Microeconomics

A. Chapter 2

1. Derive linear demand function

Points	**A**	**B**	**C**	**D**	**E**
P_X	16	12	8	4	0
Q_X	0	20	40	60	80

<u>Answer</u>

Since, linear demand function $Qd_x=a-bP_X$

Based on given schedule

$Qd_x=80$ at $P_X=0$

a=80

At any two consecutive[i.e. A and B and so on]

$b=\frac{\Delta Q}{\Delta P}$

$=\frac{20}{-4}$

=-5

=|-5|

=5

$Qd_x=80-5P_X$

2. Derive linear supply function

Points	A	B	C	D	E
P_X	0	8	16	24	32
Q_X	40	80	120	160	200

Answer

Since, linear supply function $Qd_x=a+bP_X$

Based on given schedule

$Qd_x=40$ at $P_X=0$

a=40

At any two consecutive[i.e. A and B and so on]

$b=\frac{\Delta Q}{\Delta P}$

$=\frac{40}{8}$

=5

$Qd_x=40+5P_X$

3. **Find the equilibrium quantity and price in a market if Q_d=126-6p and Q_s=8p**

→ From above

8p=126-6p

Or, 14p=126

P=9

Q=8*9

=72

4. **Suppose there are 200 identical consumers in the market for the commodity X, with demand function Q_d=380-10x and 100 identical producers of the commodity X, each with a supply function given by Q_s=40+4p**

a. **Find the market demand and market supply function and determine the equilibrium price and equilibrium quantity in the market**

→ Individual demand function Q_d=380-10x

Since there are 200 consumer

Market demand function Q_d=200(380-10x)

=76000-2000x

Individual supply function Q_s=40+4p

Since there are 100 producer

Market supply function Q_s=100(40+4p)

=4000+400p

76000-2000x=4000+400x

2400x=72000

x=30

q=4000+400*30

=4000+12000

=16000

b. What happen if the government grants per unit cash subsidy to all the producers of commodity X

→ When government grants per unit cash subsidy to all the producers of commodity X, cost of production of all producer decrease. As a result, their supply functions increases due to more production. After increase in market supply functions, equilibrium price decrease but equilibrium quantity increase

5. Suppose the demand function Q_d=1000-20x and supply function Q_s=100+40p

a. Fill the table given below

→

Price	Quantity demand	Quantity supply
5	1000-20(5)=900	100+40(5)=300
10	1000-20(10)=800	100+40(10)=500
15	1000-20(15)=700	100+40(15)=700
20	1000-20(20)=600	100+40(20)=900
25	1000-20(25)=500	100+40(25)=1100

b. Find equilibrium price and quantity

→ Qd=Qs

1000-20x=100+40x

60x=900

X=15

Q=100+40x

=100+40*15

=100+600

=700

c. **Show graph**
6. **The individual demand function Q_d=24-4x and market supply function Q_s=40p. if there are 10 individual customers in the market for commodity X, find**

a. **Market demand function**

→ Individual demand function Q_d=24-4x

Since there are 10 consumer

Market demand function Q_d=10(24-4x)

=240-40x

b. **Market demand schedule and market supply schedule**
c. **Derive market demand curve and market supply curve**
d. **Obtain equilibrium price and quantity mathematically**

→ Qd=Qs

40x=240-40x

80x=240

X=30

Q=30*40

=120

7. **A market consist of three consumers A, B and C, whose individual demand equations are Q_{dA}=30-P, Q_{dB}=22.5-0.75p and Q_{dC}=37.5-1.25p and the industry supply equation is Q_s=40+3.5p**

a. **Find market demand function and derive market demand curve**

→ Market demand function $Q_d=Q_{dA}+Q_{dB}+Q_{dc}$

=30-P+22.5-0.75p+37.5-1.25p

=90-3p

b. **Determine the equilibrium price and quantity mathematically**

→ Qd=Qs

90-3p=40+3.5p

6.5p=50

P=7.69

Q=90-3*7.69

=90-23.07

=66.93

c. **Determine the amount that will be purchased by each individual**

→

Q_{dA}=30-7.69

=22.31

Q_{dB}=22.5-0.75*7.69

=22.5-5.7675

=16.7325

Q_{dC}=37.5-1.25*7.69

=37.5-9.6125

=27.8875

8. Compute cross elasticity

	Commodity	Before		After	
		Price	**Quantity**	**Price**	**Quantity**
Case 1	X	10	100	15	80
	Y	25	50	25	60
Case 2	X	20	200	30	160
	Y	40	150	40	80

→ Case I

In term of percent

$$Ep=\frac{\frac{60-50}{50}*100}{\frac{15-10}{10}*100}$$

$$=\frac{10*2}{5*10}$$

$$=\frac{20}{50}$$

=0.4>0

Case II

In term of percent

Ep=$\frac{\frac{80-100}{100}*100}{\frac{30-20}{20}*100}$

=$\frac{-20}{10*5}$

=$\frac{-20}{50}$

=-0.4<0

B. Chapter 4

9. Let the production function Q=20L+10L^2-L^3. Derive marginal product function. Compute profit maximizing units of labour and maximum output

