

Break Even Analysis

Sales:

profit: Profit is the difference between sales and cost. Here cost means both fixed and variable cost.

If variable cost is denoted by v , fixed cost by F and sales by S , then profit,

$$P = S - (v + F)$$

Contribution: Contribution is the difference between sales and variable cost. It is denoted by C or ~~SP~~, then,

$$C = S - v \quad \text{--- (i)}$$

but we know,

$$S = P + v + F \quad \text{--- (ii)}$$

From (i) and (ii)

$$\therefore C = (P + v + F) - v = P + F$$

So contribution may also be defined as the sum of profit and fixed cost.

P/V ratio: The profit/volume ratio, which is popularly known as P/V ratio is the ratio of profit to volume of production. It expresses the relation of contribution.

$$P/V \text{ ratio} = \frac{\text{contribution}}{\text{sales}} = \frac{C}{S}$$

But $c = S - v$

$$\therefore P/V \text{ ratio} = \frac{S - v}{S}$$

Break even point: The break even point is the sales volume where total sales revenues are equal to total expenses and thus there is no profit or loss.

$$\text{Break even point in unit} = \frac{F \text{ (total)}}{(S - v) \text{ (per unit)}}$$

\downarrow
Contribution

$$\text{Break even point in sale volume} = \frac{F \times S}{c}$$

$$= \frac{F}{c/S}$$

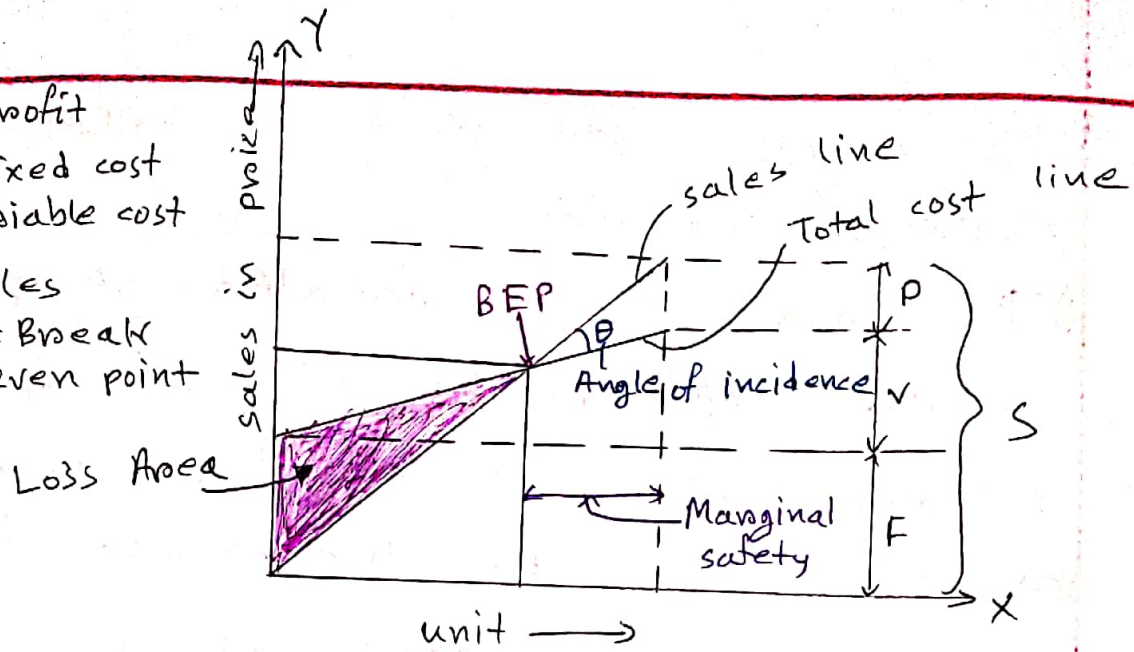
$$= \frac{F}{P/V \text{ ratio}}$$

$$= \frac{F}{\frac{S - v}{S}}$$

$$= \frac{FS}{S - v}$$

Break even chart: The break even chart is a graphical representation of marginal cost. It can be defined as the chart, which shows a point where there is no profit and loss.

