

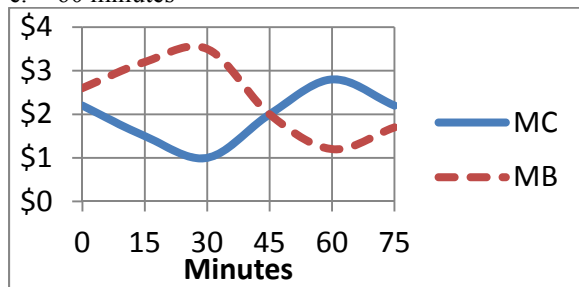
### FINAL EXAMINATION VERSION B

**INSTRUCTIONS:** This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators or calculators with alphabetical keyboards 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, 22 pts total]

- (1) The assumption in economics that people are rational means that people
- a. maximize their income.
  - b. use math to make decisions.
  - c. ignore "soft" concerns like friendships and charity.
  - d. do the best one can with what they have.
  - e. make sacrifices today for a better future.

- (2) The graph below shows Caitlin's marginal cost (MC) and marginal benefit (MB) from exercise. If Caitlin is rational, she will choose to exercise
- a. 0 minutes.
  - b. 15 minutes.
  - c. 30 minutes.
  - d. 45 minutes.
  - e. 60 minutes

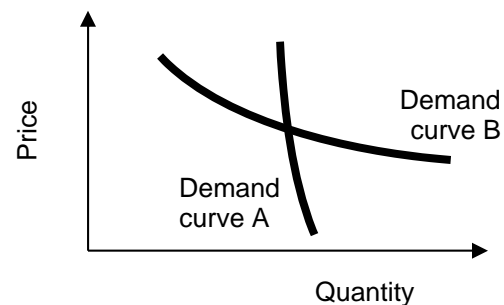


- (3) If the price of gasoline rises, demand for hybrid cars will shift right, because hybrid cars and gasoline are
- a. inferior goods.
  - b. complementary goods.
  - c. substitute goods.
  - d. normal goods.

- (4) A rise in consumers' income will shift the demand for macaroni-and-cheese dinners to the left, because macaroni-and-cheese dinners are
- a. inferior goods.
  - b. complementary goods.
  - c. substitute goods.
  - d. normal goods.

- (5) The units of measure for the price elasticity of demand for electricity are
- a. kilowatt-hours per dollar.
  - b. dollars per kilowatt-hour.
  - c. The elasticity is a pure number and has no units of measure.
  - d. percent.

- (6) Which demand curve below is *less* elastic?
- a. Demand curve A.
  - b. Demand curve B.
  - c. Both have the same elasticity because they pass through the same point.
  - d. Cannot be determined from information given.



(7) Suppose the price of apples in Des Moines is \$2.00 per pound and the cost of shipping apples between Des Moines and Omaha is \$0.20 per pound. Markets are *in equilibrium* if the price of apples in Omaha is

- a. \$1.10 per pound.
- b. \$1.50 per pound.
- c. \$1.90 per pound.
- d. \$2.30 per pound.

(8) Suppose the price elasticity of supply for items sold on the internet in Iowa is 8.0 and the price elasticity of demand is -1.0. If Iowa imposes a tax on internet sales,

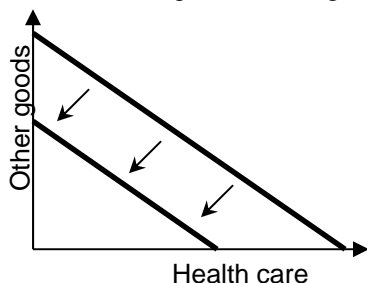
- a. Sellers will pay most of the tax.
- b. Buyers will pay most of the tax.
- c. Sellers and buyers will each pay half of the tax.
- d. Answer depends on which side is legally required to remit the tax to the government.

(9) A change in the number of people who buy bottled water is called a change at the

- a. extensive margin.
- b. intensive margin.
- c. marginal product.
- d. marginal revenue.

(10) In the graph below, the shift in the budget line could be caused by

- a. an increase in income.
- b. a decrease in income.
- c. an increase in the price of health care.
- d. a decrease in the price of health care.
- e. an increase in the price of other goods.
- f. a decrease in the price of other goods.



(11) At its current level of output, ABC Company's average cost is \$10, its marginal cost is \$7, and its marginal revenue is \$15. If ABC produces and sells one more unit of output, its profit will

- a. increase by \$3.
- b. increase by \$5.
- c. increase by \$8.
- d. increase by \$15.
- e. remain constant.

(12) Suppose the market for flash drives is a competitive market and is in *short-run* equilibrium. Assume all firms have the same cost curves. Then price equals

- a. marginal cost of every firm in the industry.
- b. average cost of every firm in the industry.
- c. both (a) and (b).
- d. neither (a) nor (b), necessarily.

(13) Suppose the market demand elasticity for computers is -3 and Firm X has market share of 20% (or 0.2). Then, assuming other firms do not change their market quantity, Firm X perceives an elasticity of demand for its own computers equal to

- a. -0.05.
- b. -0.15.
- c. -3.
- d. -5.
- e. -15.
- f. -60.

