

CMA Final

**STRATEGIC COST
MANAGEMENT –
DECISION MAKING**



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1.5 THROUGHPUT ACCOUNTING

Throughput (or Cycle) Time – the average time required to convert raw materials into finished goods ready to be shipped to customer. It includes the time required for activities such as material handling, production processing, inspecting and packaging.

Throughput time ratio =
$$\frac{\text{Time spent adding customer value to product or service}}{\text{Total cycle time}}$$

It is also known as the 'ratio of work content to lead time'.

Operating Expenses = All company expenses including totally variable expenses are considered the price that a company pays to ensure that it maintains its current level of capacity.

Total Factory Cost: With the exception of material costs, in the short run, most factory costs (including direct labour) are fixed. These fixed costs can be grouped together and called total factory costs (TFC).

Manufacturing Response Time: With JIT, products should not be made, unless there is a customer waiting for them, because the ideal inventory level is zero. The effect of this will be that there will be idle capacity in some operations except the operation, which is bottleneck of the moment. Working on output just to increase WIP or Finished Goods stocks creates no profit and so would not be encouraged. This means that profit is inversely proportional to the level of inventory in the system. It can be expressed as follows:

$$\text{Profit} = f = \frac{1}{\text{MRT}}$$

Where, MRT = Manufacturing Response Time

Problems associated with throughput accounting:

1. When throughput accounting is the driving force behind all production scheduling, a customer that has already placed an order for a product, which will result in a sub-optimal profit level for the manufacturing, may find that its order is never filled.

2. The company's ability to create the highest level of profitability is now depends on the production scheduling staff, who decides, what products are to be manufactured and in what order.
3. Another issue is that all costs are totally variable in the long-run since the management then, has the time to adjust them to long-range production volumes.

{CMA inter J14, 3 marks}

PRACTICAL PROBLEMS

Question 1: Modern Co produces 3 products, A, B and C, details of which are shown below:

Particulars	A	B	C
Selling price per unit (₹)	120	110	130
Direct material cost per unit (₹)	60	70	85
Variable overhead (₹)	30	20	15
Maximum demand (units)	30,000	25,000	40,000
Time required on the bottleneck resource (hours per unit)	5	4	3

There are 3,20,000 bottleneck hours available each month. Budgeted factory cost for the period is ₹35,20,000

Required: Calculate the optimum product mix based on the throughput concept.

Answer:

Particulars	A	B	C
Selling price per unit (₹)	120	110	130
- Direct material cost per unit (₹)	60	70	85
Throughput	60	40	45
Time required on the bottleneck resource (hours per unit)	5	4	3
Return per hour	12	10	15

Rank		II	III	I
Throughput Accounting Ratio	$\left[\frac{\text{Contribution p.m.}}{\text{Cost p.m.}} \right]$	1.09	0.91	1.36

Note: $\text{Cost per minute} = \frac{\text{Total factory cost}}{\text{Resource time available}} = \frac{35,20,000}{3,20,000} = 11$

Calculation of optimum product mix

Total Available hours			3,20,000
- Hours used for C (40,000 x 3)		1,20,000	
- Hours used for A (30,000 x 5)		1,50,000	2,70,000
Balance hours available for B			50,000
Number of units that can be made in balance hours	$\frac{50,000}{4}$		12,500

Statement showing optimum mix:

	A	B	C
Number of units	30,000	12,500	40,000

Question 2: A factory has a key resource (bottleneck) of Facility A which is available for 31,300 minutes per week. Budgeted factory costs and data on two products, X and Y, are shown below:

Product	Selling Price / Unit	Material Cost / Unit	Time in Facility A
X	₹35	₹20.00	5 minutes
Y	₹35	₹17.50	10 minutes

Budgeted factory costs per week:

	₹
Direct labour	25,000
Indirect labour	12,500
Power	1,750
Depreciation	22,500
Space costs	8,000
Engineering	3,500

Administration	5,000
----------------	-------

Actual production during the last week is 4,750 units of product X and 650 units of product Y. Actual factory cost was ₹78,250.

Calculate:

1. Total factory costs (TFC)
2. Cost per Factory Minute
3. Return per Factory Minute for both products
4. Throughput Accounting (TA) ratios for both products.
5. Throughput cost per week.
6. Efficiency ratio

Answer:

1. Total factory cost [total cost except direct material cost]

	₹
Direct labour	25,000
Indirect labour	12,500
Power	1,750
Depreciation	22,500
Space costs	8,000
Engineering	3,500
Administration	5,000
Total factory cost	78,250

2. Cost per factory minutes

$$\frac{\text{Total factory cost}}{\text{Minutes available}} = \frac{\text{₹78,250}}{31,500} = \text{₹2.50}$$

3. Return per bottle-neck minute = $\frac{\text{throughput}}{\text{minutes}}$

$$\text{For X} = \frac{35 - 20}{5} = \text{₹3} \quad \& \quad \text{For Y} = \frac{35 - 17.5}{10} = \text{₹1.75}$$

4. Throughput Accounting Ratio = $\frac{\text{Return per minute}}{\text{Cost per minute}}$

$$\text{For X} = \frac{3}{2.5} = 1.2 \quad \& \quad \text{For Y} = \frac{1.75}{2.5} = 0.7$$

Product Y is not profitable.

