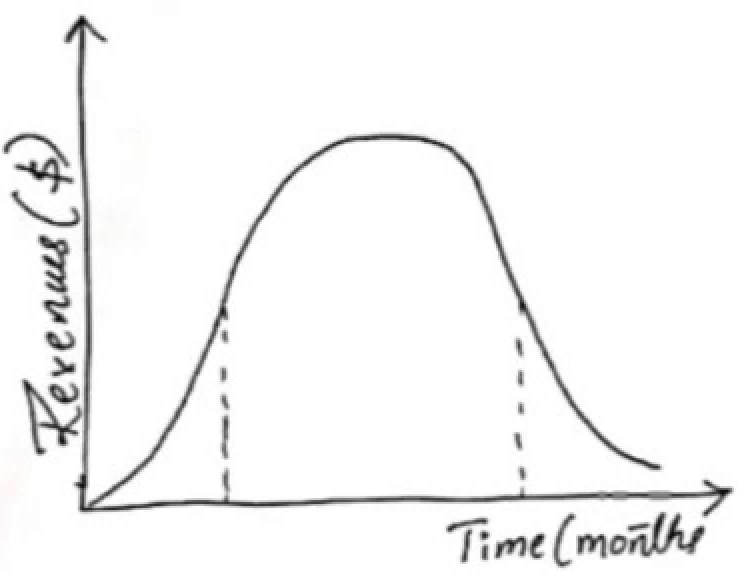
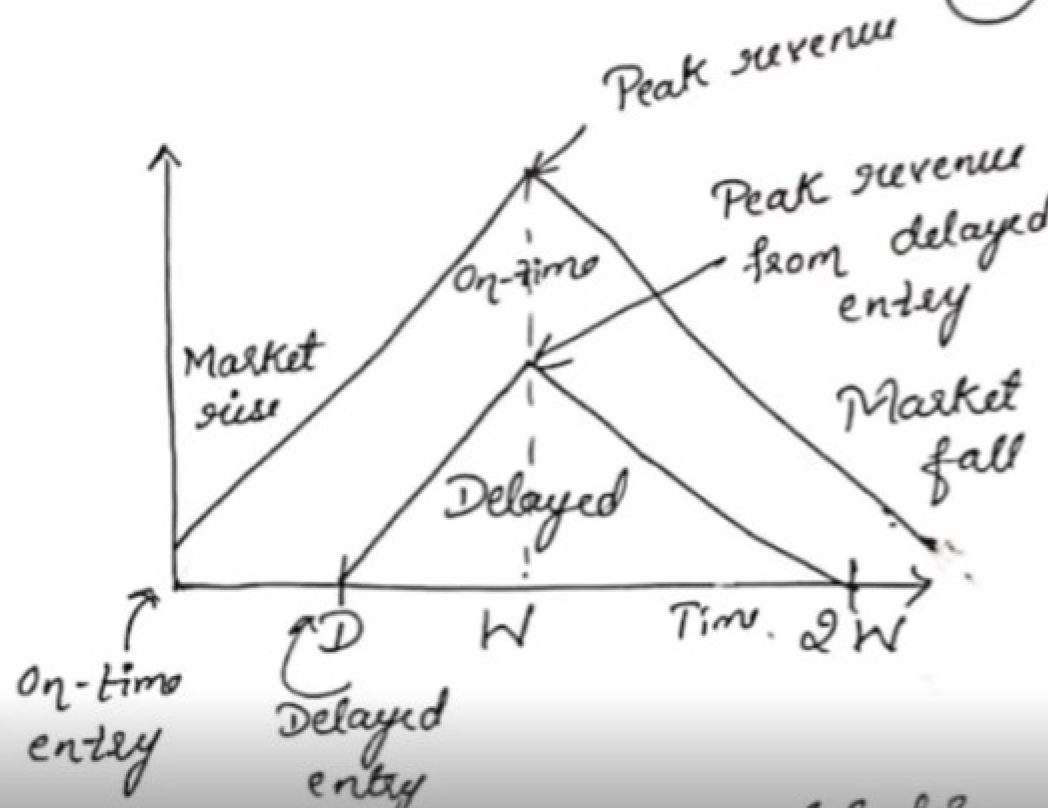
Example :

7



(a) Market window



S/w expert, as ...