P = profit
 F = Fixed cost
 V = variable cost
 S = sales
 BEP = Break even point



19/10/23(b) Fig: Break even chart

Marginal safety % (M/S)

An area which indicates "Access sales over the break even point", it is called the area of marginal safety. After the break even point, the more the marginal safety,

$$\begin{aligned}
 \text{Marginal safety, } M/S &= P \div \frac{S}{S} \\
 &= \frac{P \times S}{S}
 \end{aligned}$$

= Total sales - break even point

The M/S is an indicator of business strength.

What is the angle of incidence? what does it indicate?

Ans:

Angle of incidence: The angle formed by the sales line and total cost line after

The break even point is called the angle of incidence.

§ This angle is an indicator of profit earning capacity. It indicates a relation between sales and cost. The more the angle of incidence, the more the profit earning capacity of the business.

It indicates that if the angle of incidence is larger, then the profit after break even point also grows larger.

Angle of incidence is shown in previous figure.

BREAK EVEN ANALYSIS

BEP = Break even point

P = profit

V = variable cost

F = Fixed cost

S = Total sales / sales

Degree of operating leverage = $\frac{CM}{P}$

Operating leverage = $\frac{\text{Fixed cost}}{\text{Total cost}}$

CM = contribution Margin / contribution

CM ratio = P/V ratio = $\frac{CM}{S}$

Marginal safety, M/S = Total sales - Break even point

M/S = S - BEP

Formula

$$\rightarrow P = S - (V + F)$$

$$\rightarrow CM = S - V \quad , \quad CM = F + P$$

• Sale per unit = $\frac{S}{\text{unit}}$

• variable cost per unit = $\frac{V}{\text{unit}}$

$$\rightarrow (CM) \text{ per unit} = (S - V) \text{ per unit}$$

$$\rightarrow S = F + V + P$$

• $CM = S - V = F + V + P - V = F + P$

$$\rightarrow \text{CM ratio} / (P/V) \text{ ratio} = \frac{CM}{S}$$

$$\rightarrow M/S = S - \text{BEP (in sale volume)}$$

$$\rightarrow \text{BEP in unit} = \frac{F}{CM \text{ per unit}} = \frac{F}{(S - V) \text{ per unit}}$$

$$\rightarrow \text{BEP in sales volume} = \frac{FS}{CM} = \frac{FS}{S - V}$$

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$$\rightarrow \text{unit for desired profit} = \frac{F + \text{Desired profit}}{\text{CM per unit}}$$

$$\rightarrow \text{sale for desired profit} = \frac{F + \text{Desired profit}}{\text{P/V ratio}}$$

$$\rightarrow \text{Total cost} = F + v$$

Note: Unit change \Rightarrow BEP change হয় না।

\rightarrow per unit sale change \Rightarrow BEP change হয়।

\rightarrow Unit change \Rightarrow variable cost (v) change হয়।

\rightarrow per unit price বাড়ালে / sale বাড়লে v change হয় না।

\rightarrow Unit change \Rightarrow যদি উল্লেখ থাকে। নাহলে কল্পনা unit change \Rightarrow হয় না।

\rightarrow At BEP \rightarrow profit, $P=0$

2019 (SECTION-A)

Q. 3(a)

$$\text{BEP in sale volume} = \frac{FS}{\text{CM}} = \frac{F(F+v+P)}{S-v}$$

$$= \frac{F(F+v)}{F+v+P-v}$$

$$= \frac{F(F+v)}{F}$$

$$= F+v$$

$$= \text{Total cost}$$

$$\therefore \text{Total cost} = 500000 \text{ Tk (A)}$$

Q. 3(b) Units = 5000 per unit price = Tk 500

$$F = \text{Tk } 400000, v = \text{Tk } 1000000$$

$$\therefore S = 5000 \times 500 = \text{Tk } 2500000$$

$$\textcircled{1} \text{ CM} = S - V = 2500000 - 1000000$$

$$= \text{TK } 1500000$$

$$\text{CM ratio} = \frac{\text{CM}}{S} = \frac{1500000}{2500000} = 0.6 = 60\%$$

$$\textcircled{2} P = S - (F + V) = 2500000 - (400000 + 1000000)$$

$$= \text{TK } 1100000$$

$$\rightarrow \text{BEP in unit} = \frac{F}{\text{CM per unit}} = \frac{400000}{\frac{1500000}{5000}}$$

