

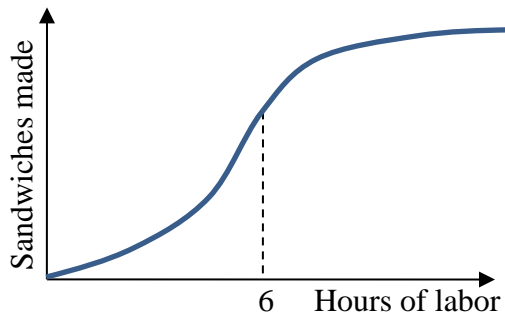
FINAL EXAMINATION VERSION B

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, 26 pts total]

- (1) "Reducing inflation is more important than reducing unemployment" is an example of
- a positive statement.
 - a normative statement.
 - both of the above.
 - none of the above.

- (2) Is the production function below characterized by diminishing returns to labor input?
- Yes, for all levels of labor input.
 - No, not for any levels of labor input.
 - Yes, but only after 6 hours of labor input.
 - Yes, but only before 6 hours of labor input.



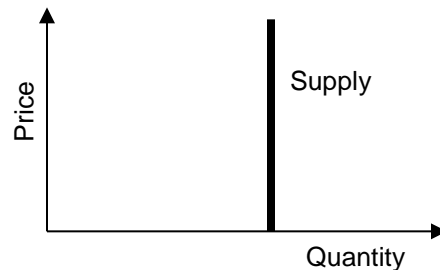
- (3) Farm A can produce 100 units of corn or 100 units of soybeans per acre. Farm B can produce 300 units of corn or 150 units of soybeans per acre. Which farm has a comparative advantage in soybeans?
- Farm A.
 - Farm B.
 - Both farms.
 - Neither farm.

- (4) The Law of One Price means
- efficient markets eliminate price dispersion.
 - the total quantity buyers want to buy is negatively related to the price.
 - a good cannot be resold.
 - all sellers are required by law to quote the same price.
 - the buyer and the seller in each transaction must agree on a price.

- (5) A fall in the price of Android smart phones will shift the demand for Apple iPhones to the left, since Android phones and iPhones are
- complementary goods.
 - substitute goods.
 - normal goods.
 - inferior goods.

- (6) A good that has no close substitutes will likely have a price elasticity of demand that is
- small, in absolute value.
 - large, in absolute value.
 - zero.
 - infinite.
 - cannot be determined.

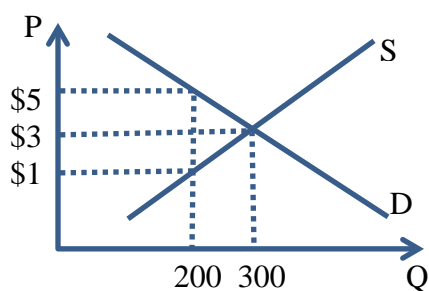
- (7) The supply curve in the graph below is
- perfectly elastic.
 - perfectly inelastic.
 - unitary elastic.
 - Cannot be determined from information given.



- (8) To pass the *compensation test of Kaldor and Hicks*, a change in the economy must result in
- cost savings for the government.
 - a rise in wages, salaries, and other compensation.
 - winners but no losers.
 - gains to winners that exceed any losses to losers.
 - at least some winners.

- (9) Suppose the price of a pumpkin in Des Moines is \$5 and the cost of shipping a pumpkin between Des Moines and Minneapolis is \$1.50. Markets are *out of equilibrium* if the price of pumpkins in Minneapolis is
- \$3.
 - \$4.
 - \$5.
 - \$6.

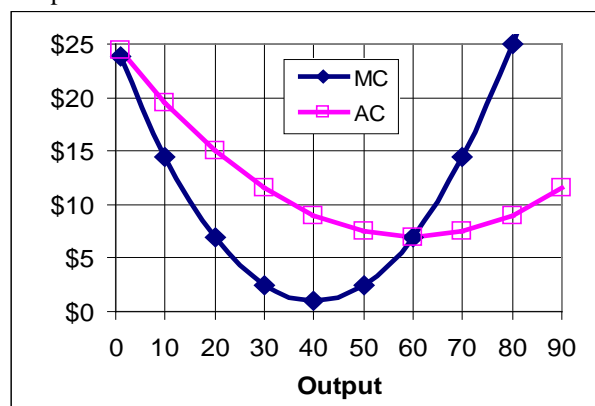
- (10) Consider the market for sandwiches depicted in the graph below. Suppose a law is passed prohibiting *sellers from selling more than 200 sandwiches*. With this quota, the price of sandwiches will be
- \$1.
 - \$3.
 - \$4.
 - \$5.
 - Cannot be determined from information given.



