TUTORIAL 1

Introduction

TUTORIAL 1 OUTLINE

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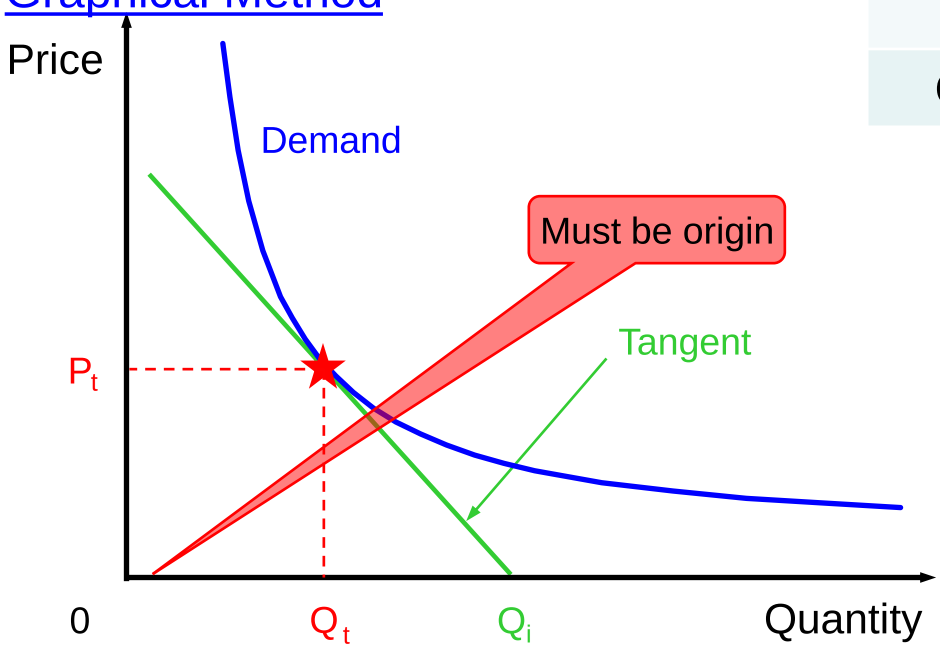
1.1 DEMAND SCHEDULE

Consider the demand schedule shown to the right.

- Plot the demand curve
- Approximate the point elasticity at C, D, and E using the graphical method.
- Compute the arc elasticity of C-D, D-E, & C-E.
- Compare your results

Point	Price ($/unit)	Quantity Demanded (units/period)
A	7	450
B	6	750
C	5	1 250
D	4	2 000
E	3	3 250
F	2	4 750
G	1	8 000

