

### FINAL EXAMINATION VERSION B

INSTRUCTIONS: This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators, calculators with alphabetical keyboards, wireless devices and mobile phones are NOT permitted. Numerical answers, if rounded, must be correct to at least 3 significant digits. Point values for each question are noted in brackets. Maximum total points are 200.

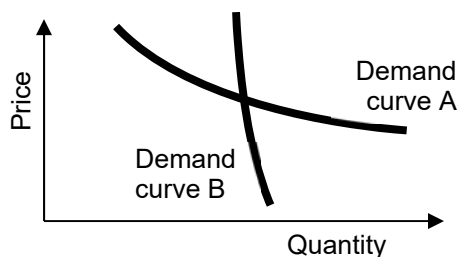
**I. Multiple choice:** Please circle the one best answer to each question. [1 pt each, 17 pts total]

- (1) In economics, *rational behavior* means
- using math to make decisions.
  - ignoring "soft" concerns like friendships and charity.
  - doing the best one can with what one has.
  - making sacrifices today for a better future.
  - maximizing one's income.

- (2) Brian buys a ticket to a concert for \$50. When he arrives at the venue, he discovers that scalpers are willing to pay \$75 for his ticket. His *opportunity cost* of attending the concert is
- \$0.
  - \$25.
  - \$50.
  - \$75.

- (3) In economics, an *equilibrium* is a situation where
- total costs equal total benefits.
  - no one wants to change their choices.
  - inflation equals zero percent.
  - economic growth is zero.

- (4) Which demand curve below is *more* elastic?
- Demand curve A.
  - Demand curve B.
  - Both have the same elasticity because they pass through the same point.
  - Cannot be determined from information given.



- (5) Suppose the price of watermelons is \$5 in Kansas City and the cost of shipping a watermelon between Des Moines and Kansas City is \$2. Markets are *in equilibrium* if the price of melons in Des Moines is
- \$1.
  - \$4.
  - \$8.
  - \$10.

- (6) The number of motorcycles actually sold would decrease if the government enacted a
- a tax on motorcycles.
  - a quota (or legal maximum quantity) on sellers of motorcycles.
  - a price ceiling (or legal maximum price) for motorcycles.
  - a price floor (or legal minimum price) for motorcycles.
  - all of the above.
  - none of the above.

- (7) Production of electric cars is increasing. An increase in the number of companies who produce electric cars is called a change at the
- extensive margin.
  - intensive margin.
  - marginal product.
  - marginal revenue.

- (8) Price times a firm's quantity of output equals the firm's
- average cost.
  - marginal cost.
  - total cost.
  - average revenue.
  - marginal revenue.
  - total revenue.

(9) The slope of the firm's total cost curve by definition equals the firm's

- a. total revenue.
- b. average revenue.
- c. marginal revenue.
- d. total cost.
- e. average cost.
- f. marginal cost.

(10) Suppose the price of a pair of jeans is \$30 and the price of a teshirt is \$6. If the economy is perfectly competitive, then these prices indicate that the *economy's* opportunity cost of a pair of jeans is

- a. 1/5 of a teshirt.
- b. 1/6 of a teshirt.
- c. 1 teshirt.
- d. 5 teshirts.
- e. 6 teshirts.

(11) A "natural monopoly" is a firm that enjoys

- a. a downward-sloping average cost curve.
- b. patent protection.
- c. an exclusive government franchise allowing it alone to sell the product.
- d. exclusive ownership of a natural resource essential for producing the product.

(12) At its current level of output, Acme Manufacturing's marginal revenue is \$5 and its marginal cost is \$7. Acme can increase its profit by

- a. increasing output.
- b. decreasing output.
- c. Acme cannot increase profit by either increasing or decreasing output.
- d. Cannot be determined from information given.

(13) Newspapers like the *Wall Street Journal* and the *New York Times* offer online versions. Many people can access the online versions without interfering with each other. However, the newspapers can require viewers to pay for access. An online newspaper is therefore

- a. a nonrival good.
- b. a nonexcludable good.
- c. both of the above.
- d. none of the above.

(14) The preservation of endangered species, such as the bald eagle, is a benefit we all can enjoy simultaneously, but no one can be forced to pay for enjoying it. Therefore species preservation is

- a. a nonrival good.
- b. a nonexcludable good.
- c. both of the above.
- d. none of the above.

(15) The American bison ("buffalo") was nearly wiped out in the nineteenth century. No one could be prevented from killing a buffalo, but when someone did, there were fewer buffalo for others. Buffalo were

- a. a nonrival good.
- b. a nonexcludable good.
- c. both of the above.
- d. none of the above.

(16) When my neighbor buys and plants a shade tree, it cools *my* house in the summer. My neighbor buying and planting that tree therefore creates

- a. an external benefit.
- b. an external cost.
- c. a common property resource.
- d. a superior good.