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

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

(15) Suppose a sandwich stand sells 10 sandwiches per hour if the price is \$5, and sells 11 sandwiches if the price is lowered to \$4.75. The stand's marginal revenue of the 11th sandwich is therefore

- a. \$0.25 .
- b. \$2.25 .
- c. \$2.50 .
- d. \$4.75 .
- e. \$5.00 .
- f. \$10.00 .

(16) Suppose the bungee-cord industry has five firms, each of which has the same marginal cost, and that the market elasticity of demand is  $-2$ . If the industry is a Cournot oligopoly, the markup of price over marginal cost  $(P-MC)/P$  must be

- a. 2%.
- b. 5%.
- c. 10%.
- d. 40%.
- e. Cannot be determined from information given.

(17) When manure is spread on farm fields while the ground is still frozen, it runs off quickly into rivers and streams, forcing downstream water treatment plants to spend more money on chlorination. Thus, spreading manure on frozen fields creates

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

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

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

(19) Wind can be harnessed for a variety of purposes, such as generating electricity. But one person using the wind does not leave less for others, and no one can be forced to pay for it. Wind is therefore

- a. a rival good.
- b. an excludable good.
- c. both of the above.
- d. none of the above.

(20) The grocery store requires you to pay for all oranges that you take. The same orange cannot be taken by more than one person. Oranges are therefore

- a. a rival good.
- b. an excludable good.
- c. both of the above.
- d. none of the above.

(21) A certain downtown bridge is so crowded that traffic is very slow. Each car that uses the bridge prevents another car from using the bridge. However, the city has no way to force people to pay for using the bridge. Therefore the bridge is

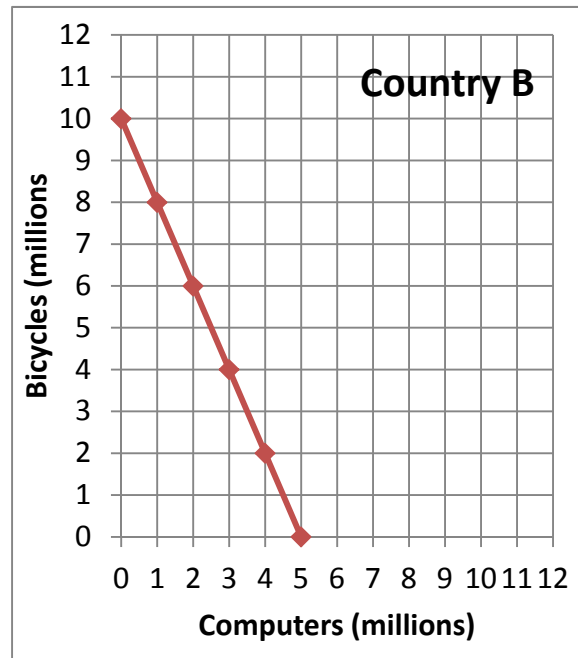
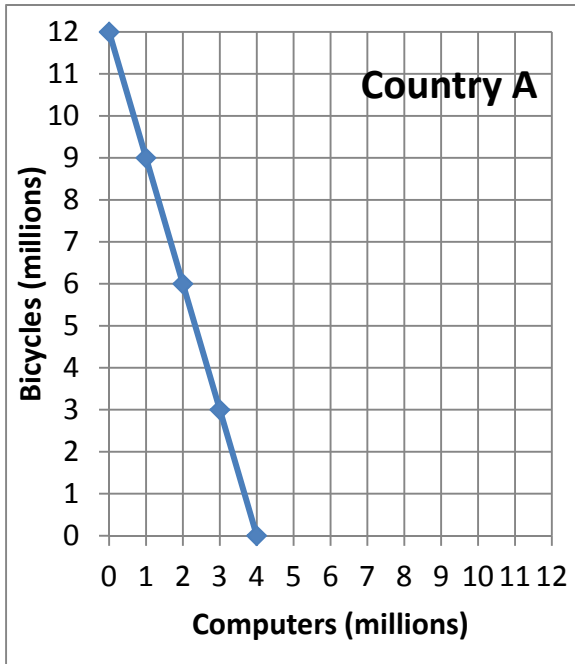
- a. a rival good.
- b. an excludable good.
- c. both of the above.
- d. none of the above.

(22) Satellite radio broadcasts can be enjoyed by many people without interfering with each other. But the satellite broadcaster encrypts the signal, so no one can listen without paying. Satellite radio broadcasts are therefore

- a. a rival good.
- b. an excludable good.
- c. both of the above.
- d. none of the above.

**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 A and Country B both can make bicycles and computers. They each face a tradeoff between these two products because their resources are limited. Their production possibility curves are shown below.



- [2 pts] What is Country A's opportunity cost of a bicycle?
- [2 pts] What is Country B's opportunity cost of a bicycle?
- [2 pts] What is Country A's opportunity cost of a computer?
- [2 pts] What is Country B's opportunity cost of a computer?
- [2 pts] Which country has a comparative advantage in producing bicycles?
- [2 pts] Which country has a comparative advantage in producing computers?
- [3 pts] Fill in the blanks: *Both* countries can consume combinations of bicycles and computers *outside* their individual production possibility curves if \_\_\_\_\_ exports **five** million bicycles to \_\_\_\_\_, which exports \_\_\_\_\_ million computers in return.
- [2 pts] **Plot** the trade that you propose in part (g) on the graph above. For each producer, plot and label the starting point representing **production before trade**, and the ending point representing **consumption after trade**.

computers
computers
bicycles
bicycles

(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 sodapop: Consumers become more interested in avoiding junk food.

