ENVIRON 805K Problem Set 1

Each sub-question is worth of 10 points.

1. Below is a demand schedule for goods A and B. Please derive the aggregate demand.

Price	A	B
0	9	6
1	6	5
2	4	3
4	2	1
5	0	0

2. Arc Elasticities: using the demand schedule in Q1, derive the price elasticity of demand for A, B and aggregate demand. Please derive the elasticities step by step not just the one between the first and last point.

3. If Winnie-the-Pooh's price elasticity of demand for honey is -0.25, how much would the quantity demanded fall if the price were to rise 10%?

4. Point Elasticities: suppose that the demand function for iPhone 6 is described by

$$Q = 4 - 2P + 2Y + 3P_a$$

In this form Q is quantity, P is iPhone price, Y is income and P_a is Android phone price. Assume that $P = 5, Y = 100, P_a = 4$. Please answer the following questions.

   (a) Trivial: What is the quantity demanded for iPhone 6?
   (b) Please derive the price, income and cross-price elasticities.
   (c) Please derive three elasticities under new parameters: $P = 4, Y = 200, P_a = 5$

5. Peter is working for a company with an annual salary at $70,000. Since Peter loves pizza and beer so much that he decides to start his own business that produces both goods. The estimated annual revenue is $200,000 and annual explicit expense is $90,000. He does not pay his own salary. He has $100,000 personal funds to start the business. The market annual interest rate is 2%. He uses his own second house for production. The annual rent is $20,000 on the market. Shall Peter start his own business? Explain.

6. A firm's short-run cost function is given by $TC = 20 + 5Q + 2Q^2$, please derive the firm's short-run marginal cost, average total cost, average fixed cost, average variable cost.

7. A firm's short-run cost function is given by $TC = 20 + 5Q + 2Q^2$. The firm faces a demand function given by $Q = 65 - P$. Please answer the following questions:

   (a) Derive the firm's inverse demand function.
   (b) Derive the firm's marginal revenue function.
   (c) Show demand curve and marginal revenue curve graphically.
   (d) What is the firm's optimal output?
   (e) Calculate the maximum profit that the firm can achieve.

8. In a perfectly competitive market, the demand function is $Q^d = 3 - P$ and the supply function is $Q^s = 2P$. Answer the following questions. Show your results both numerically and graphically.

   (a) What is the competitive equilibrium?

   (b) What is the consumer surplus?

   (c) What is the producer surplus?

   (d) If the government imposes a tax of $0.5 per unit, what are the new equilibrium quantity and price?

   (e) What are the consumer surplus and producer surplus with the above tax?

   (f) What is the deadweight loss caused by the above tax?

9. Suppose the cost function for the typical firm in a perfectly competitive market is $C(Q) = 25 - 4Q + Q^2$. Forty such firms in the market. Please answer the following question:

   (a) What is the firm's supply function?

   (b) What is the market supply function?

10. In a pure monopoly market, the demand function is $Q = 2 - 2P$ and the monopolist's cost function is $C = Q^2$. Answer the following questions both numerically and graphically.

   (a) What is the marginal cost and marginal revenue?

   (b) What is the equilibrium quantity and price under monopoly?

   (c) What is the maximum profit for the monopolist?

   (d) What are the consumer surplus and producer surplus?

   (e) What is the deadweight loss?