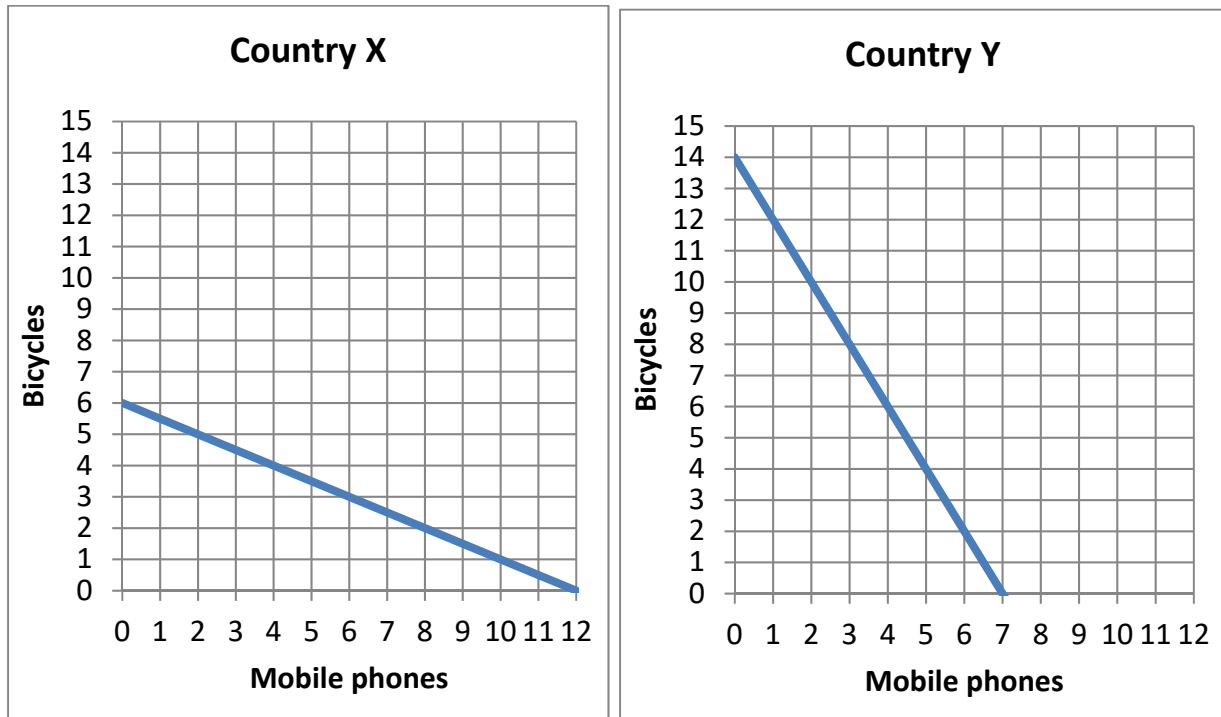
(17) Economists believe that environmental problems are caused, for the most part, by

- a. misaligned incentives.
- b. market power.
- c. lack of awareness.
- d. moral failing.

---

**II. Problems:** Insert your answer to each question in the box provided. Use margins and graphs for scratch work. Only the answers in the boxes will be graded. Work carefully—partial credit is not normally given for questions in this section.

(1) [Comparative advantage, gains from trade: 17 pts] Country X and Country Y can each produce bicycles and mobile phones. They each face a tradeoff between these two products because of limited workforces. Their production possibility curves are shown below.



- What is Country X's opportunity cost of producing a phone?
- What is Country Y's opportunity cost of producing a phone?
- What is Country X's opportunity cost of producing a bicycle?
- What is Country Y's opportunity cost of producing a bicycle?
- Which country has a comparative advantage in producing phones?
- Which country has a comparative advantage in producing bicycles?

_____	bicycles
_____	bicycles
_____	phones
_____	phones
_____	
_____	

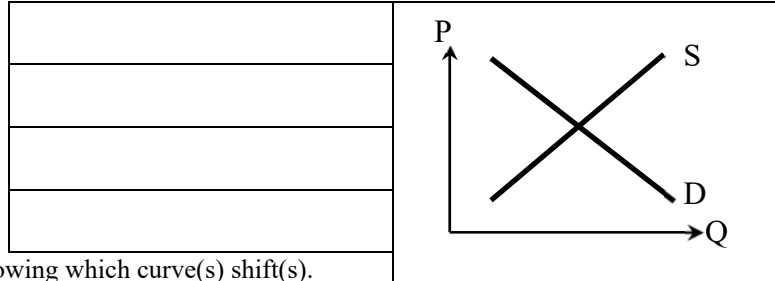
g. [3 pts] Fill in the blanks: *Both* countries can consume combinations of products *outside* their individual production possibility curves if \_\_\_\_\_ exports *two* bicycles to \_\_\_\_\_, which exports \_\_\_\_\_ phones in return.

h. **Plot** the trade that you propose in part (g) on the graphs above. For each country, plot and label the starting point representing **production before trade**, and the ending point representing **consumption after trade**.

(2) [Shifts in demand and supply: 15 pts] Analyze each of the following markets according to the accompanying imaginary scenario.

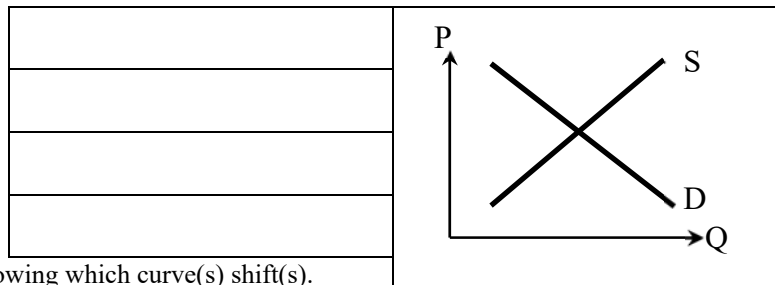
a. Consider the market for **new houses**: The price of lumber rises.

Does demand shift *left*, shift *right*, or remain *unchanged* ?  
 Does supply shift *left*, shift *right*, or remain *unchanged* ?  
 Does the equilibrium price *increase*, *decrease*, or *cannot be determined* ?  
 Does the equilibrium quantity *increase*, *decrease*, or *cannot be determined* ?  
 Sketch a graph of this scenario at right, showing which curve(s) shift(s).



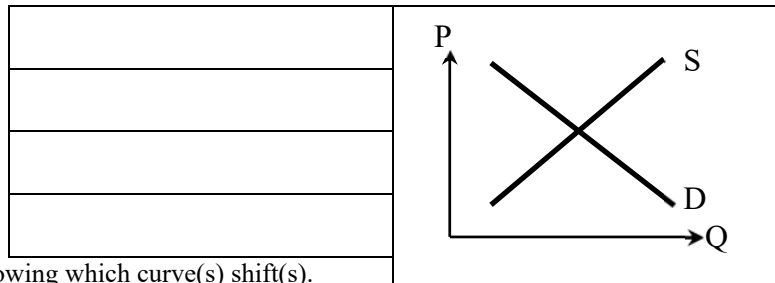
b. Consider the market for **Brussels sprouts**. Suppose a new government study is published, showing that eating Brussels sprouts every day can prevent cancer.

