Particulars	Budget based on 100 per cent capacity	Shut down expenditure
Direct wages	Rs 2,09,964	
Direct materials	2,44,552	
Works expenses	88,292	Rs 93,528
Selling and distribution expenses	21,000	40,188
Administrative expenses	9,492	20,508
Net sales	8,40,000	

*S*olution   **Determination of P/V ratio**

(i) *Net sales*		Rs 8,40,000
Less: Variable costs:		
Direct wages	Rs 2,09,964	
Direct materials	2,44,552	
Works expenses	88,292	
Selling and distribution expenses	21,000	
Administrative expenses	9,492	5,73,300
Contribution (C)		2,66,700
P/V ratio (C ÷ Sales) (per cent)		31.75

BEP (amount) = Fixed costs (shut down expenditure)/P/V ratio = Rs 1,54,224/0.3175 = Rs 4,85,744.88
(ii) Break-even sales/Sales at 100 per cent capacity = Rs 4,85,744.88/Rs 8,40,000 = 57.83 per cent

P.7.9 Calculate the break-even sales from the following data for a company producing three products:

Product	Sales	Variable costs
A	Rs 10,000	Rs 6,000
B	5,000	2,500
C	5,000	2,000
	20,000	10,500

Total fixed costs amount to Rs 5,700.

*S*olution   **Determination of weighted P/V ratio**

Product	Sales	Variable costs	Contribution
A	Rs 10,000	Rs 6,000	4,000
B	5,000	2,500	2,500
C	5,000	2,000	3,000
	20,000	10,500	9,500

Weighted P/V ratio = (Total contribution/Total sales) × 100 = (Rs 9,500/ Rs 20,000) × 100 = 47.5 per cent

BEP = FC/Weighted P/V ratio = Rs 5,700/0.475 = Rs 12,000

P.7.10 Market Well Ltd manufactures filing cabinets. For the current year, the company expects to sell 4,000 cabinets involving a loss of Rs 2,00,000. Only 40 per cent of the plant's normal capacity is being utilised during the current year. The fixed costs for the year are Rs 10,00,000 and fully variable costs are 60 per cent of sales value.

You are required to

1. Calculate the break-even point;
2. Calculate the profit if the company operates at 70 per cent of its normal capacity;
3. Calculate the sales required to achieve a profit of Rs 60,00,000;
4. Calculate the revised break-even point if the existing selling prices are decreased by 10 per cent, the total fixed and variable expenses remaining the same.

Solution

1. BEP (amount) = FC/ PV ratio = Rs 10,00,000/0.40 = Rs 25,00,000

2. **Determination of the existing sales volume and sales price per cabinet**

Sales revenue	X
Less: Variable cost (0.60)	0.6 X
Contribution	$(X - 0.6X)$
Less: Fixed costs	Rs 10,00,000
Loss (given)	2,00,000
0.4 X – Rs 10,00,000 = (– Rs 2,00,000)	
0.4 X = Rs 8,00,000	
X = 20,00,000 (sales revenue)	
Sales price per cabinet = Rs 20,00,000/4,000 cabinets = Rs 500	
Number of cabinets sold at 70 per cent capacity = 7,000 = (4,000 × 70/40)	

Projected income statement at 70 per cent capacity

Sales revenue (7,000 × Rs 500)	Rs 35,00,000
Less: Variable cost (0.60)	21,00,000
Contribution	14,00,000
Less: Fixed costs	10,00,000
Profit	4,00,000

Alternatively, (Expected sales revenue-Break-even sales revenue) × P/V ratio or (Margin of safety) × P/V ratio = (Rs 35,00,000 – Rs 25,00,000) × 0.40 = Rs 4,00,000

3. Desired sales volume to earn a profit of Rs 60,00,000 = (FC + Rs 60,00,000)/0.40 = (Rs 10,00,000 + Rs 60,00,000)/0.40 = Rs 1,75,00,000