- The designer must have expertise in both areas.

The Time-to-Market Design Metric

- The Time-to-market is demanding in recent years.
- Introducing an embedded system to the marketplace early can make a big difference in the system's profitability, since market windows for products are becoming quite short, with such windows often measured in months.

entry

(b) Simplified revenue model for computing revenue loss from delayed entry.

- Fig(a) shows a sample market window during which time a product would have highest sales.
- Missing this window, which means that the product begins being sold further to the right on the time scale, can mean significant loss in sales.
- In some cases, each day that a product is delayed from introduction to the market can translate to a one million dollar loss.

to market constraint has been

- In some ... from introduction to the market can translate ... one-million-dollar loss.
- The average time-to-market constraint has been reported as having shrunk to only 8 months!
- The time-to-market constraint is the fact that embedded system complexities are growing due to increasing IC capacities.
- Rapid growth in IC capacity translates into pressure on designers to add more functionality to a system.
- Designers today are being asked to do more in ... time

- Fig (b): To investigate the loss of revenue that can occur due to delayed entry of a product in the market. Assume market rise angle is 45°.
- This model assumes the peak of the market occurs at the halfway point, denoted as 'W' of the product life, & that the peak is the same even for a delayed entry.
- The revenue for an on-time market entry is the area of the triangle labeled On-time, & the revenue for a

labeled Delayed.

- The revenue loss for a delayed entry is just the difference of these two triangles areas.

$$\boxed{\%\text{ percentage of revenue loss} = \frac{\text{On-time} - \text{Delayed}}{\text{On-time}} \times 100\%}$$

- ∴ Area of on-time triangle $= \frac{1}{2} \times \text{base} \times \text{height}$

$\tan 45° = 1 = \frac{opp}{adj}$

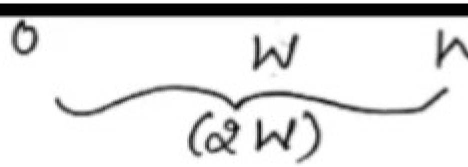
$1 = \frac{opp}{adj}$

$opp = adj$

$$= \frac{1}{2} \times 2W \times W$$

$$= \frac{1}{2} \times 2W^2$$

$$= W^2.$$



∴ Area of delayed triangle $= \frac{1}{2} \times \text{base} \times \text{height}$

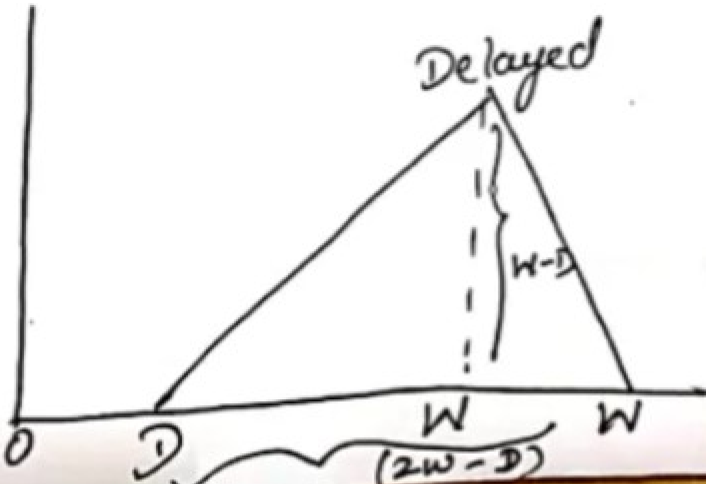
$$= \frac{1}{2} \times (2W-D) \times (W-D)$$