Does demand shift *left*, shift *right*, or remain *unchanged* ?  
 Does supply shift *left*, shift *right*, or remain *unchanged* ?  
 Does the equilibrium price *increase*, *decrease*, or *cannot be determined* ?  
 Does the equilibrium quantity *increase*, *decrease*, or *cannot be determined* ?  
 Sketch a graph of this scenario at right, showing which curve(s) shift(s).



c. Consider the market for **coal**: Suppose new safety regulations raise the cost of digging coal. Simultaneously, the price of natural gas falls sharply.

Does demand shift *left*, shift *right*, or remain *unchanged* ?  
 Does supply shift *left*, shift *right*, or remain *unchanged* ?  
 Does the equilibrium price *increase*, *decrease*, or *cannot be determined* ?  
 Does the equilibrium quantity *increase*, *decrease*, or *cannot be determined* ?  
 Sketch a graph of this scenario at right, showing which curve(s) shift(s).



(3) [Calculating elasticities: 2 pts] Suppose that if the price of Brand X apple cider is \$3, a store sells 70 bottles per day, but if the price is \$5, the same store sells only 10 bottles per day. Compute the price elasticity of demand for Brand X apple cider at that store using the “arc-elasticity” formula.

--

(4) [Using price elasticity of demand: 10 pts] Suppose the natural gas utility *raises* its price by 5%. Suppose the price elasticity of demand for natural gas is -0.6. Assume everything else affecting demand for natural gas remains constant.

- a. According to the information above, is demand for natural gas *elastic, inelastic, or unitary-elastic*?
- b. As the price rises, will the amount of natural gas consumed *increase, decrease, or remain constant*?
- c. ... by approximately how much?
- d. Will the total revenue received by the gas utility *increase, decrease, or remain constant*?
- e. ... by approximately how much?

	%
	%

(5) [Discounting: 4 pts] Answer the following questions, assuming the interest rate is **10 %**.

- a. Suppose a particular project will *cost* a firm \$600 today, but will bring \$200 in revenue one year from today, and \$500 in revenue two years from today. Compute the *net present value* of this project to the nearest whole dollar.
- b. Suppose a firm expects to enjoy \$2 million in profit every year, perpetually, beginning a year from today. Compute the value of the firm.

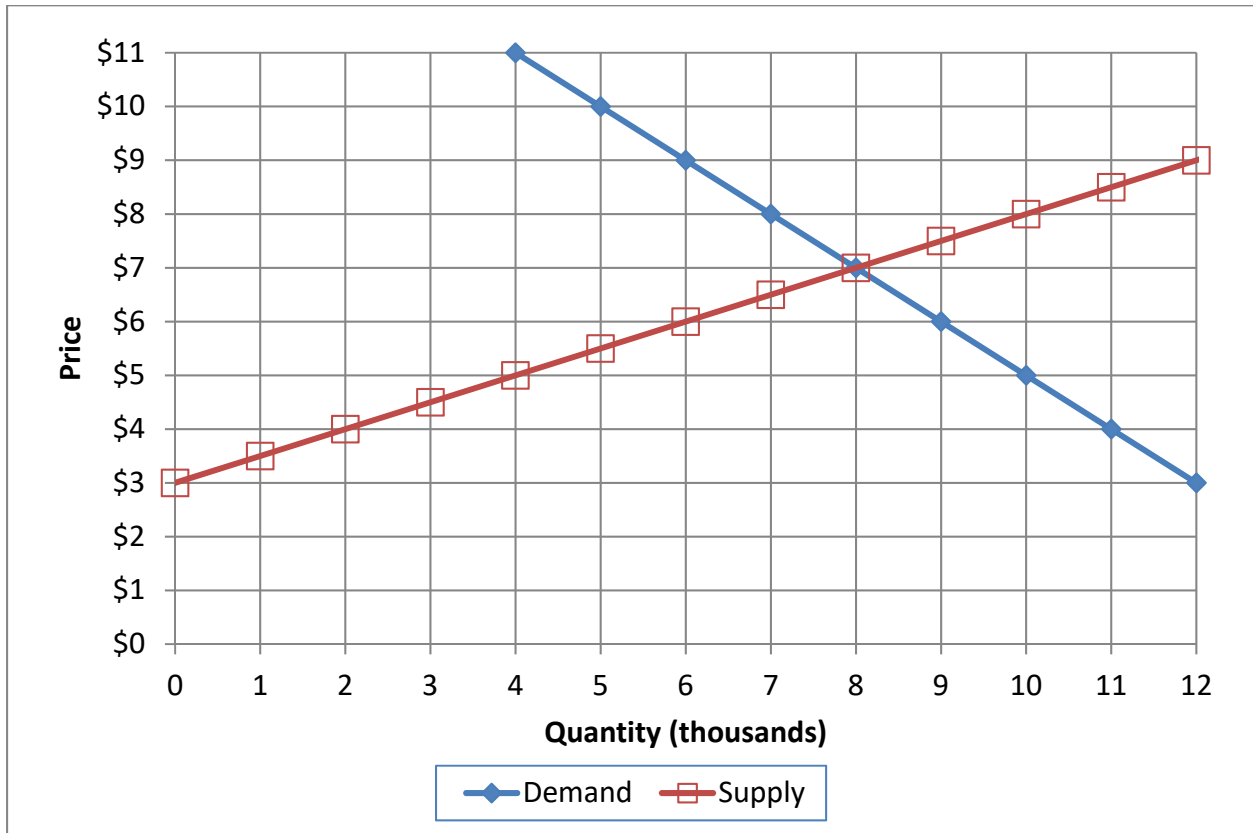
\$	
\$	million

(6) [Monopoly price discrimination: 4 pts] Suppose the Nutcracker Ballet sells tickets to both children and adults. The ballet believes the elasticity of demand by children is -6, and the elasticity of demand by adults is -2. Assume the ballet’s marginal cost of a ticket is \$15.