- (11) A change in the number of people who buy bottled water is called a change at the
- extensive margin.
 - intensive margin.
 - marginal product.
 - marginal revenue.

- (12) Zippy Lube currently changes oil on 100 cars a day, and its daily cost of operation is \$4000. If it expands its business to 200 cars a day, its daily cost will rise to \$10,000. Its marginal cost over this range is therefore about
- \$30 per oil change.
 - \$40 per oil change.
 - \$50 per oil change.
 - \$60 per oil change.
 - \$100 per oil change.
 - Cannot be determined from information given.

- (13) ABC Company is a small firm in a big market and therefore takes the market price as given. Its marginal cost (MC) and average cost (AC) curves are shown below. To maximize profit, ABC Company should set its output at
- 30 units.
 - 40 units.
 - 50 units.
 - 60 units.
 - 70 units.
 - Cannot be determined without knowing market price.



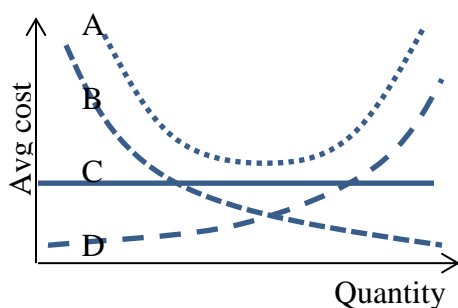
- (14) In the *short run*, a firm should continue operating if its revenue is sufficient to pay at least its
- accounting cost.
 - fixed cost.
 - variable cost.
 - total cost.

- (15) *Price equals average cost* in a competitive industry in long-run equilibrium because
- business owners have a sense of fairness.
 - individual firms adjust their output levels using the rule "price equals average cost" to maximize profit.
 - consumers refuse to pay more than what is reasonable.
 - positive profits encourage entry of new firms while negative profits encourage existing firms to leave the industry.
 - the threat of government regulation causes firms to hold prices down.

- (16) Suppose the paper industry is perfectly competitive and the price of a ream of paper is \$4. Then any firm in the paper industry believes its marginal revenue is
- exactly equal to \$4.
 - more than \$4.
 - less than \$4.
 - zero.

- (17) Suppose the price of a pair of jeans is \$30 and the price of a teeshirt is \$5. If the economy is perfectly competitive, then these prices indicate that the *economy's* opportunity cost of a pair of jeans is
- 1/5 of a teeshirt.
 - 1/6 of a teeshirt.
 - 1 teeshirt.
 - 5 teeshirts.
 - 6 teeshirts.

- (18) Which average cost curve below implies that the firm enjoys a natural monopoly?



- Curve A.
- Curve B.
- Curve C.
- Curve D.
- None of the above.

- (19) 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
- \$0.25 .
 - \$2.25 .
 - \$2.50 .
 - \$4.75 .
 - \$5.00 .
 - \$10.00 .

- (20) Products are said to be "differentiated" if
- different consumers buy different quantities of them.
 - one can buy them in fractional amounts.
 - consumers do not view them as perfect substitutes.
 - they are sold through different retail channels (stores, online, catalogs, etc.)

- (21) A large grocery store attracts many customers who also stop to shop at *other* nearby smaller stores. Those nearby stores become more profitable as a result. A large grocery store therefore creates
- an external benefit.
 - an external cost.
 - a differentiated product.
 - a superior good.

- (22) 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 purification. Thus, spreading manure on frozen fields creates
- an external benefit.
 - an external cost.
 - an elasticity.
 - an inferior good.

- (23) Suppose the marginal private cost of producing a gallon of gasoline is \$3 and the marginal social cost is \$5. Then the marginal external cost is
- \$2.
 - \$3.
 - \$5.
 - \$8.
 - \$15.