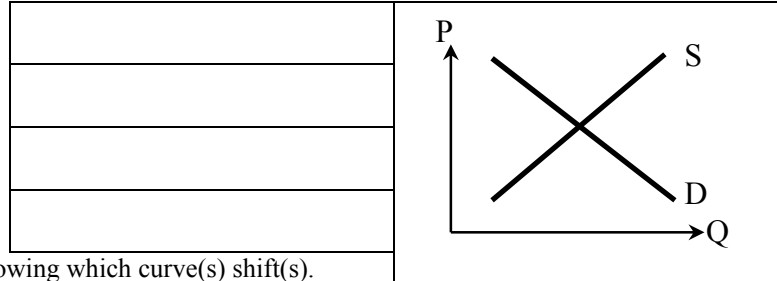
Does demand shift *left*, *shift right*, or remain *unchanged* ?

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 high-efficiency light bulbs. Suppose new technology allows these bulbs to be manufactured at much lower cost.

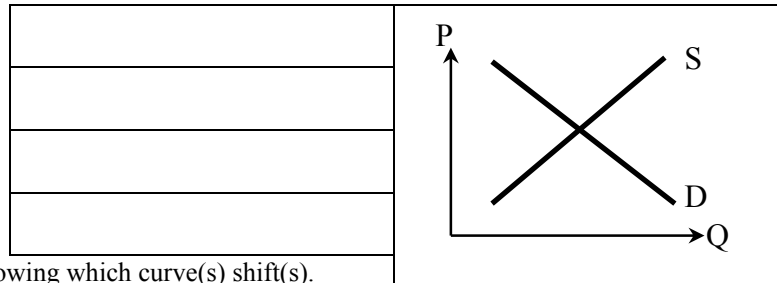
Does demand shift *left*, *shift right*, or remain *unchanged* ?

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 gasoline: Consumers' incomes fall due to a recession. Simultaneously, the price of petroleum rises. (Gasoline is made from petroleum.)

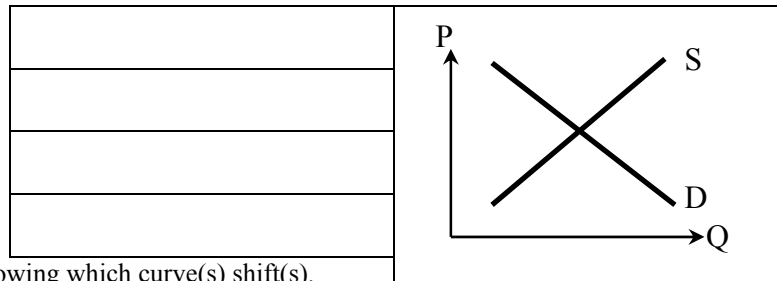
Does demand shift *left*, *shift right*, or remain *unchanged* ?

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) [Using price elasticity of demand: 10 pts] Suppose we want to reduce cigarette consumption by 6 percent. Also suppose that the price elasticity of demand for cigarettes is -0.3.

- a. According to the information above, is demand for cigarettes *elastic*, *inelastic*, or *unitary-elastic*?
- b. To reduce cigarette consumption by the targeted amount, should the price *increase*, *decrease*, or remain *constant*?
- c. ... by approximately how much?
- d. Will total spending by consumers on cigarettes *increase*, *decrease*, or remain *constant*?
- e. ... by approximately how much?