4. Break-even point (revised) at reduced selling price by 10 per cent

Sales price	Rs 450
Less: Variable cost (0.60 × Rs 500)	300
CM	150
P/V ratio (Rs 150/Rs 450) (%)	33.33
BEP Rs (10,00,000/0.3333)	30,00,000

P.7.11 Hansa Ltd manufacturing a single product is facing severe competition in selling it at Rs 50 per unit. The company is operating at 60 per cent level of activity at which level sales are Rs 12,00,000; variable costs are Rs 30 per unit; semi-variable costs may be considerd fixed at Rs 90,000 when output is nil and the variable element is Rs 250 for each additional 1 per cent level of activity; fixed costs are Rs 1,50,000 at the present level of activity, but if a level of activity of 80 per cent or above is reached, these costs are expected to increase by Rs 50,000.

To cope with the competition, the management of the company is considering a proposal to reduce the selling price by 5 per cent. You are required to prepare a statement showing the operating profit at levels of activity of 60 per cent, 70 per cent and 82 per cent, assuming that:

1. The selling price remains at Rs 50; and
2. The selling price is reduced by 5 per cent.

Show also the number of units, which will be required to be sold to maintain the present profits if the company decides to reduce the selling price of the product 5 by per cent.

Solution

Statement showing operating profit (flexible budgets)

Particulars	Percentage of capacity					
	60		70		82	
	Old selling price	New selling price	Old selling price	New selling price	Old selling price	New selling price
Units	24,000	24,000	28,000	28,000	32,800	32,800
Sales price	Rs 50	Rs 47.50	Rs 50	Rs 47.50	Rs 50	Rs 47.50
Sales revenue	12,00,000	11,40,000	14,00,000	13,30,000	16,40,000	15,58,000
Less: Costs:						
Variable costs	7,20,000	7,20,000	8,40,000	8,40,000	9,84,000	9,84,000
Semi-variable costs	1,05,000	1,05,000	1,07,500	1,07,500	1,10,500	1,10,500
Fixed costs	1,50,000	1,50,000	1,50,000	1,50,000	2,00,000	2,00,000
Total costs	9,75,000	9,75,000	10,97,500	10,97,500	12,94,500	12,94,500
Operating profit	2,25,000	1,65,000	3,02,500	2,32,500	3,45,500	2,63,500

Sales volume required to maintain present level of profit: (Fixed costs + Profit)/CM per unit = (Rs 1,50,000 + 90,000 + 2,25,000)/Rs 16.875 = 27,556 units

Working note
Selling price		Rs 47.50
Less: Variable cost	Rs 30.00	
Semi variable cost (variable element)	0.625	30.625
CM per unit		16.875

P.7.12 After a study of cost-volume relationships, the Kaling Tubes Company Ltd concluded that its costs for any given volume of sales could be expressed as Rs 1,00,000 for fixed costs plus variable costs equal to 60 per cent of sales. The company's range of volume was from zero to Rs 8,00,000 of sales.

Prepare a graph, which will illustrate this cost-volume relationship. Also draw a proper sales line to the graph to form a break-even chart. Determine the break-even point.

A competitor operating a plant of the same size as Kaling also has fixed cost of approximately Rs 1,00,000 per year, but his break-even point is Rs 3,00,000 of sales. What may be the probable causes of the difference between the break- even points of the Kaling Company Ltd and its competitor?

Solution Since selling price per unit is not given, it is necessary to draw the cost-volume graph on the same scale so that a 45° line can be the proxy of the sales line.