5. Standard minutes of throughput for the week

$$= [4,750 \times 5] + [650 \times 10] = 30,250 \text{ minutes}$$

$$\text{Throughput cost per week} = 30,250 \times ₹2.50 = ₹75,625$$

6. Throughput Efficiency % = $\frac{\text{throughput cost}}{\text{actual TFC}} \% = \frac{75,625}{78,250} \% = 96.6\%$

Question 3: Cat Co makes a product using three machines – X, Y and Z. The capacity of each machine is as follows:

	X	Y	Z
Machine capacity per week (in units)	800	600	500

The demand for the product is 1,000 units per week. For every additional unit sold per week, profit increases by ₹50,000. Cat Co is considering the following possible purchases (they are *not* mutually exclusive):

Purchase 1 Replace machine X with a newer model. This will increase capacity to 1,100 units per week and costs ₹60 Lakhs.

Purchase 2 Invest in a second machine Y, increasing capacity by 550 units per week. The cost of this machine would be ₹68 Lakhs.

Purchase 3 Upgrade machine Z at a cost of ₹75 Lakhs, thereby increasing capacity to 1,050 units.

Required: Which is Cat Co’s best course of action under throughput accounting?

Answer: Bottleneck resource in order of preference is firstly machine ‘Z’, secondly machine ‘Y’ and lastly machine ‘X’ because the no. of units is in that order in the existing capacity.

Particulars	X	Y	Z	D	Cost ↑	Revenue ↑	P/L
Capacity	800	600	500*	1,000			
Buy Z	800	600*	1,050	1,000	75L	25L	Loss
Buy Z & Y	800*	1,150	1,050	1,000	143L	150L	Profit
Buy Z, Y & X	1,100	1,150	1,050	1,000*	203L	274L	Profit

* = bottleneck resource

All the three machines to be purchased in the above order to meet the existing demand

Question 4: T Ltd, produces a product which passes through two processes – cutting and finishing.

The following information is provided:

	Cutting	Finishing
Hours available per annum	50,000	60,000
Hours needed per unit of product	5	12
Fixed operating costs per annum excluding direct material	10,00,000	10,00,000

The selling price of the product is ₹1,000 per unit and the only variable cost per unit is direct material, which costs ₹400 per unit. There is demand for all units produced.

Evaluate each of the following proposals independent of each other:

1. An outside agency is willing to do the finishing operation of any number of units between 5,000 and 7,000 at ₹400 per unit.
2. An outside agency is willing to do the cutting operation of 2,000 units at ₹200 per unit.
3. Additional equipment for cutting can be bought for ₹10,00,000 to increase the cutting facility by 50,000 hours, with annual fixed costs increased by ₹2 lakhs.

Answer:

	Cutting	Finishing
Hours available per annum	50,000	60,000
Hours needed per unit of product	5	12
Units can be produced	10,000	5,000
Bottleneck	No	Yes

Maximum units can be produced – 5,000 units only

Throughput = SP – TVC = ₹1,000 – ₹400 = ₹600.

Alternative 1:

Additional contribution = (₹600 – ₹400) × 5,000 units = ₹10,00,000

Alternative 2 & 3 – not recommended as cutting process is not a bottleneck.

Question 5: Given below is the basic data relating to New India Company for three years:

Production and Inventory data	YEAR		
	1	2	3
Planned production (in units)	2,500	2,500	2,500
Finished goods inventory (in units), Jan 1	0	0	750
Actual production (in units)	2,500	2,500	2,500
Sales (in units)	2,500	1,750	3,250
Finished goods inventory (in units), Dec 31	0	750	0
Revenue and cost data, all three-years			
Sales price per unit			₹48
Manufacturing costs per unit			
Direct material			12
Direct labour			8
Variable manufacturing overhead			4
Total variable cost per unit			24
Used only under absorption costing:			
Fixed manufacturing OH			12
	$\frac{\text{Annual fixed OH}}{\text{Annual Production}} = \frac{\text{₹30,000}}{2,500}$		
Total absorption cost per unit			₹36
Variable selling and administrative cost per unit			₹4
Fixed selling and administrative cost per year			₹5,000

You are required to Prepare:

- Absorption Costing Income Statement
- Variable Costing Income Statement.
- Reconciliation of Income under Absorption and Variable Costing.
- Throughput Costing Income Statement and Comment how it is relatively more useful.

Draw your conclusion.

Answer:

Absorption Costing Income Statement

(a)	Particulars	Year 1	Year 2	Year 3
	Sales revenue (at ₹48 per unit)	1,20,000	84,000	1,56,000
(-)	Cost of goods sold (at absorption cost of ₹36 per unit)	90,000	63,000	1,17,000
	Gross margin	30,000	21,000	39,000
(-)	Selling and administrative expenses:			
	Variable (at ₹4 per unit)	10,000	7,000	13,000
	Fixed	5,000	5,000	5,000
	Operating Income	15,000	9,000	21,000