- (24) If one person downloads a particular electronic book, the same e-book can be downloaded by other people. However, everyone who downloads the e-book is forced to pay for it. This e-book is therefore
- a nonrival good.
 - a nonexcludable good.
 - both of the above.
 - none of the above.

- (26) Absent some sort of regulation, common property resources are inevitably
- ignored.
 - produced in excessive quantity.
 - underused.
 - overused.

- (25) Overfishing in the oceans is a big problem. Some species are being wiped out. The more fish some people take, the less fish are left for others. But there is no effective mechanism to stop people from overfishing, so these ocean fish species are
- a nonrival good.
 - a nonexcludable good.
 - both of the above.
 - none of the above.

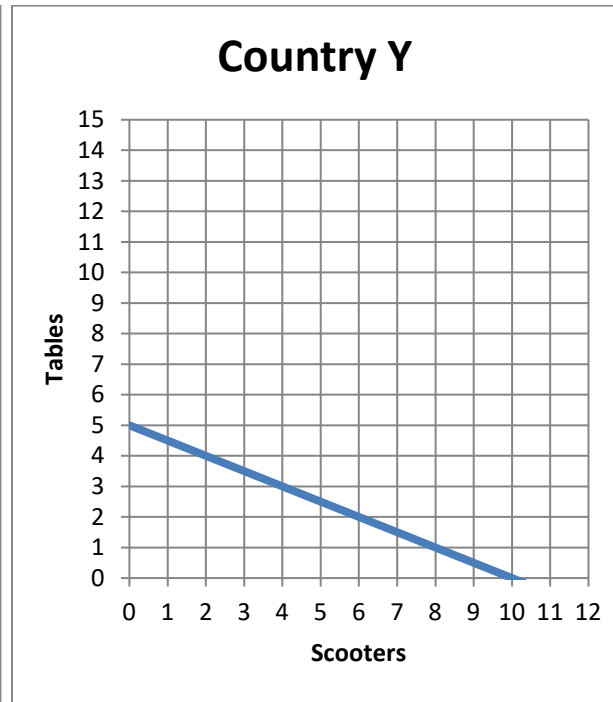
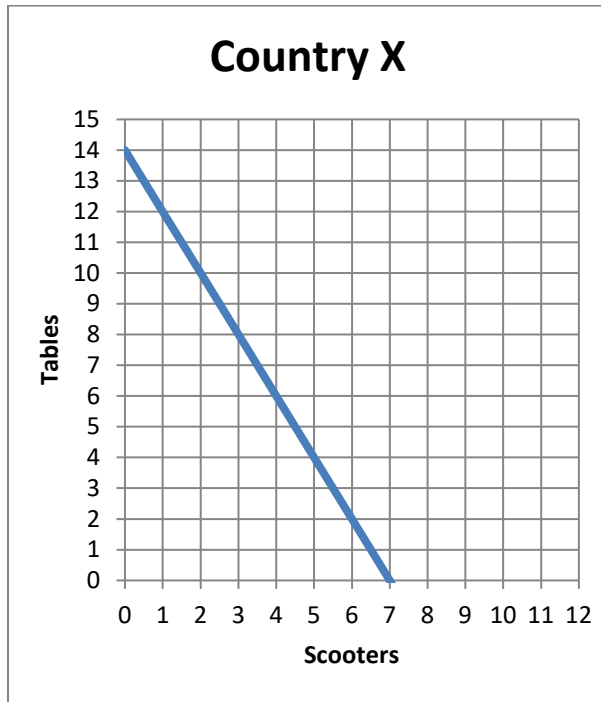
II. Problems: Insert your answer to each question in the box provided. Use margins and graphs for scratch work. Only the answers in the boxes will be graded. Work carefully—partial credit is not normally given for questions in this section.

(1) [Production functions: 7 pts] A work crew trims trees. Complete the table by computing the work crew's average product and marginal product and placing your answers in the unshaded cells of the third and fourth columns below. Then answer the question below.

