Dale Carrigie
How to stop worrying and start learning

Engineering Economics (EE)

↳ ast of science that ↳ consumptions and deals with tangible productions and solutions i-e engines, material status machines, buildings etc.

ABET ↳ Engineering is the profession in which knowledge of mathematics and natural sciences gained by study, experience and practice is applied with judgement to develop ways to utilize "Economically" the materials and forces of nature for the ~~beneficial~~ benefits of man kind".

+ Engineering Design Process:

① Problem Description:

- Problem Definition
- Problem evaluation
  - aspects of project
- Problem recognition

② Potential Alternates.
③ Pros and Cons of Each Alternate/Focus on Differences.
④ Create a common view point.
⑤ Common Unit of measure.
⑥ Consider all relevant criteria.
⑦ Make risk and uncertainity explicit.

How to Design a Problem according these steps.

wrecked car = 2000
Repaired car = $ 14500
Insurance = 1000
In Repairing = 2000

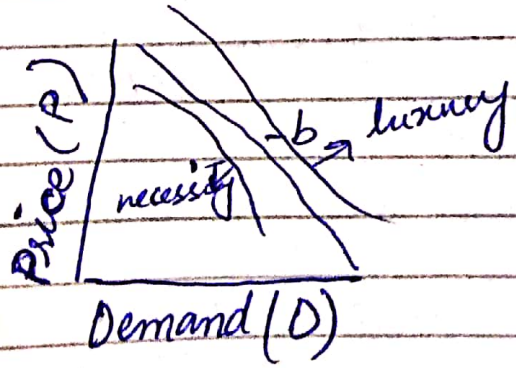
PT tech Repairing = $ 11,000

General Economic Environment:
↳ Consumess and Producers.
↳ Goods and sevices.
↳ Consumess and Producers Goods & services.
↳ Competition

PRICE AND DEMAND RELATIONSHIP:

Price = a - b D → Price lies on which range.
↳ Price
↳ Intercept + on Price
↳ negative slope
↳ Demand.

a and b decides by economist



$$D = \frac{a-P}{b}$$

* TOTAL REVENUE FUNCTION:

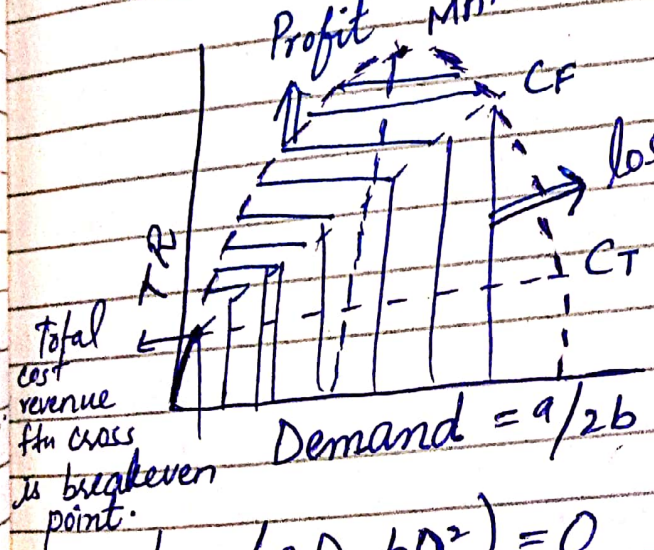
$TR = P \times D$

Total revenue is a function of price in demand.

how much Product is saled.