Variable Costing Income Statement

(b)	Particulars	Year 1	Year 2	Year 3
		(₹)	(₹)	(₹)
	Sales revenue (at ₹48 per unit)	1,20,000	84,000	1,56,000
(-)	Variable expenses:			
	Variable manufacturing costs (at variable cost of ₹24 per unit)	60,000	42,000	78,000
	Variable selling & admn. Costs (at ₹4 per unit)	10,000	7,000	13,000
	Contribution margin	50,000	35,000	65,000
(-)	Fixed expenses:			
	Fixed manufacturing overhead	30,000	30,000	30,000
	Fixed selling & admn. Expenses	5,000	5,000	5,000
	Operating Income	15,000	0	30,000

(c) Reconciliation of Income under Absorption and Variable Costing

Particulars	Year 1 (₹)	Year 2 (₹)	Year 3 (₹)
Cost of goods sold under absorption costing	90,000	63,000	1,17,000
Variable manufacturing costs under variable costing	60,000	42,000	78,000
Difference	30,000	21,000	39,000
Fixed manufacturing overhead as a period expense under variable costing.	(30,000)	(30,000)	(30,000)
Balance	0	(9,000)	9,000
Operating Income under variable costing	15,000	0	30,000
Operating income under absorption costing	15,000	(9,000)	(21,000)
Balance	0	(9,000)	9,000

Throughput Costing Income Statement				
(d)	Particulars	Year 1 (₹)	Year 2 (₹)	Year 3 (₹)
	Sales revenue (at ₹48 per unit)	1,20,000	84,000	1,56,000
(-)	Direct material cost	30,000	21,000	39,000
	Throughput	90,000	63,000	1,17,000
(-)	Operating costs:			
	Direct labour	20,000	20,000	20,000
	Variable manufacturing overhead	10,000	10,000	10,000
	Fixed manufacturing overhead	30,000	30,000	30,000
	Variable Selling & Admn. Costs	10,000	7,000	13,000
	Fixed selling & Admn. Costs	5,000	5,000	5,000
	Total Operating costs	75,000	72,000	78,000
	Operating Income	15,000	(9,000)	39,000

Notes:

1. Standard direct-material cost per unit of ₹12 multiplied by sales volume in units.
2. Assume that management has committed to direct labour sufficient produce the planned annual production volume of 2500 units; direct labour cost is used at a rate of ₹8 per unit produced.
3. Assumes management has committed to support resources sufficient to produce the planned annual production volume of ₹2500 units; variable overhead cost is used at a rate of ₹4 per unit produced. Fixed overhead is ₹30,000 per year.
4. Variable selling and administrative costs used amount to ₹4 per unit sold. Fixed selling and administrative costs are ₹5,000 per year.

2.1. MARGINAL COSTING – DECISION MAKING

Marginal Cost: Variable cost [additional cost for one unit of product or service]

Marginal costing: Application of marginal cost principle.

whereby variable cost = product cost and fixed cost = period cost

Absorption Costing: A method of costing by which all direct cost and applicable overheads are charged to products or cost centres for finding out the total cost of production. Absorbed cost includes production cost as well as administrative and other cost.

Comparison between absorption costing and marginal costing

Question 1: The following data relates to XYZ Ltd. which makes and sells computers

Production	1,00,000 units
Sales	80,000 units
Selling price per unit	15
Direct material	2,50,000
Direct labour	3,00,000
Factory overhead: Variable	1,00,000
Factory overhead: Fixed	2,50,000
Selling and distribution overhead: Variable	1,00,000
Selling and distribution overhead: Fixed	2,00,000

You are required to present income statements using (a) absorption costing & (b) Marginal Costing. Account briefly for the difference in net profit between the two income statements.

(a)	INCOME STATEMENT (Absorption costing)		
	Sales	(80000×15)	1,200,000

Less:	Cost of goods manufacture		
	Direct material	250,000	
	Direct labour	300,000	
	Factory overheads: Variable	100,000	
	Factory overheads: Fixed	250,000	
	Total	900,000	
Less:	Closing Stock [$\frac{20}{100} \times 900,000$]	180,000	720,000
	Gross Profit		480,000
Less:	Selling & Distribution Expenses: Fixed	200,000	
	Selling & Distribution Expenses: Variable	100,000	300,000
	Net Profit		180,000

(b)	INCOME STATEMENT (Marginal costing)		
	Sales	(80,000×15)	12,00,000
Less:	cost of goods manufacture		
	Direct Material	2,50,000	
	Direct Labour	3,00,000	
	Factory overheads : variable	1,00,000	
	Total	6,50,000	
Less:	Closing Stock [$\frac{20}{100} \times 650,000$]	1,30,000	
	Total	5,20,000	
	Selling & Distribution Expenses: variable	1,00,000	6,20,000
	Contribution		5,80,000
Less:	Factory overhead – fixed	2,50,000	
	Selling & distribution expenses – fixed	2,00,000	4,50,000
	Net Profit		1,30,000

Break Even Point: Total revenue = Total cost

Cash Breakeven Point: Total revenue = Total **cash** cost

Cost Break Even Point (Cost indifference point): Equal cost in two alternatives

Margin of Safety: Total Sales – BEP sales

	Basic Formulas
1	$P/(L) = S - V - F$
2	$Contribution = S - V$
3	$PVR = \frac{C}{S} \% \text{ or } \frac{\Delta P}{\Delta S} \%$
4	$BEP = \frac{F}{PVR}$
5	$MOS = \frac{P}{PVR}$
6	$TS = BEP + MOS$
7	$DP = \frac{F + P}{PVR}$

Practical Problems

Question 1: Sales ₹2,00,000; VC ₹1,20,000; FC ₹50,000 & NP ₹30,000

Calculate the P/V ratio, BEP and MOS.