Determination of two points for drawing the total cost line:

Sales revenue	FC	VC	TC
Rs 1,00,000	Rs 1,00,000	Rs 60,000	Rs 1,60,000
8,00,000	1,00,000	4,80,000	5,80,000

The point of intersection of the TC line and sales line is BEP (Rs 2,50,000).
Verification: FC/P/V ratio = Rs 1,00,000/0.40 = Rs 2,50,000
Possible causes for the differences in BEP:
1. The competitors are having a higher variable cost to volume ratio than the Kaling Tubes Ltd. It is 66.67 per cent for the competitors, assuming the selling price per unit for both the firms is same.
   BEP = FC/ P/V ratio = Rs 3,00,000 = Rs 1,00,000 P/V ratio
   P/V ratio = Rs 1,00,000/ Rs 3,00,000 = 33.33 per cent
2. The competitors are having lower sales price per unit. Their prices per units are 6.67 per cent lower than those of the Kaling Tubes Ltd as shown below:
   BEP = Rs 1,00,000/(0.9333-0.60) = Rs 1,00,000/0.3333 = Rs 3,00,000
3. Partly due to higher variable cost to volume ratio or partly due to lower selling price, the sum of the difference is 6.67 per cent.

P.7.13 During the current year, *AB* Ltd showed a profit of Rs 1,80,000 on a sale of Rs 30,00,000. The variable expenses were Rs 21,00,000.

You are required to work out:
1. The break-even sales at present
2. The break-even sale if variable cost increase by 5 per cent
3. The break-even sale to maintain the profit as at present, if the selling price is reduced by 5 per cent.

Solution

Rs 30,00,000, Sales = Rs 21,00,000, VC + FC + Rs 1,80,000, profit or FC = Rs 7,20,000

1. BEP = Rs 7,20,000/ PV ratio = Rs 7,20,000/0.30 = Rs 24,00,000
   P/V ratio = Rs 9,00,000/30,00,000 = 0.30
2. BEP (revised) = Rs 7,20,000/0.265 = Rs 27,16,981
   P/V ratio = Rs 7,95,000/ Rs 30,00,000 = 0.265
   Rs 7,95,000 Contribution = (Rs 30,00,000 – Rs 22,05,000, VC)
3. Revised P/V ratio with reduction in price

Sales revenue	Rs 28,50,000
Variable costs	21,00,000
Contribution	7,50,000

P/V ratio (Rs 7,50,000 ÷ Rs 28,50,000) = 26.316 per cent
Desired sales volume = Rs 9,00,000 (FC + *DP*)/0.26316 = Rs 34,19,973

P.7.14 There are two similar plants under the same management. The management desires to merge these two plants. The following particulars are available:

	Factory I	Factory II
Capacity (%)	100	60
Sales (Rs lakh)	300	120
Variable costs	220	90
Fixed costs	40	20

You are required to calculate: (a) What the break- even capacity of the merged plant would be, and (b) What the profitability on working at 75 per cent of the merged capacity would be?

*S*olution

(a) Break-even capacity

	Factory I (at 100% capacity)	Factory II (at 100% capacity)	Combined (at 100% capacity)
Sales (Rs lakh)	300	200	500
Less: Variable costs	220	150	370
Contribution	80	50	130

Break-even (amount) = Fixed costs/Combined P/V ratio = Rs 60 lakhs/0.26 = Rs 230.769 lakh
0.26 = (Rs 130 lakh/Rs 500 lakh) × 100
Break-even point (per cent capacity) = (Break-even sales/Total capacity) × 100
= (Rs 230.8 lakh/ Rs 500 lakh) × 100 = 46.15 per cent. The break-even capacity of the merged plant would be approximately 46.15 per cent.

(b) Income statement at 75 per cent merged capacity

Sales (Rs lakh)	375.00
Less: Variable costs (0.74 × *V/V* ratio)	277.50
Contribution	97.50
Less: Fixed costs	60.00
Net profit	37.50

Alternatively, (Actual sales – BE sales) × P/V ratio = (Rs 375 lakh – Rs 230.769 lakh) × 0.26 = Rs 37.50 lakh

P.7.15 The question as to which products to stress in order to obtain the most profitable sales-mix has always been of prime importance to businessmen. The amount of profit contribution, or the difference between the selling price and the variable costs, tells how much each product is contributing to fixed costs and profit in the present sales-mix. This information assists management in forming an opinion as to which products will add to profits if sales of these units can be increased.

