Query 01:-

$D = 980 - 15p \Rightarrow \dfrac{15p}{15} = \dfrac{980 - D}{15}$

$C_F = \$1800$

$C_V = \$45$

$\Rightarrow P = 65.3 - 0.066D$

Comparing with

$P = a - bD$

$\boxed{a = 65.3}$, $\boxed{b = 0.066}$

(i) number of products for max profit.

$$D_{\substack{profit\\max}} = \frac{a - C_V}{2b}$$

Putting values

$$D_{\substack{profit\\max}} = \frac{65.3 - 45}{2(0.066)} = \boxed{153.78}$$

(ii) For profit, two conditions must be verified.

(a) $a - C_V > 0 \Rightarrow \boxed{65.3 - 45 > 0}$ holds true

(b) $T_R > T_C$

$\Rightarrow T_R = P \times D_{\substack{profit\\max}}$

$$T_R = (a - bD_{\substack{profit\\max}}) \times D_{\substack{profit\\max}}$$

Putting values

$$T_R = (65.3 - (0.066)(153.78)) \times 153.78$$

$$T_R = (65.3 - 10.14948) \times 153.78$$

$$\boxed{T_R = 8481.046}$$

Now $T_c = C_F + C_V D_{\substack{profit \\ max}}$

$T_c = 1800 + (45)(153.78)$

$\boxed{T_c = \$8720.1}$

Now in this case, $T_R \ngtr T_c$ i-e

$T_R < T_c$

So, we are in loss scenario.

(iii) Number of products for max. revenue.

$D_{TRMax} = \frac{a}{2b} = \frac{65.3}{2(0.066)} = \boxed{494.69}$

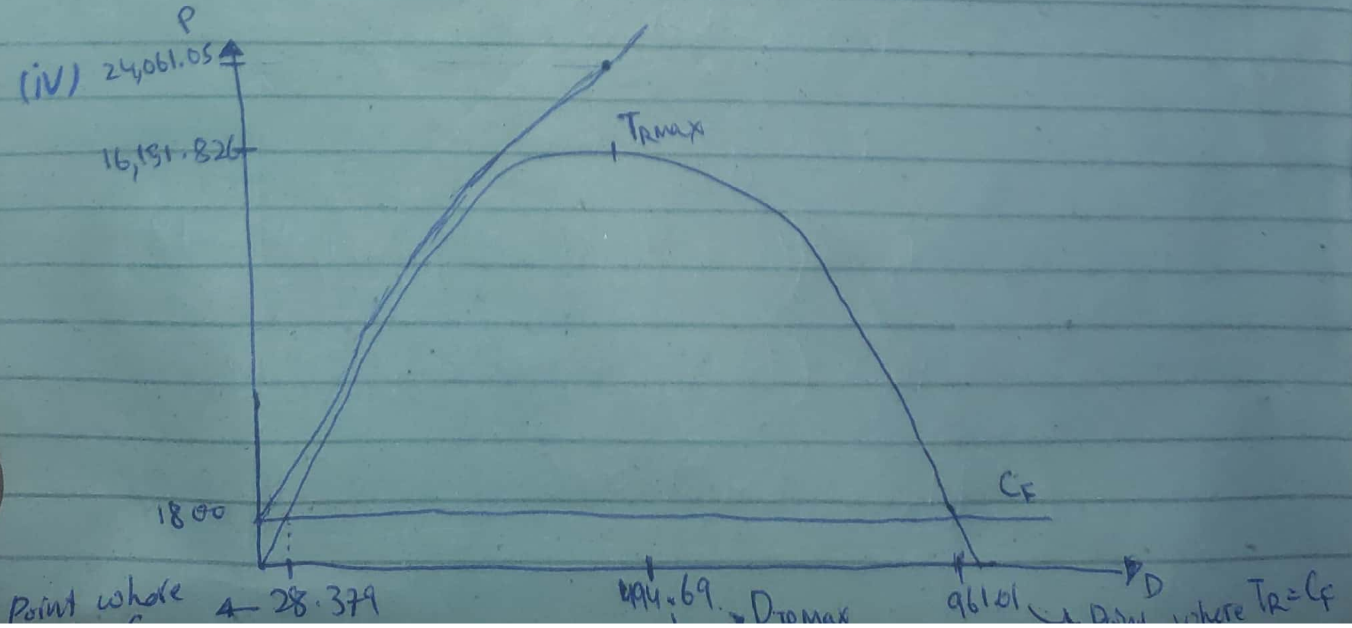
$TR_{max} = a \cdot D_{TRMax} - b \cdot D^2_{TRMax}$

$TR_{max} = (65.3)(494.69) - (0.666)(494.69)^2$

$TR_{max} = 32303.257 - 16151.40$

$\boxed{TR_{max} = \$16,151.856}$

(iV)



(V) As our total cost is higher than total revenue, there is no breakeven point.