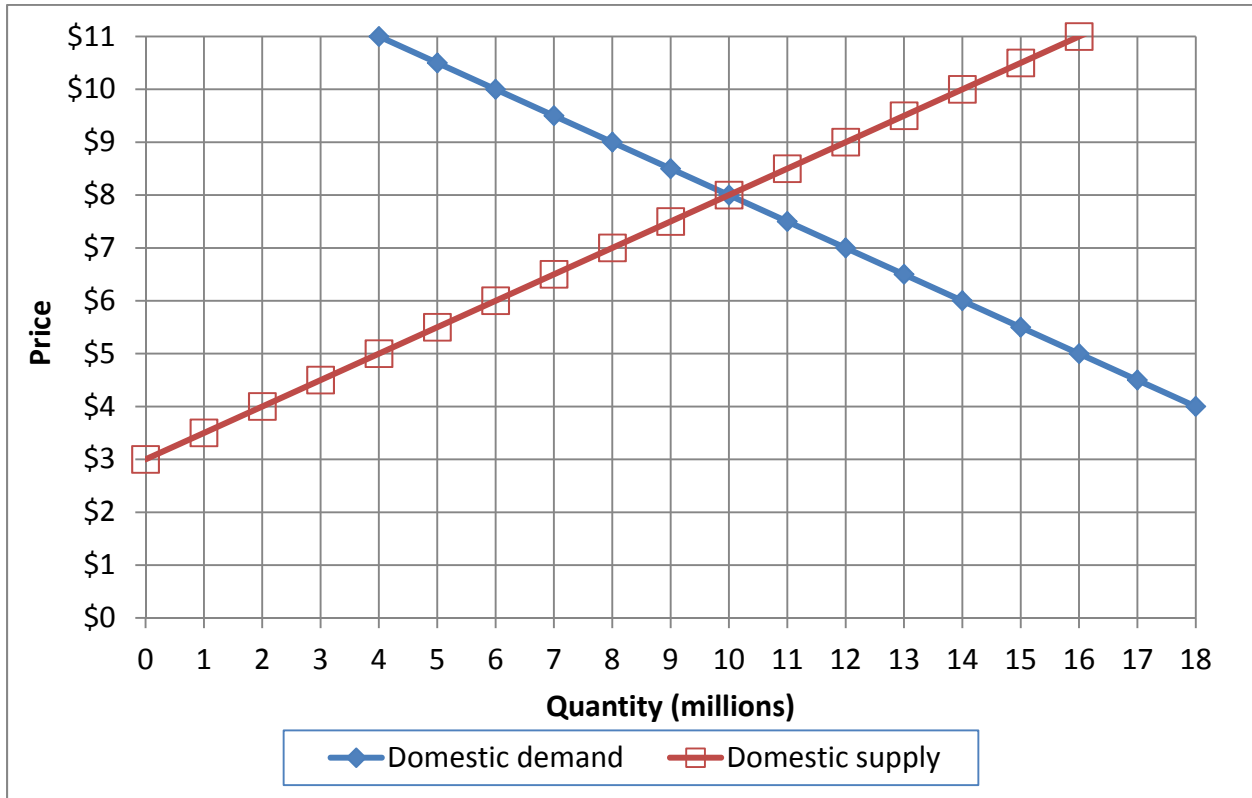
	%
	%

(4) [Using income elasticities: 10 pts] Suppose the income elasticity of demand for televisions is 1.4. Now suppose consumers' income *rises* by 5%. Assume the price of televisions does not change.

- a. According to the information above, are televisions a *necessary good*, an *inferior good*, or a *luxury (or superior) good*?
- b. As income rises, will the quantity of televisions demanded *increase*, *decrease*, or remain *constant*?
- c. ... by about how much?
- d. Will consumer spending on televisions, as a fraction of a consumer's total budget, *increase*, *decrease*, or remain *constant*?
- e. ... by about how much?

	%
	%

(5) [Welfare effects of international trade: 18 pts] Domestic supply and demand for hammers in a particular country are given by the following diagram.



a. At first, international trade in hammers is not permitted. Find the equilibrium price without international trade.

\$	
----	--

Then this industry is opened to international trade and the international price of hammers turns out to be **\$ 6**.

b. Will this country now *export* or *import* hammers?

--

c. How many?

million
---------

d. Does consumer surplus in this country *increase* or *decrease* from international trade in hammers?

--

e. By how much?

\$	million
----	---------

f. Does producer surplus in this country *increase* or *decrease* from international trade in hammers?

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g. By how much?

\$	million
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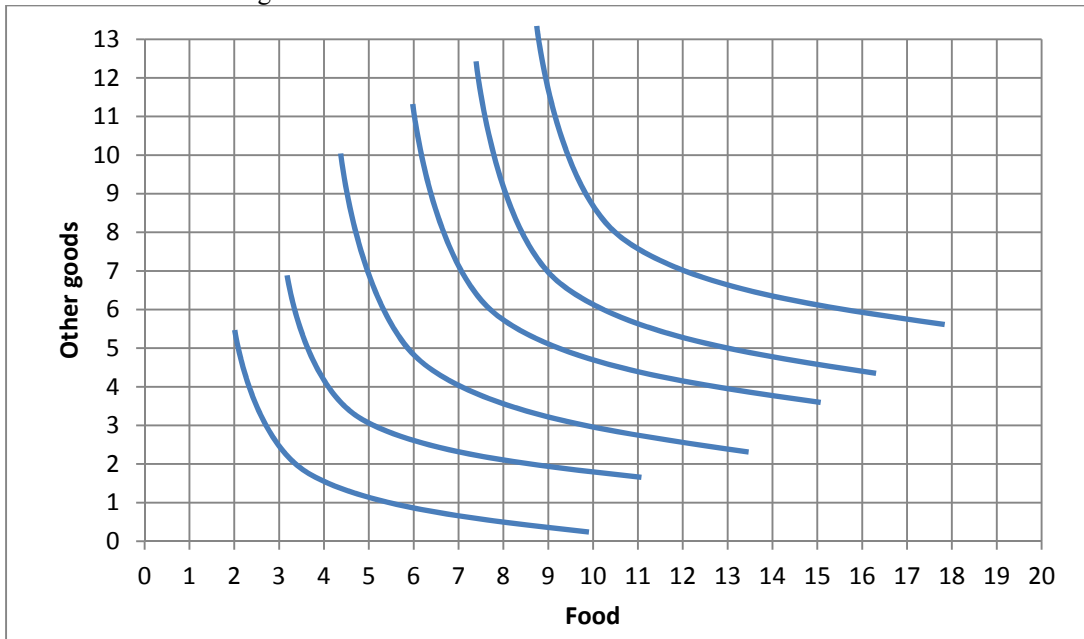
h. Does total social welfare in this country *increase* or *decrease* from international trade in hammers?