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

Question 2: Sales ₹240,000; VC ₹60 p.u.; Profit 25% and Sales price ₹120 p.u.

Find out the fixed cost

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

Question 3: Find out the margin of safety: Sales ₹500 lacs; Profit ₹150 lacs; VC 60%.

Particulars	% or p.u.	Total	BEP	MOS
Sales				

Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

Question 4: Find out the profit: VC ₹200,000; Sales ₹500,000 and BEP Sales ₹300,000

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit / Loss				

Question 5: Find the VC p.u. Sales ₹20,000; FC ₹4,000; BEP sales ₹16,000; Selling price ₹25 p.u.

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

Question 6: Find the missing figures

	Units	Sales	VC	FC	Profit	B.E.P
A	1000	2,00,000	?	1,00,000	-	200,000
B	1000	?	60%	?	50,000	160,000

Answer:

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

Question 7: Fixed expenses ₹4,000 and Break Even point ₹10,000. Calculate:
P/V ratio | Profit when sales are ₹20,000 | Sales to earn a profit of ₹20,000

Answer:

Particulars	% or p.u.	BEP		
Sales			20,000	
Variable Cost				

Contribution				
Fixed Cost				
Profit/Loss				20,000

Question 8: Selling price per unit is ₹150; Variable cost per unit is ₹90 and Fixed cost is ₹600,000

- (a) What will be the selling price per unit if the breakeven point is 8000 units and
 (b) Compute the sale required to earn a profit of ₹220,000.

Answer:

			8,000	
Particulars	% or p.u.	Total	BEP	
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				2,20,000

Question 9: Sales is ₹200,000. VC is ₹150,000. FC is 30,000

You are required to calculate Present P/V Ratio, BEP and MOS

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

Revised P/V Ratio, BEP and MOS in each of the following cases:

(i) 25% increase in selling price

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

(ii) 10% decrease in selling price

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

(iii) 20% increase in fixed cost

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

(iv) 10% decrease in fixed cost

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

(v) 10% increase in variable cost

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

(vi) 10% decrease in variable cost

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

(vii) 10% increase in selling price accompanied by 10% decrease in variable cost

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit / Loss				

(viii) 10% decrease in selling price accompanied by 10% increase in variable cost

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

(ix) 10% increase in sales volume

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

(x) 10% decrease in sales volume

Particulars	% or p.u.	Total	BEP	MOS
Sales				
Variable Cost				
Contribution				
Fixed Cost				
Profit/Loss				

10. Question:

	Particulars	
1	Selling Price p.u.	₹100
2	Variable Cost p.u.	₹60
3	Total Fixed Cost	₹10000
4	Units sold	400

From the above data, calculate the following

1	Contribution (C)	15	Calculate PVR, BEP & MOS and impact on these in the following cases
2	Profit or Loss		
3	Profit Volume Ratio (PVR)	(i)	If variable cost increases by 10%
4	Break-even point (BEP) in units	(ii)	If variable cost decreases by 10%
5	Break-even point in rupees	(iii)	If fixed cost increases by 10%

6	Break-even point in percent	(iv)	If fixed cost decreases by 10%
7	Margin of safety (MOS) in units	(v)	If variable cost increases by 10% and fixed cost decreases by 10%
8	Margin of safety in rupees		
9	Margin of safety in percent	(vi)	Sales price increases by 10%
10	Sales required to earn a profit of ₹10,000	(vii)	Sales price decreases by 10%
11	Sales required to earn a profit of 10% on sales	(viii)	Sales volume increases by 10%
12	Sales required to earn a profit of 10% on cost	(ix)	Sales volume decreases by 10%
13	Profit if sales is ₹30,000	(x)	Sales price increases by 10%, variable cost increases by 10% and fixed cost increases by ₹2,000
14	Revised sales price required to get		
(i)	BEP in 200 units	(xi)	Sales price increases by 10%, variable cost decreases by 5% and fixed cost increases by ₹5,000
(ii)	BEP in 400 units		

Answer:

	Particulars	Formula	Calculation	Answer
1	Contribution (C) p.u. and total	$S - V$		
2	Profit or Loss	$S - V - F$		
3	Profit Volume Ratio (PVR)	$\frac{C}{S}\%$		
4	Break-even point (BEP) in units	$\frac{F}{C \text{ p. u.}}$		
5	Break-even point in rupees	$\frac{F}{C} \times S$		
6	Break-even point in percent	$\frac{BEP}{S}\%$		
7	Margin of safety (MOS) in units	$\frac{P}{C \text{ p. u.}}$		
8	Margin of safety in rupees	$\frac{P}{C} \times S$		
9	Margin of safety in percent	$\frac{MOS}{S}\%$		
10	Sales required to earn a profit of ₹10,000	$\frac{F + FDP}{C \text{ p. u.}}$		
11	Sales required to earn a profit of 10% on sales	$\frac{F}{(C - VDP) \text{ p. u.}}$		
12	Sales required to earn a profit of 10% on cost	$\frac{F + FDP}{(C - VDP) \text{ p. u.}}$		
13	Profit if sales is ₹30,000	$S \times PVR - F$		
14	Revised sales price required to get			
(i)	BEP in 200 units	$\frac{F}{\text{Sale units}} + V$		
(ii)	BEP in 400 units			

