Assignment 1
Coursename: Managerial Economics(MSC506)
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Assignment Solutions

Q1.

a. Marginal cost Function in Continuous case, $\frac{dc(x)}{dx}$ = 90-0.1x
   Marginal cost Function in Discrete case,
   Exact cost of producing the (x + 1)st item = C(x + 1) - C(x) = 89.95 - 0.1x
b. Marginal Cost at a Production Level of 500 tanks/week , MC(500) = 40 rs/- , if Production is increased by a very small amount at the level of 500 units, then the cost will increase by rs 40/- , which is the instantaneous rate of change
c. Exact Cost of Producing the 501^{th} item is , C'(x) = 89.95- 0.1x , C'(x) = 39.95 rs/-

Q2.

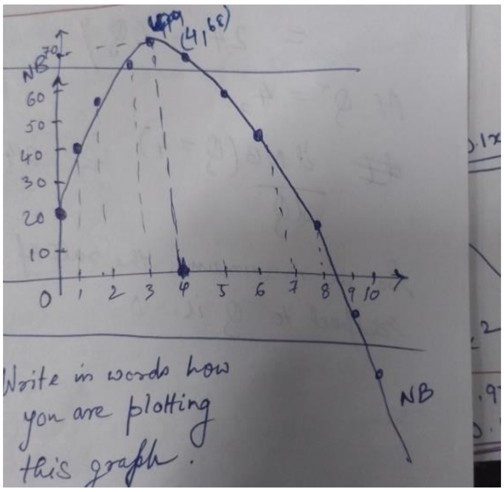
$B(Q) = 100+36-3Q^2$

C(Q)= 80+12Q

a. NB(Q) = B(Q) – C(Q)
   $= 20+24Q-3Q^2$

b.

Q	TB	TC	NB
0	100	80	20
1	133	92	41
2	160	104	56
3	181	116	65
4	196	128	**68**
5	205	140	65
6	208	152	56
7	205	164	41
8	196	176	20
9	181	188	-7
10	160	200	-40



c. Q* = 4, since NB reaches maximum of 68 at Q* = 4 and is lower than 68 at every point before or after Q*, this is Maximum.

d. Differentiating the NB Function

NB (Q) = 20+24Q-3Q^2

$$\frac{d(NB)}{dQ} = 24 - 6Q$$

At Q* =4 , 24-6Q = 24-6(4) = 0
So, at maximum, the rate of Change of NB function with respect to Q is 0.

e. First Derivative , $\frac{dNB(Q)}{dQ} = 24 - 6Q$

As per the First order derivative Condition, Q can be Maxima or Minima, To find out whether Q is Maxima or Minima, we will Apply Second Order Condition

Second derivative of NB' (Q)
$\frac{\mathrm{dNB}'(\mathrm{Q})}{\mathrm{dQ}} = -6$ <0
AS -6 <0, Q is at Maxima.

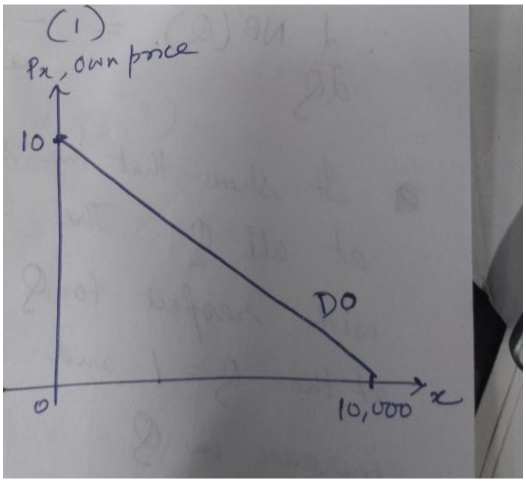
f. MB = B'(Q) = 36-6Q

MC = C' (Q) = 12

At Q=2, MB = 24, MC =12

MB >MC at Q=2, if Q is Increased, benefits increase more than Costs and hence net benefits also increase if Q is Increased. So we can't operate at Q=2, but it will pay to Increase Output from Q=2.