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i. By how much?

\$	million
----	---------

(6) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Brittany's preferences for food and other goods.



- a. Would Brittany rather have 10 units of food and 6 units of other goods, or 6 units of food and 11 units of other goods?
- b. Would Brittany rather have 9 units of food and 2 units of other goods, or 7 units of food and 4 units of other goods?

	units of food and	units of other goods
	units of food and	units of other goods

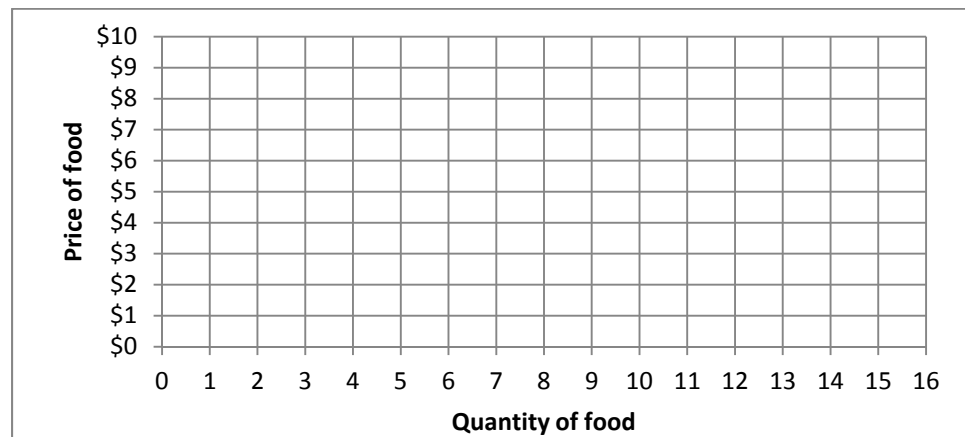
Suppose Brittany has a budget of \$60 to spend on food and other goods. The price of other goods is \$5.

- c. **Using a straightedge**, carefully draw Brittany's budget line when the price of food is \$3. Label this budget line "A".
- d. How much food will Brittany buy if the price of food is \$3?
- e. **Using a straightedge**, carefully draw Brittany's budget line when the price of food is \$6. Label this budget line "B".
- f. How much food will Brittany buy if the price of food is \$6?

	units of food
--	------------------

	units of food
--	------------------

- g. Plot two points on Brittany's demand curve for food, and sketch his demand curve at right.





(7) [Rational choice: 10 pts] The state government is considering building a bridge. The following are cost and benefit estimates for bridges of different sizes.

Lanes	Total cost	Total benefit	Marginal cost per lane	Marginal benefit per lane
0	\$ 0	\$0		
			\$ million	\$ million
2	\$20 million	\$40 million		
			\$ million	\$ million
4	\$38 million	\$54 million		
			\$ million	\$ million
6	\$56 million	\$64 million		
			\$ million	\$ million
8	\$72 million	\$70 million		

- a. [4 pts] Compute the marginal cost schedule. Insert your answers above.
- b. [4 pts] Compute the marginal benefit schedule. Insert your answers above.
- c. [2 pts] How many lanes should the bridge have? (Answer must be 0, 2, 4, 6, or 8.)

lanes
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(8) [Basic definitions, cost and revenue: 3 pts] Insert the appropriate term from the list below in each box. The same term may be entered in more than one box.

