Econ 303 - Intermediate Microeconomic Theory
College of William and Mary
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March 28, 2014

Midterm 2

You have until 1:50pm to complete the exam, be certain to use your time wisely. Answer all questions directly on the exam. You must show all of your work to receive full credit. Calculators may be used although you may leave answers as fractions. Unless a problem says otherwise, you can assume that firms can use fractions of units of inputs and produce fractions of units of output. Remember to put your name on the exam. Good luck!

Name:

1. (30 points) A firm uses wood (W) and metal (M) to make desks (D). Wood can be used in place of metal and metal can be used in place of wood. The marginal product of a sheet of wood is constant and equal to 10 (one sheet of wood produces 10 desks). The marginal product of a sheet of metal is constant and equal to 20 (one sheet of metal produces 20 desks).
   (a) Write down a production function for the firm giving the number of desks they can produce as a function of the sheets of metal and wood used ($f(M, W)$).
   (b) Given your production function from part (a), determine whether the firm's technology exhibits increasing, decreasing or constant returns to scale. Be certain to fully justify your answer.
   (c) Graph the isoquants for the firm corresponding to output levels of 20, 40, and 80 desks. Label all slopes and intercepts with numerical values if possible.
   (d) Suppose that the price of a sheet of wood is \$100 and the price of a sheet of metal is \$150. Find an expression for the firm's minimum costs of producing D desks ($C(D)$). Be certain to clearly show how you arrived at your answer.

2. (20 points) Suppose that demand for apartments in Williamsburg is perfectly inelastic; everyone needs a place to live so they will pay whatever they need to for an apartment. The supply of apartments is not perfectly inelastic. If rents are higher, more apartments will be built and rented out. If rents are low, some apartments will be converted to other uses and no longer rented out. The supply curve for apartments is linear.

   (a) Suppose that the rental market is in equilibrium and the current market rent is $900 with 100 apartments being rented out. Graph the supply and demand curves for apartments and show this equilibrium on the graph.

   (b) Landlords lobby the City of Wililamsburg to start controlling rents. They claim they cannot make enough money to survive and therefore need higher rents. The lobbying efforts succeed and the city imposes a rent floor of $950, meaning that no rent can be set below $950. Rents can be set higher than that. Show the effects of this rent floor on the equilibrium rent and number of apartments rented in Williamsburg on your graph. Label all relevant points with numerical values if possible.

   (c) Calculate the change in consumer surplus, change in producer surplus and the deadweight loss created by the rent floor.

3. (30 points) A printer operating in a perfectly competitive industry faces the following total cost function for producing books:

$$C(B) = B^2 + 10B \tag{1}$$

where B is the number of books that the printer produces. Given this cost function, the marginal cost of producing a book is given by:

$$MC(B) = 2B + 10 \tag{2}$$

   (a) Find expressions for the firm's average cost curve ($AC(B)$) and average variable cost curve ($AVC(B)$). Graph these curves along with the marginal cost curve. Label all intercepts and slopes with numerical values if possible.

   (b) What is the price at which the firm would shut down?

   (c) Suppose that the market price is \$100. Determine the quantity of books the firm will decide to produce.

   (d) Find an expression giving the firm's profits as a function of the market price ($\pi(p)$). Your expression should only contain price and numerical constants.

4. (20 points) A mattress manufacturer has three different factories. Two of the factories, factory A and factory B, are older and have the following costs functions:

$$C_A(M_A) = 10M_A^2 \tag{3}$$

$$C_B(M_B) = 10M_B^2 \tag{4}$$

where $C_A(M_A)$ is the total cost of producing M_A mattresses at factory A and $C_B(M_B)$ is the total cost of producing M_B mattresses at factory B. The third factory, factory C, uses a different technology and has constant marginal costs of \$100 per mattress, leading to the following total cost function:

$$C_C(M_C) = 100M_C \tag{5}$$

   (a) Graph the marginal cost curves for all three factories, using a separate graph for each.

   (b) Suppose that the mattress manufacturer wants to produce 20 mattresses. How many mattresses will the manufacturer produce at each factory? Be certain to show work to justify your answer.

   (c) Find the total costs of the manufacturer for producing M mattresses ($C(M)$) assuming the manufacturer optimally distributes production across its factories.