- a. Compute the profit-maximizing ticket price for children.
- b. Compute the profit-maximizing ticket price for adults.

\$	
\$	

(7) [Welfare analysis of tax or subsidy: 18 pts] The graph below shows the market for leaf rakes.

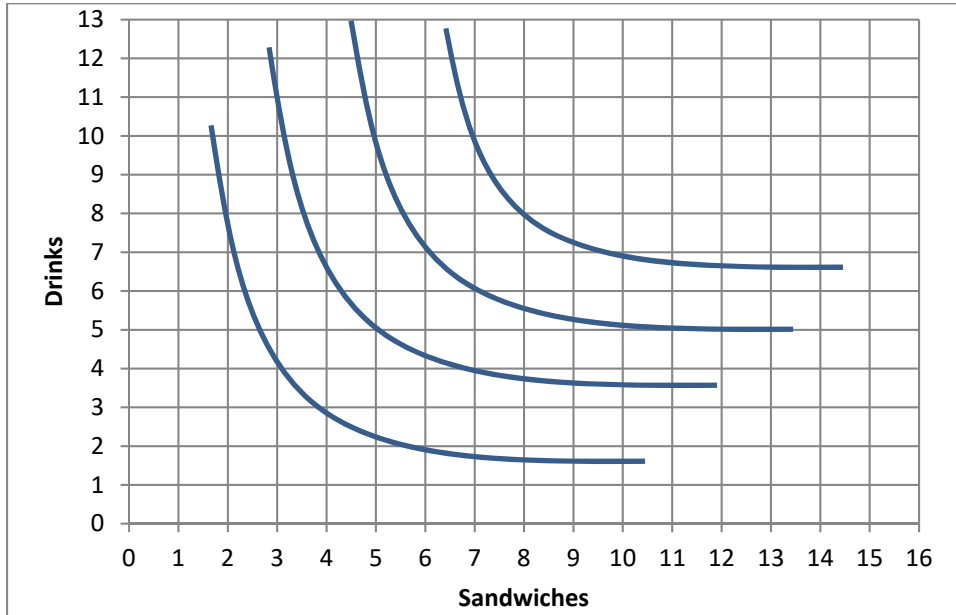


Suppose the government offers a **subsidy of \$ 3** per leaf rake.

- Compute the equilibrium quantity sold.
- Compute the equilibrium total price received by sellers (including the subsidy).
- Compute the equilibrium net price paid by buyers (excluding the subsidy).
- Does producer surplus *increase, decrease, or remain constant* because of the subsidy?
- By how much?
- Does consumer surplus *increase, decrease, or remain constant* because of the subsidy?
- By how much?
- Compute the direct cost of the subsidy to the government—that is, the amount that the government will have to pay buyers and sellers.
- Compute the deadweight social loss caused by the subsidy.

	thousand
\$	per rake
\$	per rake
\$	thousand
\$	thousand
\$	thousand
\$	thousand

(8) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Barbara's preferences for drinks and sandwiches.



- a. Would Barbara rather have 11 drinks and 3 sandwiches, or 7 drinks and 6 sandwiches?
- b. Would Barbara rather have 10 drinks and 7 sandwiches, or 5 drinks and 13 sandwiches?

drinks and	sandwiches
drinks and	sandwiches

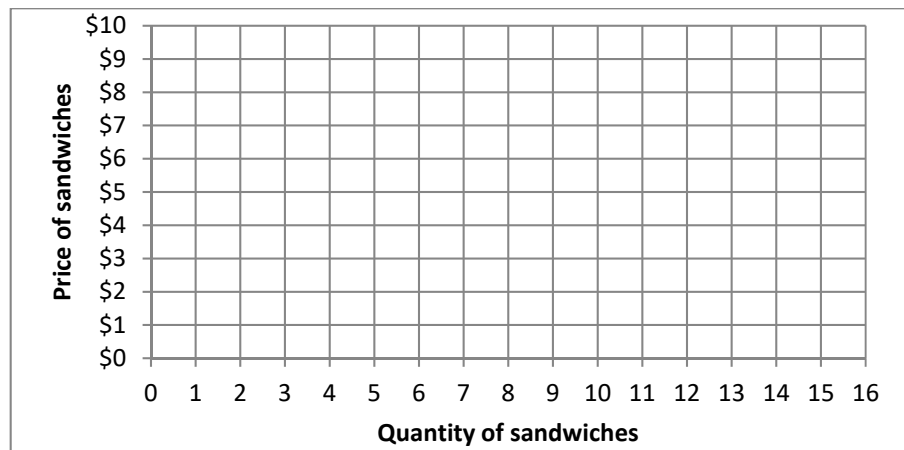
Suppose Barbara has a budget of \$40 to spend on drinks and sandwiches. The price of drinks is \$4.

- c. **Using a straightedge**, carefully draw Barbara's budget line when the price of sandwiches is \$4. Label this budget line "A".
- d. How many sandwiches will Barbara buy if the price of sandwiches is \$4?
- e. **Using a straightedge**, carefully draw Barbara's budget line when the price of sandwiches is \$8. Label this budget line "B".
- f. How many sandwiches will Barbara buy if the price of sandwiches is \$8?