15	Calculate PVR, BEP & MOS and impact on these	$PVR = \frac{C}{S} \%$	$BEP = \frac{C}{S} \%$	$MOS = \frac{C}{S} \%$
(i)	If variable cost increases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(ii)	If variable cost decreases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(iii)	If fixed cost increases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(iv)	If fixed cost decreases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(v)	If variable cost increases by 10% and fixed cost decreases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(vi)	Sales price increases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(vii)	Sales price decreases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(viii)	Sales volume increases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(ix)	Sales volume decreases by 10%			
	Impact = $\frac{N - O}{O} \%$			
(x)	Sales price increases by 10%, variable cost increases by 10% and fixed cost increases by ₹2,000			

	$\text{Impact} = \frac{N - O}{O} \%$			
(xi)	Sales price increases by 10%, variable cost decreases by 5% and fixed cost increases by ₹5,000			
	$\text{Impact} = \frac{N - O}{O} \%$			

Question 11: The sales turnover and profit during two periods were as follows:

	Sales	Profit
Period I	20 lakh	2 lakh
Period II	30 lakh	4 lakh

Calculate: PVR, the sales required to earn a profit of ₹5 lakh and the profit when sales are ₹10 lakh.

Answer:

	Particulars	Formula	Calculate	Answer
a	Profit volume ratio	$\frac{\text{Change in Profits}}{\text{Change in Sales}} \%$	$\frac{4,00,000 - 2,00,000}{30,00,000 - 20,00,000} \%$	20%
B	Fixed cost	$\text{Sales} \times \text{PVR} - \text{Profit}$	$30,00,000 \times 20\% - 4,00,000$	₹2,00,000
c	Sales to earn ₹5 lacs	$\frac{\text{Fixed cost} + \text{Desired Prof}}{\text{PVR}}$	$\frac{2,00,000 + 5,00,000}{20\%}$	₹35,00,000
d	Profit if sales is ₹10 lacs	$\text{Sales} \times \text{PVR} - \text{Fixed Cost}$	$10,00,000 \times 20\% - 2,00,000$	0

Question 12: A company sells its products 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 breakeven point in terms of rupees as well as in units.

Answer:

	Particulars	Formula	Calculate	Answer
a	PVR	$\frac{\text{Change in Profits}}{\text{Change in Sales}} \%$	$\frac{20,000 \times 4 + 8,000 \times 5}{15(20,000 - 8,000)} \%$	$66\frac{2}{3} \%$
b	Fixed cost	$\text{Sales} \times \text{PVR} - \text{Profit}$	$15 \times 20,000 \times 66\frac{2}{3} \% - 20,000 \times 4$	₹120,000
c	BEP in ₹	$\frac{\text{Fixed cost}}{\text{PVR}}$	$\frac{120,000}{66\frac{2}{3} \%}$	₹180,000
d	BEP in units	$\frac{\text{BEP in ₹}}{\text{Sale price per unit}}$	$\frac{180,000}{15}$	12,000 u

Question 13: From the details given below

	Sales	Total cost
First 6 months	10 lakh	8 lakh
Second 6 months	15 lakh	11 lakh

Calculate: PVR, the sales required to earn a profit of ₹5 lakh and the profit when sales are ₹20 lakh.

Answer:

	Particulars	Formula	Calculate	Answer
a	Profit volume ratio	$\frac{\text{Change in Profits}}{\text{Change in Sales}} \%$	$\frac{4,00,000 - 2,00,000}{15,00,000 - 10,00,000}$	40%
b	Fixed cost for 6 months	$\text{Sales} \times \text{PVR} - \text{Profit}$	$10,00,000 \times 40\% - 2,00,000$	₹200,000

	Fixed cost for full year		$2,00,000 \times 2$	₹4,00,000
c	Sales to earn ₹5 lacs	$\frac{\text{Fixed cost} + \text{Desired Profit}}{\text{PVR}}$	$\frac{400,000 + 500,000}{40\%}$	₹22,50,000
d	Profit if sales is ₹20 lacs	$\text{Sales} \times \text{PVR} - \text{Fixed Cost}$	$20,00,000 \times 40\% - 4,00,000$	4,00,000

Problem Type: Decision Making & Profit Planning

1. Indifference Point
2. Sales Mix
3. Limiting Factor
4. Elimination of Product
5. Accepting Foreign Order
6. Shut down
7. Make or Buy
8. Plant Merger

Indifference Point

Question 1: Two businesses, Y Ltd. and Z Ltd., sell the same type of product in the same type of market. Their budgeted profit and loss accounts for the coming year are as follows:

	Y Ltd	X Ltd
Sales per unit	150	150
Variable Cost per unit	120	100
Fixed Cost	15,000	35,000

You are required to calculate

1. the breakeven point of each business;
2. the sales volume at which each of business will earn ₹5,000 profit;
3. at which sales volume both the firms will earn equal profits.
4. state which business is likely to earn greater profit in conditions of:
 - a. heavy demand for the product;
 - b. low demand for the product and briefly give your reasons.

