Answerkey

P1/7

1. **(3.5*2=7 marks)** State whether you agree or disagree with each of the following statements. Using appropriate **diagrams, explain** your response (marks will depend on the explanation).
   a. Two indifference curves cannot intersect.
   Agree: See Chapter.3 for details.

   b. For a normal good, income effect and substitution effect would move in the opposite direction.
   Disagree: See Chapter.4 for details PP (112–113)

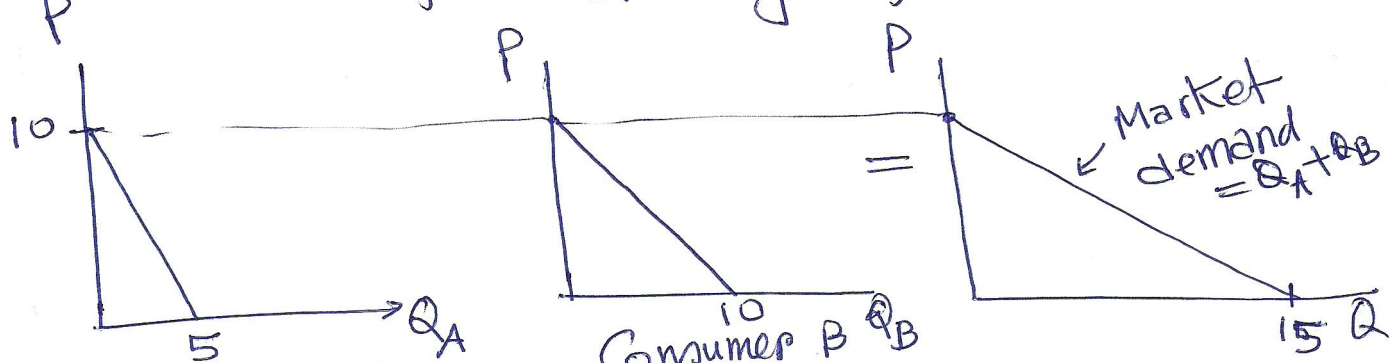
2. a. **(4 marks)** What is the law of demand? Using diagrams, show that the market demand curve is the sum of individual demand curves.
   b. **(3 marks)**Suppose that the demand for pencils by a consumer is given by
   $$Q_d = 25 + 0.4Y - 3P + 2P_f$$
   Suppose that Q= 20, Y (income) = $20, P=$1, Pf (fountain pen) = $2
   i. Calculate the price elasticity, cross-price elasticity and income elasticity of demand for pencils.
   ii. Suppose that the consumer's income decreased by 10%, what will be the percentage change in demand for pencils.

(a) Ceteris Paribus, if Price goes down quantity demanded would go up.

$Q_d = f(P)$

Ceteris paribus = other things remaining the same (such as income, price of related goods)

Hints:



Suppose there are two consumers: A+B

(b)

$$Q_d = 25 + 0.4Y - 3P + 2P_f$$

(i) Elasticity (E):

$$\epsilon_p = \frac{dQ}{dP} \cdot \frac{P}{Q} = -3 \left[\frac{1}{20}\right]$$

*Cross-Price:

$$\epsilon_{P_f} = \frac{dQ}{dP_f} \cdot \frac{P_f}{Q} = 2 \left[\frac{2}{20}\right]$$

Income: $\epsilon_Y = \frac{dQ}{dY} \cdot \frac{Y}{Q} = .4 \left[\frac{20}{20}\right]$

(ii)

$$\epsilon_Y = \frac{\%\Delta Q}{\%\Delta Y} = .4$$

$$\%\Delta Q = .4\ \%\Delta Y$$

$$= .4\,(10)\% = 4\%$$

∴ If income decreased by 10%. Quantity demand would drop by 4%

P 3/7

3. a) **(3 marks)** Using diagrams, explain the derivation of a Marshallian demand curve from the price consumption curve.
See Chapter.4

b. I) **(2 marks)** Calculate the MRS of the following utility functions, and state whether the MRS is diminishing or not:

$MRS = -\frac{MU_1}{MU_2}$
$MU_1 = \partial U/\partial q_1$
$MU_2 = \partial U/\partial q_2$

$U = 5q_1^{0.6} q_2^{0.4}$ (i)

$MRS = \frac{5(.6)q_1^{-.4}q_2^{.6}}{5(.4)q_1^{.6}q_2^{-.6}} = \frac{q_2}{q_1}$ diminishing if $q_1 \uparrow \rightarrow MRS \downarrow$

$U = 5q_1 + 4q_2$ (ii) Constant $\rightarrow MRS = -\frac{5}{4}$

II). **(2 marks)** Michael spends \$200 on two goods (q_1 and q_2). Michael's utility function is:

$$U = 2q_1q_2$$

i) Assuming P_1=\$4 and P_2 = \$5, find Michael's utility-maximizing bundle, his level of utility.