$$= \frac{4000}{3} \text{ unit}$$

$$= 1333.33 \text{ unit}$$

\therefore BEP in sale volume

$$= \frac{4000}{3} \times 500 = 666666.67 \text{ TK}$$

\rightarrow Margin of safety, Mrs = Total sale - BEP in sale volume

$$= 2500000 - 666666.67$$

$$= 1833333.33 \text{ TK}$$

$$\textcircled{3} \text{ units} = 8000$$

$$\therefore S = 8000 \times 500 = 4000000 \text{ TK}$$

$$V = \frac{1000000 \times 8000}{5000} = 1600000 \text{ TK}$$

$$F = 400000 \text{ TK}$$

$$\therefore P = S - (F + V) = 4000000 - (400000 + 1600000)$$

$$= \text{TK } 2000000$$

$$\textcircled{4} S = 2500000 + 2500000 \times 0.1 = 2750000 \text{ TK}$$

$$F = 400000$$

$$V = 1000000$$

$$\therefore \text{CM} = S - V = 2750000 - 1000000 = \text{TK } 1750000$$

$$\therefore \text{BEP in unit} = \frac{F}{\text{CM per unit}} = \frac{400000}{\frac{1750000}{5000}} = 1142.85 \text{ unit}$$

[per unit price change 24(6)]

$$\text{BEP in sales volume} = \frac{FS}{\text{CM}} = \frac{400000 \times 2750000}{1750000}$$

$$= \text{TK } 628571.43$$

2018 (SECTION - A)

Q.4(b) ① $CM = S - V = 1200000 - 900000 = \text{TK } 300000$

$CM \text{ ratio} = \frac{CM}{S} = \frac{300000}{1200000} = 0.25 = 25\%$

② variable expenses ratio = $\frac{V}{S} = \frac{900000}{1200000} = 0.75 = 75\%$

③ BEP in unit = $\frac{F}{CM \text{ per unit}} = \frac{240000}{15} = 16000 \text{ unit}$

BEP in sale volume = $\frac{FS}{CM} = \frac{240000 \times 1200000}{300000}$

④ ~~Desire~~ unit = $\frac{\text{Fixed cost} + \text{Desire unit}}{CM \text{ per unit}} = \text{TK } 960000$

= $\frac{240000 + 90000}{15} = 22000$

④ Net operating income = profit

$S = 1200000 + 400000 = 1600000$

$\therefore P = S - (F + V) = 1600000 - (240000 + 900000) = 460000$

$\therefore \text{Net operating income increase} = 460000 - 60000 = \text{TK } 400000$

⑤ Margin of safety, $M/S = S - \text{BEP in sales volume} = 1200000 - 960000$

= 240000 TK

⑥ Degree of operating leverage = $\frac{CM}{P} = \frac{300000}{60000}$

Extra:

operating leverage = $\frac{\text{Fixed cost}}{\text{Total cost}} = \frac{240000}{240000 + 900000} = 0.21$

2017 (SECTION - A)

Q.4(c) $S = 5000 \times 200 = 1000000 \text{ TK}$
Units = 5000

① $CM \text{ ratio} = \frac{CM}{S}$

$\Rightarrow CM = CM \text{ ratio} \times S = 0.45 \times 1000000 = \text{TK } 450000$

$\therefore V = S - CM = 1000000 - 450000 = \text{TK } 550000$

$$\textcircled{1} \text{ BEP in unit} = \frac{F}{\text{cm per unit}} = \frac{77000}{\frac{450000}{5000}} = 856.56 \text{ unit}$$

$$\textcircled{2} \text{ Units} = 6000$$

$$S = 6000 \times 200 = 1200000 \text{ TK}$$

$$V = \frac{550000 \times 6000}{5000} = \text{TK} 660000$$

$$\therefore P = S - (V + F) = 1200000 - (660000 + 77000) \\ = \text{TK} 463000$$