→ MR=20+20L-3L^2

0=20+20L-3L^2

L$=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$$=\frac{-20\pm\sqrt{20^2-4*(-3)*20}}{2*(-3)}$$

$$=\frac{-20\pm\sqrt{640}}{-6}$$

$$=\frac{-20\pm25.3}{-6}$$

+ve value

L=7.55

-ve value

L=-0.88

So L=8

$Q=20L+10L^2-L^3$

$=20*8+10*8^2-8^3$

=200+640-512

=328

10. Let the production function $Q=100\sqrt{LK}$, r=50, w=40, P=2, C=1000

a. Compute marginal productivities of two inputs

→ $MP_K=\frac{dQ}{dK}$

$=\frac{d100\sqrt{LK}}{dK}$

$=100L^{1/2}*\frac{1}{2}*K^{1/2-1}$

$=50\ L^{1/2}*K^{-1/2}$

$MP_L=\frac{dQ}{dL}$

$=\frac{d100\sqrt{LK}}{dL}$

$=100K^{1/2}*\frac{1}{2}*L^{1/2-1}$

$=50\ K^{1/2}*L^{-1/2}$

b. Derive expansion path

→

$\frac{\text{MPK}}{\text{MPL}}=\frac{w}{r}$

$\frac{50\ \text{L}1/2*\text{K}-1/2}{50\ \text{K}1/2*\text{L}-1/2}=\frac{50}{40}$

$\frac{\text{L}1/2*\text{K}-1/2}{\text{K}1/2*\text{L}-1/2}=\frac{5}{4}$

$\frac{\text{L}}{\text{K}}=\frac{5}{4}$

L=$\frac{5}{4}$*K

c. Compute units of labour and capital that maximize output

→

rK+wL=C

50K+40L=1000

5K+4L=100

5K+4[$\frac{5}{4}$K]=100

10K=100

K=10units

L=$\frac{5}{4}$*10

=12.5units

d. Compute maximum output and profit

→ Q=100$\sqrt{LK}$

=100$\sqrt{12.5 * 10}$

=1118

Profit=TR-TC

=P*Q-TC

=2*1118-1000

=2236-1000

=1236

11. Let the production function Q=A$L^{0.8}K^{0.5}$, Q=A$L^{0.6}K^{0.4}$, Q=A$L^{0.3}K^{0.5}$,

a. Compute factor intensity

→ $\frac{0.8}{0.5}$>1 labour intensive

$\frac{0.6}{0.4}$>1 labour intensive

$\frac{0.3}{0.5}$<1 capital intensive

b. Compute degree of return to scale

→0.5+0.8=1.3>1 IRS

0.6+0.4=1 CRS

0.3+0.5=0.8<1 DRS

c. Compute $MRTS_{KL}$ where L=20 and k=10

→ We know that

$MRTS_{KL}=\frac{\beta}{\alpha}*\frac{L}{K}$

$MRTS_{KL}=\frac{0.5}{0.8}*\frac{20}{10}$

$=\frac{10}{8}$

=1.25

$MRTS_{KL}=\frac{0.4}{0.6}*\frac{20}{10}$

$=\frac{8}{6}$

$=\frac{4}{3}$

$MRTS_{KL}=\frac{0.5}{0.3}*\frac{20}{10}$

$=\frac{10}{3}$

C. Chapter 5

12. Let cost function $C=128+169Q-Q^2+Q^3$ find TFC, TVC, TC, AC, AFC, AVC and MC at output 64.5 units

→ At Q=0

$C=128+169Q-Q^2+Q^3$

=128+0-0+0

=128

TFC=128

At 64.5units

$TVC=169Q-Q^2+Q^3$

$=169*64.5-(64.5)^2+(64.5)^3$

$=10900.5-4160.25+268336.125$

$=275076.375$

TC=TFC+TVC

$=128+275076.375$

$=275204.375$

AFC=$\frac{128}{64.5}$

$=1.98$

AVC=$\frac{TVC}{Q}$

$=\frac{169\text{Q}-\text{Q}2+\text{Q}3}{Q}$

$=169-Q+Q^2$

At Q=64.5

AVC=169-64.5+4160.25

$=4264.75$

AC=AVC+AFC

$=4264.75+1.98$

$=4266.73$

MC=$\frac{dTVC}{dQ}$

$=\frac{d(169Q - Q2 + Q3)}{dQ}$

$=169-2Q+3Q^2$

At Q=64.5

$=169-2*64.5+3(64.5)^2$

=169-129+12480.75

=12520.75

13. Compute TC, AC, AFC, AVC and MC at FC=100 in the given table

Output	0	1	2	3	4	5	6	7	8	9
TVC	0	10	18	24	32	50	80	124	180	200

→

Output	**TVC**	**TFC**	**TC**	**AFC**	**AVC**	**AC**	**MC**
0		100	100				
1	10	100	110	100	101	110	10
2	18	100	118	50	9	59	8
3	24	100	124	33.3	8	41.3	6
4	32	100	132	25	8	33	8
5	50	100	150	20	10	30	18
6	80	100	180	16.7	13.3	30	30
7	124	100	224	14.3	17.7	32	44
8	180	100	280	12.5	22.5	35	56
9	200	100	380	11.1	28.9	40	80

14. If AR=20 and MR=10 find ep

→ We know that

ep=$\frac{AR}{AR-MR}$

=$\frac{20}{20-10}$

=$\frac{20}{10}$

=2

D. Chapter 6

1. If P=20-Q and C=Q^2+8Q+2 find the price and total profit

→ We know that

R=P*Q

=20Q-Q^2

Profit=R-C

=20Q-Q^2-Q^2-8Q-2

= -2Q^2+12Q-2

For order condition

First derivative=0

-4Q+12=0

12=4Q

Q=3

Second order derivative of profit

$-4<0$

Therefore profit function can be maximize

At $Q=3$

$P=20-Q$

$=20-3$

$=17$

$\text{Profit}=-2Q^2+12Q-2$

$=-2*9+12*3-2$

$=-18+36-2$

$=16$

$TR=P*Q$

$=17*3$

$=51$