ECON 001
Fall 2016
Midterm 2
November 2, 2016
Time Limit: 60 Minutes

Name (Print): _____

Recitation Section: _____

Name of TA: _____

- This exam contains 8 pages (including this cover page) and 10 questions. Check to see if any pages are missing.
- The exam is scheduled for 1 hour.
- This is a closed-book, closed-note exam, no calculator exam.
- Answer the multiple choice questions by circling the correct answer. Make sure that your answer is clearly circled or it will be marked incorrect.
- Write your answers to the other questions in the spaces provided below them. If you don't have enough space, continue on the back of the page and state clearly that you have done so.
- Do not remove any pages or add any pages. No additional paper is supplied
- Show your work when applicable. Use diagrams where appropriate and label all diagrams carefully.
- You must use a pen instead of a pencil to be eligible for remarking.
- This exam is given under the rules of Penn's Honor system.

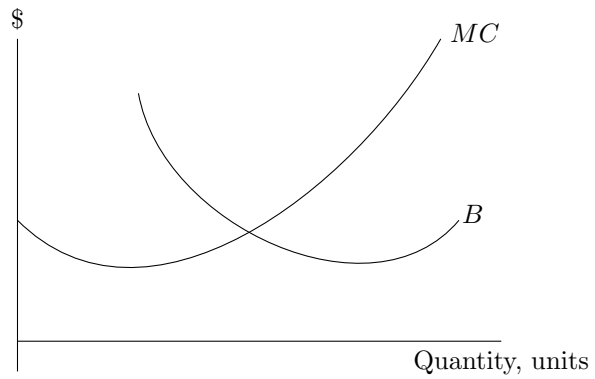
My signature certifies that I have complied with the University of Pennsylvania's Code of Academic Integrity in completing this examination.

Please sign here _____ Date _____

Question	Maximum	Grade
MC (Q1-8)	35	
1st SA (Q9)	40	
2nd SA (Q10)	25	
Total	100	

Multiple Choice Questions (best 7 out of 8: 35 points)

1. (5 points) Curve MC in the following graph represents a firm's marginal cost. Curve B accurately represents:



   A. Average total cost
   B. Average fixed cost
   C. Average variable cost
   D. None of the above

   Solution: D

2. (5 points) Consider a natural monopoly that can be regulated with two different policies: Marginal Cost Pricing and Average Cost Pricing. Which of the following is correct?
   A. Both policies yield the efficient output.
   B. Producer surplus is higher under Average Cost Pricing than under Marginal Cost Pricing
   C. Consumer surplus is higher under Average Cost Pricing than under Marginal Cost Pricing
   D. Total surplus is higher under Average Cost Pricing than under Marginal Cost Pricing

   Solution: B

3. (5 points) A single-price monopolist facing a linear downward sloping demand is initially producing the profit-maximizing output. If the government forces the firm to produce the efficient output, which of the following consequences is correct?
   A. The price elasticity of demand increases
   B. The price elasticity of demand stays the same
   C. The price elasticity of demand decreases
   D. Not enough information

Solution: C

4. (5 points) For which of the following firms is it possible to be producing in the upward sloping part of its average total cost curve?

   I. A monopolistically competitive firm in the long run equilibrium

   II. A profit-maximizing monopolist

   A. I

   B. II

   C. I and II

   D. neither I nor II

Solution: B

5. (5 points) A given firm faces a cost schedule according to this following information: $TC = 188 + 21q + 40q^2$. Given the TC alone, what is the lowest price at which the firm is still willing to operate (stay open) in the short-run?

   A. 80

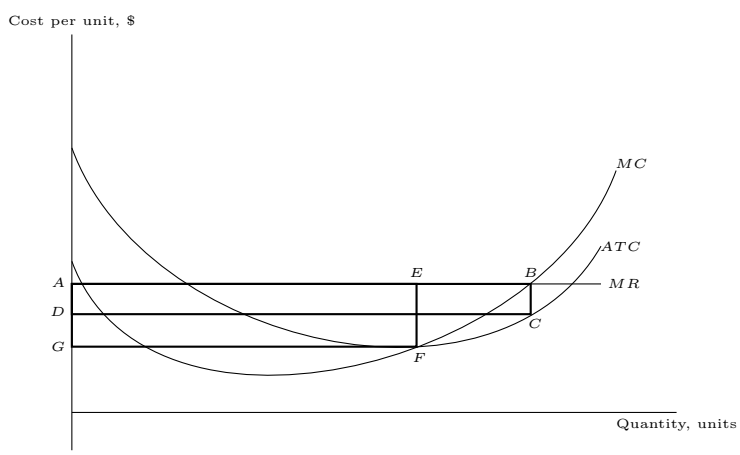
   B. 21

   C. 40

   D. 20

Solution: B

6. (5 points) Consider a firm facing the cost curves and marginal revenue (MR) as below. *Note: Picture Not Drawn to Scale.*



Which of the following is the correct relationship between rectangle $ABCD$ and rectangle $AEFG$?