Direct cost data can be utilised in this type of analysis when management seeks an answer to the question: "Which product shall we push"?

Data	Product A	Product B
Selling price	Rs 12.60	Rs 5.50
Variable cost	9.62	4.18
Fixed costs	2.07	0.65
Units per hour	45	0.70

1. What is the amount of net profit for each product?
2. What is the percentage of profit to selling price for each product?

3. What is the amount of profit contribution towards fixed cost and the profit for each product?
4. What is the profit contribution ratio?
5. What is the profit contribution per hour for each product?
6. If one allocates: (a) 200 hours to Product *A* and 100 hours to Product *B* or (b) 100 hours to Product *A* and 200 hours to Product B, which of the two courses is more profitable?

Solution

1. Net profit for products *A* and *B*

Particulars	A	B
Selling price	Rs 12.60	Rs 5.50
Less: Costs:		
Variable	9.62	4.18
Fixed	2.07	0.65
Net profit	0.91	0.67

2. Percentage of profit to selling price = (Net profit × 100) ÷ Selling price		7.22	12.18
3. Profit contribution (Selling price-Variable costs)		2.98	1.32
4. P/V ratio (%)		23.65	24
5. (Profit contribution per unit × Units produced per hour)			
Product *A* : Rs 2.98 × 45		134.10	
B : Rs 1.32 × 70			92.40
6. Statement of Profit			

Particulars	Alternative (a)	Alternative (b)
Product A (Profit contribution per hour	Rs 134.10	Rs 134.10
× Hours)	× 200	× 100
	(a) 26,820	(a) 13,410
Product B (Profit contribution per hour	92.40	92.40
× Hours)	× 100	× 200
	(b) 9,240	(b) 18,480
Total profit [(a) + (b)]	36,060	31,890

Alternative (a) of allocating 200 hours to Product *A* and 100 hours to Product *B* is the more profitable course as it yields higher profits.

P.7.16 A.T. Ltd operating at 80 per cent level of activity furnishes the following information:

Particulars	Products		
	A	B	C
Selling price/units	Rs 10	Rs 12	Rs 20
Profit as percentage on selling price	25	33.33	20
Units produced and sold	10,000	15,000	5,000
Fixed costs	40,000	45,000	25,000

During the year, the variable costs are expected to increase by 10 per cent. There will, however, be no change in fixed costs, the selling prices and the units to be produced and sold. The sales potential for each of the products is unlimited.
 (i) You are required to prepare a statement showing the P/V ratio, break-even point and margin of safety for each product and for the company as a whole.
 (ii) The company intends to increase the production of only one of the three products to reach the full capacity level by utilising the spare capacity available. Assuming that all the three products take the same machine time, advise with reasons, which of the three products should be produced so that the overall profitability is the maximum.

Solution

(i) Statement showing BEP, margin of safety and P/V ratio of A.T. Ltd for Year 1 and 2

Particulars	Year 1				Year 2			
	A	B	C	All combined	A	B	C	All combined
Units produced and sold	10,000	15,000	5,000	30,000	10,000	15,000	5,000	30,000
Selling price per unit	Rs 10	Rs 12	Rs 20	Rs 12.666	Rs 10	Rs 12	Rs 20	Rs 12.666
Sales revenue	1,00,000	1,80,000	1,00,000	3,80,000	1,00,000	1,80,000	1,00,000	3,80,000

Particulars								
Less: Variable costs (see working notes)	35,000	75,000	55,000	1,65,000	38,500	82,500	60,500	1,81,500
Contribution	65,000	1,05,000	45,000	2,15,000	61,500	97,500	39,500	1,98,500
Less: Fixed costs	40,000	45,000	25,000	1,10,000	40,000	45,000	25,000	1,10,000
Operating profit	25,000	60,000	20,000	1,05,000	21,500	52,500	14,500	88,500
P/V ratio (%)	65	58.33	45	56.58	61.5	54.17	39.5	52.24
BEP				1,94,419				2,10,580
Margin of safety				1,85,581				1,69,420

Working Notes

A Rs 1,00,000 = 40,000 FC + Rs 25,000 profit (0.25 × Rs 1,00,000) + VC, that is, Rs 35,000.