③ ④

$$S = 1000000 + 1000000 \times 0.2 = 1200000$$

$$V = 550000$$

$$\therefore \text{CM} = S - V = 1200000 - 550000 = 650000$$

$$\text{BEP in unit} = \frac{F}{\text{cm per unit}} = \frac{77000}{\frac{650000}{5000}} = 592.3 \text{ unit}$$

$$\text{BEP in sales volume} = \frac{FS}{\text{cm}} = \frac{77000 \times 1200000}{650000}$$

$$= 142153.846 \text{ TK}$$

$$\textcircled{3} \text{ Sales} = \frac{F + \text{Desired profit}}{\text{cm ratio}} = \frac{77000 + 120000}{0.45} \\ = 437777.78 \text{ TK}$$

$$\textcircled{5} \text{ M/S} = 1000000 - (\text{BEP in unit}) \times 200 \\ = 1000000 - 856.556 \times 200 = 828688.8 \text{ TK}$$

2015 (SECTION-A)

$$\textcircled{\text{Q. 3(b)}} S = 2500 \times 200 = 500000 \text{ TK}$$

$$\text{cm ratio} = 0.4$$

$$\therefore \text{cm} = S \times 0.4 = 500000 \times 0.4 = 200000 \text{ TK}$$

$$V = S - \text{cm} = 500000 - 200000 = 300000$$

$$\textcircled{1} \text{ BEP in unit} = \frac{F}{\text{cm per unit}} = \frac{200000}{2500}$$

$$\Rightarrow 1000 \times \frac{200000}{2500} = F$$

$$\therefore F = \text{TK} 80000$$

$$\text{(ii) Units} = 3000$$

$$S = 3000 \times 200 = \text{TK} 600000$$

$$V = \frac{300000 \times 3000}{2500} = 360000 \text{ TK}$$

$$\therefore P = S - (F + V) = 600000 - (80000 + 360000) = 160000 \text{ TK}$$

$$\text{(iii) BEP in unit} = \frac{F}{\text{cm per unit}}$$

$$\Rightarrow 800 = \frac{80000}{S \text{ per unit} - V \text{ per unit}}$$

$$= \frac{80000}{S \text{ per unit} - 120}$$

$$\Rightarrow 800 S \text{ per unit} - 120 \times 800 = 80000$$

$$\Rightarrow S \text{ per unit} = \frac{80000 + 120 \times 800}{800}$$

~~$$S \text{ per unit} = \frac{80000}{2500} = 32 \text{ TK}$$~~
~~$$= 32 \text{ TK}$$~~

$$V \text{ per unit} = \frac{300000}{2500} = 120$$

(BEP change \times amt sale = 220 per unit change)

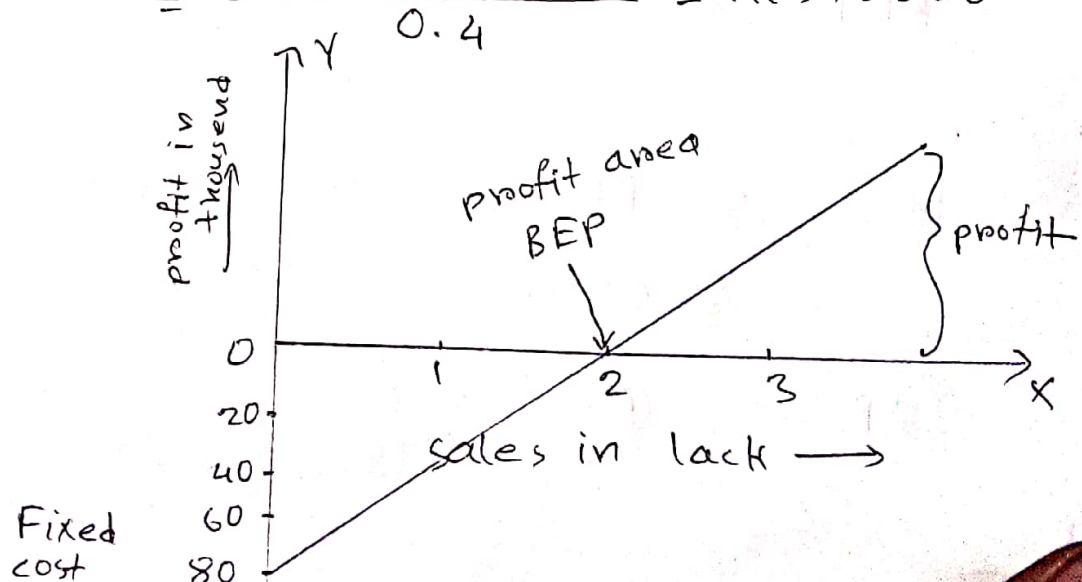
$$\therefore S = 220 \times 2500 = 550000 \text{ TK.}$$