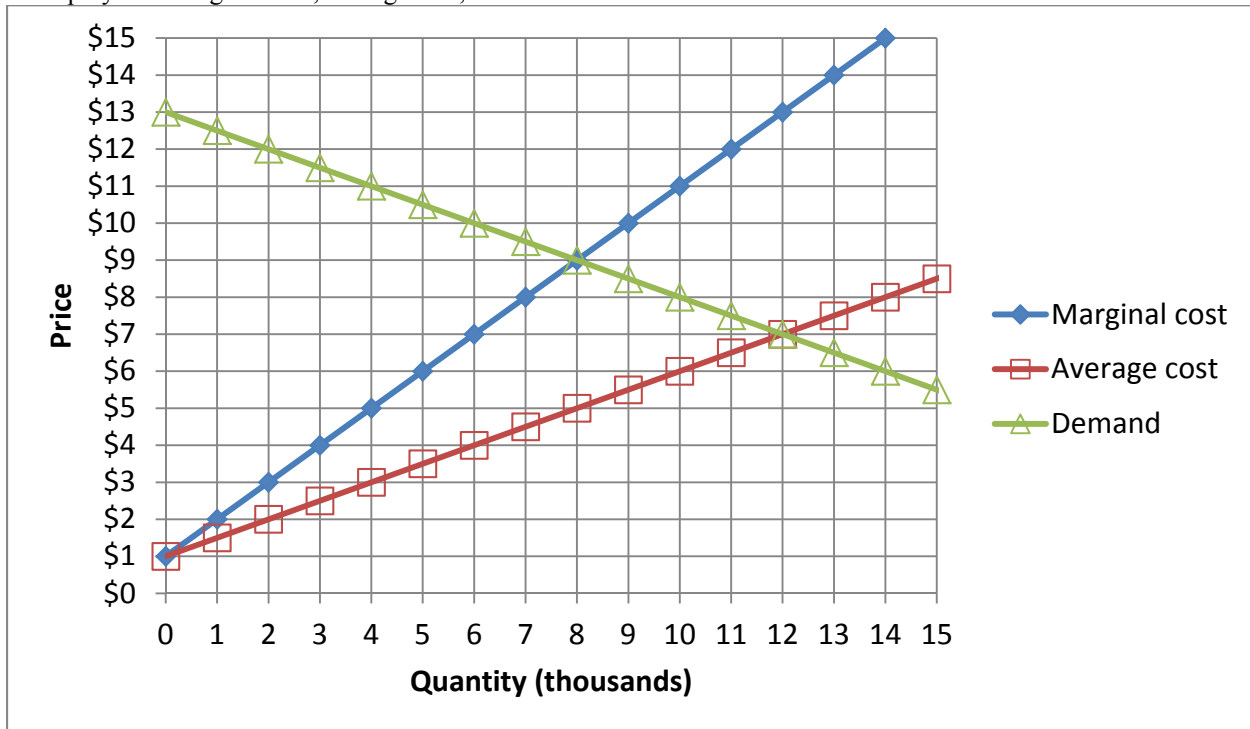
*Total revenue*  
*Total cost*

*Average revenue*  
*Average cost*

*Marginal revenue*  
*Marginal cost*

- a. Change in total revenue divided by change in output.
- b. All money paid for inputs purchased or hired.
- c. Increase in total cost from producing another unit of output.


(9) [Monopoly, price discrimination: 22 pts] Megahamburgers is the only fast-food outlet in town, so it has a monopoly. Its marginal cost, average cost, and demand curves are shown below.



First, suppose Megahamburgers must charge the same price on every hamburger sold.

- Using a straightedge, draw and label Megahamburgers' marginal revenue curve.
- Compute Megahamburgers' profit-maximizing quantity.
- Compute the price that the Megahamburgers would charge.
- Compute Megahamburgers' profit.
- Compute consumer surplus
- Compute the social deadweight loss.

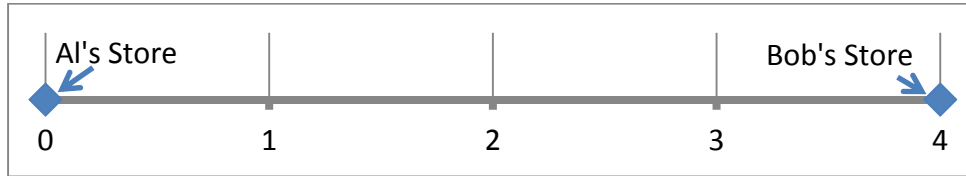
	thousand
\$	
\$	thousand
\$	thousand
\$	thousand

Second, suppose Megahamburgers can charge a different price for every hamburger sold. In other words, suppose *perfect price discrimination* is possible, where every hamburger can be sold for the maximum price the buyer is willing to pay.

- Compute Megahamburgers' profit-maximizing quantity.
- Compute Megahamburgers' revenue.
- Compute Megahamburgers' profit.
- Compute consumer surplus.
- Compute the social deadweight loss.

	thousand
\$	thousand
\$	thousand
\$	thousand
\$	thousand

(10) [Monopolistic competition: 12 pts] Two convenience stores selling milk are located four miles apart on a road with customers spread between them. Let  $x$  denote a particular customer's position on this road as shown in the diagram below. Thus  $x$  is the distance in miles from that customer to Al's Store, and  $(4-x)$  is the distance to Bob's Store.



Assume each customer wants to buy one gallon of milk but dislikes driving. In particular, each customer perceives a cost of \$0.25 per mile (for gasoline, time wasted, etc.) for driving. So each customer perceives the total price of milk from Al's Store as  $P_A^* = P_A + 0.25x$ , and the total price of milk from Bob's store as  $P_B^* = P_B + 0.25(4-x)$ , where  $P_A$  and  $P_B$  denote the actual prices of milk charged at the cash register. Naturally, each customer buys milk from the store with the lowest perceived total price.

Further assume that 500 customers per mile live along this road. Given these assumptions, it can be shown that the number of customers choosing to buy one gallon of milk from Al's Store is  $Q_A = 1000(P_B - P_A + 1)$ . This can be rearranged to give the demand equation  $P_A = P_B + 1 - (Q_A/1000)$ . Al's marginal cost of milk is \$2 per gallon.

First, assume Bob's Store sets a price of \$2.50 per gallon of milk.

a. Find the equation for Al's marginal revenue curve. (The only variable should be  $Q_A$ ).