<i>Number of workers</i>	<i>Trees trimmed per day</i>	<i>Average Product</i>	<i>Marginal Product</i>
0 workers	0 trees trimmed		
			trees trimmed per worker
3 workers	3 trees trimmed	trees trimmed per worker	
			trees trimmed per worker
6 workers	12 trees trimmed	trees trimmed per worker	
			trees trimmed per worker
9 workers	27 trees trimmed	trees trimmed per worker	

Is the work crew's production function characterized by *diminishing returns* to their labor input? Answer YES or NO.

(2) [Comparative advantage, gains from trade: 17 pts] Country X and Country Y can each produce dining-room tables and scooters. 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 table?
- What is Country Y's opportunity cost of producing a table?
- What is Country X's opportunity cost of producing a scooter?
- What is Country Y's opportunity cost of producing a scooter?
- Which country has a comparative advantage in producing tables?
- Which country has a comparative advantage in producing scooters?

	scooters
	scooters
	tables
	tables

g. [3 pts] Fill in the blanks: *Both* countries can consume combinations of products *outside* their individual production possibility curves if _____ exports *two* tables to _____, which exports _____ scooters 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**.

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

a. Consider the market for **natural gas**. Suppose new horizontal hydraulic fracturing (fracking) technology lowers the cost of producing natural gas.

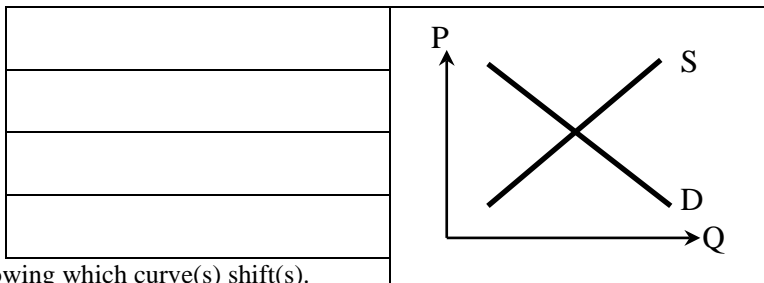
Does demand shift *left*, shift *right*, or remain *unchanged* ?

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.

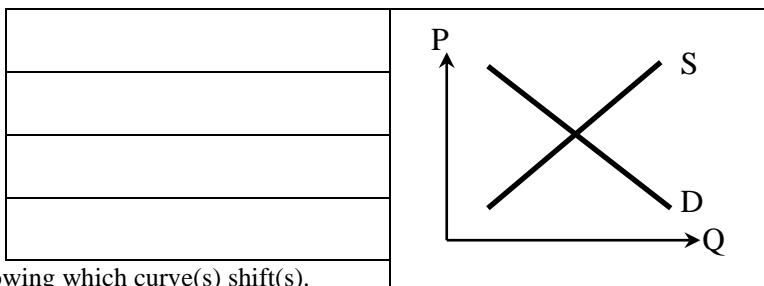
Does demand shift *left*, shift *right*, or remain *unchanged* ?

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 **cotton clothing**: The price of raw cotton falls. Simultaneously, cotton clothing becomes more fashionable in the minds of consumers.

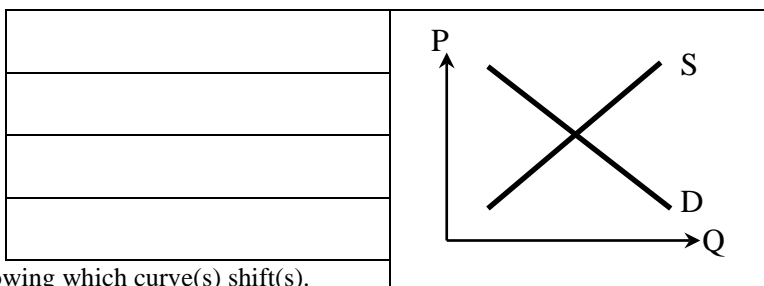
Does demand shift *left*, shift *right*, or remain *unchanged* ?