$$= \frac{1}{2}\left[2W^2 - 2WD - WD + D^2\right]$$

$$= \frac{1}{2}\left[2W^2 - 3WD + D^2\right]$$

$$= \frac{2W^2}{2} - \frac{3WD + D^2}{2}$$

$$= W^2 - \frac{D(3W-D)}{2}$$



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$\therefore$ Percentage of Revenue loss $= \dfrac{W^2 - \left[W^2 - \dfrac{D(3W-D)}{2}\right]}{W^2} \times 100\%$ (8)

$$= \dfrac{W^2 - W^2 + \dfrac{D(3W-D)}{2}}{W^2} \times 100\%$$

$$\boxed{\% \text{ of Revenue loss} = \dfrac{D(3W-D)}{2W^2} \times 100\%} \Rightarrow \dfrac{3WD-D^2}{2W^2} \times 100\%$$

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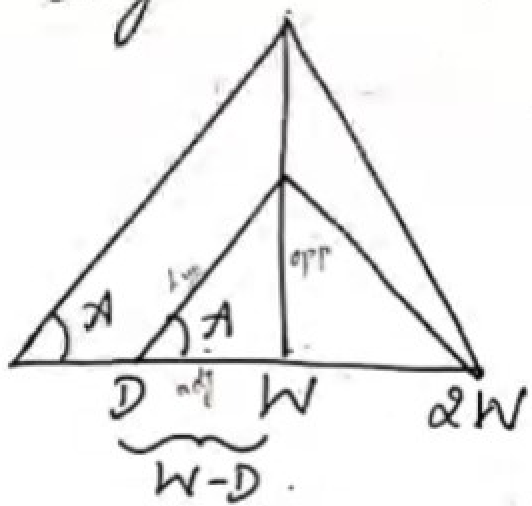
2. Derive an equation for percentage revenue loss for

2). Derive an equation for percentage revenue loss for any rise angle



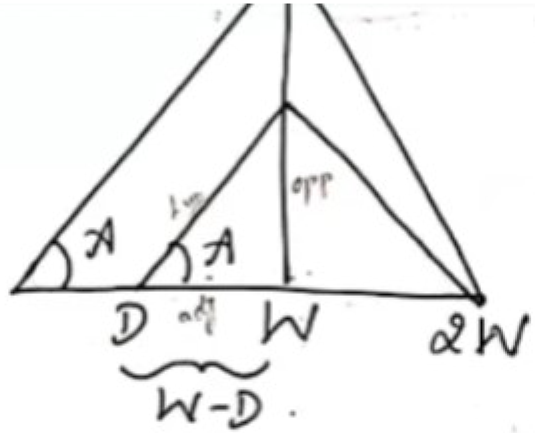
$\sin\theta = \frac{opp}{hyp}$

$\cos\theta = \frac{adj}{hyp}$

$\tan\theta = \frac{opp}{adj}$

$\Rightarrow$ W.K.T $\tan A = \frac{Opp}{adj}$

$Opp = \tan A \times adj$



$\sin\theta = \frac{opp}{hyp}$

$\cos\theta = \frac{adj}{hyp}$

$\tan\theta = \frac{opp}{adj}$

$\Rightarrow$ W.K.T $\tan A = \frac{Opp}{adj}$

$$Opp = \tan A \times adj$$

$$\boxed{\text{Revenue loss} = \cancel{\text{Ont}}\ \frac{\text{On-time} - \text{delayed}}{\text{On-time}} \times 100\%} \rightarrow (1)$$