ii. Now suppose that P_1=\$5 . Find the compensated bundle at the new price ratio

(i) Maximize $U = 2q_1q_2$

Subject to, $5q_2 + 4q_1 = 200$

$q_2 = 40 - \left(\frac{4}{5}\right)q_1$

At equilibrium (e):

$MRS = MRT$

$MRS = -\frac{\partial U/\partial q_1}{\partial U/\partial q_2} = -\frac{2q_2}{2q_1} = -\frac{q_2}{q_1}$

$MRT = -\frac{4}{5}$

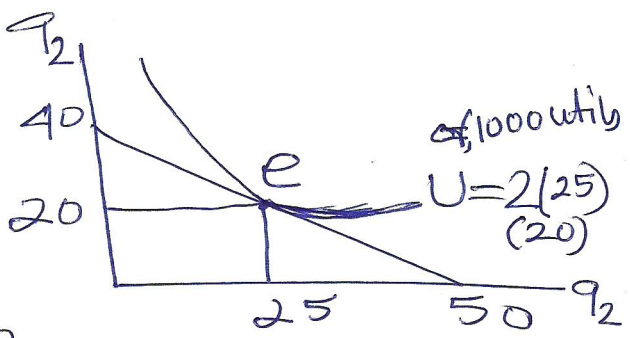
$\therefore -\frac{4}{5} = -\frac{q_2}{q_1}$

$q_1 = \frac{5}{4}q_2$

$q_2 = 40 - \left(\frac{4}{5}\right)\left(\frac{5}{4}\right)q_2$

$2q_2 = 40 \therefore q_2 = 20$ units

$q_1 = \frac{5}{4}(20) = 25$



(11)

$P_1 = \$5$,

For Compensated bundle:

Minimize expenditure

$5q_1 + 5q_2 = Y$

subject to, $\bar{U} = 2q_1q_2 = 1000$ utils.

At equilibrium (e).

$MRS = MRT$

$$-\frac{q_2}{q_1} = -\frac{5}{5} \quad \therefore \quad q_2 = q_1$$

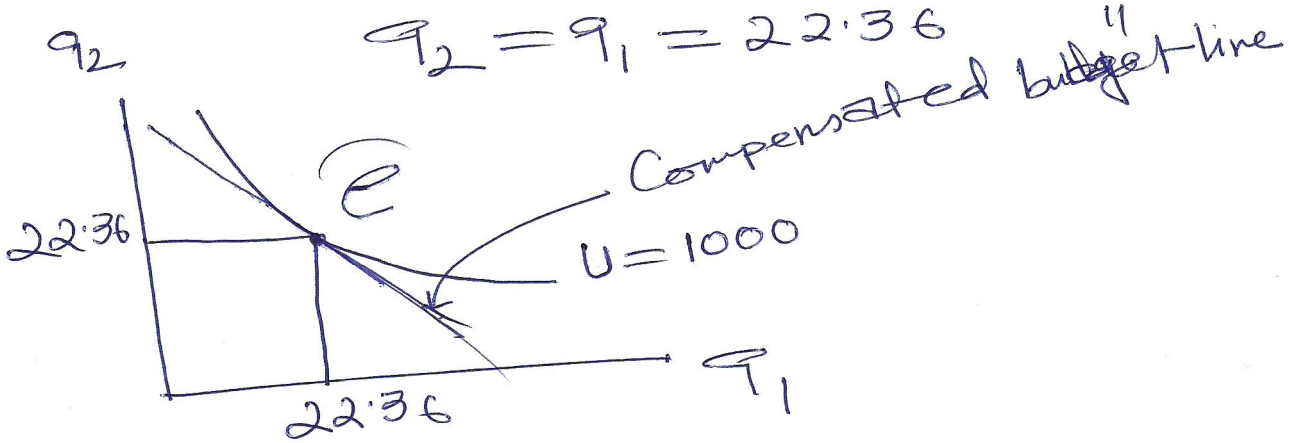
$$U = 2q_2q_1 = 1000$$

$$2q_1^2 = 1000$$

$$q_1^2 = 500$$

$$\therefore q_1 = \sqrt{500} = 22.36 \text{ units}$$

$$q_2 = q_1 = 22.36$$



P5/7

4. a) (**3 marks**) Using diagrams, explain the derivation of a Compensating demand curve.