$TR = (a - bD) \times D$

$TR = aD - bD^2$



$$\frac{d}{d(D)}(aD - bD^2) = 0$$

$$a - 2bD = 0$$

$$D = \frac{a}{2b} \Rightarrow$$ max demand for which you will get max TR.

$$= a\left(\frac{a}{2b}\right) - b\left(\frac{a}{2b}\right)^2$$

$$= \frac{a^2}{2b} - \frac{a^2}{4b}$$

Profit = TR − C_T (fixed cost, variable cost) — −ve value, lose; +ve value, profit

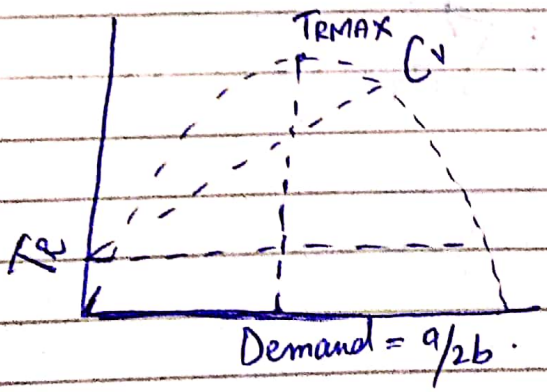
$C_T = C_F + C_V$

Profit = TR − (C_F + C_V) ⇒ Variable Cost.

* Breakeven point ⇒ range of profit and lose.

$TR_{MAX} = a^2/2b - a^2/4b$

$$D_{TRMAX} = \frac{a}{2b}$$



Profit = $aD - bD^2 - (C_F + C_V D)$

* BREAKEVEN POINT:

$$0 = \underset{a}{-bD^2} + (\underset{b}{a} - C_V)D - \underset{c}{C_F}$$

(The profit of demand in which no loss and no profit)

$$D = \frac{-(a - C_V) \pm \sqrt{(a - C_V)^2 - 4(-b)(-C_F)}}{2(-b)}$$

~~$\frac{dP}{dD} = -bD^2 + (a - C_V)D - C_F$~~

~~$0 = -2bD + (a - C_V)$~~

$a = 2b$

value of demand for which max profit occurs.

$$\frac{d}{dD}\left(\frac{-bD^2 + (a - C_V)D - C_F}{dD}\right)$$

$$\Rightarrow -2bD + (a - C_V) = 0$$

$$\Rightarrow \boxed{\frac{a - C_V}{2b} = D}$$

* Conditions For Profit:

1. $a - C_V > 0$
2. $T_R > C_T$

Example #2.6

~~$\frac{a - C_V}{2b} = D$~~

1. $D = \frac{a - C_V}{2b}$

$$= \frac{180 - 83 \text{ per unit}}{2(0.02)}$$

$$= \frac{97}{0.04}$$

Verification :

① $a - C_V > 0$

$180 - 83 = 97$

$C_T = C_F + C_V$ ($T_R > C_T$)

② $T_R = aD - bD^2$

$= (180)(2425) - (0.02)(2425)^2$

$= 436,500 - 117,612.5$

$= 318,887.5$

$C_T = C_F + C_V$

$C_T = 73,000 + 83$

$= 73,083$

$T_R > C_T$

② ⇒ By Quadratic formula

Answer:

Example # 2-7

$C_V = \$62$

$P = \$85.56$

$C_F = \$2024000$

Breakeven point:

$T_R = C_T$

$P \times D = C_F + C_V(D)$

$C_T = C_F + C_V$

$C_T = \$2024000 + \$62$

$= 2024062$

① $D = 85,908.3191$

② $C_F \frac{-10}{100} \times C_F$

10% of C_F is reduced

⇒ Example 2.7

$C_V = 62$

$P = 85.56$

$C_F = 2024080$

max. output = 160,000

$P = 1.38\ C_V$

→ $TR = C_T$

$P \times D = C_F + (C_V \times D)$

$PD = C_F + DC_V$

$PD - DC_V = C_F$

$D = \frac{C_F}{(P - C_V)}$

$= \frac{2024080}{(85.56) - (62)}$

$= 85908.3$ Per hour

$\frac{D}{160,000} = 53\%$

Answer:

Example # 2.7

$C_V = \$62$
$P = \$85.56$
$C_F = \$2024000$

Breakeven point:

$T_R = C_T$
$P \times D = C_F + C_V(D)$

① $D = 85,908.3191$

② $C_F - \frac{10}{100} \times C_F$ — 10% of C_F is reduced

$C_T = C_F + C_V$
$C_T = \$2024000 + \$62$
$= 2024062$

Chapter #03
Time- Money Relationship

Capital : wealth in the form of money.