Answer:

		Formula	Y Ltd	Z Ltd
	PVR	$\frac{\text{Contribution}}{\text{Sales}}\%$	20%	33.33%
1	BEP	$\frac{\text{Fixed Cost}}{\text{PVR}}$	75,000	105,000
2	Sales to earn ₹5,000	$\frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{PVR}}$	100,000	120,000
3	Indifference point (Cost BEP)	$\frac{\text{Difference in fixed cost}}{\text{PVR}}$	150,000	
4 (a)	Heavy demands	High PVR & FC		Suitable
4 (b)	Low demands	Low PVR & FC	Suitable	

Sales Mix

Question 2: Accelerate Co. Ltd. manufactures and sells four types of products under the brand NAMES OF A, B, C A & D. The sales mix in value comprises $33\frac{1}{3}\%$, $41\frac{2}{3}\%$, $16\frac{2}{3}\%$ & $8\frac{1}{3}\%$ of products A, B, C and D respectively. The total budgeted sales (100% are ₹60,000 p.m.). Operating Cost is:

	Variable Costs
Product A	60% of selling price
Product B	68% of selling price

Product C	80% of selling price
Product D	40% of selling price

Fixed Cost: ₹14,700 p.m.

- (a) Calculate the break-even-point for the products on overall basis and
 (b) Also calculate break-even-point, if the sales mix is changed as follows the total sales per month remaining the same. (Mix: - A-25%: B-40%: C-30%: D-5%)

Answer:

(a) Computation of BEP on overall basis							
			A	B	C	D	Total
Sales	₹		20,000	25,000	10,000	5,000	60,000
Variable Cost	₹		12,000	17,000	8,000	2,000	39,000
Contribution	₹		8,000	8,000	2,000	3,000	21,000
Fixed cost	₹						14,700
Profit	₹						6,300
P/V ratio	%		40%	32%	20%	60%	35%
Break even sales	₹		$\frac{14,700}{35} \%$				42,000

(b) Computation of BEP if the sales mix is changed							
			A	B	C	D	Total
Sales	₹		15,000	24,000	18,000	3,000	60,000
Variable Cost	₹		9,000	16,320	14,400	1,200	40,920
Contribution	₹		6,000	7,680	3,600	1,800	19,080
Fixed cost	₹						14,700
P/V ratio	%		40%	32%	20%	60%	31.8%
Break even Sales	₹		$\frac{14,700}{31.8} \%$				46,266

Limiting Factor

Question 3: The Following particulars are extracted from the records of a company.

Product	A	B
Sale Price (₹)	100	110
Consumption of Materials (kgs)	5	4
Material cost	24	14
Direct wages	2	3
Machine hours used	2	3
Variable overheads	4	6

Comment on the profitability of each product (both use the same raw material) when:

- (i) Total sales potential in units is limited.
- (ii) Total sales potential in value is limited.
- (iii) Raw material is in short supply.
- (iv) Production capacity (in terms of machine hour) is the limiting factor.

Answer:

	Product	A	B
	Sale Price	100	110
Less	Variable Cost	30	23
	Contribution	70	87
	Profit volume ratio	70%	79%
	Contribution per kg of material	14	21.75
	Contribution per machine hour	35	29
	Ranking based on key factor		
(i)	Sales in units is limited	II	I
(ii)	Sales in ₹ is limited	II	I

(iii)	Raw material is limited	II	I
(iv)	Machine hour is limited	I	II

Limiting Factor and Optimum Product Mix

Question 4: ABC Ltd. is manufacturing three products X, Y and Z. All the products use the same raw material which is scarce and available to the extent of 61,000 kg only. The following information is available from records of the company:

Particulars	Product X	Product Y	Product Z
Selling price per unit (₹)	100	140	90
Variable cost per unit (₹)	75	10	65
Raw material requirement per unit (kg)	5	8	6
Market demand (units)	5,000	3,000	4,000

Fixed costs are ₹1,50,000. Advise the company about the most profitable product mix. Compute the amount of profit resulting from such product mix.

{CMA inter}

Answer:

	Ranking	X	Y	Z
	Selling price	100	140	90
Less:	Variable cost	75	110	65
	Contribution per unit	25	30	25
	Raw material required per unit	5	8	6
	Contribution per unit of raw material	5	3.75	4.17
	Ranking	I	III	II

Working notes:

1	Optimum product mix as per ranking			Balance
	Available raw material			61,000 kg
	Produce product X (being I rank) maximum	5,000×5	25,000 kg	36,000 kg
	Produce product Z (being II rank) maximum	4,000×6	24,000 kg	12,000 kg
	Produce product Y (being III rank) maximum	1,500×8	12,000 kg	0

2	Profit for the optimum product mix				
	Product	X	Y	Z	Total
	Produced & Sale	5,000	1,500	4,000	
	Contribution per unit	25	30	25	
	Contribution	1,25,000	4,50,000	1,00,000	
	Total contribution				2,70,000
Less	Fixed cost				1,50,000
	Profit				1,20,000

Limiting Factor and Optimum Product Mix

Question 5: Z Ltd., makes a range of five products to which the following standards apply:

	Per Unit				
	A	B	C	D	E
	₹	₹	₹	₹	₹
Sales price	50	60	70	80	90
Direct Materials	9	10	17	12	21
Direct wages	16	20	24	28	32
Variable production overheads	8	10	12	14	16
Variable selling and distribution overheads	5	6	7	8	9
Fixed overheads	4	5	6	7	8
	42	51	66	69	86

The direct labour wage rate is ₹4 per hour. Fixed overheads have been allocated on the basis of direct labour hours. The company has committed to produce a minimum of 200 units of each product per month with a maximum demand of 1,000 units of each product per month. Direct hours cannot exceed 13,000 per month.