Q3.



a. X= 1000-1000P
P= 10 - 0.001x

b. P>0

10-.001x >0

X< 10,000

Domain of the Function is 0<x<10,000

c. C(X) = 7000+2x
MC = C'(X) =2

Marginal Cost is Constant at 2 units. It implies at any level of Output the rate of change or Instantaneous change in cost due to change in output is same at 2 units.

d. R= x.P(X)

R = 10X- 0.001 X^2

e. MR =R'(X) = $\frac{d(10x-0.001x^2)}{dx}$

MR = 10-0.002X

MR(X=3000) =10 – 0.002 (3000)

= 4

MR(X=5000) =10 – 0.002 (5000)

= 0

MR(X=7000) =10 – 0.002 (7000)

= -4

MR is Falling as X increases , So we cannot increase revenue indefinitely, As more output is Produced , Diminishing Marginal Utility Starts Operating and Firm also Experiences that revenues Increase but at a falling rate.

f. Optimal Output is where MB=MC ,

10-0.002x=2

X = 4000 units

Q4. B (Q) = 10Q-2Q^2, C (Q) = 2+Q^2

Net Benefit, NB (Q) = B (Q) – C (Q)

= 10Q -3Q^2-2

Net Benefit is maximised when MB = MC or $\frac{dNB(Q)}{dQ} = 0$,

Q = 10/6

Other Method

First Derivative, $\frac{dNB(Q)}{dQ} = 10 - 6Q$

As per the First order derivative Condition, Q can be Maxima or Minima, to find out whether Q is Maxima or Minima, we will Apply Second Order Condition

Second derivative of NB' (Q)

$$\frac{\mathrm{dNB'(Q)}}{\mathrm{dQ}} = -6$$

AS -6 <0, Q is at Maxima.

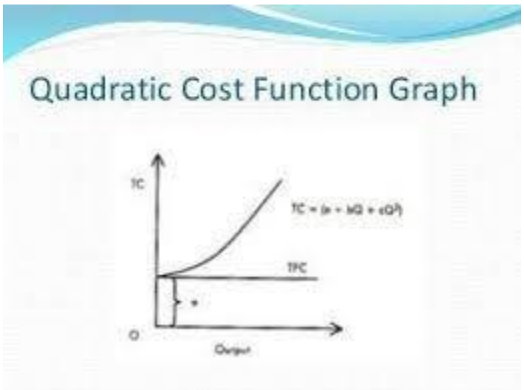
Q5. Total benefit, B (Q) = 25Q-Q^2, Total Cost, C (Q) = 5+2Q^2

a. Total benefit at Q = 2 ,B(Q=2) =46 , B(Q=10) = 150

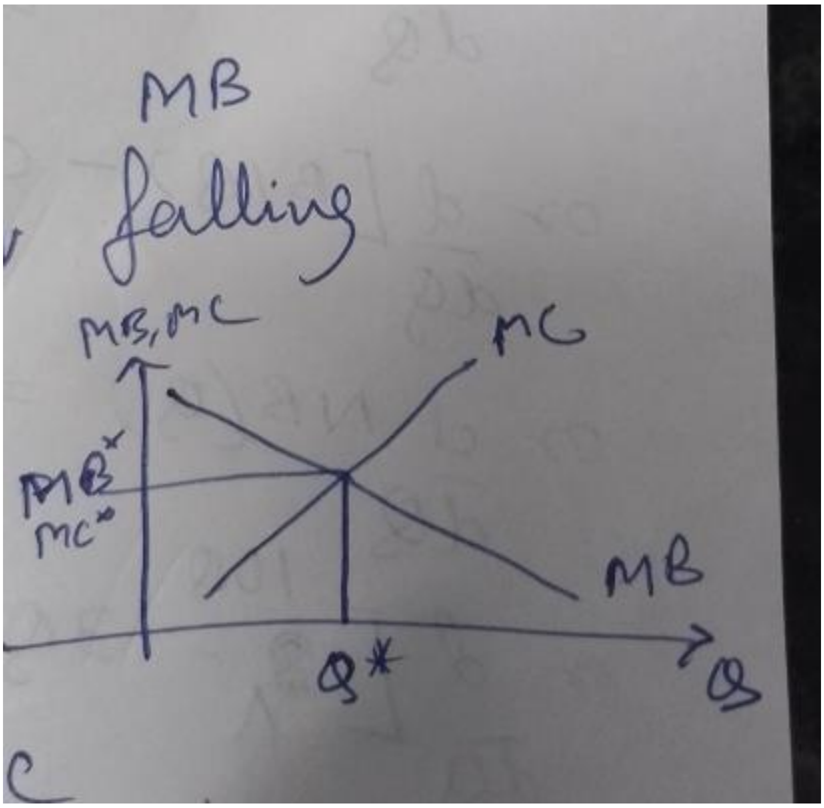
b. MB =B’(Q) =25-2Q , MB (Q=2) = 21 , MB (Q=10) = 5
c. MC =C’(Q) = 4Q , MC (Q=2) =8 , MC (Q=10) =40
d. C (Q) = 5+2Q^2 , C’(X) = 4Q As per FOC , C’(X) =0 , 4Q =0 , Q=0 (Subject to minima or Maxima)