Depth / Equity ⇒ owned capital

⇓

Borrowed capital.

Why consider return on capital?

* Purchasing Power.
* Profit Capability.
* Time value of capital.

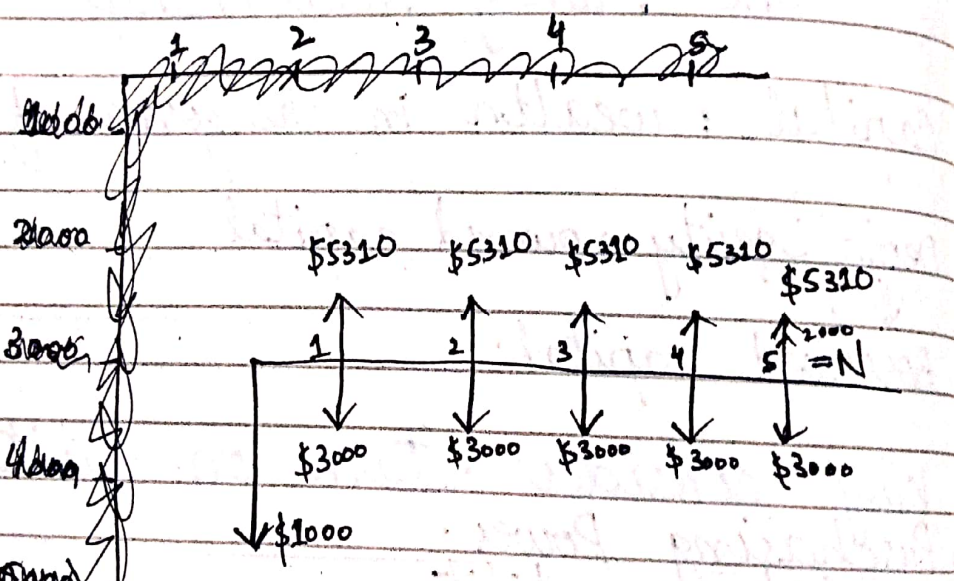
Cash Flow Diagram:

Horizontal Axis → Time
Vertical Axis → Dash
Perspective / → lender / Borrower

Data:

Investment = $ 10000
Uniform Annual Revenue ⇒ $5310 each year.
Salvage ⇒ $2000 at the end of 5 years.

Annual Expenses = $ 3000 each year.



5 year plan =
At beginning investment =
Positive return = $5310 each year
Negative loss of money = $3000 each year

SIMPLE INTEREST:

The mechanism of applying interest only on initial amount.

$I = P * N * i$ → Interest rate.
↓ ↓
principle number of year.

End of year ↑ Beginning of year ↑

EOY	BOY	Interest Earned	Ending Balance.
0	–	–	$1000
1	$1000	$80	$1080.
2	$1080	$80	$1160
3	$1160	$80	$1240

Data = $1000
i = 8.%
N = 3
= 1000 * 3 + 0.08
= $240

$P_s = I + P = \$1000 + \$240$
$= \$1240$

Compound Interest:

The mechanism of applying interest on previously accumulated amount.

EOY	BOY	Interest Earned	Ending Balance.
0	–	–	$1000
1	$1000	$80 = 8/100 x 1000	$1080
2	$1080	$86.40 8/100 x 1080	$1166.40
3	$1166.40	$93.3 8/100 x 1160	$1259.7

1080 − 500

420 x 8 / 100

$0 - P$

$1 - P + P(i) = F_1 = P(1+i)$

$2 - F_1 + F_1(i)$

$= P(i+1) + P(1+i)(i)$

$F_2 = P(i+1)(i+1)$

$F_2 = P(i+1)^2$

Compound Interest Formula:

- $F_N = P(1+i)^N$

Fundamental Economic Formula..