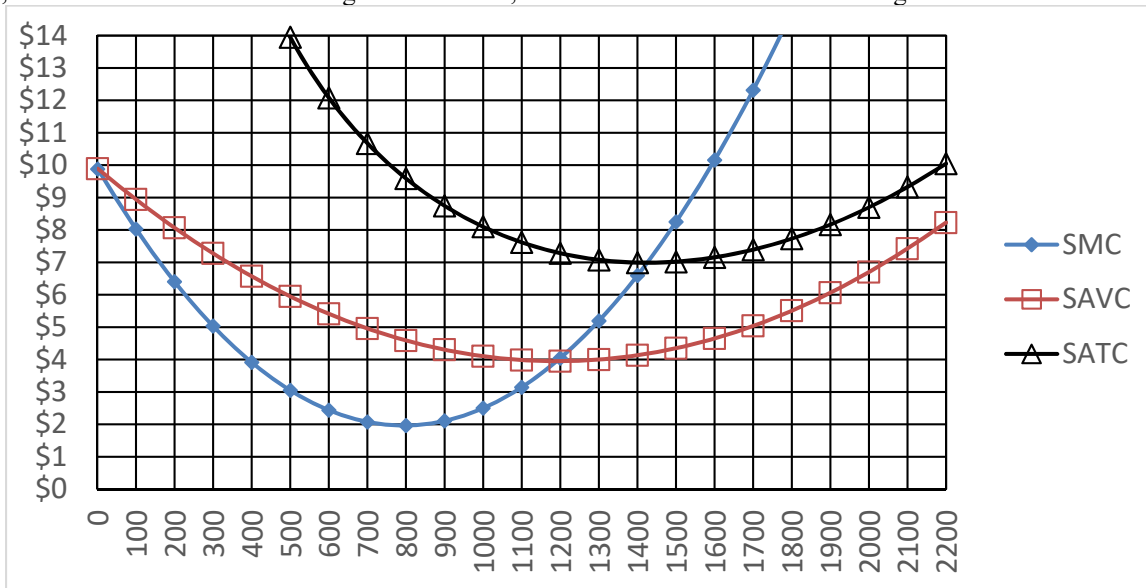
sandwiches

sandwiches

- g. Plot two points on Barbara's demand curve for sandwiches, and sketch Barbara's demand curve at right.



(9) [Short-run cost curves and supply: 20 pts] ABC Manufacturing Company makes a small part used in automobiles. ABC is a small company in a big market, and therefore takes its output price as given. In the short run, the company faces daily cost curves as shown in the following diagram. Here, SMC denotes short-run marginal cost, SAVC denotes short-run average variable cost, and SATC denotes short-run average total cost.



Suppose the company were currently producing 500 parts for some unknown reason.

- Compute the company's short-run total cost, to the nearest thousand dollars.
- Compute the company's short-run variable cost, to the nearest thousand dollars.
- Compute the company's short-run fixed cost, to the nearest thousand dollars.

\$	thousand
\$	thousand
\$	thousand

- Suppose the company were currently producing 300 parts for some unknown reason. If the company produced one more part, by how much would its total cost increase? That is, what would be the *change in total cost* as the company increased output from 300 to 301 parts? (Give an answer to the nearest dollar.)

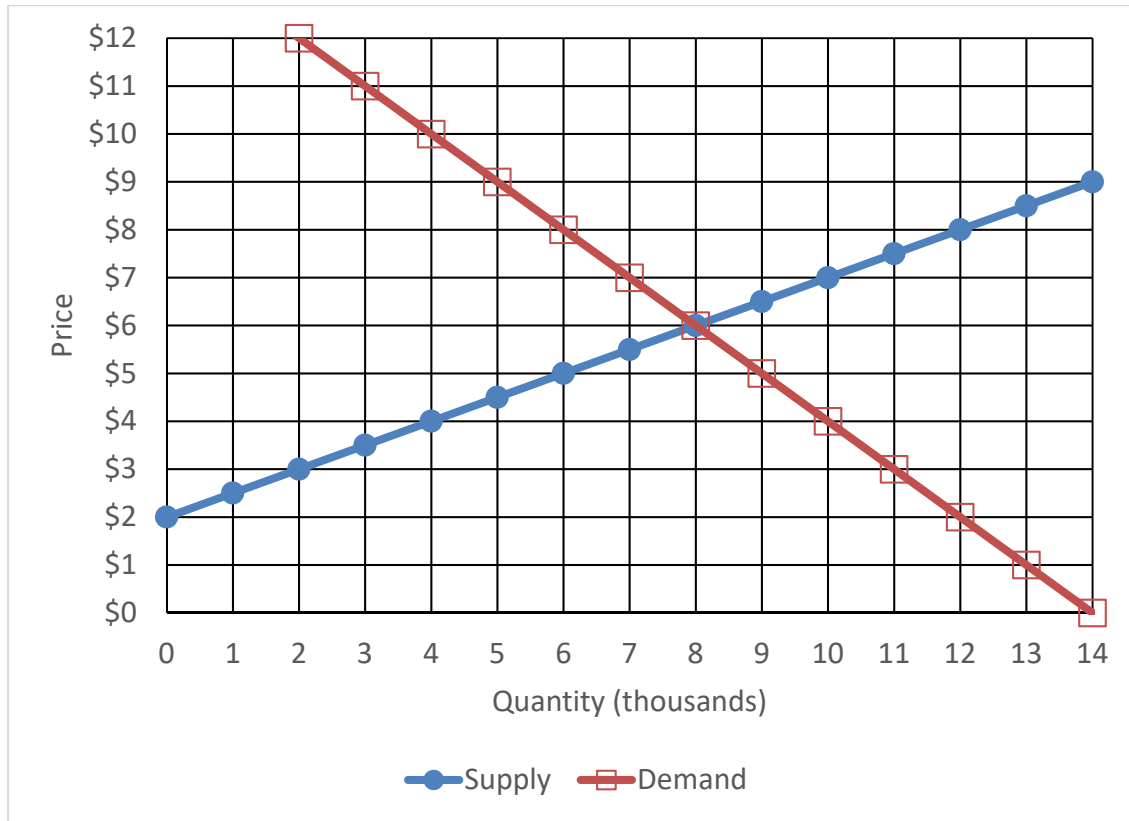
\$
----

- What is the company's break-even price—that is, the lowest price at which the company can avoid losses? (Give an answer to the nearest dollar.)
- What is the company's shut-down price—that is, the lowest price at which it will remain in operation in the short run? (Give an answer to the nearest dollar.)
- Suppose the price of parts is \$3. How many parts should the company produce? (Give an answer to the nearest hundred.)
- Will the company make a *profit* or a *loss* at a price of \$3?
- Suppose the price of parts is \$5. How many parts should the company produce? (Give an answer to the nearest hundred.)
- Will the company make a *profit* or a *loss* at a price of \$5?