See Chapter.4, ~~Pages~~ 114-115

b. (**4 marks**). Michael spends \$300 on two goods (q_1 and q_2). Michael's utility function is:

$$U = q_1 q_2$$

i. Assuming P_1=\$15 and P_2 = \$10, find Michael's utility-maximizing bundle, his level of utility.
ii. Now suppose P_1= \$10; find Michael's new utility-maximizing bundle, his new level of utility.
iii. Find the compensated bundle at the new price ratio.
iv. Find the substitution and income effects of this price change. Graph your results.

(1) Michael's objective is to

Maximize $U = q_1 q_2$

Subject to, $15q_1 + 10q_2 = 300$

At equilibrium

$MRS = MRT$

$$MRS = -\frac{\partial U/\partial q_1}{\partial U/\partial q_2} = -\frac{q_2}{q_1}$$

$$MRT = -\frac{P_1}{P_2} = -\frac{15}{10}$$

$$\therefore \frac{q_2}{q_1} = \frac{15}{10} \text{ or } 15q_1 = 10q_2$$

$$\therefore 10q_2 + 10q_2 = 300$$

$$\therefore q_2 = 15 \text{ units}$$

$$q_1 = \frac{10}{15} q_2 = 10 \text{ units}$$

$U = (10)(15) = 150$ utils.

4.b (ii)

New Price, $P_1 = \$10$

$MRS = MRT$

$$-\frac{q_2}{q_1} = -\frac{10}{10}$$

$$q_1 = q_2$$

$$10q_1 + 10q_1 = 300$$

$q_1 = 15$ units
$q_2 = 15$ units

$U = (15)(15)$
$= 225$ utils

(iii) Compensated bundle (Original I.C. Utility = 150)

$U = 150$

$MRS = MRT$

$$-\frac{q_2}{q_1} = -\frac{10}{10}$$

$$q_2 = q_1$$

$$q_1 q_2 = 150$$

$$q_1 q_1 = 150$$

$$q_1^2 = 150$$

$$q_1 = \sqrt{150} = 12.247 \cong 12.25$$

$$q_2 = 12.25$$

4b (iv)

Using answers from (i), (ii), (iii), ~~we~~ draw the following graph:

$$15q_1 + 10q_2 = 300$$

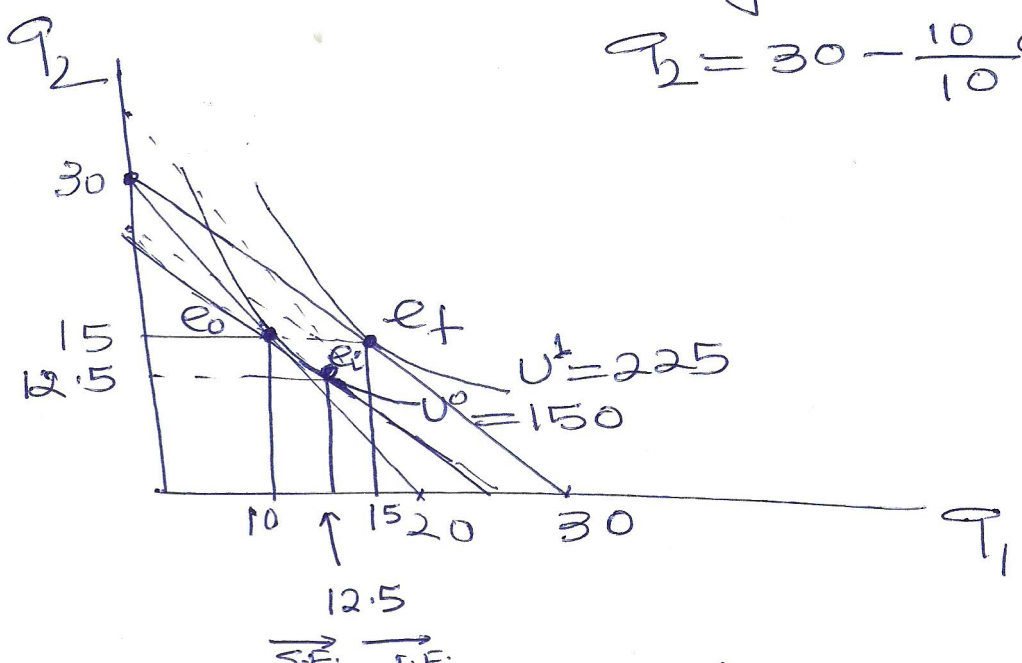
$$10q_2 = 300 - 15q_1$$

$$q_2 = 30 - \frac{15}{10}q_1 \quad \text{——— (1)}$$

q_2	q_1
30	0
0	20

New budget line

$$q_2 = 30 - \frac{10}{10}q_1$$



2.5 + 2.5 = 5 units

q_1 2.5 ~~S.E.~~ along the Original I.C. $U^0 = 150$

2.5 I.E Movement from U^0 to U^1