(Vi) The net profit/loss is given by:

$$\text{profit/loss} = T_R - T_c$$

putting values

$$\text{Profit/loss} = 8481.046 - 8720.1$$

$$\boxed{\text{Profit/loss} = -239.059}$$

QUERY 02:-

Ans:- $C_F = \$1450$

$C_v = \$5.5$

$a = \$5.6$, $b = \$0.0125$

(i) Volume for max profit = ?

$$D_{\substack{max \\ profit}} = \frac{a - C_v}{2b} = \frac{5.6 - 5.5}{2(0.0125)} = 4$$

Now for profit case, two conditions must be satisfied.

(a) $a - C_v > 0 \longrightarrow 5.6 - 5.5 > 0$ ✓

Holds true

(b) $T_R > T_c$

$$T_R = aD_{\substack{max\\profit}} - bD^2_{\substack{max\\profit}}$$

$$T_R = (5.6)(4) - (0.0125)(4)^2$$

$$T_R = 22.4 - 0.2 = \boxed{\$22.2}$$

$$T_C = C_F + c_v D_{\substack{max\\profit}}$$

$$T_C = 1450 + (5.5)(24)$$

$$T_C = 1450 + 22$$

$$T_C = \$1472$$

Now in this case, $T_R \not> T_C$ i-e $T_R < T_C$

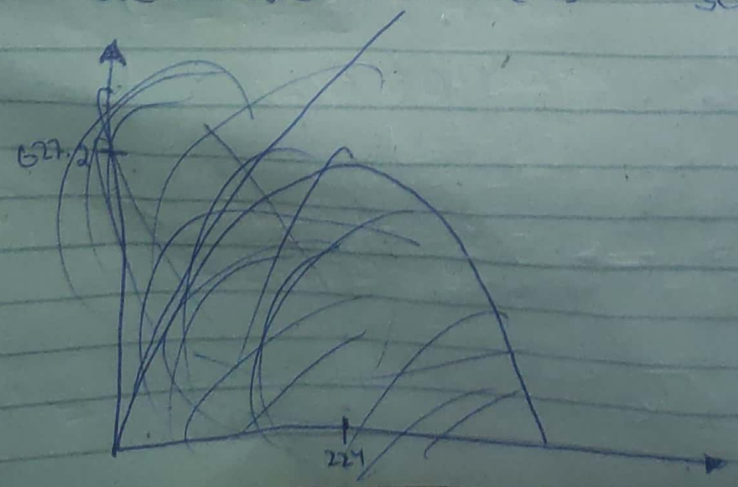
So, we are in the loss scenario.

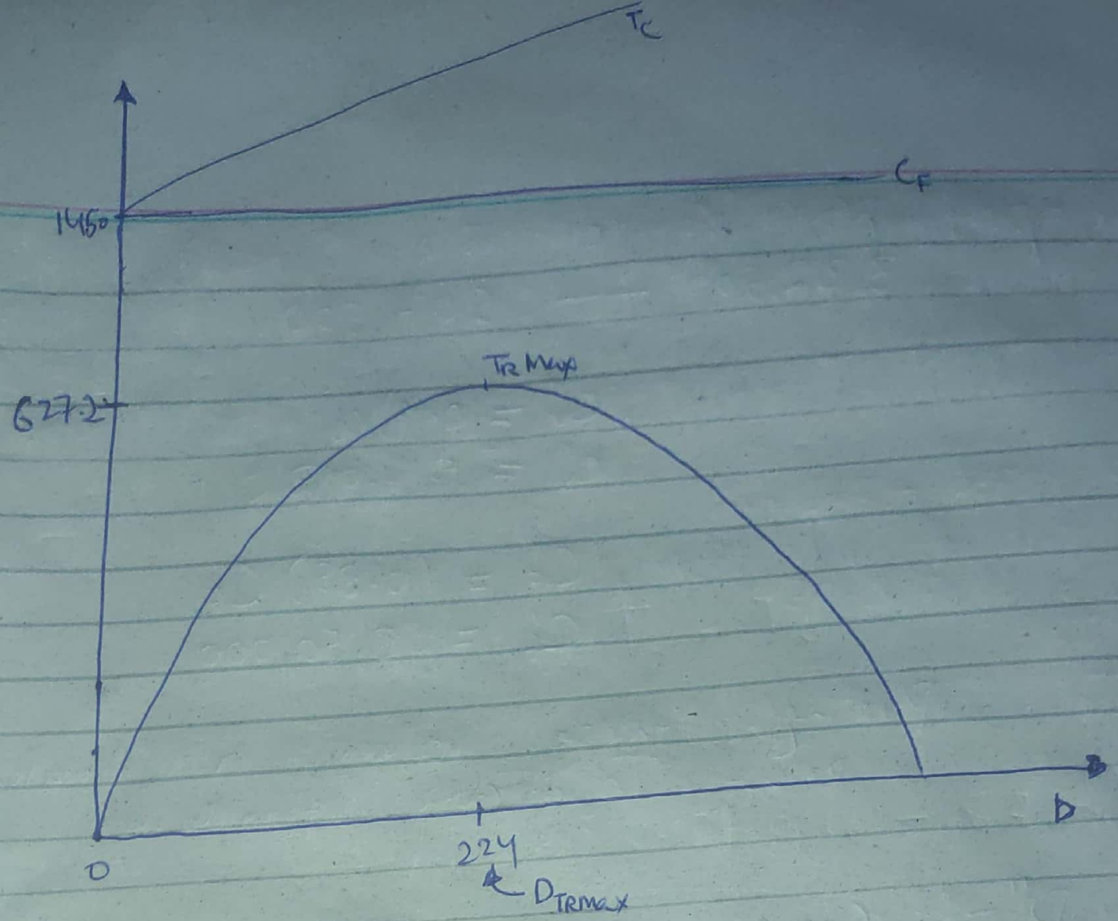
(ii) $D_{Tr\,Max} = \dfrac{5.6}{2(0.0125)} = 224$