Required: Give recommendations, supported by calculations, to show how direct labour hours in the existing factory should be utilized in order to maximize profits.

Answer:

	Ranking	A	B	C	D	E
		₹	₹	₹	₹	₹
1	Selling price	50.00	60.00	70.00	80.00	90.00
2	Variable Cost					
(a)	Direct material	9.00	10.00	17.00	12.00	21.00
(b)	Labour cost	16.00	20.00	24.00	28.00	32.00
(c)	Variable POH	8.00	10.00	12.00	14.00	16.00
(d)	Variable S/D OH	5.00	6.00	7.00	8.00	9.00
		38.00	46.00	60.00	62.00	78.00
3	Contribution (1-2)	12.00	14.00	10.00	18.00	12.00
	Hours required {col. (b)/₹4}	4	5	6	7	8
	Contribution per labour hour	3.00	2.80	1.67	2.57	1.50
	Priority	I	II	IV	III	V

1	Optimum product mix as per ranking			Balance
	Available raw material			13,000 hours
	Produce the minimum requirement of ALL products	200×30	6,000	7,000 hours
	Produce product A (being I rank) maximum	800×4	3,200	3,800 hours
	Produce product B (being I rank) maximum	760 ×5	3,800	0 hours

2 Profit for the optimum product mix							
	Product	A	B	C	D	E	Total
	Produced & Sale	1,000	940	200	200	200	
	Cont. per unit	12	14	10	18	12	
	Contribution	12,000	13,160	2,000	3,600	2,400	
	Total contribution						33,260
Less	Fixed cost						13,000
	Profit						20,260

Elimination of a product

Question 6: A company manufactures 3 products A, B and C. There are no common processes and the sale of one product does not affect prices or volume of sales of any other. The Company's budgeted profit / loss for 2020 has been abstracted thus:

	Total	A	B	C
Sales	300,000	45,000	225,000	30,000
Production Cost: Variable	180,000	24,000	144,000	12,000
Production Cost: Fixed	60,000	3,000	48,000	9,000
Factory Cost	240,000	27,000	192,000	21,000
Sales & Administration Cost: Variable	24,000	8,100	8,100	7,800
Sales & Administration Cost: Fixed	6,000	2,100	1,800	2,100
Total Cost	2,70,000	37,200	201,900	30,900
Profit	30,000	7,800	23,100	(900)

Answer:

		Products			Total
		A	B	C	
	Sales	45,000	2,25,000	30,000	3,00,000
Less	Marginal cost				

	Product cost	24,000	1,44,000	12,000	
	Sales & Administration cost	8,100	8,100	7,800	
	Total	32,100	1,52,100	19,800	2,04,000
	Contribution per unit	12,900	72,900	10,200	96,000
Less	Fixed Cost (60,000 + 6,000)				66,000
	Profit				30,000
	PVR	28.67%	32.4%	34%	

From the above it is clear that the product C is contributing ₹10,200 towards the FOH of the company. If product C is eliminated, the profit of the company will be reduced to ₹19,800.

Accepting Foreign Order

Question 7: Novina Industrial Ltd. has received an export order for its only product that would require the use of half of the factory's present capacity of 4,00,000 units per annum. The factory is currently operating at 60% level to meet the demand of its domestic market.

As against current price of ₹6.00 per unit, the export order offers @ ₹4.50 per unit, which is less than the cost of production, the details of which are given below:

Direct materials	₹2.50 per unit
Direct labour	₹1.00 per unit
Variable overheads	₹0.50 per unit
Fixed overheads	₹1.00 per unit

The condition of the export is that it has either to be accept in full or totally rejected. The following alternative proposals are available for decision:

- Accept the order and keep domestic sales unfulfilled to the extent of the excess demand for the same.
- Increase factory capacity by installing a new machinery and also by working extra time to meet the balance of the required capacity. This will

increase fixed overheads by ₹20,000 annually and the additional cost of overtime will work out to ₹40,000 per annum.

- (c) Out-source the production of additional requirement by supplying direct materials and paying conversion charges of ₹1.75 per unit to a small converter, and engaging one supervisor at a cost of ₹3,000 per month to look after quality, packing and dispatch.
- (d) Reject the order and remain with the domestic market only.

As a management Accountant, you are required to make comparative analysis of various proposals and suggest which of the alternative proposals is the most attractive to Novina Industries Ltd.

