

Exam 1
Spring 2010

VERSION G

Instructions

1. Write your SU ID ****NUMBER**** and the exam ****VERSION**** letter above on your blue book. Please **DO NOT** write your name.
2. Do not open the exam until you are told to do so.
3. Please turn off the ringer on your phone right now – before the exam begins.
4. If you are wearing a baseball cap, please remove it or turn it backward.
5. **SHOW ALL YOUR WORK.** Numerical answers without supporting work will receive little or no credit.
6. You have 80 minutes to work on the exam. There are 75 points possible; please budget your time accordingly. Also note that many of the questions have (a), (b), etc., inserted into the text to help you avoid overlooking part of the answer.
7. Collaboration of any kind on the exam is not allowed. *Use of phones or other wireless devices at any time during the exam will be presumed to be collaboration – so don't do it.* Cheating of any kind will result in an F on the exam and referral of the case to the Dean's office for further sanctions.
8. Calculators *may not* be shared.
9. Some handy formulas:

Present Value: $PV = \frac{B}{(1+r)^t}$ $PV = \frac{B}{r}$

Areas: Triangle = $\frac{bh}{2}$ Trapezoid = $\left(\frac{b_1 + b_2}{2}\right)h$

Question 1 (15 points)

Suppose that a new mining technique allows a resource to be produced at a marginal cost of \$20 per unit. However, it also creates risks for local landowners. For each unit of the resource extracted, there is a 0.005% chance (1 in 20,000) that the local water supply will be harmed. If that occurs, there is a 75% chance the problem would be minor and could be fixed immediately with a one-time treatment costing \$20,000. However, there is a 25% chance the problem would be major and could not be fixed. In that case, it would cause \$10,000 of harm every year forever. The elasticity of demand for the resource is -0.5 and the interest rate is 10%.

Suppose the government wishes to use a tax to manage the externality. Please compute (a) the expected present value of the risk associated with extracting a unit of the resource. Then determine (b) the efficient tax, (c) price of the resource and (d) the percentage change in extraction that would occur under the efficient tax.

Question 2 (15 points)

Production of a good creates a positive externality. The market willingness to pay for the good is $W2P = 1500 - 2*Q$ and the marginal cost of producing it is $MC = 1200$. The external marginal benefits are given by $MB_{ext} = 1*Q$.

Please compute: (a), (b) the price and quantity at the market equilibrium, (c) the efficient quantity, (d) the price buyers would have to be charged to reach the efficient Q , (e) the subsidy rate that would be needed, and (f) the total cost of the subsidy to the government.

Question 3 (15 points)

A pollutant is emitted by 100 type-1 firms and 10 type-2 firms. Every firm of each type initially emits 50 tons of pollution (5500 tons total). Each type-1 firm has a marginal cost of abatement given by $MCA_i = (1/2)*Q_i$ where Q_i is the amount of abatement done by type-1 firm i . Each type-2 firm has an MCA curve given by $MCA_j = (1/10)*Q_j$ where Q_j is the amount of abatement done by type-2 firm j . The marginal benefit of abatement is $MBA = 12 - (2/300)*Q_t$, where Q_t is total abatement. The government wishes to use a tax to control the externality.

Please calculate: (a) the efficient total amount of abatement, (b) the efficient tax rate on emissions, (c), (d) the amount of abatement done by an *individual* firm of each type, (e), (f) the abatement cost for a firm of each type, and (g), (h) the tax payment by each type of firm.

Exam continues on the next page ...

Question 4 (15 points)

Three sources each emit 32 tons of a pollutant (96 tons total). Their marginal abatement costs are given by: $MCA_1 = 1 \cdot Q_1$, $MCA_2 = (1/2) \cdot Q_2$ and $MCA_3 = (1/4) \cdot Q_3$. The marginal benefit of abatement is given by $MBA = 16 - (1/7) \cdot Q_t$, where Q_t is total abatement.

Design a tradable permit system that will achieve the efficient amount of abatement while splitting the total compliance cost so that sources 1 and 2 each pay 25% of the total and source 3 pays the remaining 50%. Please determine: (a) the equilibrium price of a permit, and (b), (c) and (d) the number of permits that should be distributed to each source.

Question 5 (15 points)

Suppose that consumption of a particular product creates a negative externality. The good is purchased by 30 individuals, each of whom has an identical willingness to pay given by the equation $W_2P_i = A - B \cdot Q_i$, where A and B are parameters and i is a subscript indicating individual i . Survey data indicate that when $P = \$55$, a typical individual would buy 25 units and when $P = \$70$ the individual would buy 20. The marginal cost of producing the good is given by $MC = (1/10) \cdot Q$ and the external cost is given by $MC_{ext} = \$20$.

Please calculate: (a), (b) the values of A and B , (c), (d) the market equilibrium price and quantity, and (e), (f) the efficient price and quantity. Please note that you do NOT need to propose a specific policy: just calculate the two equilibria.