$$T_{R\,max} = (5.6)(224) - (0.0125)(224)^2$$

$$T_{R\,max} = 1254.4 - 627.2 = \boxed{\$627.2}$$

(iii) There are no breakeven points and max profi as we are in loss scenario.





QUERY 03:-

$D_{\substack{max \\ capacity}} = 3,000,000$

$P = 19.25 - 0.000002D$

$C_V = \$15.57$

$C_F = \$1,000,000$

(i) Breakeven points

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

Putting values

$$D' = \frac{-(3.68) \pm \sqrt{(3.68)^2 - 4(2)}}{-0.000004}$$

$$D' = \frac{-3.68 \pm 2.35}{-0.000004}$$

$D_1' = 332,500$, $D_2' = 1,507,500$

Hence, profitable range is :
3,32,500 — 1,507,500

C_v reduced by 10 %, $c_v' = (0.9) c_v$
$c_v' = \$14.013$

C_F reduced by 15 %, $C_F' = (0.85) C_F$
$C_F' = \$8,50,000$

Putting these values in breakeven point quadratic formula.

$$D'' = \frac{-(19.25 - 14.013) \pm \sqrt{(19.25-14.013)^2 - 4(-0.000002)(8,50,000)}}{2(-0.000002)}$$

$$D'' = \frac{-5.237 \pm \sqrt{(5.237)^2 - 4(1.7)}}{-0.000004}$$

$$D'' = \frac{-5.237 \pm \sqrt{27.426169 - 6.8}}{-0.000004}$$

$$D'' = \frac{-5.237 \pm 4.542}{-0.000004}$$

$$D_1'' = \frac{-5.237 + 4.542}{-0.000004}, \quad D_2'' = \frac{-5.237 - 4.542}{-0.000004}$$

$$D_1'' = 1,73,750, \quad D_2'' = 2,444,750$$

Now the new range is

1,73,750 —— 2,444,750

The first breakeven point is reduced by 47.7 % while the 2nd is increased by 62.1 %. Hence by reducing the variable and fixed cost, the profitable range has increased. (Approximately by 100 %).

QUERY 04:-

$C_F = \$1000$

$C_V = \$25$

$D = 500 - 5P$

OR

$\boxed{P = 100 - 0.2D}$

(i) Optimal number of services for max profit = ?

$$D_{\substack{max \\ Profit}} = \frac{a - C_V}{2b} = \frac{100 - 25}{2(0.2)} = \frac{75}{0.4}$$

$$D_{\substack{max \\ Profit}} = 187.5$$

Now for profit scenario,

(a) $a - C_V > 0 \Rightarrow 100 - 25 > 0 \Rightarrow 75 > 0$ ✓ Holds true

(b) $T_R > T_C$

$T_R = aD_{\substack{max\\profit}} - bD^2_{\substack{max\\profit}}$

$T_R = (100)(187.5) - (0.2)(187.5)^2$

$T_R = 18750 - 7031.25$

$T_{R\,(\substack{max\\profit})} = 11,718.75$

$T_C = C_F + C_V D_{\substack{max\\profit}}$

$T_C = 1000 + (25)(187.5)$

$T_C = 5687.5$

The second condition is also satisfied here because $T_R > T_C$. So we are in the profit scenario.

(ii) Max Profit = ?

$\cancel{D_{\substack{max\\profit}}} \cancel{= \ldots}$

$$\text{Max Profit} = T_{R\,(\substack{max\\profit})} - T_C$$

$$\text{Max Profit} = 11,718.75 - 5687.5$$

$$\boxed{\text{Max Profit} = \$6031.25}$$

(iii) Profitable range = ?

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

$$D' = \frac{-(100 - 25) \pm \sqrt{(100 - 25)^2 - 4(-0.2)(-1000)}}{2(-0.2)}$$

$$D' = \frac{-75 \pm \sqrt{75^2 - 4(200)}}{-0.4}$$

$$D' = \frac{-75 \pm \sqrt{5625 - 800}}{-0.4}$$

$$D' = \frac{-75 \pm 69.46}{-0.4}$$

$$D_1' = \frac{-75 + 69.46}{-0.4}, \quad D_2' = \frac{-75 - 69.46}{-0.4}$$

$$D_1' = 13.85, \quad D_2' = 361.15$$

The profitabl range is 13.85 — 361.15

Scanned with CamScanner