{CMA inter J06}

Answer:

Options →		(a)	(b)	(c)	(d)
Domestic sales (u)		2,00,000	2,40,000	2,40,000	2,40,000
Foreign Sales (u)		2,00,000	2,00,000	2,00,000	-
	₹ / p.u.				
Domestic sales	6.00	12,00,000	14,40,000	14,40,000	14,40,000
Foreign Sales	4.50	9,00,000	9,00,000	9,00,000	
Total Sales		21,00,000	23,40,000	23,40,000	14,40,000
VC [DM+DL+VOH]	₹4.00	16,00,000	17,60,000	17,60,000	9,60,000
Additional VOH			40,000	10,000 ¹	
Contribution		5,00,000	5,40,000	5,70,000	4,80,000
Fixed OH ²		2,40,000	2,40,000	2,40,000	2,40,000
Additional FOH			20,000	36,000	-
Profit		2,60,000	2,80,000	2,94,000	2,40,000
Option				Select	

¹ Incremental conversion cost × units sub contracted = (₹1.75 – ₹1.5) × 40,000

² ₹1 per unit for current level of operation (2,40,000 × ₹1)

Shut down

Question 8: Sale price – ₹100, VC p.u. – ₹60 and FC – ₹50,000. FC – ₹20,000 is to be incurred even if closed. Find out sales at shut down

Answer: $Sales\ at\ shut\ doen = (FC - Shut\ down\ cost) \times \frac{Sale}{VC} = (50,000 - 20,000) \times \frac{100}{60} = 75,000$

Question 9: The company is presently passing through a period of very lean market demand and operating at 50% capacity and have also selling its product at a discounted price generating a total sales revenue of ₹60,000 at that level.

It is expected that the market scenario will improve in the next year and, on a conservative estimate, the company is likely to operate at 70% capacity level with increased sales revenue of ₹1,20,000.

Note: VA, FC and total cost at 100% capacity are ₹1,01,000, 19,000 and 1,20,000 respectively.

As an option, the management is considering to close down the operation for one year and restart operation after one year when the market conditions are likely to improve. If closed down for the year it is estimated that

- (a) The present fixed costs will reduce by 60%.
- (b) There will be a cost of ₹10,000 towards closing down operations;
- (c) To maintain a skeleton maintenance service for which ₹24,000 to be incurred;
- (d) An initial cost of re-opening of ₹20,000 to be incurred.

You are required to work out the profitability under the two options and give your comment.

Answer:

Profitability between two options				
Operation	100%	50%	Shutdown	70%
Revenue		60,000	Nil	1,20,000
Variable cost	1,01,000	50,500	Nil	70,700

Fixed costs	19,000	19,000	61,600 ³	19,000
Profit/(loss)		-9,500	-61,600	30,300
Choice		Select		

Make or buy decisions

Question 10: A manufacturing company finds that while the cost of making a component part is ₹10, the same is available on the market at ₹9 with an assurance of continuous supply. Give your suggestion whether to make or buy this part. Give also your views in case the supplier reduces the price from ₹9 to ₹8. The cost information is as follows:

Direct Material	3.50
Direct Labour	4.00
Variable Over Head	1.00
Fixed Over Head	1.50
Total	10.00

Answer: If buy-price > TVC, make else buy. If BP is ₹9 then make. If BP is ₹8 then buy

Plant Merger

Question 11: Two manufacturing companies which have the following operating details to merge:

	Company 1	Company 2
Capacity utilization %	90	60
Sales (₹Lakhs)	540	300
Variable costs (₹Lakhs)	396	225
Fixed costs (₹Lakhs)	80	50

Assuming that the proposal is implemented, calculate:

³ 40% of FC + closing down + maintenance + reopening costs =
(7,600+10,000+24,000+20,000)

- (a) Break-even sales of the merged plant and the capacity utilization at that stage.
- (b) Profitability of the merged plant at 80% capacity utilization.
- (c) Sales turnover of the merged plant to earn a profit of ₹75 lakhs.
- (d) When the merged plant is working at a capacity to earn a profit of ₹75 lakhs, what percentage increase in selling price is required to sustain an increase of 5% in fixed overheads.

Answer:

	₹ in lacs						(b)	(c)	(d)
	Company 1		Company 2		(a) Merged				
Capacity utilization	90%	100%	60%	100%	100%	80%			
Sales [S]	540	600	300	500	1,100	880	791 ⁴	797.5	
Less: Variable costs [V]	396	440	225	375	815	652	586	586.0	
Contribution [C]	144	160		125	285	228	205	211.5	
Less: Fixed cost [FC]	80	80	50	50	130	130	130	136.5	
Profit [P]	64	80		75	155	98	75	75.0	
P/V ratio [PVR] [$\frac{C}{S}$ %]					25.91%				
BEP [$\frac{FC}{PVR}$]					₹501.74				
Capacity at BEP [$\frac{BEP}{S}$ %]					45.61%				
Profitability [$\frac{P}{S}$ %]						11.14%			
Sales price increase in %									0.82% ⁵

$$^4 \text{ Sales to earn 75 lacs} = \frac{\text{Desired Profit}}{\text{PVR}} = \frac{75}{25.91\%}$$

$$^5 \text{ Sales price increase in \%} = \frac{\text{Increase in sales}}{\text{Sales to earn 75 lacs}} \%$$