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

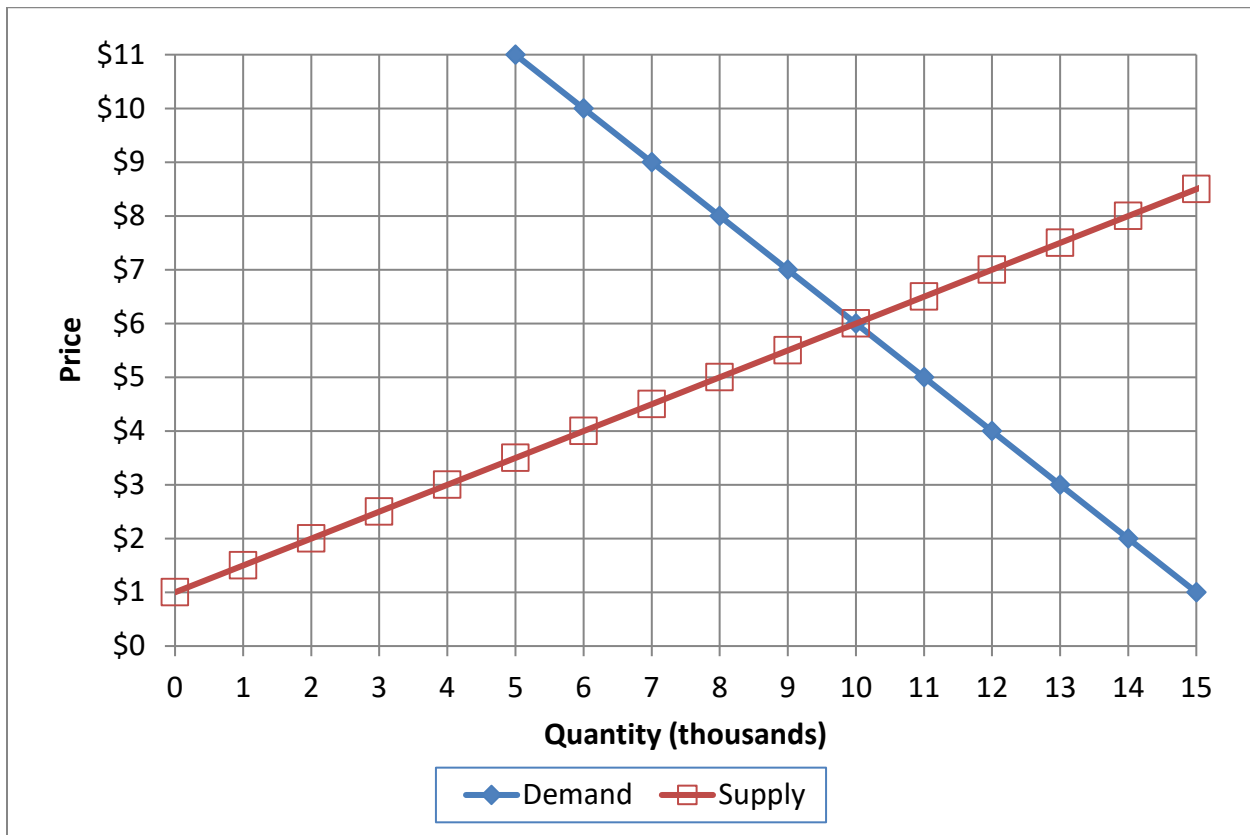
Does the equilibrium price *increase*, *decrease*, or *cannot be determined* ?

Does the equilibrium quantity *increase*, *decrease*, or *cannot be determined* ?

Sketch a graph of this scenario at right, showing which curve(s) shift(s).



(4) [Welfare analysis of tax or subsidy: 18 pts] The graph below shows the market for snow shovels.

