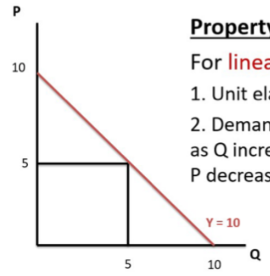
# HW2

## Linear function: slope v.s. elasticity

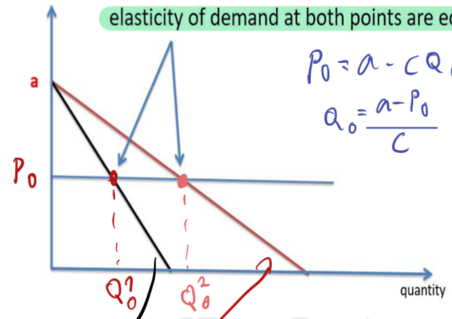



**Property:**

For linear demand curve:

1. Unit elasticity at the mid point.
2. Demand becomes more inelastic as Q increases, (correspondingly to P decreases)

point-PED is the same for 2 line




3. Fixing the same intercept, $a$

elasticity of demand at both points are equal!!

$P_0 = a - cQ_0$

$Q_0 = \frac{a - P_0}{c}$

$\frac{Q_0^2 - Q_0^1}{a - a} \times \frac{a}{Q_0^1}$

**Exercise 2.A:**

$p = a - cQ$ use $\frac{\Delta Q}{\Delta P} \times \frac{P_0}{Q_0}$

2.A.1) Given a demand function by $p = a - bQ$, derive the formula for the elasticity of demand, and show that the third property holds

& point PES

2.A.2) Given the market supply $p = c + dQ$ where $d \geq 0$, show that

(i) elasticity of supply is always greater than 1 if $c > 0$,

(ii) elasticity of supply is always eqaul to 1 if $c = 0$, Hint: use $\frac{\% \Delta Q_S}{\% \Delta P} = \frac{\frac{Q_1 - Q_0}{Q_0}}{\frac{P_1 - P_0}{P_0}}$

(iii) elasticity of supply is always less to 1 if $c < 0$.

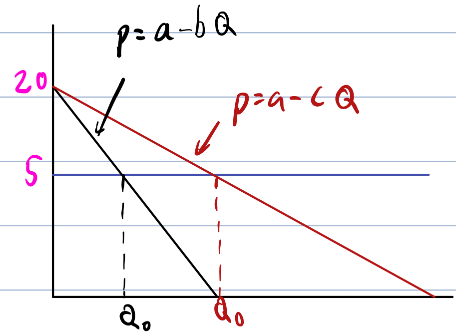
2 A.1) $P_0 = a - cQ_0$ $Q_0 = \frac{a - P_0}{c}$

$p = a - bQ$ for black line

$p = a - cQ$ for Red line

elasticity $= \frac{\Delta Q}{\Delta P} \times \frac{P_0}{Q_0}$ or $PED = \frac{1}{-b} \times \frac{P_0}{Q_0}$

same intercept → PEDs are equal




$$\frac{1}{-b} \times \frac{P_0}{Q_0^1} = \frac{1}{-c} \times \frac{P_0}{Q_0^2}$$

$$\frac{1}{-3} \times \frac{5}{5} = \frac{1}{-2} \times \frac{5}{7.5}$$

$$-\frac{1}{3} = -\frac{1}{3}$$

If assume $a = 20$ $p = 7$

| | |
|---|---|
| $p = a - bQ_0^1$ | $p = a - cQ_0^2$ |
| $5 = 20 - 3Q_0^1$ | $5 = 20 - 2Q_0^2$ |
| $Q_0^1 = 5$ | $Q_0^2 = 7.5$ |

∴ Since elasticity is how change in p affect change in q so at the same price level the elasticity will equal and even there are a different in slope but as other component are the same so the equation will adjust it self to make left hand side $= P_0$

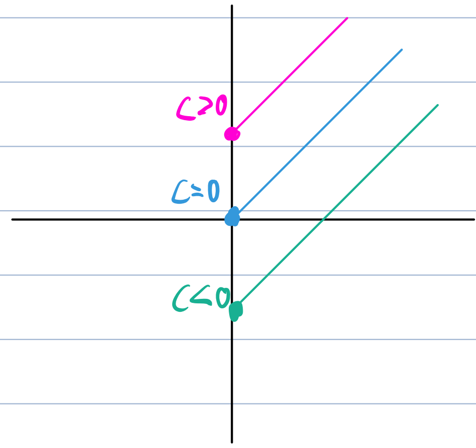
2.A.2) $p = c + dQ$

$$\frac{\Delta P}{\Delta Q} = d \rightarrow \frac{\Delta Q}{\Delta P} = \frac{1}{\frac{\Delta P}{\Delta Q}} = \frac{1}{d}$$

$$PED = \frac{\%\Delta Q^s}{\%\Delta P} = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

$$= \frac{1}{d}\left(\frac{c}{Q} + d\right)$$

$$= \frac{c}{dQ} + 1$$




d = slope always positive
Q = quantity always positive

(i) $c > 0$ $\quad \varepsilon^s_{Q,P} > 1$

d = slope always positive
Q = quantity always positive

assume $c = 0.1$

$$\frac{0.1}{d \cdot Q} + 1 \rightarrow \text{always} > 1$$

(ii) $c = 0$ $\quad \varepsilon^s_{Q,P} = 1$

$$\frac{0}{dQ} + 1 \rightarrow 0 + 1 = 1$$

(iii) $c < 0$ $\quad \varepsilon^s_{Q,P} < 1$ $\quad$ assume $c = -0.1$

$$-\frac{0.1}{dQ} + 1 \rightarrow \text{always} < 1$$