



EE 320 Introductory Mathematical Economics (Section 046402)

Semester 1/2013

**Homework 4**

Due 29 October 2013

*There are four questions in total. Each of them is worth 4 points.*

1. Suppose that Mr. Pai's utility depends on two commodities:  $x_1$  and  $x_2$ . His utility function is given by

$$U = 25x_1 + 27x_2 - 3x_1^2 - 7x_1x_2 - 4x_2^2$$

- (a) Determine the marginal utility function of each commodity.
- (b) Find the marginal rate of substitution (MRS) between the two commodities when  $x_1 = 2$  and  $x_2 = 1$ .

2. Write the Hessian matrix for each of the following functions:

(a)  $U(x, y) = 6x^2 + 5xy + 9y^2$

(b)  $z(x, y) = 3(11x - 6y)^2$

3. Find the total differentials for the following functions:

(a)  $z = 4x^3 - 13xy - 6y^5$

(b)  $z = (2x^2 - y)(3x - 4y^3)$

$$(c) z = \frac{7y^3}{(5x-2y)}$$

$$(d) z = 8x^{\frac{1}{2}}z^{\frac{1}{4}}w^{\frac{1}{4}}$$

4. Given the equation for the production isoquant

$$18[0.2K^{-0.4} + 0.8L^{-0.4}]^{-2.5} = 1936$$

Use the implicit function rule to find the marginal rate of technical substitution (MRTS) of L for K.

5. Let the demand for a commodity be

$$Q_d = D(P, Y_0, t_0), \quad \frac{\partial D}{\partial P} < 0; \frac{\partial D}{\partial Y_0} > 0; \frac{\partial D}{\partial t_0} > 0$$

$$Q_s = S(P, T_0), \quad \frac{\partial S}{\partial P} > 0; \frac{\partial S}{\partial T_0} > 0$$

Where  $P$  is the price,  $Y_0$  is the consumer's income,  $t_0$  is the taste for the commodity and  $T_0$  is the tax on the commodity. All derivatives are continuous. Find  $\frac{\partial P^*}{\partial t_0}$ ,  $\frac{\partial P^*}{\partial T_0}$ ,  $\frac{\partial Q^*}{\partial Y_0}$ , and  $\frac{\partial Q^*}{\partial T_0}$ . Discuss their economic implications.