Area of On-time $= \frac{1}{2} \times base \times height \rightarrow opp$

$\Rightarrow$ W.K.T $\tan A = \dfrac{opp}{adj}$

$$opp = \tan A \times adj$$

$$\boxed{\text{Revenue loss} = \cancel{\text{On}}\ \frac{\text{On-time} - \text{delayed}}{\text{On-time}} \times 100\%} \longrightarrow (1)$$

$$\text{Area of On-time} = \frac{1}{2} \times \text{base} \times \text{height}_{\to opp}$$

$$= \frac{1}{2} \times 2W \times \tan A . W$$

$$\boxed{\text{Area of On-time} = W^2 \tan A} \longrightarrow (2)$$

$$\text{Area of delay} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times [(W-D)+W] \times \tan A\,(W-D)$$

$$\boxed{\text{Area of delay} = \frac{1}{2} \times [2W-D] \times \tan A\,(W-D)} \longrightarrow 3$$

Substituting eq^n 2 & eq^n 3 in eq^n 1, we get

$$\text{Revenue loss} = \frac{(\tan A \times W^2) - \left[\frac{1}{2} \times (2W-D) \times \tan A \times (W-D)\right]}{\tan A \times W^2} \times 100\%$$

$$- \left[\frac{1}{2}(2W^2 - 2WD - WD + D^2)\right] \times 100\%$$

$$\text{Area of delay} = \frac{1}{2} \times [2W - D] \times \tan A\,(W-D) \quad \text{---} (3)$$

Substituting eq^n (2) & eq^n (3) in eq^n (1), we get

$$\text{Revenue loss} = \frac{(\tan A \times W^2) - \left[\frac{1}{2} \times (2W - D) \times \tan A \times (W-D)\right]}{\tan A \times W^2} \times 100\%$$

$$= \frac{W^2 - \left[\frac{1}{2}(2W^2 - 2WD - WD + D^2)\right]}{W^2} \times 100\%$$

$$= \frac{\frac{2W^2 - 2W^2 + 2WD + WD - D^2}{2}}{W^2} \times 100\%$$

$$= \frac{W^2 - \left[\frac{1}{2}\left(2W^2 - 2WD - WD + D^2\right)\right]}{W^2} \times 100\%$$

$$= \frac{\dfrac{2W^2 - 2W^2 + 2WD + WD - D^2}{2}}{W^2} \times 100\%$$

$$= \frac{2W^2 - 2W^2 + 2WD + WD - D^2}{2W^2} \times 100\%$$

$$\boxed{\text{Percentage loss} = \frac{3WD - D^2}{2W^2} \times 100\%}$$

... loss if the products lifetime is

$$\boxed{\text{Percentage loss} = \frac{3WD - D^2}{2W^2} \times 100\%}$$

37. Determine the revenue loss, if the products lifetime is 52 weeks & the delay in the market is 4 weeks.

⇒ Given,

Life time = 52 Weeks

$$W = \frac{52}{2} = 26 \text{ Weeks}$$

Delay $D = 4$ Weeks

$$\% \text{ Revenue loss} = \frac{D(3W-D)}{2W^2} \times 100\%.$$

$$= \frac{4(3\times 26-4)}{2\times(26)^2}\times 100\%$$

$$= \frac{296}{1352}\times 100\%$$

$$\boxed{\%\ \text{Revenue loss} = 21.89\%}$$

4). Determine the revenue loss if the products lifetime is 52 weeks & the delay in the market is 10 weeks

52 weeks & the delay in the market is 10 weeks

$\Rightarrow$ Given,

$W = \frac{52}{2}$ weeks, $W = 26$ weeks, $D = 10$ weeks

$$\% \text{ Revenue loss} = \frac{D(3W - D)}{2W^2} \times 100\%$$

$$= \frac{10(3 \times 26 - 10)}{2 \times (26)^2} \times 100\%$$

$$= \frac{680}{1352} \times 100\%$$

$$\boxed{\% \text{ Revenue loss} = 50.29\%}$$

$$= \frac{6\left[(3\times 32)-6\right]}{2\times(32)^2}\times 100\%$$

$$= \frac{540}{2048}\times 100\%$$

$$\boxed{\%\ \text{Revenue loss} = 26.36\%}$$

9). Using the revenue model, compute the % revenue loss if $D = 5$ & $W = 10$. If the company whose product entered the market on-time earned a total revenue of $25 million, How much revenue did the company that entered the market late lose ?

$$\boxed{\%\ \text{Revenue loss} = 26.36\%}$$

9) Using the revenue model, compute the % revenue loss if D = 5 & W = 10. If the company whose product entered the market on-time earned a total revenue of $25 million, How much revenue did the company that entered the market 5 weeks late loss?