\$	
\$	
	parts
	parts



(10) [Efficiency of competition: 16 pts] The following graph shows the market for can openers.



Suppose only 4,000 can openers were produced for some unknown reason.

- a. How much would consumers be willing to pay for a 4001st can opener?
- b. By how much would the can opener industry's total costs increase from producing a 4001st can opener?
- c. If the 4001st can opener were produced, would total surplus *increase*, *decrease*, or *remain constant*?
- c. By how much?

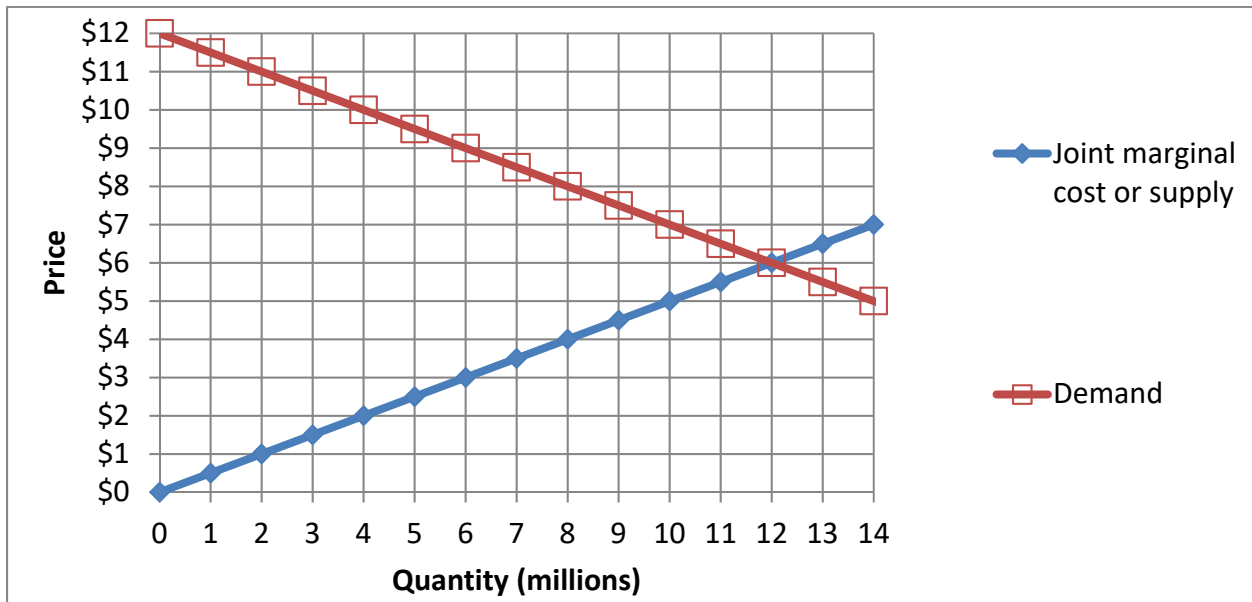
\$
\$
\$

Alternatively, suppose 10,000 can openers were produced for some unknown reason.

- d. How much were consumers willing to pay for the 10,000th can opener?
- e. How much would the can opener industry's total cost decrease from NOT producing the 10,000th can opener?
- f. If the 10,000th can opener were NOT produced, would total surplus *increase*, *decrease*, or *remain constant*?
- g. By how much?

\$
\$
\$

(11) [Competition versus collusion: 16 pts] Suppose a small group of firms produce laundry soap. The graph below shows the demand curve and the joint marginal cost or supply curve of the group of firms.



First, assume the firms *compete* with each other, each maximizing its own profit while taking the market price as given.

a. What will be the equilibrium market quantity?

	million
b. If output increased by one more unit at any firm, total costs would increase by how much?	\$
c. What will be the equilibrium market price?	\$

Second, alternatively assume the firms *collude* with each other, setting price jointly as a cartel to maximize the sum of their profits.

d. *Using a straightedge*, draw and label the colluding firms' marginal revenue curve.

e. What total quantity will the firms produce?

f. If output increased by one more unit at any firm, total costs would increase by how much?

g. What price will the firms jointly set?

h. Compute the social deadweight loss from collusion.