Graphical Method

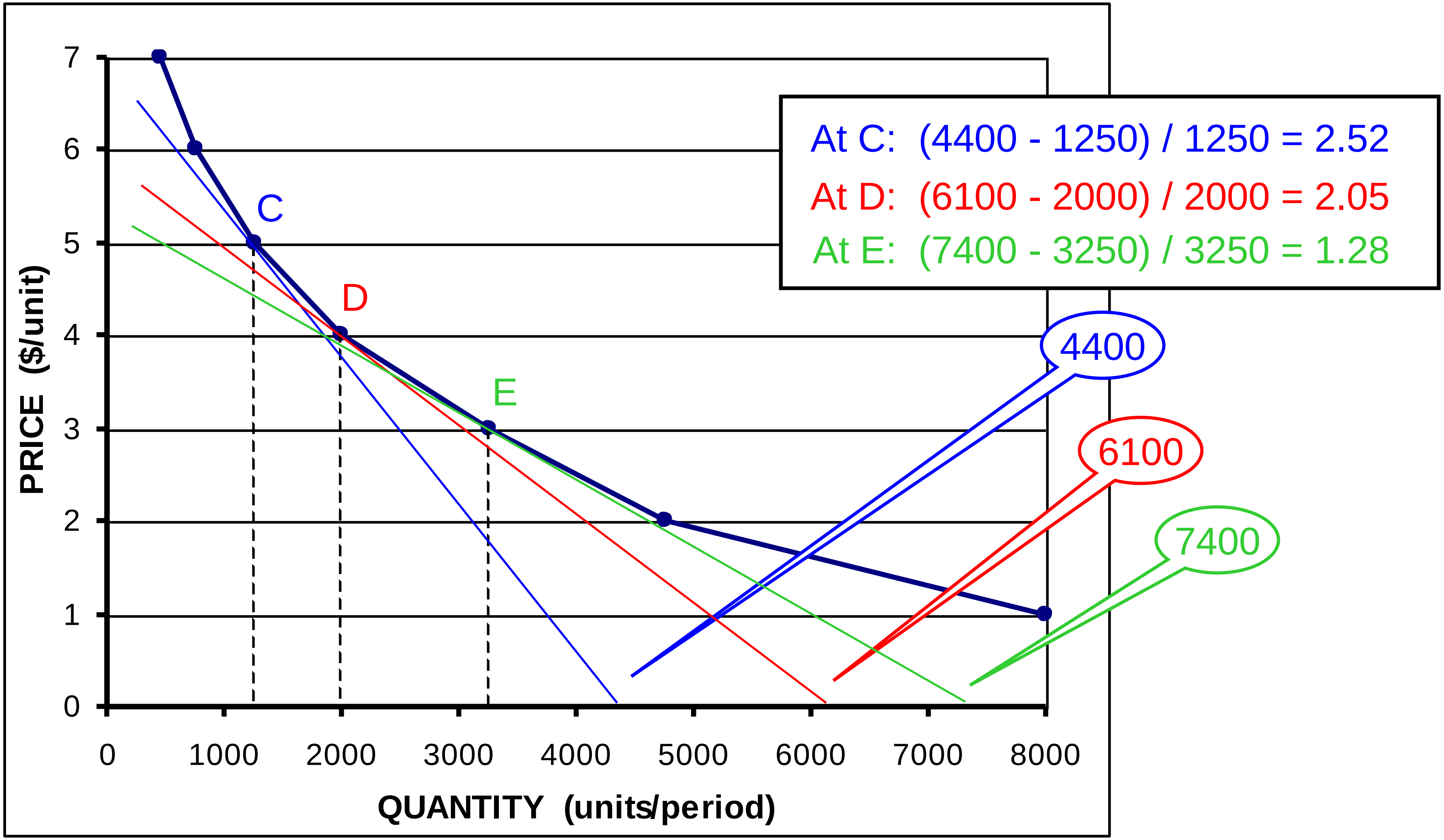


$$E_D = \frac{(Q_i - Q_t)}{P_t} \bigg/ \frac{Q_t}{P_t}$$

$$= \frac{(Q_i - Q_t)}{P_t} \cdot \frac{P_t}{Q_t}$$

$$= (Q_i - Q_t) / Q_t$$

1.1 DEMAND SCHEDULE



To verify, AE_{CD} = -[(2000 - 1250) / (2000 + 1250)] / [(4 - 5) / (4 + 5)] = 2.08

Likewise, AE_{DE} = 1.67 and AE_{CE} = 1.78

1.2 ELASTICITY OF DEMAND

Rank the following in increasing order of elasticity of **demand**.

i)	$Quantity_D$: 333 - 85P	$Quantity_S$: 108 + 12P	Point (2.32, 135.8)
ii)	$Quantity_D$: 825 - 72P	$Quantity_S$: 428 + 52P	Point (3.20, 594.4)
iii)	$Quantity_D$: 723 - 91P	$Quantity_S$: 213 + 15P	Point (4.81, 285.15)
iv)	$Quantity_D$: 195 - 28P	$Quantity_S$: 125 + 25P	Point (1.32, 158.0)

***What do you notice about all the points given?**
****Is there any link between market equilibrium and elasticity?**

Elasticity = - dQ/dP * (P/Q)
i) –(-85)(2.32/135.8) = 1.452
ii) –(-72)(3.20/594.4) = 0.388
iii) –(-91)(4.81/285.15) = 1.535
iv) –(-28)(1.32/158.0) = 0.234
Rank: iv), ii), i), iii)

***The market equilibrium points are given.**
****There is no link between market equilibrium and elasticity.**

1.3 SHORTAGE AND SURPLUS

Consider the table presented below. For each price determine the shortage or surplus.