$\Rightarrow$ % Revenue loss $= \dfrac{D[3W - D]}{2W^2} \times 100\%$

$= \dfrac{5[(3 \times 10) - 5]}{2 \times (5)^2} \times 100\%$

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total ... that ...
did the company loss?
5 weeks late

$$\Rightarrow \% \text{ Revenue loss} = \frac{D[3W - D]}{2W^2} \times 100\%$$

$$= \frac{5[(3 \times 10) - 5]}{2 \times (5)^2} \times 100\%$$

$$\% \text{ Revenue loss} = 62.5\%$$

$$\text{Revenue loss} = \$25{,}000{,}000 \times 0.625$$

$$\boxed{\text{Revenue loss} = \$\,15{,}625{,}000}$$

The NRE & Unit Cost Design Metrics

NRE cost: NRE cost is the nonrecurring engineering cost. It is the one time monetary cost of designing the system.

Total cost:

$$\boxed{\text{Total Cost} = \text{NRE Cost} + \text{Unit cost} \times \text{Number of Units}}$$

Per-product cost:

Per-product cost = Total cost

Per-product cost:

$$\text{Per-product cost} = \frac{\text{Total cost}}{\text{No of Units}}$$

$$= \frac{\text{NRE cost} + \text{unit cost} \times \text{No of units}}{\text{No of Units}}$$

$$= \frac{\text{NRE cost}}{\text{No. of Units}} + \frac{\text{Units cost} \times \text{No of units}}{\text{No of units}}$$

$$\boxed{\text{Per-product Cost} = \frac{\text{NRE Cost}}{\text{No. of Units}} + \text{Unit Cost}}$$

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Example:

Technology A would result in a NRE cost of \$2,000 & unit cost of \$100, technology B would have an NRE cost of \$30,000 & unit cost of \$30, & technology C would have an NRE cost of \$100,000 & unit cost of \$2 versus the number of units produced.

i) Plot total cost versus the number of units produced.

ii) Plot per-product cost versus the number of units produced.

⇒ Total cost = NRE cost + [Unit cost × No of Units]

Technology A

NRE cost = \$2000

Unit cost = \$100

No of Units	Total Cost in \$
0	2000
1	2100
100	12,000
200	22,000
400	42,000
800	82,000
1200	1,22,000
1600	2,02,[illegible]

Technology B

NRE cost = \$ 30,000

Unit cost = \$30

No of Units	Total Cost in \$
0	30,000
1	30,030
100	33,000
200	36,000
400	42,000
800	54,000
1200	66,000
1600	78,000

Technology C

NRE cost = \$ 100,000

Unit cost = \$ 2

No of Units	Total cost in \$
0	1,00,000
1	1,00,002
100	1,00,200
200	1,00,400
400	1,00,800
800	1,01,60
1200	1,02,400
1600	1,03,200
2000	1,04,000