$MR =$
--------

b. Compute the quantity of milk $Q_A$ that Al's Store should try to sell to maximize profit.	gallons
c. Compute the price $P_A$ Al's Store should set for milk.	\$

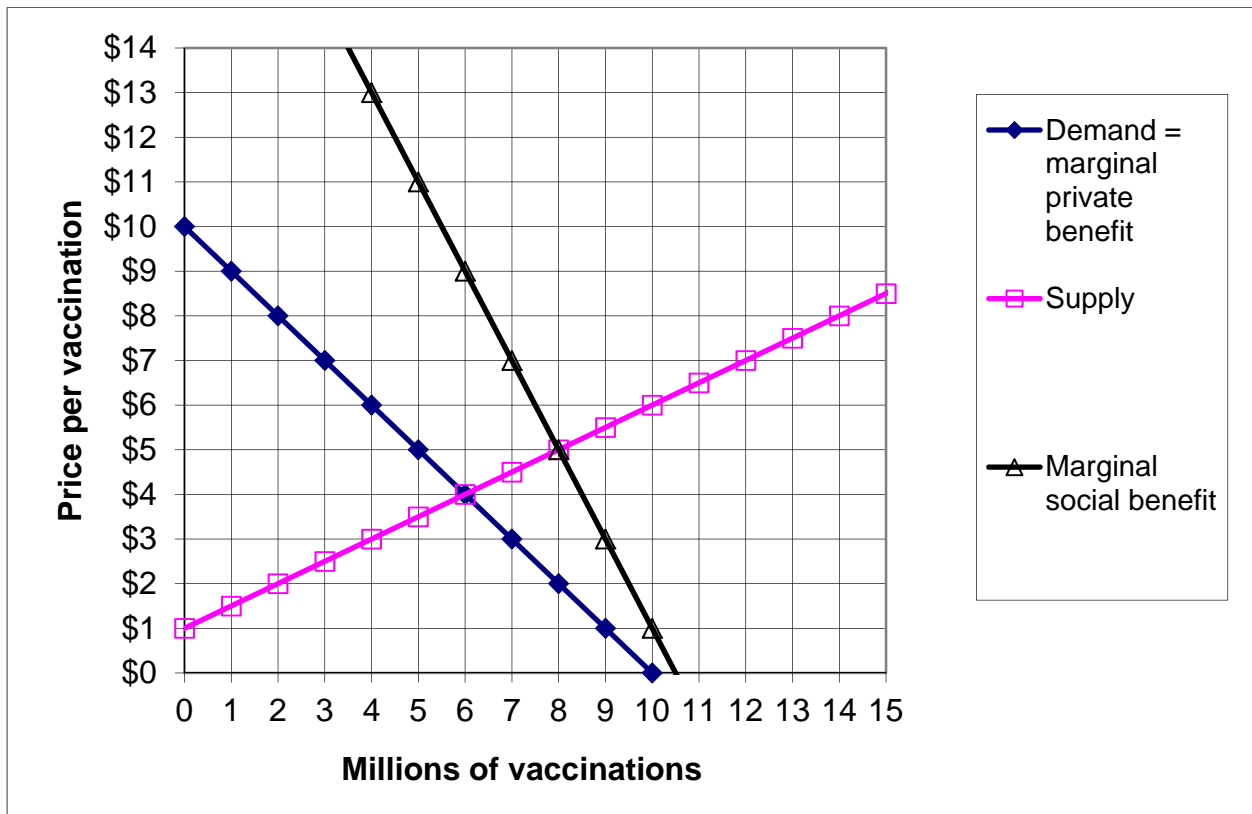
Second, assume Bob's Store sets a price of \$4.00 per gallon of milk.

d. Find the new equation for Al's marginal revenue curve. (The only variable should be  $Q_A$ ).

$MR =$
--------

e. Compute the new quantity of milk $Q_A$ that Al's Store should try to sell to maximize profit.	gallons
f. Compute the new price $P_A$ Al's Store should set for milk.	\$

(11) [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 impose a *tax* or a *subsidy*?
- What should be the tax rate or subsidy rate?

\$	
	million
	million
\$	million
\$	per vaccination

(12) [Regulating pollution: 20 pts] Seven factories are each producing one unit of pollution per year. The government has determined that total pollution must be reduced to 4 units per year (a reduction of 3 units). The cost of cleaning up pollution at each factory is given below.

Factory	Annual costs of cleaning up pollution
Factory A	\$5 thousand
Factory B	\$8 thousand
Factory C	\$10 thousand
Factory D	\$12 thousand
Factory E	\$14 thousand
Factory F	\$19 thousand
Factory G	\$35 thousand

Consider alternative approaches to regulating pollution.

**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?

\$                      thousand

**Auction:** Suppose 4 permits to pollute were sold by the government to factories at auction. In this auction, the price rises in increments of \$1 thousand.

- c. Which 4 factories would win the permits? Give their letters.
- d. What would be the final auction price of a permit to pollute?
- e. What would be the total cost of cleaning up for those 3 factories that did not win permits in the auction?

\$                      thousand
\$                      thousand

**Cap and trade:** Suppose 4 permits to pollute were distributed to factories at random. Then the factories were permitted to trade permits in a market among themselves.

- f. Which 4 factories would eventually own the permits? Give their letters.
- g. What would be the approximate market price of a permit to pollute? Give an answer to the nearest thousand dollars.
- h. What would be the total cost of cleaning up for those 3 factories that did not own permits?