B Rs 1,80,000 = 45,000 FC + Rs 60,000 profit (0.3333 × Rs 1,80,000) + VC, that is, Rs 75,000.

C Rs 1,00,000 = 25,000 FC + Rs 20,000 profit (0.20 × Rs 1,00,000) + VC, that is, Rs 55,000.

(ii) Product *C* should be produced to utilise the *SP* are capacity of 20 per cent as its marginal contribution per unit is maximum as shown below:

Particulars	A	B	C
Sales price	Rs 10	Rs 12	Rs 20
Less: Variable cost per unit	3.5	5.0	11
CM	6.5	7.0	9.0

Review Questions

7.16 1. From the following information, calculate the break-even point and turnover required to earn a profit of Rs 30,000:

Fixed overheads	Rs 21,000
Variable costs (per unit)	2
Selling price	5

If the company is earning a profit of Rs 30,000, express the margin of safety available to it.

2. At a break-even point of 1,000 units sold, variable costs were Rs 15,000 and fixed costs were Rs 10,000. What will the 1,001st unit sold contribute to profit before income-tax?

3. *ABC* Ltd plans to sell 5,000 units of product @ Rs 3 per unit. Management expects to break-even at this level of sales. If the P/V ratio is 40 per cent, what are the fixed costs and variable costs?

7.17 From the following data draw a simple break-even chart:

Selling price per unit	Rs 10
Trade discount (%)	5
Direct material cost per unit	3
Direct labour cost per unit	2
Fixed overheads	10,000
Variable overheads on as percentage direct labour cost	100

If sales are 10 per cent and 15 per cent above the break-even volume, determine the net profits.

7.18 1. From the following data of a manufacturing unit, find out (a) the sales to break-even and (b) the sales to earn a profit of Rs 8,000;

Sales (8,000 units @ Rs 10)	Rs 80,000
Variable expenses	64,000
Contribution	16,000
Fixed expenses	24,000
Loss	(8,000)

2. The following information is available for companies *A* Ltd and *B* Ltd

Particulars	A Ltd		B Ltd	
Units produced and sold		40,000		40,000
Revenues		Rs 80,000		Rs 80,000
Variable costs	Rs 20,000		Rs 60,000	
Fixed costs	50,000	70,000	10,000	70,000

Net operating income	10,000	10,000

(a) What is the break-even point for each company?

(b) How would you explain the difference that you observe between these companies' break-even points?

7.19 The Taylor Company Ltd produces two products, *A* and *B*. Expected data for the first year of operations are:

Particulars	A	B
Expected sales (units)	8,000	12,000
Selling price	Rs 45	Rs 55
Variable costs	30	35

Total fixed cost are expected to be Rs 3,60,000 for the year. You are required to answer the following:
1. If sales, prices and costs are as expected, what will be the operating income and the break-even volume in sales revenue.
2. Assume that prices and costs were as expected but Taylor Ltd sold 12,000 units of *A* and 8,000 units of *B*. Recalculate the operating income and the break-even volume in sales revenue.

7.20 The sales of Forma Ltd in the first half of the year amounted to Rs 2,70,000 and profit earned was Rs 7,200. The sales in the second half year registered an increase and amounted to Rs 3,42,000. The profit earned was Rs 20,700 in that half year. Assuming no change in fixed cost, calculate: (i) P/V ratio; (ii) The amount of sales required to earn a profit of Rs 36,000.