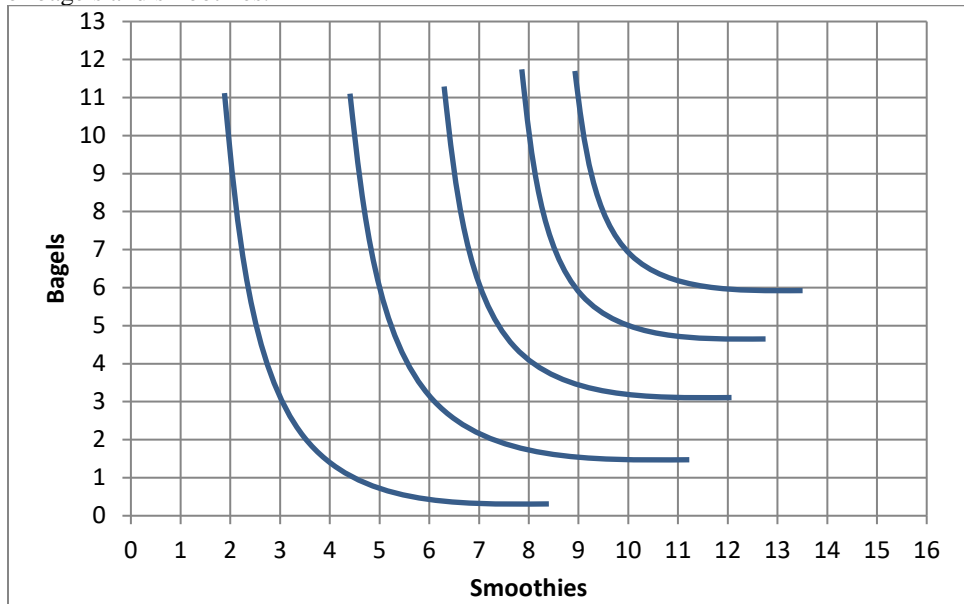


Suppose the government imposes an excise **tax of \$ 6** per snow shovel.

- Compute the equilibrium quantity sold.
- Compute the equilibrium net price received by sellers (excluding the tax).
- Compute the equilibrium total price paid by buyers (including the tax).
- Does producer surplus *increase, decrease, or remain constant* because of the tax?
- By how much?
- Does consumer surplus *increase, decrease, or remain constant* because of the tax?
- By how much?
- Compute the total tax revenue collected by the government.
- Compute the deadweight social loss caused by the tax.

	thousand
\$	per shovel
\$	per shovel
\$	thousand
\$	thousand
\$	thousand
\$	thousand

(5) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Jessica's preferences for bagels and smoothies.



- a. Would Jessica rather have 11 bagels and 8 smoothies, or 7 bagels and 10 smoothies?
- b. Would Jessica rather have 3 bagels and 12 smoothies, or 6 bagels and 9 smoothies?

	bagels and	smoothies
	bagels and	smoothies

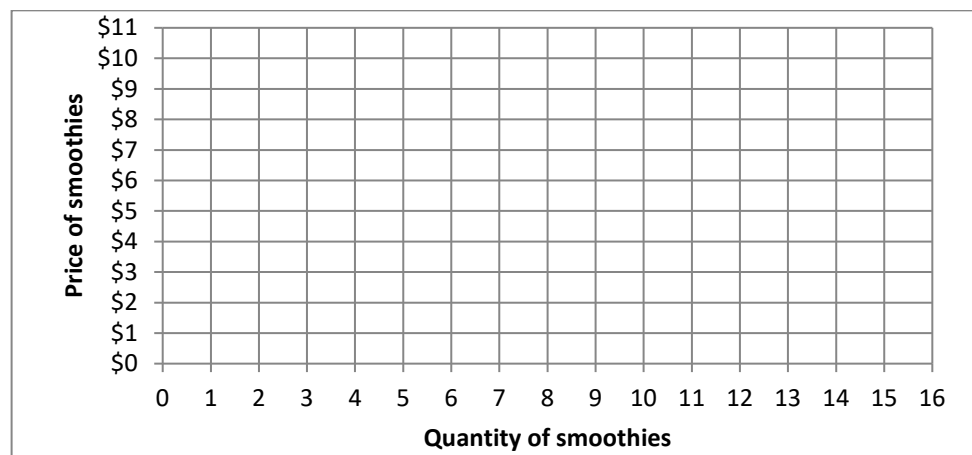
Suppose Jessica has a budget of \$24 to spend on bagels and smoothies. The price of bagels is \$2.

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

smoothies

smoothies

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



(6) [Using income elasticities: 10 pts] Suppose the income elasticity of demand for concert tickets is 1.5. Now suppose income *rises* by 4%. Assume the price of concert tickets does not change.

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

%
%

(7) [Rational choice: 10 pts] The city government for a rapidly growing city needs to build new fire stations. The following are cost and benefit estimates.

