

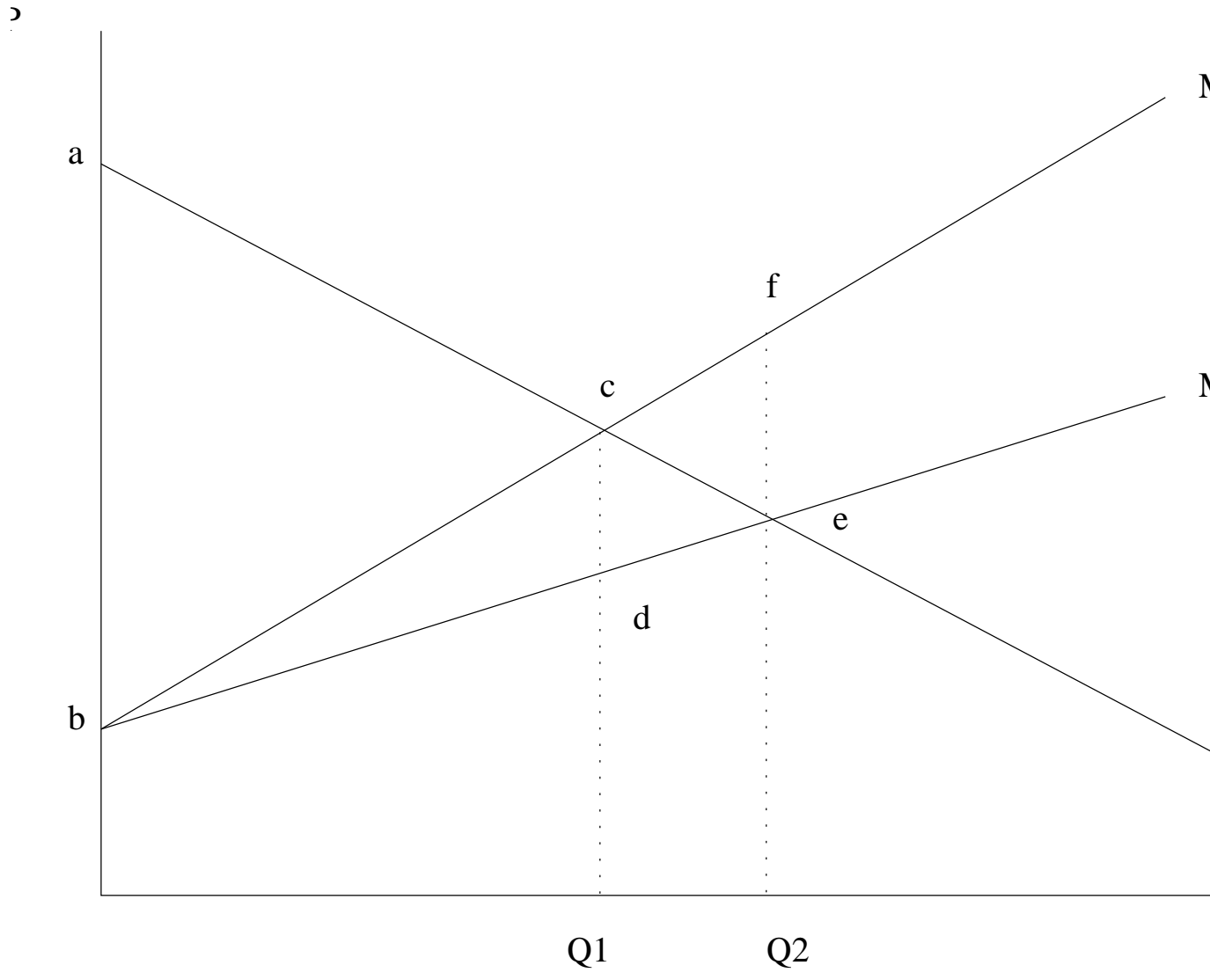
Problem Set 2

Introduction to Environmental and Resource Economics, October 3, 2004

Due Oct. 12

(Some questions from Dr. Nora Underwood; some from Dr. Parker)

1. In your own words, define the term “externality”. Give an example of two things that you do every day that generate negative externalities. Give two examples of ways in which you generate positive externalities. What do you think would induce you to do more or less of each? Why?
2. The included graph represents the market for a good whose production generates external costs. Use the graph and points marked to answer the following questions:
 - (a) Explain the difference between the marginal private cost and marginal social cost curves.
 - (b) Identify the competitive market solution
 - (c) Identify the socially optimal solution
 - (d) Moving from Q_2 to Q_1 , what does area cde represent?
 - (e) Moving from Q_2 to Q_1 , what does area $cdef$ represent?
 - (f) Which area represents the net gain to society in moving from the market solution to the socially optimal solution? Is this movement Pareto improving? Does it meet the Kaldor-Hicks criteria?
 - (g) Referring to your graph, use this example to explain why the competitive market solution is not economically efficient when exclusivity is violated.



3. Consider the market for cookies. At the market solution, bakers produce cookies at a private marginal cost of 5 cents per cookie. However, production of each cookie generates external benefits from the pleasant aroma for passers-by equal to 2 cents per cookie.
- Draw a plausible demand curve for cookies, the private marginal cost curve (assuming no fixed costs), and the social marginal benefit curve.
 - In the competitive solution, identify all of the social gains from cookie production. Use letters to represent the areas on your graph, as in problem 2. (Hint: There are three types of benefits.)
 - In the case of a positive externality, is there likely to be overproduction of cookies or underproduction? Explain.
4. Suppose that you own a house along a river and like to swim and fish in the river every day after work. Suppose further that several factories open upriver from your house and begin to dump waste into the river.

The factory faces the following demand curve for its product:

$$P = 300 - 6Q$$

and the factory's marginal cost curve is:

$$P = 30 + \frac{3}{2}Q$$

- Assuming a perfectly competitive market with no policy interventions, what level of output will the factory supply, and what will be the price? What are the values for consumer surplus, producer surplus, and total surplus?
- Suppose that the pollution being dumped in the river is giving you a rash, and you are catching fish with more than two eyes. A highly-paid consulting firm estimates that these events impose a marginal cost to you represented by:

$$MEC = \frac{3}{2}Q$$

and a total external cost of:

$$TEC = \frac{3}{4}Q^2$$

What is the socially optimal level of output for the factory? What would be the price at this level of output?

- What are the values of consumer and producer surplus? (note: a little tricky in this case).
- In terms of only consumer and producer surplus, does the move from the competitive to socially optimal solution improve welfare?

- (e) What are the total external costs for both the competitive market and socially optimal solutions? (note: again, a little tricky in this case). Why isn't the total external cost zero at the socially optimal solution?
 - (f) Using the information from the previous two questions, calculate the net gain to society (improvement in total welfare) from moving from the competitive solution to the social optimum.
 - (g) Graph the problem, labeling each level of output and price and indicating which area represents the net gain from moving to the social optimum.
 - (h) For this problem, what happens to externality damage as the firm's output increases? Can you think of any real-world examples where externalities might have this characteristic?
5. Read the two editorials about HOT traffic lanes, and discuss the HOT proposal using externality theory. Analyze three possible scenarios: the status quo (HOV lanes for carpool and mass transit only), HOV lanes with no congestion tolls, and HOV lanes with congestion tolls. In each case, what costs and benefits are generated? Who pays the costs and benefits? How might we try to evaluate whether the costs and benefits of each proposal would justify its implementation? How might the answer depend on specific conditions? How might the behavior of the different groups of users change in the different scenarios? *Note:* This is a very complicated question with no simple answers! So there is certainly no one correct answer.