Price	Demand	Supply
1.5	3 151	2 160
2.0	3 018	2 280
2.5	2 885	2 400
3.0	2 752	2 520
3.5	2 619	2 640
4.0	2 486	2 760
4.5	2 343	2 880
5.0	2 220	3 000
5.5	2 087	3 120

1.3 SHORTAGE AND SURPLUS

Price	Demand	Supply	Shortage / Surplus
1.5	3 151	2 160	Shortage: 991
2.0	3 018	2 280	Shortage: 738
2.5	2 885	2 400	Shortage: 485
3.0	2 752	2 520	Shortage: 232
3.5	2 619	2 640	Surplus: 21
4.0	2 486	2 760	Surplus: 274
4.5	2 343	2 880	Surplus: 527
5.0	2 220	3 000	Surplus: 780
5.5	2 087	3 120	Surplus: 1033

***Notice how all numbers are positive.*

1.4 SHIFT IN SUPPLY CURVE

The introduction of new technology caused a shift in the supply curve of a particular commodity as follows:

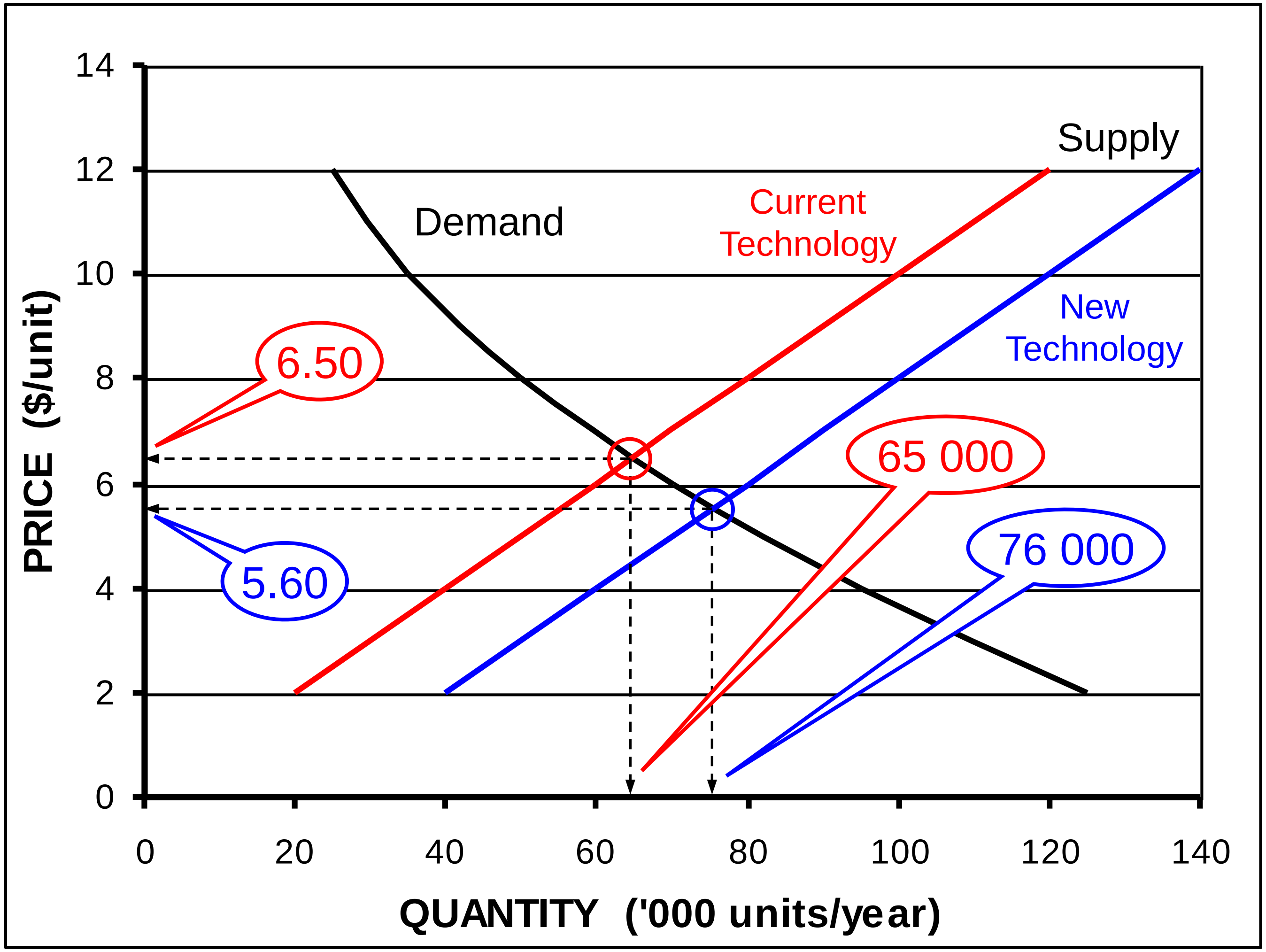
Price ($/unit)	2	4	6	8	10	12
Demand (‘000 units/year)	125	95	70	50	35	25
Supply (‘000 units/year)						
Current Technology	20	40	60	80	100	120
New Technology	40	60	80	100	120	140