7.21 *SV* Ltd multi-product company furnishes you the following data relating to the current year:

Particulars	First half of the year	Second half of the year
Sales	Rs 45,000	Rs 50,000
Total cost	40,000	43,000

Assuming that there is no change in prices and variable costs and that the fixed expenses are incurred equally in the two half-year periods, calculate for the year:

(1) The P/V ratio, (2) Fixed expenses, (3) Break-even sales, (4) Percentage of margin of safety.

7.22 The revenue account of Goodwill Ltd has been summarised as shown below:

Sales		Rs 60,00,000
Direct materials	Rs 18,00,000	
Direct wages	12,00,000	
Variable overheads	4,80,000	
Fixed overheads	17,20,000	52,00,000
Profit		8,00,000

The licensed capacity of the company is Rs 80,00,000 but the key factor is sales demand.

It is proposed by the management that in order to utilise the existing capacity, the selling price of the product should be reduced by 5 per cent.

You are required to prepare a forecast showing the effect of the proposed reduction in selling price after taking into account the following changes in cost:

Sales forecasts are Rs 76,00,000 (at reduced prices). Direct wage rates and variable overheads are expected to increase by 5 per cent. Direct material prices are expected to increase by 2 per cent. Fixed overheads will increase by Rs 80,000.

7.23 A company is producing an identical product in two factories. The following are the details in respect of both the factories:

Particulars	Factory X	Factory Y
Selling price per unit	Rs 50	Rs 50
Variable cost per unit	40	35
Fixed cost	2,00,000	3,00,000
Depreciation included in above	40,000	30,000
Sales (units)	30,000	20,000
Production capacity (units)	40,000	30,000

You are required to determine:
1. The break-even point (BEP) for each factory, individually.
2. Which factory is more profitable?
3. The cash BEP for each factory individually.

4. The BEP for company as whole, assuming the present product-mix.
5. The effect on profits and the BEP if the product-mix is changed to 2:3 and total demand remains constant.

7.24 The following particulars relate to a manufacturing company:

Turnover at present (40,000 units)		Rs 4,00,000
Variable cost (40,000 units)	Rs 2,40,000	
Fixed cost	80,000	3,20,000
Net profit		80,000

Due to severe competition, the company proposes to reduce the selling price. In the ensuring year, variable cost per unit (cost of material and labour) is expected to go up by 20 per cent and the fixed cost will rise by 10 per cent. If the present level of profit is to be maintained, you are required to calculate the number of units to be sold if the proposed reduction in selling price is (i) 5 per cent, (ii) 10 per cent, and (iii) 15 per cent.

Answers

7.16   (a) BEP 7,000 units; Desired sales volume 17,000 units to earn profits of Rs 30,000; Margin of safety Rs 50,000.
(b) Rs 10.
(c) Rs 9,000 variable costs, Rs 6,000 fixed costs.

7.17   Rs 38,000; BEP, net profit, Rs 1,000 if sales are above 10 per cent and Rs 1,500 when sales are 15 per cent above BEP.

7.18   (a) BEP, Rs 1,20,000
(b) Rs 1,60,000

7.19   (i) BEP Rs 10,20,000, income zero.
(ii) Rs 10,37,647, loss Rs 20,000.

7.20   (I) 18.75 per cent;
(ii) Loss Rs 2,925 (if sales are in 6 month), loss; Rs 46,350 (if sales are in 12 months);
(iii) Rs 6,55,200.

7.21   (i) 40 per cent;
(ii) Rs 26,000;
(iii) Rs 65,000;
(iv) 31.6 per cent;

7.22   Profit Rs 10,00,000.

7.23   (a) Rs 10,00,000 (factory X), Rs 10,00,000 (factory Y);
(b) Rs 10,00,000 (factory X), zero (factory Y);
(c) Rs 8,00,000 (factory X), Rs 9,00,000 (factory Y);
(d) Rs 20,83,333 (e) Rs 19,23,077.

7.24   (i) 76,522 unit (5 per cent),
(ii) 97,778 (10 per cent),
(iii) 1,35,385 (15 per cent).