

CM 1021 Mathematical Methods for Computing I

Exercise Sheet 6

When answering these questions, work through the calculations involved rather than simply substituting numbers into the formulas developed in the lectures.

1. The supply (Q_S) and demand (Q_D) for a product are related to its price (P) by

$$Q_D = 8 - 2P$$

$$Q_S = 1 + P.$$

- (a) Find the equilibrium price P_E and quantity Q_E .

- (b) An excise tax t is applied to this product.

State the new supply equation which includes the tax t .

Find the equilibrium price $P_E(t)$ and quantity $E(t)$ as functions of t .

- (c) Find the value of the tax t which will result in the maximum tax yield being generated.

2. The demand and supply functions of a product are given by

$$P = -4Q_D + 120$$

$$P = \frac{1}{3}Q_S + 29.$$

- (a) Calculate the equilibrium price and quantity

- (b) Calculate the new equilibrium price and quantity after the imposition of a fixed excise tax of £13 per item. Who pays this tax?

3. The supply and demand functions for a product are

$$P = 2Q_S + 10$$

$$P = -5Q_D + 80$$

- (a) Find the equilibrium price and quantity.

- (b) If the government deducts as tax, 15% of the market price of each product, determine the new equilibrium price and quantity.

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4. Given the total revenue and total cost functions

$$TR = 4350Q - 13Q^2$$
$$TC = Q^3 - 5.5Q^2 + 150Q + 25000$$

Using Maple, find the breakeven points, the value of Q which maximises total revenue and the value of Q which maximises the profit function. On the same graph plot the total revenue, total cost and profit functions.

More Challenging Questions

5. The supply (Q_S) and demand (Q_D) for a product are related to its price (P) by

$$Q_D = 7 - P^2$$
$$Q_S = 1 + P.$$

- (a) Sketch the supply and demand curves.
- (b) Find the equilibrium price P_E and quantity E .
- (c) An excise tax t is applied to this product.
State the new supply equation which includes the tax t .
Find the equilibrium price $P_E(t)$ and quantity $E(t)$ as functions of t .
- (d) Find the value of the tax t which will result in the maximum tax yield being generated. (You will need to use Maple to find this value).