Assuming perfect competition,

i) Determine graphically the changes in price and quantity sold resulting from the introduction of the new technology.

ii) Determine the change in total consumer expenditure resulting from the introduction of the new technology.

1.4 SHIFT IN SUPPLY CURVE



i) Increase in quantity of 76 000 - 65 000 = 11 000 units

Decrease in price of 6.50 - 5.60 = $0.90

1.4 SHIFT IN SUPPLY CURVE

ii) Change in total consumer expenditure:

TCE_{New}	76 000 (5.60) = 425 600
$TCE_{Current}$	65 000 (6.50) = 422 500
Change	+3 100

1.5 PRODUCTIVITY

The table below contains selected information from a production schedule. Fill in the missing elements.

Input Rate ('000 units/period)	Total Product ('000 units/period)	Average Product (units/period)	Incremental Product (units/period)
0			
1		40	
2	100		
			80
3			
4		60	
5	280		
6	300		
			-20
7			

1.5 PRODUCTIVITY

Input Rate:	**INPUT**
Total Product:	**TP**
Average Product:	**AP**
Incremental Product:	**IP**

1) At INPUT=0, TP=0

2) **TP** = AP (INPUT)

3) **AP** = TP / INPUT

4) $\mathbf{TP_2} = TP_1 + IP\,(\Delta\ INPUT)$

5) $\mathbf{IP} = \dfrac{TP_2 - TP_1}{\Delta\ INPUT}$

Input Rate ('000 units/period)	**Total Product** ('000 units/period)	**Average Product** (unit/period)	**Incremental Product** (unit/period)
0	**0** 1	0 / 0 = **0** 3	
			40 - 0 = **40** 5
1	40 (1) = **40** 2	40	
			100 - 40 = **60** 5
2	100	100 / 2 = **50** 3	
			80
3	100 + 80 = **180** 4	180 / 3 = **60** 4	
			240 - 180 = **60** 5
4	60 (4) = **240** 2	60	
			280 - 240 = **40** 5
5	280	280 / 5 = **56** 3	
			300 - 280 = **20** 5
6	300	300 / 6 = **50** 3	
			-20
7	300 - 20 = **280** 4	280 / 7 = **40** 4	

1.6 MARKET EQUILIBRIUM

A particular product sold on the market has the following demand and supply functions:

$$Q_D = 1600 - 125\,P \text{ and } Q_S = 440 + 165\,P$$

i) Determine the equilibrium price and quantity.

ii) Determine the elasticity of demand at market equilibrium.

iii) Suppose that a successful advertising campaign shifts the demand curve to the right by 200 units at all prices. Determine the new equilibrium price and quantity.

i) At market equilibrium, the quantity demanded equals the quantity supplied. Thus,

$$1600 - 125\,P = 440 + 165\,P$$
$$290\,P = 1160$$

$\therefore$ P = 4

At P=4, Q = 1600 - 125 (4) = 1100

1.6 MARKET EQUILIBRIUM

ii) $E_D = -(dQ_D/dP) / (Q / P) = 125 / (1100 / 4) = 0.45$

iii) New demand function: $Q'_D = Q + 200$

$Q'_D = 1600 - 125 P + 200$

$Q'_D = 1800 - 125 P$

At market equilibrium:

