

Ec202 – Demand and Elasticity

Practice problem

Given a demand model:

$$Q_x = 5 - 3P_x - .5P_y + 2P_z + .03M$$

Where:

$P_y = \$10$, the price of good Y

$P_z = \$5$, the price of good Z

$M = \$1000$, the income of the buyer

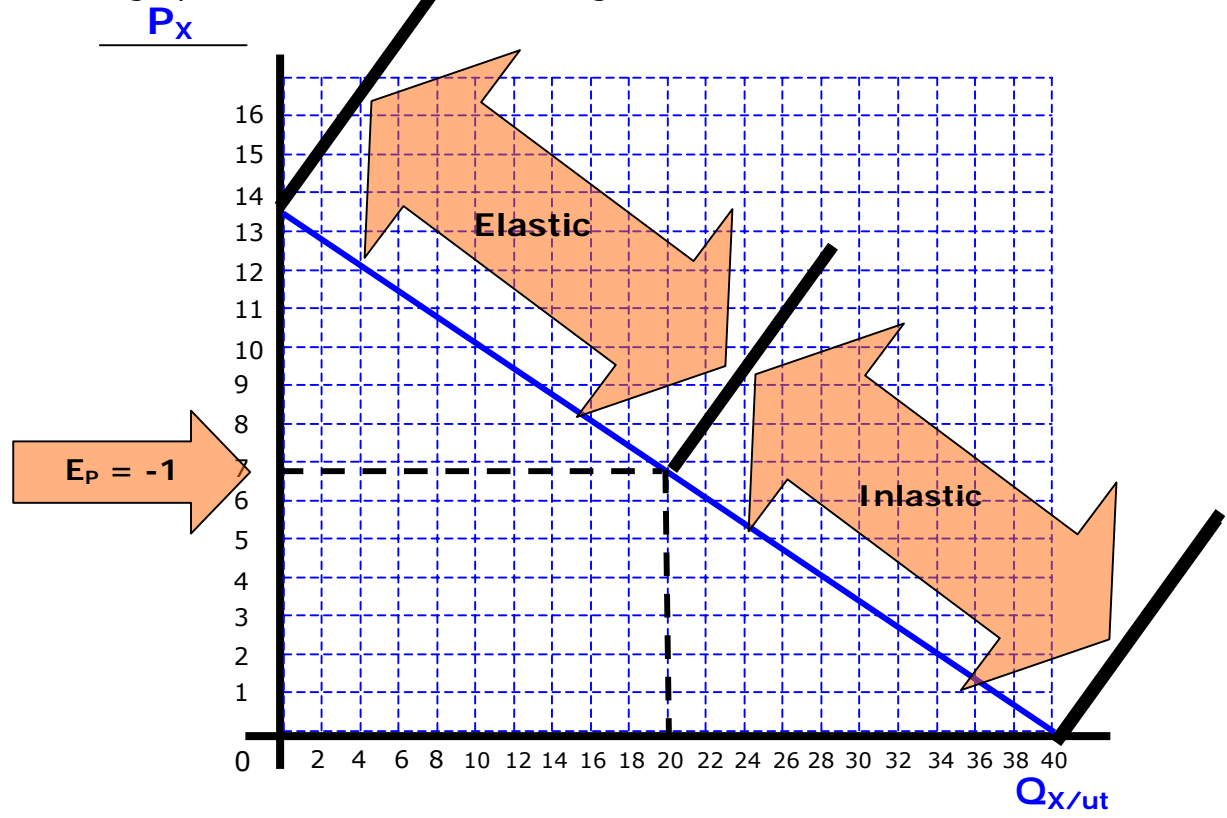
$$Q_x = 5 - 3P_x + .5(10) - 2(5) + .03(1000)$$

So,

$$Q_x = 40 - 3P_x$$

$$P_x = 13.33 - .33Q_x$$

- 1) Calculate and graph the demand function for good X.



- 2) Calculate the price elasticity of demand when $P_x = \$5$.

The slope $\left(\frac{\Delta Q_x}{\Delta P_x}\right)$ is -3

at $P_x = \$5$, $Q_x = 25$ units, $\left(\frac{P_x}{Q_x} = \frac{5}{25} = \frac{1}{5} = .2\right)$

$$E_p = \frac{\Delta Q_x}{\Delta P_x} * \frac{P_x}{Q_x} = (-3) * (.2) = -.6$$

3) Calculate the price elasticity of demand when $P_x = \$9$.

The slope $\left(\frac{\Delta Q_x}{\Delta P_x}\right)$ is -3

at $P_x = \$9$, $Q_x = 13$ units, $\left(\frac{P_x}{Q_x} = \frac{9}{13} = .692\right)$

$$E_p = \frac{\Delta Q_x}{\Delta P_x} * \frac{P_x}{Q_x} = (-3) * (.692) = -3.692$$

4) Identify and label the range on the demand function that is elastic. (inelastic). See graph

5) At what price is demand unitarily elastic?

**Using the midpoint approach: the Q intercept is 40, so half 40 is 20:
Q = 20. Half the P intercept (\$13.33) is \$6.67**

**Or by substituting 20 into $P = 13.33 - .33Q = 13.3 - .33(20) = 6.73$, so
P = \$6.70**

Notice the numbers are rounded off. The degree to which you round numbers will slightly alter your answer.

6) At what price (and quantity) will the TR be maximized given this demand?

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Notice the numbers are rounded off. The degree to which you round numbers will slightly alter your answer.

7) Calculate the income elasticity of demand when the price is \$9

Income elasticity is a measure of the percentage shift in demand "caused" by a percentage change in income (for an individual or a market).

$$E_M = \frac{\% \Delta Q}{\% \Delta M} = \frac{\Delta Q}{\Delta M} * \frac{M}{Q}$$

From the example, $Q_x = 5 - 3P_x - .5P_y + 2P_z + .03M$
M (income is \$1000), P_y (\$10) and P_z (\$5) are given. This makes the demand function, $Q_x = 40 - 3P_x$, if $P_x=9$, Q_x is 13 units.

$$E_p = \frac{\Delta Q}{\Delta M} * \frac{M}{Q} = (+.03) \frac{1000}{13} = + 2.308$$

- 8) Calculate the cross elasticity of demand of good X with respect to good Y when $P_x = \$9$ and $P_y = \$10$.

Cross elasticity measures the shift in the demand for one good given a change in the price of another.

$$E_{xy} \equiv \frac{\% \Delta Q_x}{\% \Delta P_y} = \frac{\Delta Q_x}{\Delta P_y} * \frac{P_y}{Q_x}$$

Given the information from above:

$$Q_x = 5 - 3P_x - .5P_y + 2P_y + .03M$$

M (income is \$1000), P_y (\$10) and P_z (\$5) are given. This makes the demand function, $Q_x = 40 - 3P_x$, if $P_x=9$, Q_x is 13 units.

$$E_{xy} = \frac{\Delta Q_x}{\Delta P_y} * \frac{P_y}{Q_x} = (-.5) \frac{10}{13} = -.385$$