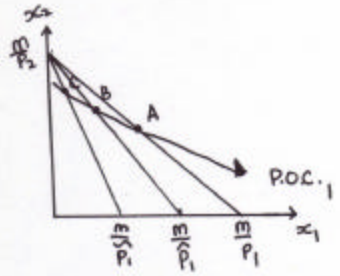
## Homework 3 (solutions)

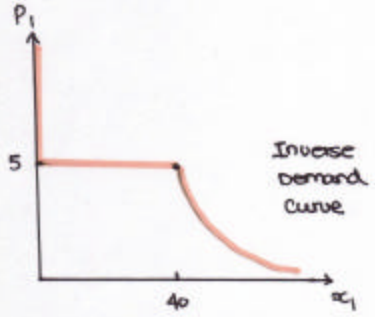
(1) If $P_1 \uparrow$ : $x_1 \downarrow$ (ordinary)

$x_2 \uparrow$ ($x_1$ and $x_2$ are substitutes)




$\tilde{P}_1 > \hat{P}_1 > P_1$

(2) $x_1 = \begin{cases} 0 & \text{if } P_1 > 5 \\ 0 \text{ or } 40 & \text{if } P_1 = 5 \\ \frac{200}{P_1} & \text{if } P_1 < 5 \end{cases}$



(3)

(a) $\frac{\partial x_1}{\partial m} = \frac{1}{P_1+4P_2} > 0$ Normal

$\frac{\partial x_2}{\partial m} = \frac{4}{P_1+4P_2} > 0$ Normal

(b) $\frac{\partial x_1}{\partial P_1} = -\frac{m}{(P_1+4P_2)^2} < 0$ Ordinary

$\frac{\partial x_2}{\partial P_2} = -\frac{16m}{(P_1+4P_2)^2} < 0$ Ordinary

(c) $\frac{\partial x_1}{\partial P_2} = \frac{\partial x_2}{\partial P_1} = -\frac{4m}{(P_1+4P_2)^2} < 0$ Complements.

(d) M : variable

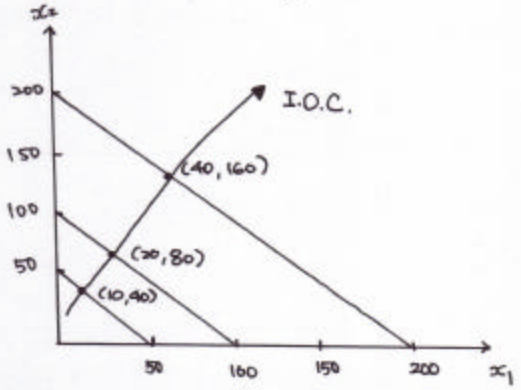
$P_1$, $P_2$ : constant.

Let $P_1 = P_2 = 1$

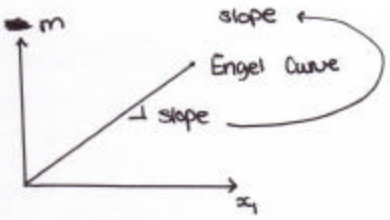
① If $M = 50$ : $x_1 = \frac{50}{(1)+4(1)} = 10$ ; $x_2 = 40$

② If $m = 100$ : $x_1 = 20$ ; $x_2 = 80$

③ If $m = 200$ : $x_1 = 40$ ; $x_2 = 160$



(e) $x_1 = \frac{m}{P_1 + 4P_2} \rightarrow (P_1 + 4P_2)\, x_1 = m$




(f) $P_2$ : variable

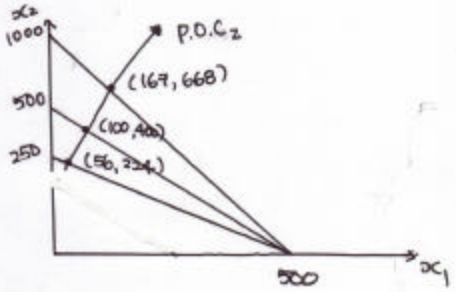
$m$, $P_1$ : fixed.

Let $P_1 = 1$, $m = 500$

① If $P_2 = 0.5$ ; $x_1 = \frac{500}{(1)+4(0.5)} = 167$ ; $x_2 = 668$

② If $P_2 = 1$ ; $x_1 = 100$ ; $x_2 = 400$

③ If $P_2 = 2$ ; $x_1 = 56$ ; $x_2 = 224$




(g) $x_1 = \frac{m}{P_1 + 4P_2}$

Inv. Demand Fcn →

$(P_1 + 4P_2)\, x_1 = m$

$P_1 x_1 + 4P_2 x_1 = m$

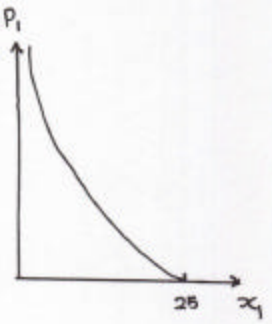
$P_1 x_1 = m - 4P_2 x_1$

$P_1 = \frac{m}{x_1} - 4P_2$

Let $m = 100$

$P_2 = 1$

$P_1 = \frac{100}{x_1} - 4$



(4)

(a) $\frac{\partial x_1}{\partial m} = \frac{2}{3P_1} > 0$ Normal

$\frac{\partial x_2}{\partial m} = \frac{1}{3P_2} > 0$ Normal

(b) $\frac{\partial x_1}{\partial P_1} = -\frac{2m}{3P_1^2} < 0$ Ordinary

$\frac{\partial x_2}{\partial P_2} = -\frac{m}{3P_2^2} < 0$ Ordinary

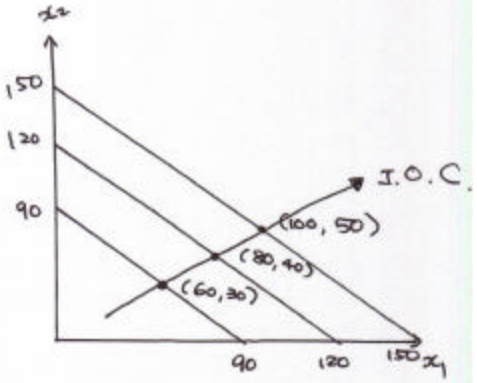
(c) $\frac{\partial x_1}{\partial P_2} = \frac{\partial x_2}{\partial P_1} = 0$ Neither

(d) $m$ : variable

$P_1, P_2$ : constant

Let $P_1 = P_2 = 1$

- If $m = 90$ : $x_1 = 60$ ; $x_2 = 30$
- If $m = 120$ : $x_1 = 80$ ; $x_2 = 40$
- If $m = 150$ : $x_1 = 100$ ; $x_2 = 50$




(e) $P_1$ : variable

$m, P_2$ : constant

Let $m = 90$, $P_2 = 1$

- If $P_1 = 1$ : $x_1 = 60$, $x_2 = 30$
- If $P_1 = 3$ : $x_1 = 20$, $x_2 = 30$
- If $P_1 = 5$ : $x_1 = 12$, $x_2 = 30$