$1800 - 125 P = 440 + 165 P$

$290 P = 1360$

$\therefore P = 4.69$

At P=4.69, Q = 1800 - 125 (4.69) = 1214

1.7 AVERAGE & MARGINAL COST

The total annual cost (TC) of pumping potable water to a small community is given by:

$$TC = 200\,000 + 0.8\,V^{1.3}$$

in which TC is given in dollars per year and V, the volume of water pumped, in m^3/day.

Determine:

i) The average cost for a volume of 4000 m^3/day;
ii) The marginal cost at a volume of 4000 m^3/day.

i) TC @ 4000 m^3/day: $200\,000 + 0.8\,(4000)^{1.3} = 200\,000 + 38\,527 = 238\,527$

$\therefore$ AC = 238 527 / [4000 (365)] = **$0.163/$m^3$**

or

$AC = 200\,000 / V + 0.8\,V^{0.3}$ Units: ($/yr) / ($m^3$/day) or **$ / 365 m^3**

$= 200\,000 / 4000 + 0.8\,(4000)^{0.3} = 50 + 9.632 =$ \$59.632 per 365 m^3
= **$0.163/$m^3$**

1.7 AVERAGE & MARGINAL COST

ii) MC = dTC/dV = 1.04 $V^{0.3}$ Units: (\$/yr) / (m^3/day) or **\$ / 365 m^3**

= 1.04 $(4000)^{0.3}$ = \$12.521 per 365 m^3
= **\$0.034/m^3**

Alternate solution:

TC @ 4000 m^3/day: 200 000 + 0.8 $(4000)^{1.3}$ = 238 527.247
TC @ 4001 m^3/day: 200 000 + 0.8 $(4001)^{1.3}$ = 238 539.769

Difference \$12.522 for 365 m^3

1.8 INCOME ELASTICITY

Income elasticity: the measure of responsiveness for the demand for a good to a change in the income of the people demanding the good.

If the income elasticity of demand for a good is currently 1.2 and consumer income increases by 3%, what is the expected approximate change in the quantity of the good demanded?

Solution:

The arc elasticity between two points ([Q_1,P_1] and [Q_2,P_2]) is:

$$AE = \frac{\left(\frac{Q_2 - Q_1}{\left(\frac{Q_1 + Q_2}{2}\right)}\right)}{\left(\frac{P_2 - P_1}{\left(\frac{P_1 + P_2}{2}\right)}\right)}$$

Define:

$$(Q_2 - Q_1) = \Delta Q$$

$$(P_2 - P_1) = \Delta P$$

1.8 INCOME ELASTICITY

Then, by algebra:

$$\frac{Q_1 + Q_2}{2} = \frac{2Q_1 + \Delta Q}{2} = Q_1 + \frac{\Delta Q}{2}$$

$$\frac{P_1 + P_2}{2} = \frac{2P_1 + \Delta P}{2} = P_1 + \frac{\Delta P}{2}$$

Define point 1 as the "initial condition" such that $Q_1 = 1$ and $P_1 = 1$. Going back to the initial equation and substituting:

$$AE = \frac{\left(\dfrac{\Delta Q}{1 + \dfrac{\Delta Q}{2}}\right)}{\left(\dfrac{\Delta P}{1 + \dfrac{\Delta P}{2}}\right)}$$

1.8 INCOME ELASTICITY

Given data is AE = 1.2 and ΔP = 0.03. Hence:

$$1.2 = \frac{\left(\dfrac{\Delta Q}{1 + \dfrac{\Delta Q}{2}}\right)}{\left(\dfrac{0.03}{1 + \dfrac{0.03}{2}}\right)} \qquad (0.03547) = \frac{\Delta Q}{1 + \dfrac{\Delta Q}{2}} \qquad \Delta Q = 0.03611$$

Hence, demand would increase by 3.611%.

Note: Elasticity x Income Change = 1.2 x 3% = 3.6% (also an approximation).