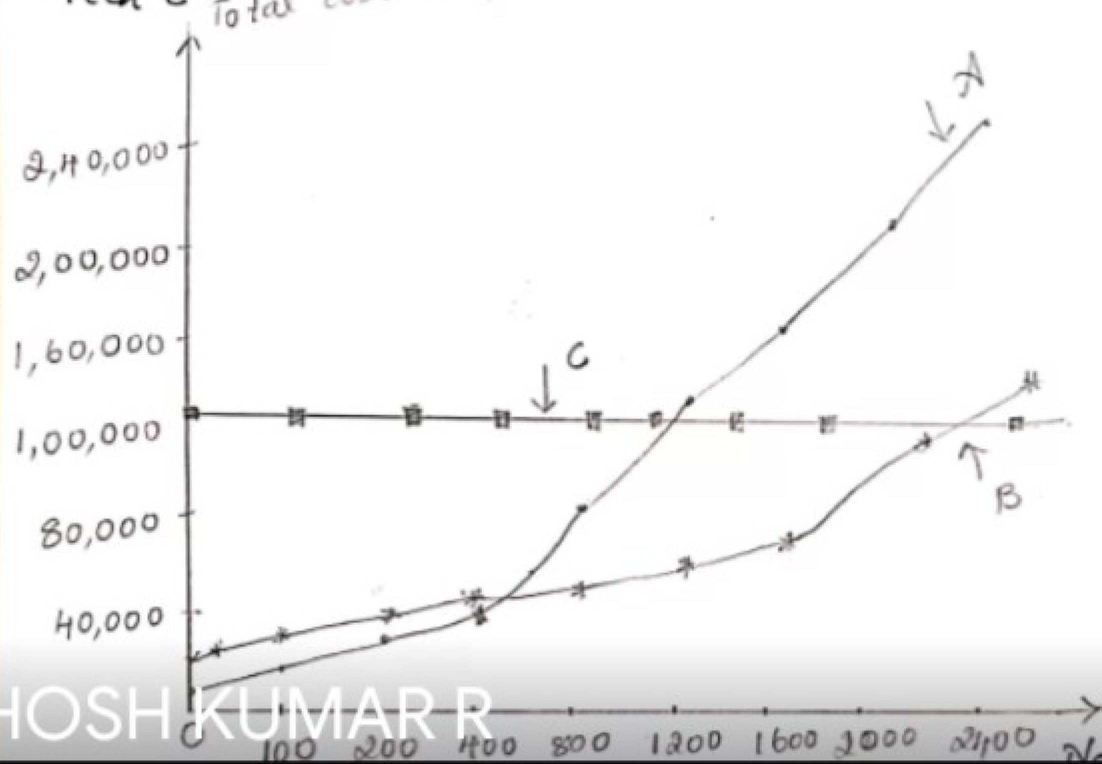
Unit cost = $100

No of Units	Total Cost in $
0	2000
1	2100
100	12,000
200	22,000
400	42,000
800	82,000
1200	1,22,000
1600	1,62,000
2000	2,02,000
2400	2,42,000

No of Units	Total Cost in $
0	30,000
1	30,030
100	33,000
200	36,000
400	42,000
800	54,000
1200	66,000
1600	78,000
2000	90,000
2400	1,02,000

No of Units	Total cost in $
0	1,00,000
1	1,00,002
100	1,00,200
200	1,00,400
400	1,00,800
800	1,01,60
1200	1,02,400
1600	1,03,200
2000	1,04,000
2400	1,04,800

- From the plot of 3 technologies, Tech A yields lowest total cost for low volumes, namely for volumes betn 1 & 400
- Tech B yields lowest total cost for volumes betn 400 & 2500.
- Tech C yields lowest cost for volumes above 2500



0 100 200 400 800 1200 1600 2000 2400 No of Units

iii). Per product cost = $\dfrac{\text{NRE cost}}{\text{No of Units}}$ + Unit cost

OR

Per product cost = $\dfrac{\text{Total cost}}{\text{No of Units}}$.

