(mathematics) $\sqrt{\ }$ inEconomics

Mathematical Methods in Economics: Problems and Solutions

Chapter 1

Problems on Equations and Functions I

1.1 The demand function for a good is defined by the following equation where q_d represents quantity demanded (units) and *p* represents market price (€).

$$q_d = 48 - 4p$$

(i) How many units of this good will consumers demand at each price given below?

p	0	3	6	8	12

(ii) What would consumers' total expenditure be at each price in (i)?

(iii) Find *p* in terms of q_d and represent this equation graphically. What term do economists use to describe the graph of this equation?

1.2 The supply function for a good is defined by the following equation where q_s represents quantity supplied, and *p*, market price.

$$q_s = f(p) = a + bp$$

(i) What information is given by the notation $f(p)$? Why is it not necessary to include this notation when defining the demand function in question 1.1?

(ii) Find $f(0)$, $f(4)$ and $f(d)$.

(iii) Find *p* in terms of q_s.

(iv) Draw the graph of the equation in (iii) on the assumptions that $a < 0$ and $b > 0$. What term do economists use to describe this graph?

1.3 A consumption function takes the following form where *C* represents consumers' expenditure and *Y* represents national income.

$$C = c(Y) = 100 + 0.8Y$$

(i) How much will consumers spend at each level of national income given in the table?

Y	200	201	250	275	336	480

(ii) Find $c(0)$, $c(120)$, $c(345)$ and $c(m)$. What does $c(0)$ represent in this model?

(iii) Saving (*S*) by consumers is defined as $S = Y - C$. The savings function expresses *S* in terms of *Y*. Find this function.

(iv) Draw the graph of the consumption function and savings function on the same diagram.

(v) Find $\frac{\Delta C}{\Delta Y}$ for the sequence of *Y* values given in (i). What does this difference quotient represent?

1.4 A short-run production function takes the form:

$$q = q(L) = 6L^{\frac{1}{2}}$$

where q = output
L = labour input

(i) How much output will be produced by a firm that employs each of the following quantities of labour?

Labour input					
0	1	4	9	25	100

(ii) Find $\frac{\Delta q}{\Delta L}$ for the sequence of values of L given in (i). What does this difference quotient represent?

(iii) Represent $q(L)$ graphically. What name is used in economics for this graph?

1.5 A firm has a long-run production function that takes the following form where q represents output, L represents labour input and K represents capital input.

$$q = f(L,K) = 20L^{0.5}K^{0.5}$$

(i) Find the level of output that will result from the use of each of the following combinations of inputs.

L	K
0	4
1	4
4	4
9	4
16	4
18	8
36	9
27	12

(ii) Find $f(0,0)$, $f(7,28)$, $f(a,b)$ and $f(L_0,K_0)$.

(iii) Use information obtained in (i) to draw the graph of the relationship between q and L when 4 units of capital are used. What term is used in economics to describe this graph?

(iv) Find the expression giving L in terms of K when $q = 120$.

(v) Find six different combinations of capital and labour that the firm could employ to produce 120 units of output *efficiently*.

(vi) Use the values obtained in (v) to draw the graph of the relationship between L and K when $q = 120$. What term is used in economics to describe this graph?