



Unit 05b: Mathematics 2 – (Math2)

Assignment – 1

1. The demand and the supply functions of a market are:

$$q^d = a - bp \quad \text{and} \quad q^s = c + dp$$

where a ,b ,c and d are positive real numbers.

- a. Show that the equilibrium price and the quantity are :

$$p_0 = \frac{a - c}{b + d} \quad ; \quad q_0 = \frac{ad + bc}{b + d} \quad (1 \text{ Mark})$$

- b. If an excise tax of  $t$  is imposed ,find the new equilibrium price  $p_1$  and quantity  $q_1$

( 2 Marks)

- c. Find the tax revenue and the value of  $t$  that maximises the tax revenue.

( 3 Marks)

- d. Show that the tax that maximises the tax revenue reduces sales by exactly half.(Hint: show that  $q_1 = \frac{1}{2} q_0$ )

( 4 Marks)

- e. The demand and the supply sets for a market are respectively:

$$p - q = 2 \quad \text{and} \quad 2p - 3q = -1$$

Find the price and the quantity at equilibrium when a purchase tax of  $t$  is imposed.

( 2 Marks)

2. Find the positive value of  $x$  at which the curves with equations  $y = 50 + 4x^2$  and  $y = x^4 + 5$  intersect. Produce a rough sketch of the curves. Find the area of the region with  $x > 0$  enclosed by these curves and the  $y$ -axis

( 8 Marks)

3. The point elasticity of demand for a good is given by  $\epsilon = 2$

Given that  $q^D(5) = 4$ , find the demand function  $q^D(p)$  .

( 5 Marks)

4. Suppose the demand function for a commodity is given by

$$q = \frac{p}{(p^2 + 8)^3}$$

Find the elasticity of demand in terms of  $p$ . Determine the value of  $p$  for which the demand is elastic.

**( 5 Marks)**

5. Expand as a power series, the functions:

a.  $f(x) = \ln\left(\frac{1+2x}{1+x}\right)$  in terms up to  $x^4$

b.  $f(x) = \frac{e^{2x}}{1-x}$  in terms up to  $x^3$

c.  $f(x) = \sin(x^2 - x)$  in terms up to  $x^5$

d.  $f(x) = \sqrt{\frac{1+x}{1-x}}$  in terms up to  $x^3$

by taking a suitable value for  $x$ , find  $\sqrt{11}$ .

**( 10 Marks)**

6. The demand equation for a good is  $p = 113 - q^2$  and the supply equation is  $p - q^2 - 2q = 1$ . Calculate the consumer surplus and the producer surplus at equilibrium.

**( 5 Marks)**

7.

Suppose the supply and demand functions for a good are, respectively,

$$q^S(p) = 5p - 2, \quad q^D(p) = 12 - 2p.$$

Determine the equilibrium price and quantity. A percentage sales tax of  $100r\%$  is imposed. (So, when a consumer buys one unit of the good at a price  $p$ , an amount  $rp$  is tax.) Find the new equilibrium price and quantity. Find also an expression for the amount of tax revenue.

**( 5 Marks)**

**END of QUESTIONS**