Technology A

NRE cost = \$2000

Unit cost = \$100

No of Units	per product cost in \$
1	2,100
100	120
400	105
800	102.5
1200	101.65
1600	101.25

Technology B

NRE cost = \$39000

Unit cost = \$30

No of Units	per product in \$
1	30,030
100	330
400	105
800	67.5
1200	55
1600	48.75

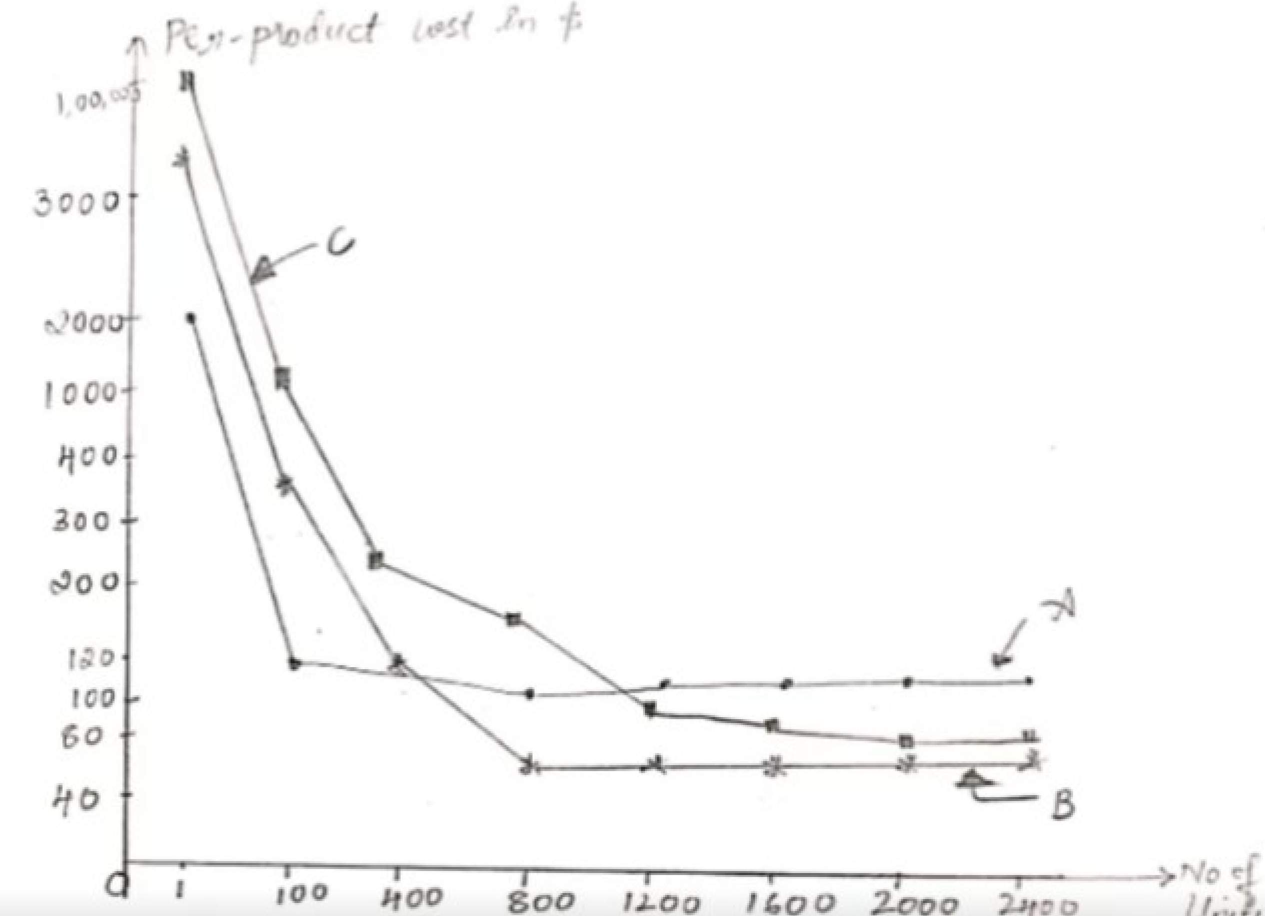
Technology C

NRE cost = \$1,0900

Unit Cost = \$2

No of Units	per-produ... in \$
1	1,00,002
100	1002
400	252
800	127
1200	85.33
1600	64.5

2400 100.85 2400 ... 2400 40.66



- ... illustrates larger the volume, the lower