   A. area $ABCD >$ area $AEFG$

   B. area $ABCD <$ area $AEFG$

C. area $ABCD$ = area $AEFG$

D. Not enough information

Solution: A

7. (5 points) An increase in a monopolist's average total cost will lead to:

   A. An increase in price only if marginal cost also increases.

   B. An increase in price by the same amount, as the monopolist passes the cost increase on to consumers.

   C. A decrease in price, as the monopolist needs to sell more in order to cover the increased costs.

   D. An increase in price only if the elasticity of demand is less than 1.

Solution: A

8. (5 points) A Pigouvian subsidy is:

   A. appropriate when the marginal social cost is above the marginal private cost.

   B. designed to discourage activities generating externalities.

   C. designed to encourage activities generating external benefits.

   D. appropriate when the marginal social cost and the marginal social benefit intersect at an inefficient level.

Solution: C

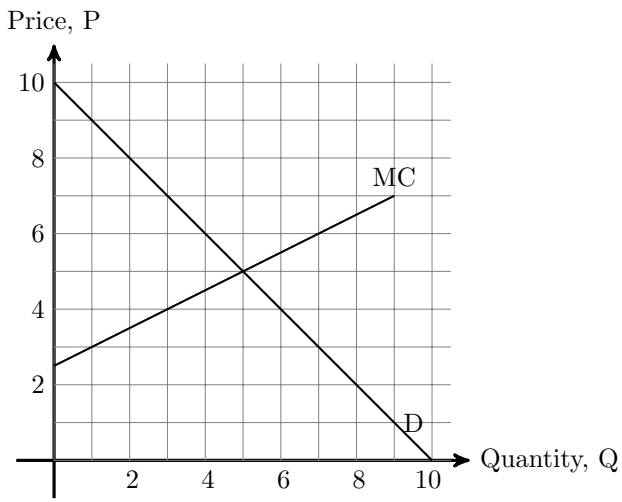
Short Answer Questions (65 points total)

9. Consider the market for tires. This industry is currently a monopoly. The market demand is $P = 10 - Q$ and the monopoly's marginal cost is $MC = 2.5 + 0.5Q$.

   (a) Find the price P_M and quantity Q_M produced by the profit-maximizing monopolist. Show your work.

   Solution: $MR = 10 - 2Q$, so $MR = MC \Leftrightarrow 10 - 2Q = 2.5 + 0.5Q \Rightarrow Q_M = 3$. Therefore, $P_M = 7$.

   (b) Calculate the deadweight loss created by the monopoly and show the area in the graph below.



Solution: $DWL = (7-4) \times (5-3) \times 0.5 = 3$. The DWL is the triangle below demand and above MC, between $Q_M = 3$ and $Q^* = 5$.

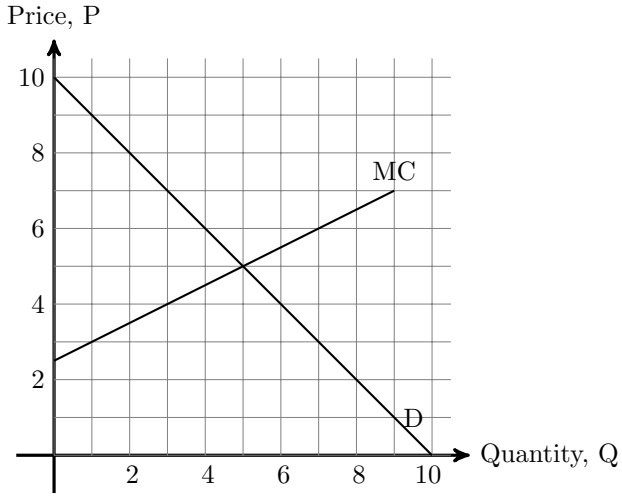
(c) If the firm's goal was not to maximize profit but to maximize its total revenue instead, what would be the quantity produced and the price charged by the monopolist?

Solution: The output would be 5, the price would be \$5.

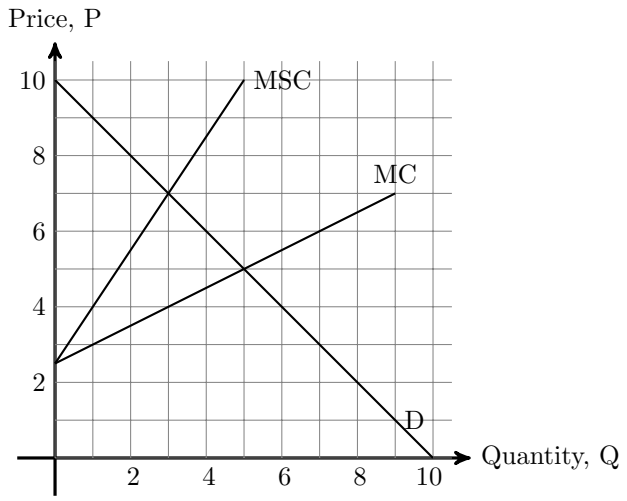
In all subsequent questions, assume that the monopolist is profit-maximizing.