\$                      thousand
\$                      thousand

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

- i. What fee would reduce the amount of pollution to 4 units? Give an answer to the nearest thousand dollars.
- j. What would be the total cost of cleaning up for those 3 factories that chose not to pay the fee?

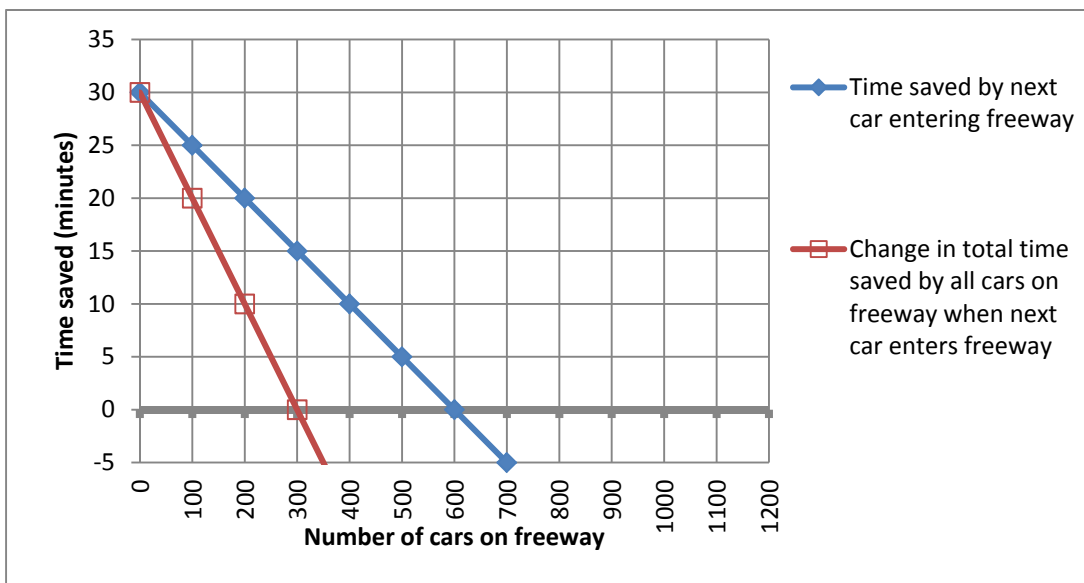
\$                      thousand
\$                      thousand

(13) [Nonrival goods: 4 pts] A city government will offer a free outdoor concert series during the summer in a neighborhood park. About **1000** people are likely to enjoy the concerts. Each concert costs **\$4000** to produce. Let  $Q$  denote the number of concerts. A typical individual person's marginal benefit from the concert series is given by the following expression (or formula):  $MB = 10 - 2Q$ .

- Give an expression (or formula) for the marginal social benefit from the concert series. [Hint: This must be a formula containing one variable:  $Q$ .]
- Compute  $Q^*$  the socially-optimal number of concerts.

$MSB =$
concerts

(14) [Common property resources: 6 pts] A certain freeway can easily get 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 time saved by each new car, and the change in total time saved by all cars, as that new car enters the freeway. Note that the change in total time saved by all cars turns negative as the freeway becomes congested.



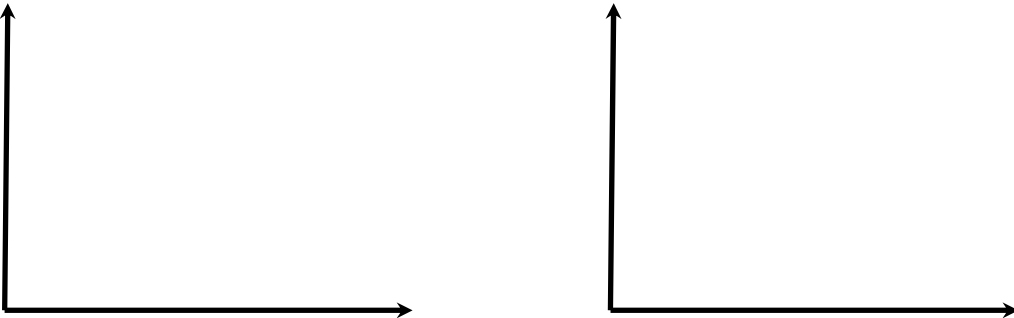
- How many cars will enter the freeway if entry onto the freeway is unregulated?
- What is the socially-optimal number of cars on the freeway—that is, the number of cars that maximizes total time saved by all cars on the freeway?
- Suppose a typical driver is willing to pay \$1 for each five minutes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

	cars
	cars
	\$

**III. Critical thinking:** Write a one-paragraph essay answering the question below. [5 pts]

- (1) Consider the following statement. “Free markets are efficient markets. When government intervenes in markets, society is worse off.” Do you agree or disagree? Give examples and illustrate your examples with graphs.

Write your answer below. Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling.



The response area is a large rectangular box containing two blank coordinate systems. Each coordinate system consists of a vertical y-axis and a horizontal x-axis, both ending in arrows. The axes are positioned at the bottom of the box, with the first graph on the left and the second on the right.

[end of exam]