   As Per SOC, C’’(X) = +ve (Minima), C’’(X) = -ve (maxima), C’’(X) = 4 (Minima)

   This implies costs are ever-increasing in Q. Costs are at minimum only when nothing is produced.



e. $\frac{dB(Q)}{dQ} = \frac{dc(Q)}{dQ}$, 25-2Q =4Q , Q=25/6



Q5. r= 0.1

Present value = $\frac{20{,}000}{1.1} + \frac{20000}{(1.1)2} + \frac{20000}{(1.1)3} + \frac{20000}{(1.1)4} + \frac{20000}{(1.1)5}$. This is the maximum value.

Q6. Profit from Investment = 200000 – 75000

= 125000

a. Accounting Profit = 125000
b. Economic Profit = Accounting Profit – Opportunity Cost

Net Salary From

Job 1 = 100000 – 10000 = 90000

Job 2 = 80000-5000 = 75000

Economic Profit from Job 1 = 125000 – 90000 = 35000

Economic Profit from Job 2 = 125000-75000 = 50000

Both for Job offer 1 and 2, EP from investment is Positive, so you should take up no offer, but continue with investment.

Q7.

C_0	П1	П2	П3	П4	П5
Energy Efficient (-500)	25	25	25	25	25
Standard (-400)	0	0	0	0	0

NPV = $\sum_{t=1}^{5} Pvt$ – C_0

NPV = $\frac{25}{1+0.5} + \frac{25}{(1+0.5)2} + \frac{25}{(1+0.5)3} + \frac{25}{(1+0.5)4} + \frac{25}{(1+0.5)5}$ - (500)

NPV = -391.77

Net Profit From the Standard Model is -400 , Negative Net Profit Implies You are Incurring Costs in both Models , Cost is Lower for Energy Efficient Model.

8. Profit of the Firm = 550000

i= 7%, g= 5%

$PV_{\text{Firm}} = \frac{\pi 0\ (1+i)}{i-g}$

a. Before the Current Firm pays out Current Profit as Dividend

Derivation as below:

Opportunity cost of funds is basically the rate of interest

$\therefore\ i = 7\% = 0.07$

Profits are expected to grow at an annual rate of 5%.

$\therefore\ g = 5\% = 0.05$

We know that firm's value is calculated using the PV formula :

$$PV_{firm} = \pi_0 \frac{(1+i)}{(i-g)} = \pi_0 + \pi_0 \frac{(1+g)}{(1+i)} + \pi_0 \frac{(1+g)^2}{(1+i)^2} + \cdots$$

a. Before the firm pays out current profit as dividends.

$$PV_{firm}^{before} = \pi_0 + \pi_0 \frac{(1+g)}{(1+i)} + \cdots$$

$$= \pi_0 \left[1 + \frac{1+g}{1+i} + \frac{(1+g)^2}{(1+i)^2} + \cdots \right]$$

$$= \pi_0 \left[\frac{1}{1 - \frac{1+g}{1+i}} \right] = \pi_0 \left[\frac{1+i}{i-g} \right]$$

$$= 550,000 \left[\frac{1 + 0.07}{0.07 - 0.05} \right] = Rs\ 550,000 \times \frac{1.07}{0.02}$$

$$= Rs\ \boxed{29.425}\ \text{million}$$

PV $_{\text{Firm}}$ = 550000 ($\frac{1+0.07}{0.07-0.05}$)

= 29.425 Million

b. After the Firm pays out Dividend

b. After the firm pays out the dividend,

$\pi_0 = 0$

But profits still grow at 5%.

1	2	3 . . . . .
$\pi_1 = \pi_0(1+g)$	$\pi_2 = \pi_0(1+g)^2$	$\pi_3 = \pi_0(1+g)^3$ . . .

$$\therefore PV^{ex\text{-}div}_{firm} = \frac{\pi_0(1+g)}{(1+i)} + \pi_0\frac{(1+g)^2}{(1+i)^2} + \cdots$$

$$= \pi_0\frac{(1+g)}{(1+i)}\left[1 + \left(\frac{1+g}{1+i}\right) + \left(\frac{1+g}{1+i}\right)^2 + \cdots\right]$$

$$= \pi_0\frac{(1+g)}{\cancel{(1+i)}} \cdot \frac{\cancel{(1+i)}}{(i-g)} = \pi_0\frac{(1+g)}{(i-g)}$$

$$= 550{,}000\left[\frac{1+0.05}{0.07-0.05}\right] = 550{,}000 \times \frac{1.05}{0.02}$$