$$\text{(iv) Sale volume} = \frac{F + \text{Desire profit}}{\text{cm ratio}}$$

$$= \frac{80000 + 150000}{0.4} = \text{TK} 575000$$

$$\text{(v) BEP in sale} = \frac{80000 \times 500000}{200000} = 200000 \text{ TK}$$

$$F = 80000 \text{ TK}$$



$$\boxed{Q. 3(c)} \quad S = 280000 \text{ TK}$$

$$V = 90000 + 30000 + 30000 = 150000 \text{ TK}$$

$$F = \text{TK}80000$$

$$CM = S - V = 280000 - 150000 = 130000 \text{ TK}$$

$$\text{BEP in sales volume} = \frac{FS}{CM} = \frac{80000 \times 280000}{130000}$$

$$M/S = S - \text{BEP} = 172307.69 \text{ TK}$$

$$= 280000 - 172307.69$$

$$= 107692.31 \text{ TK}$$

2014 - (SECTION - A)

$$\boxed{Q. 3(c)} \quad \text{Units} = 4000, \quad \text{price per unit} = 150 \text{ TK}$$

$$\therefore S = 4000 \times 150 = 600000 \text{ TK}$$

$$V = (30 + 35 + 15) \times 4000 = 320000 \text{ TK}$$

$$V \text{ per unit} = 30 + 35 + 15 = 80 \text{ TK}$$

$$F = 140000$$

$$\textcircled{1} \rightarrow CM = S - V = 600000 - 320000 = 280000 \text{ TK}$$

$$\rightarrow \text{BEP in unit} = \frac{F}{CM \text{ per unit}} = \frac{140000}{\frac{280000}{4000}} = 2000 \text{ unit}$$

$$\text{BEP in sales volume} = \frac{FS}{CM} = \frac{140000 \times 600000}{280000}$$

$$= 300000 \text{ TK}$$

$$M/S = S - \text{BEP in sales volume}$$

$$= 600000 - 300000 = 300000 \text{ TK}$$

$$\textcircled{11} P = S - (F + V) = 600000 - (140000 + 320000) = \text{TK}140000$$

$$\textcircled{iii} \text{ Units} = 5000$$

$$S = 5000 \times 150 = 750000 \text{ TK}$$

$$V = \frac{320000 \times 5000}{4000} = 400000 \text{ TK}$$

$$P = S - (V + F) = 750000 - (400000 + 140000) \\ = 210000 \text{ TK}$$

$$\textcircled{iv} \text{ Sales volume} = \frac{F + \text{Desire Profit}}{\text{cm ratio}} \\ = \frac{140000 + 200000}{\frac{280000}{500000}} = 728571.43 \text{ TK}$$

$$\textcircled{v} \text{ BEP in unit} = \frac{F}{\text{cm per unit}}$$

$$\Rightarrow 1500 = \frac{140000}{S_{\text{per unit}} - V_{\text{per unit}}} = \frac{140000}{S_{\text{per unit}} - 80}$$

$$\Rightarrow 1500 S_{\text{per unit}} - 80 \times 1500 = 140000$$

$$\Rightarrow S_{\text{per unit}} = \frac{140000 + 80 \times 1500}{1500}$$

$$= \frac{520}{3} \text{ TK per unit}$$

$$\therefore S = \frac{520}{3} \times 4000 = 693333.33 \text{ TK}$$