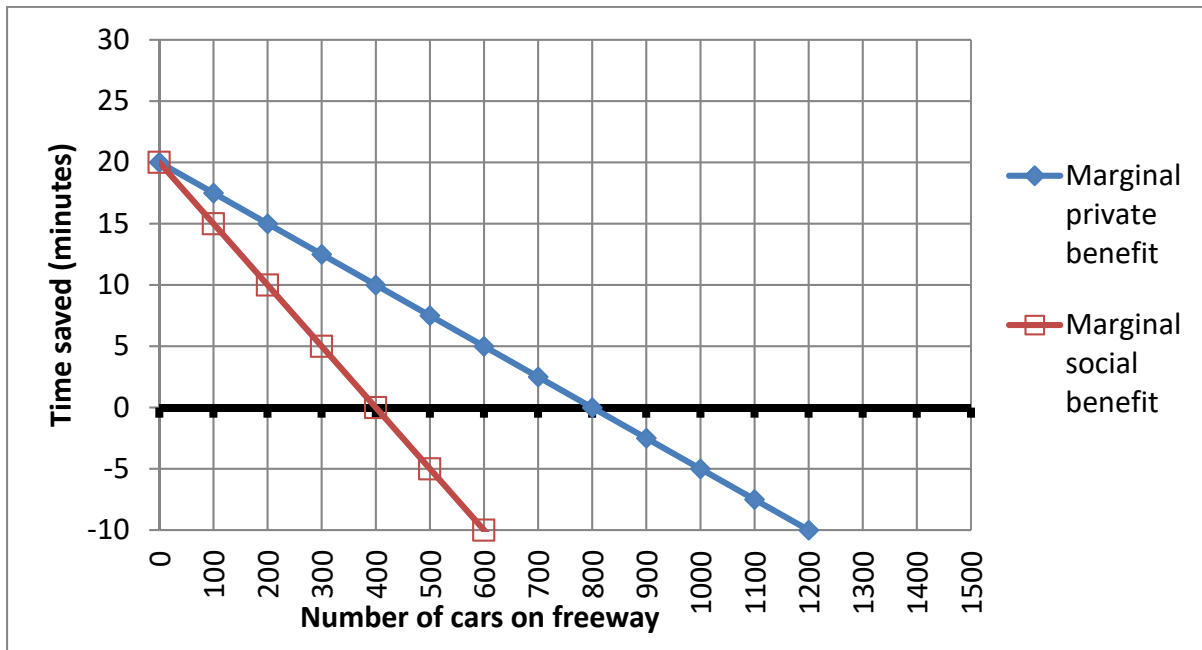
	million
	\$
	\$
	\$ million

(12) [Nonrival goods: 6 pts] Suppose 500 people live near a proposed bike trail. The trail will cost \$20,000 per mile to build. Let  $Q$  denote the length of the bike trail in miles. A typical individual person's marginal benefit from this bike trail is given by the following expression (or formula):  $MB = 100 - 6Q$ .

- How many miles of bike trail would a typical *individual* pay to build for their own use?
- Give an expression (or formula) for the marginal social benefit from the bike trail. [Hint: This must be a formula containing one variable:  $Q$ .]
- Compute  $Q^*$  the *socially-optimal* length of the bike trail.

	miles
MSB =	
	miles

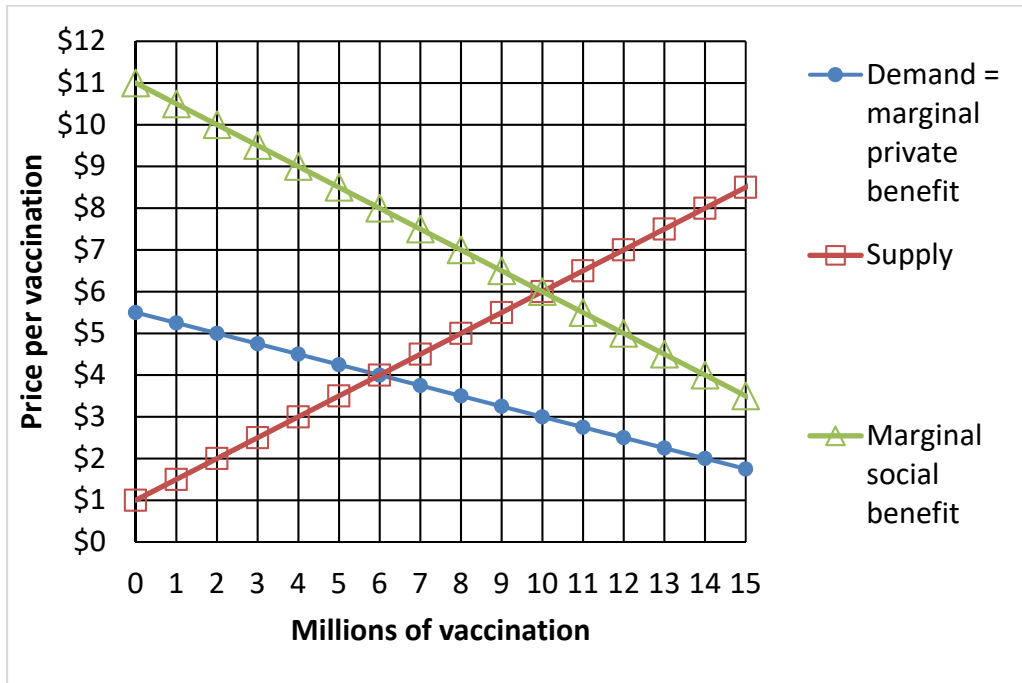
(13) [Common property resources: 6 pts] A certain freeway can easily become congested. It is the quickest route to downtown, but during rush hour, when one car enters the freeway, all the cars already on the freeway slow down a bit. The graph below shows the average time saved by each car when it enters the freeway (“marginal private benefit”), and the change in total time saved by all cars when another car enters the freeway (“marginal social benefit”). Note that the change in total time saved by all cars turns negative as the freeway becomes congested.



- How many cars will enter the freeway if entry onto the freeway is unregulated?
- What is the socially-optimal number of cars on the freeway—that is, the number of cars that maximizes total time saved by all cars on the freeway?
- Suppose a typical driver is willing to pay \$1 for each five minutes saved by entering the freeway. What toll (in dollars) would ensure that the optimal number of cars entered the freeway?

	cars
	cars
\$	

(14) [Externalities: 12 pts] The graph below shows the market for a particular vaccine. A vaccination protects the purchaser of the vaccine, but also reduces the chances of other people catching the illness. Therefore, in addition to demand and supply curves, a curve representing marginal social benefit is shown.



- Compute the (unregulated) competitive equilibrium price.
- Compute the (unregulated) competitive equilibrium quantity.
- Compute the economically efficient (or socially optimal) quantity.
- Compute the deadweight loss from unregulated competition.
- To eliminate this deadweight loss, should the government enact a *tax* or a *subsidy*?
- What should be the tax rate or subsidy rate?

\$	
	million
	million
\$	million
\$	per vaccination

(15) [Regulating pollution: 19 pts] Five factories are each producing one unit of pollution per year. The government has determined that total pollution must be reduced to 2 units per year (a reduction of 3 units). The cost of cleaning up pollution at each factory is given below.