Upon closer examination, a lot of pollution is being created by the production of tires. The marginal external harm depends on the quantity produced: External Cost $= Q$.

(d) Write the equation of the Marginal Social Cost MSC (the marginal cost to society that includes the external cost), and draw it on the graph below.



Solution: $MSC = MPC +$ external cost $= 2.5 + 0.5Q + Q = 2.5 + 1.5Q$



(e) Given this knowledge about pollution, what are the efficient quantity Q_e and price P_e? How do these compare with your answers in part (a)? Explain.

> **Solution:** $Q_e = 3$, $P_e = 7$. These are the same as the quantity and price found in part (a). The monopolist creates an inefficiency (because of underproduction) that is compensated by the inefficiency created by the externality (because of overproduction), so they cancel out each other.

(f) One possible solution to the problem of negative externalities is a corrective (Pigouvian) tax. If you were hired by the government to restore efficiency, what amount of tax per unit would you recommend? Explain.

> **Solution:** The quantity produced by the monopolist is the socially efficient quantity so there should be no tax ($t = 0$).

(g) If the monopolist was perfectly price discriminating, how would your answer to (f) change? Explain.

> **Solution:** With perfect price discrimination the monopolist produces the quantity where demand and MC intersect, which is more than the socially efficient quantity. So the tax should be equal to 3 (= the external cost at the efficient quantity).

10. Ronald, Amy, and Sharon are neighbors who are deciding on how many street lights to install in their neighborhood. Suppose that street lights are a public good. Furthermore, suppose that the cost of installing each street light is \$200, and that no one receives any benefit when there are no street lights installed. The ***total benefits*** for each resident are given in the table below.

Number of Street Lights	Ronald's *Total Benefit*	Amy's *Total Benefit*	Sharon's *Total Benefit*
1	170	180	250
2	320	250	430
3	420	280	500
4	490	300	560

Ronald has an income of \$1000, Amy has an income of \$900, and Sharon has an income of \$500.

(a) What is the socially optimal number of street lights? Explain.

Solution: We can find the *Marginal Benefits* of each neighbor:

Number of Street Lights	Ronald's *MB*	Amy's *MB*	Sharon's *MB*	Social *MB*
1	170	180	250	600
2	150	70	180	400
3	100	30	70	200
4	70	20	60	150

Socially optimal number is 3, such that total social marginal benefit is equal to $MC = 200$.

The neighbors are trying to find a way to pay for the installation of the socially optimal number of street lights. Each of them has a different proposal.

(b) Ronald proposes a flat tax – a fixed amount T paid by each neighbor. What is the minimal tax per person T required to build the socially optimal number of street lights? Who will and who will not agree to pay such a tax? Why?

Solution: Tax=\$200. All neighbors will support it: each pays an amount lower than his/her income, and their total benefit from 3 street lights is higher than the tax: For Ronald: $420 > 200$; for Amy: $280 > 200$, for Sharon: $500 > 200$.

(c) Sharon proposes that each neighbor pays a 25% income tax. Will the tax revenue cover the cost of the socially optimal number of street lights? Who will and who will not agree to pay such a tax? Why?

Solution: Ronald would pay $0.25 \times 1000 = 250$ which is less than his benefit 420 and less than his income so Ronald would support the tax; Amy would pay $0.25 \times 900 = 225$ which is less than her benefit 280 and less than her income so Amy would support the tax; Sharon would pay $0.25 \times 500 = 125$ which is less than her benefit 500 and less than her income so Sharon would support the tax. The revenue from the tax would be $250 + 225 + 125\$600$ so the tax revenue would be just enough to cover the cost of the socially optimal number of lights.

(d) Amy proposes that each neighbor pays a percentage tax $X\%$ of the *total benefit* he / she gets from the socially optimal number of street lights. What is the minimum percentage $X\%$ that generates enough revenue to cover the cost of the socially optimal number of street lights? Who will and who will not agree to pay such a tax? Why?

Solution: The total social benefit from 3 street lights is $420 + 280 + 500 = \$1200$, and the total cost of 3 street lights is \$600, so the minimum tax to finance must be 50%. All would agree since the 50% of each neighbor's total benefit is less than his/her total benefit, and less than his/her income.

Julie is moving into the neighborhood. Her income is \$800 and the ***total benefit*** that she receives from each street light is given in the table below.

Number of Street Lights	Julie's *Total Benefit*
1	75
2	140
3	200
4	250

(e) After determining the new socially optimal number of street lights, find which of the three proposals (from parts b, c and d) Julie prefers.

Solution:

Number of Street Lights	R's *MB*	A's *MB*	S's *MB*	Julie's *MB*	Social *MB*
1	170	180	250	75	675
2	150	70	180	65	465
3	100	30	70	60	260
4	70	20	60	50	200

The new socially optimal number of street lights is Q=4. Julie must pay \$200 with Ronald's proposal, $0.25 \times \$800 = \$200$ with Sharon's proposal, and $0.5 \times \$250 = \$125$ with Amy's proposal. So Julie prefers Amy's proposal.