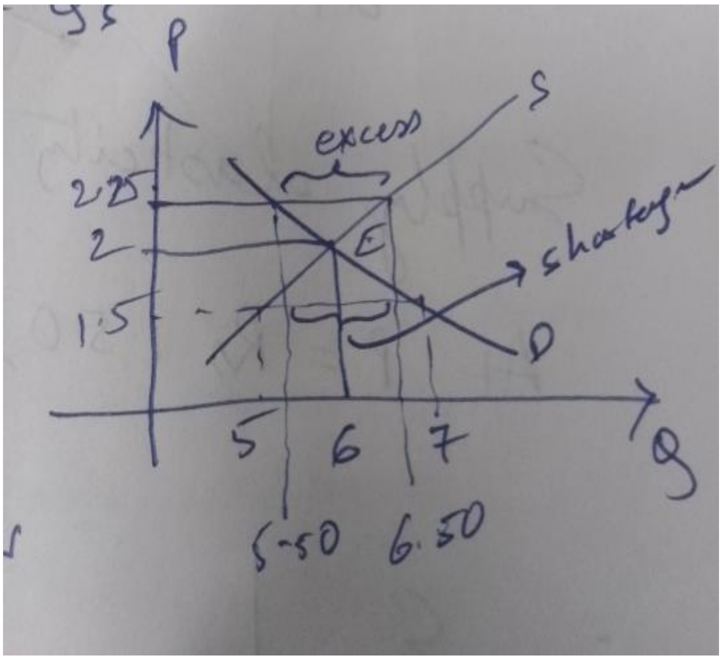
$$= \boxed{\text{Rs } 28.875 \text{ million}}$$

$PV_{\text{Firm}} = 550000\ (\frac{1+0.05}{0.07-0.05})$

= 28.875 Million

Q9.

a. Equilibrium is attained when, Q_d =Qs , P= 2 , Q =6
b. Q_d (P=1.50) = 7 , Q_s(p=1.50) =5 , Q_d >Qs , Shortage in the market for Wheat Flour .
c. Q_d (P=2.25) = 5.50 , Q_s(p=2.25) =6.50 , Q_d <Qs , Excess Supply



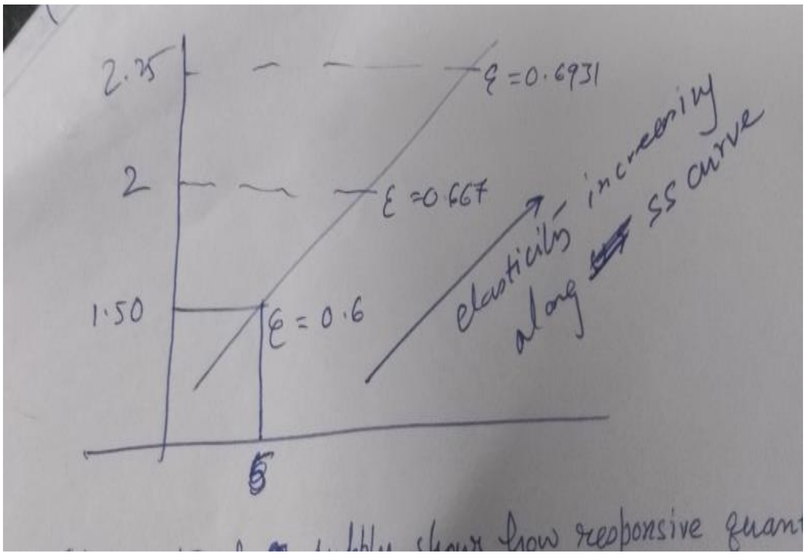
d. Supply Curve Qs = 2+2p , dQ/dP = 2

Supply elasticity, with respect to own Price, e = dQ/dP * P/Q
At P = 1.50, Q = 5

$E_{S,P}$ = 0.6 (P= 1.50)

$E_{S,P}$ = 0.667 (P= 2)

$E_{S,P}$ = 0.69231(P= 2.25)



Elasticity of Supply Shows how responsive Quantity Supplied is to a Change in Price, here we are taking own Price. Here as Producers Get higher Prices, they are willing to sell more and with every change in Price, the quantity Supplied Changes at an increasing rate because of producers Objective to increase Profit.

e. $Q_d = 10 - 2P$, New Supply Curve $Q_s = 4+2.5P$, At Equilibrium Q= 7.33 , P =1.33