Factory	A	B	C	D	E
Annual cost of cleaning up pollution	\$55	\$35	\$25	\$45	\$15

**Command-and-control:**

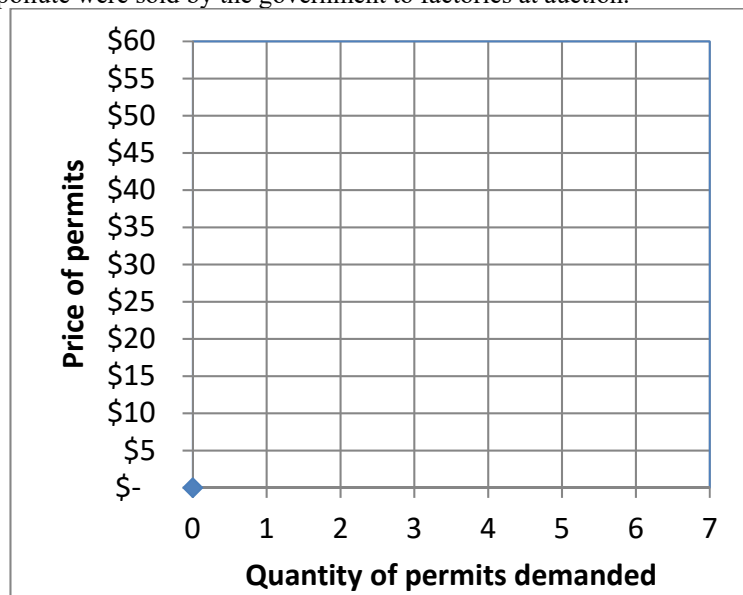
- a. To minimize the total cost of cleaning up, which 3 factories should be commanded to clean up? Give their letters.
- b. What would be the total cost of cleaning up for these 3 factories together?

\$

Now suppose the government does not know each factory's cost of cleaning up, so the command-and-control approach is infeasible. Consider the following alternative approaches.

**Auction:** Suppose 2 permits (or waivers) to pollute were sold by the government to factories at auction.

- c. [5 pts] Draw the factories' demand curve for permits in the graph at right. (Be sure to draw correct "stairsteps.")



In this auction, the price starts at \$0 and rises in increments of \$10.

- d. Which 2 factories would win the permits? Give their letters.
- e. What would be the final auction price of a permit to pollute?
- f. What would be the total cost of cleaning up for those 3 factories that did not win permits in the auction?

\$
\$

**Pollution fee:** Suppose the government imposed a fee for pollution. Factories could either pay the fee or pay the cost of cleaning up.

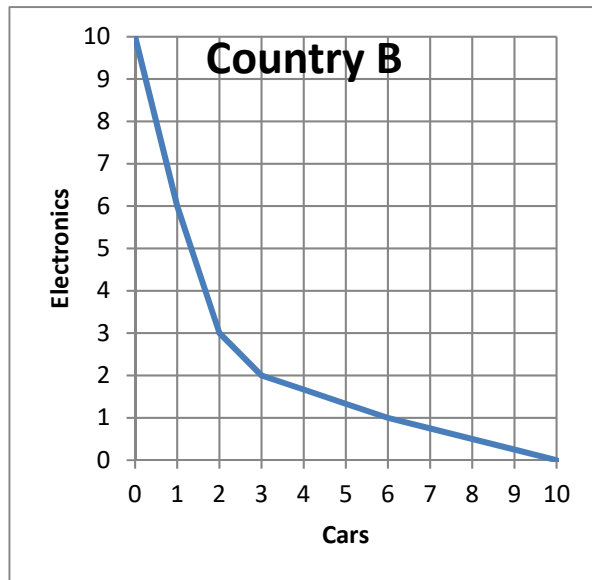
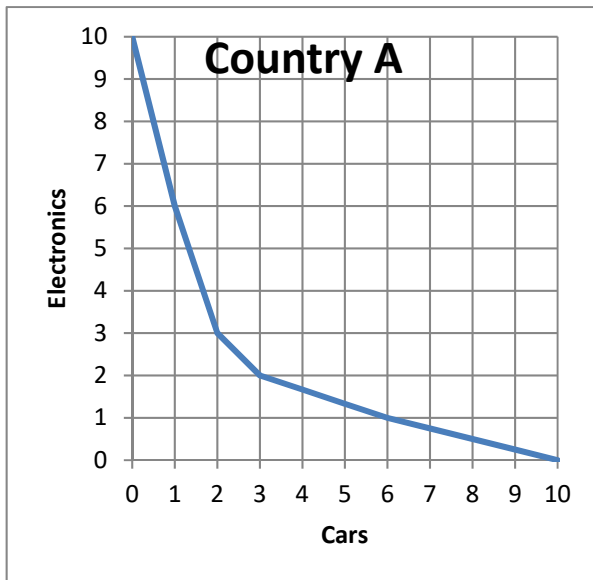
- g. What fee would reduce the amount of pollution to 2 units: \$0, \$10, \$20, \$30, \$40, \$50, or \$60?
- h. What would be the total cost of cleaning up for those 3 factories that chose not to pay the fee?

\$
\$

**III. Critical thinking:** Write a one-paragraph essay answering *one* question below (your choice). [4 pts]

- (1) Most people use money to make trades, instead of bartering goods and services for other goods and services. Why do people prefer to use money? (Ignore the graphs below.)
- (2) In this course, we have emphasized gains from trade based on *differences* in production possibility curves. Now consider the PP curves of two countries shown below, which are *identical*. Can both countries enjoy combinations of goods outside their individual PP curves through trade? If you answer NO, explain why not. If you answer YES, state verbally an example of a trade that puts both countries outside their individual PP curves, and plot that trade on the graphs.

Please circle the question you are answering. Write your answer below. Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling.



[end of exam]