Practice Problem Set 4

180.102 Elements of Microeconomics - TA Section 03

Pinda Wang, 20 September 2024

Part I. Elasticity

1. If Liam always uses 5% of his income to buy ice cream, what is his income elasticity of demand for ice cream? (Suppose the price of ice cream does not change.)
2. If demand is inelastic, how does seller's total revenue change when price rises? Give intuition for your answer.
3. Suppose the demand curve of a good is given by $P = a - bQ$, where P is price and Q is quantity demanded.
   (a) As P increases, how does the price elasticity of demand change?
   (b) At which point is demand elasticity equal to 2? Show your work. (Hint: use the mid-point method)

Solutions to Practice Problem Set 4

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Part I. Elasticity

1. The income elasticity of demand for ice cream equals 1. To see this, suppose Liam's income is x. He uses $0.05x$ to buy ice cream. Since the price of ice cream does not change, the quantity of ice cream he buys is proportional to his expenditure on ice cream. If Liam's income changes by $y\%$, the quantity of ice cream he buys also changes by $\frac{0.05x \times y\%}{0.05x} = y\%$. The income elasticity of demand, then, is 1.

2. Seller's total revenue increases when price rises. Intuition: when demand is inelastic, the seller "has the upper hand" – he can afford to rise price by a lot without buyers cutting their purchase by much. The effect of the price rise on revenue dominates.

3. (a) The price elasticity of demand increases. Notice that the demand elasticity $E_D = \frac{\Delta Q/Q}{\Delta P/P} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$. The demand curve is linear, so $\frac{\Delta Q}{\Delta P}$ remains fixed at $\frac{1}{b}$. As P increases, Q will fall, so $\frac{P}{Q}$ increases. Demand elasticity E_D increases.

   (b) With a demand elasticity of 2, we have $E_D = \frac{\Delta Q/Q}{\Delta P/P} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{1}{b} \times \frac{P}{Q} = 2$. We then get $\frac{P}{Q} = 2b \Rightarrow P = 2bQ$. Putting this together with the demand equation: $P = 2bQ = a - bQ$. Solving, we get $P = \frac{2a}{3},\ Q = \frac{a}{3b}$.