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## Final Exam

You have until 3:30pm 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. Non-graphing calculators may be used (no graphing calculators or phones can be used). You may leave answers as fractions. Unless a problem says otherwise, you can assume that firms can produce fractions of units and charge non-integer prices (so a firm could produce 82.4 units and sell at a price of \$5.325 per unit). Remember to put your name on the exam. Good luck!

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**Name:**

**ID Number:**

1. (15 points) A politician is proposing the elimination of auto safety standards, claiming that an unregulated market for new automobiles will lead manufacturers to choose the efficient level of safety features.
  - (a) Explain how the unregulated market could in theory provide the efficient level of safety.
  - (b) Explain two reasons that the unregulated market would lead to inefficiently low levels of safety.

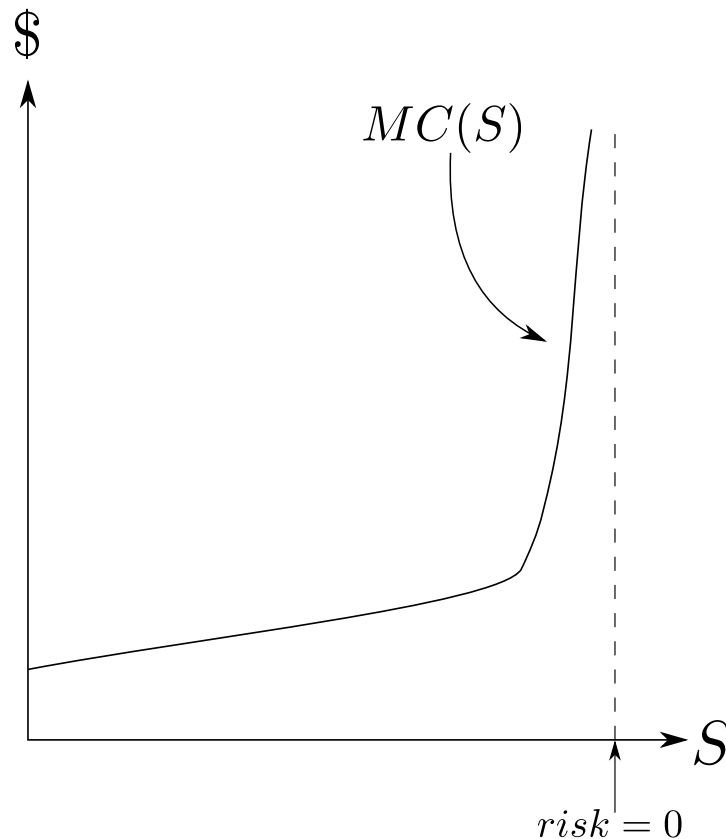
2. (20 points) There are two factories in Williamsburg polluting the local rivers. Without spending any money on pollution controls, each factory's runoff would add 200 units of pollution to the rivers. It costs Factory *A* \$40 to eliminate an additional unit of pollution regardless of its current level of pollution reductions. It costs Factory *B* \$60 to eliminate an additional unit of pollution regardless of its current level of pollution reductions. The marginal benefit of reducing water pollution by one more unit is given by:

$$MB(R) = 100 - \frac{1}{4}R \quad (1)$$

where  $R$  is the current level of pollution reductions made by both factories combined.

- (a) Suppose that the government decides to fine the factories for each unit of pollution they produce. The government decides to set this fine at \$55 per unit of pollution. Given this fine, determine how much money each factory will spend in fines and how much money each factory will spend on pollution reductions.
- (b) Does this fine lead to the efficient level of pollution reductions? Use numerical evidence and a written explanation to support your answer.
- (c) Suppose that instead of using fines, the government decides to create tradeable permits for pollution. Each permit allows a firm to produce one unit of pollution. The government allocates 150 permits to each firm. After the firms have a chance to buy and sell permits from each other, what will the final equilibrium allocation of permits be?
- (d) Would you recommend that the government increase the total number of permits, decrease the total number or keep it the same? Be certain to fully justify your answer.

3. (20 points) We discussed in class how OSHA does not necessarily set safety standards in the way an economist concerned with efficiency would. Recall that the 1970 Occupational Safety and Health Act was intended to “assure so far as possible every working man and woman in the Nation safe and healthful working conditions.” The graph below shows the level of safety in workplace settings and the marginal cost to a company of increasing the level of safety by an additional unit. The dashed line represents the level of safety at which there is no longer any risk of accidents in the workplace.
- Show the level of safety that would correspond to the way OSHA determines workplace safety standards. Label this level of safety  $S_{OSHA}$ . Explain in one or two sentences why you chose this point.
  - Suppose that the level of safety you identified in part (a) requires inefficiently high spending on safety precautions by firms. Show a curve on the graph representing the marginal benefits to workers of additional safety that is consistent with this statement. Show the deadweight loss generated by OSHA setting  $S_{OSHA}$  as the safety standard.
  - Suppose that OSHA eliminated all safety standards. On the graph, show the affect this would have on the equilibrium level of safety,  $S^*$ , and on workers’ wages when the firms move from  $S_{OSHA}$  to  $S^*$ .





6. (20 points) The City of Williamsburg is concerned about the pollution associated with the generation of electricity. City officials have determined that the marginal environmental damage from an additional kilowatt hour of electricity is given by the following function:

$$MC_{env}(K) = \frac{1}{2}K \quad (2)$$

where  $K$  is the current level of electricity being produced. The marginal costs paid by the electric company to produce an additional kilowatt hour of electricity are constant and equal to \$10. Demand for electricity is given by the following equation:

$$D(p) = 200 - 2p$$

where  $p$  is the price of a kilowatt hour of electricity.

- (a) What will the equilibrium price and quantity of electricity be if there is no regulation of the market and the market is competitive?
- (b) What is the socially efficient quantity of electricity?
- (c) On a graph with kilowatt hours on the horizontal axis, show the deadweight loss generated by being at the outcome in part (a) rather than the socially efficient quantity you found in part (b). Be certain to clearly label any relevant curves and points.
- (d) The city is considering three possible approaches to regulating the electricity market. Approach A is to simply cap the amount of electricity that can be sold as the efficient quantity you found in part (b). Approach B is to tax the electricity producers, setting the tax per kilowatt hour such that the new equilibrium quantity is the efficient quantity. Approach C is to tax the consumers of electricity such that the new equilibrium quantity is the efficient quantity. Which of these approaches would you consider the most equitable? Which would you consider the least equitable? Be certain to explain your answers.