Course Code : MATH 1101   Course Title: Fundamentals of Mathematical Economics

Time: 2.5 Hours   Full Marks: 50

Answer any __FIVE__ of the following questions. All parts of a question must be answered sequentially. Figures in the right margin indicate full marks.

1.(a) Consider the following market models: 10
   1. $Q_d = 18 - 2P$
      $Q_s = -2 + 3P$
   2. $Q_{d1} = 18 - 2P_1 + P_2$ $Q_{d2} = 20 + P_1 - P_2$
      $Q_{s1} = -2 + 3P_1$ $Q_{s2} = -1 + 2P_2$

   Are the models complete for solution?
i)   Compute the equilibrium prices and quantities.
ii) Suppose the government imposes a tax of Tk.6.00 per unit of output. What will be the
iii) impact on the model? Find the new supply function for both the models.

2. a) What is the difference between partial and general equilibrium market model?   2
    b) Given the following model: 8
        $Y = C + I_0 + G_0$
        $C = 25 + 6Y^{1/2}$
        $I_0 = 16$
        $G_0 = 14$

    i)   How many endogenous and exogenous variables are there?
    ii) Find the equilibrium values of Y and C.
    iii) Are the results meaningful?

3.   Consider the following function: 10
        $y = f(x) = 4x^2 + 9$
    i)   Find the difference quotient as a function of x_0 and Δx. Does $\Delta y / \Delta x$ vary with Δx?
    ii) Find the derivative dy/dx and calculate $f'(6)$.

4. a) "The derivative dy/dx is nothing but the slope of a curve as $\Delta x \rightarrow 0$"- Explain.   2
    b) Differentiate the following functions: 8
        i) $y = (9x^2 - 2)(3x + 1)$
        ii) $y = \log_7 7x^2$
        iii) $y = 5e^{2-x^2}$
        iv) $y = \dfrac{ax^2 + b}{cx + d}$

5. a) Partially differentiate the following if the utility function of an individual takes the   5
form as follows:

     i) $f(u, v) = \dfrac{2u - 3v}{u + v}$

     ii) $f(p, q) = 2p^3 - 11p^2q + 3q^2$

  b) $U = U(x_1, x_2) = (x_1 + 2)^3(x_2 + 3)^2$ 5

    Where U is total utility and x_1 and x_2 are the quantities of two commodities consumed.

     i)   Find MU_1 and MU_2.

     ii)   Find the value of MU_1 when 6 units of each commodity are consumed.

6. a) Find the total derivatives: 5

     i) $z = 4x^2 - 3xy + 2y^2$, where $x = y^{-1}$

     ii) $z = 7u + vt$, where $u = 2t^2$ and $v = t + 1$

  b)   Use the rules of differentials to find dy from the following function: 5

$$y = \frac{2x_1x_2}{x_1 + x_2}$$

7. i)   Given the demand function $Q_x = 100 - 2P_x + 3P_y + \sqrt{M}$, where $P_x = 25$, $P_y = 20$, and   10
       $M = 81$

  ii)   Calculate the demand for x at the given prices and income.

  iii) . Determine the own price, the cross price and the income elasticities of demand.
       Comment on the elasticity coefficients in Part (ii).