Fire stations	Total cost	Total benefit	Marginal cost per station	Marginal benefit per station
0	\$ 0	\$0		
			\$ million	\$ million
2	\$10 million	\$14 million		
			\$ million	\$ million
4	\$18 million	\$24 million		
			\$ million	\$ million
6	\$24 million	\$28 million		
			\$ million	\$ million
8	\$28 million	\$29 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 fire stations should the city build? (Answer must be 0, 2, 4, 6, or 8).

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

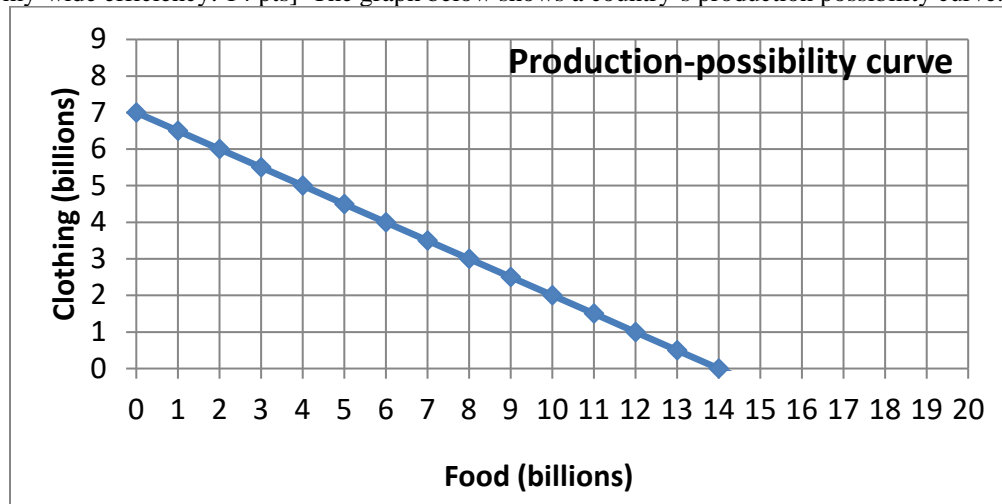
Total revenue
Total cost

Average revenue
Average cost

Marginal revenue
Marginal cost

- a. Change in total cost divided by change in output.
- b. Total cost divided by the quantity of output.
- c. Slope of total revenue curve.

(9) [Economy-wide efficiency: 14 pts] The graph below shows a country's production possibility curve.



- a. What is this **country's** opportunity cost of a unit of food?
- b. What is this **country's** opportunity cost of a unit of clothing?

units of clothing
units of food

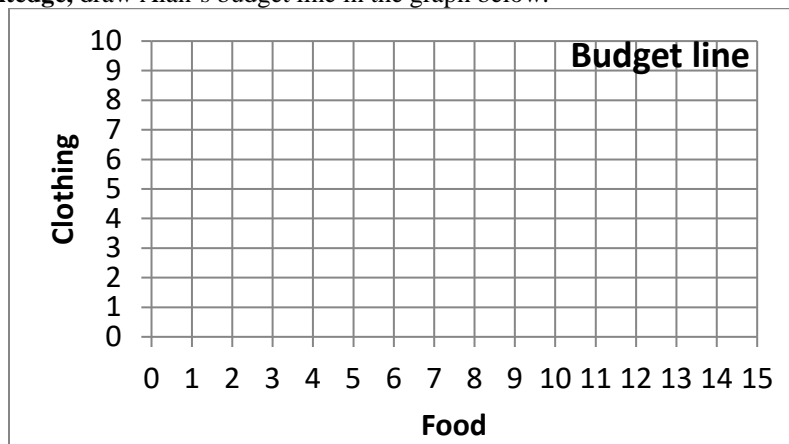
Assume this country's economy is in competitive equilibrium in all markets and the price of a unit of clothing is \$6.

- c. What must be the price of a unit of food?

\$

Alan is a consumer in this economy. He has an income of \$ 30.

- d. Using a **straightedge**, draw Alan's budget line in the graph below.



- e. What is **Alan's** opportunity cost of a unit of food?
- f. What is **Alan's** opportunity cost of a unit of clothing?
- g. Sketch an indifference curve tangent to Alan's budget line. What is the slope of that indifference curve (that is, Alan's marginal rate of substitution) at the tangency point?

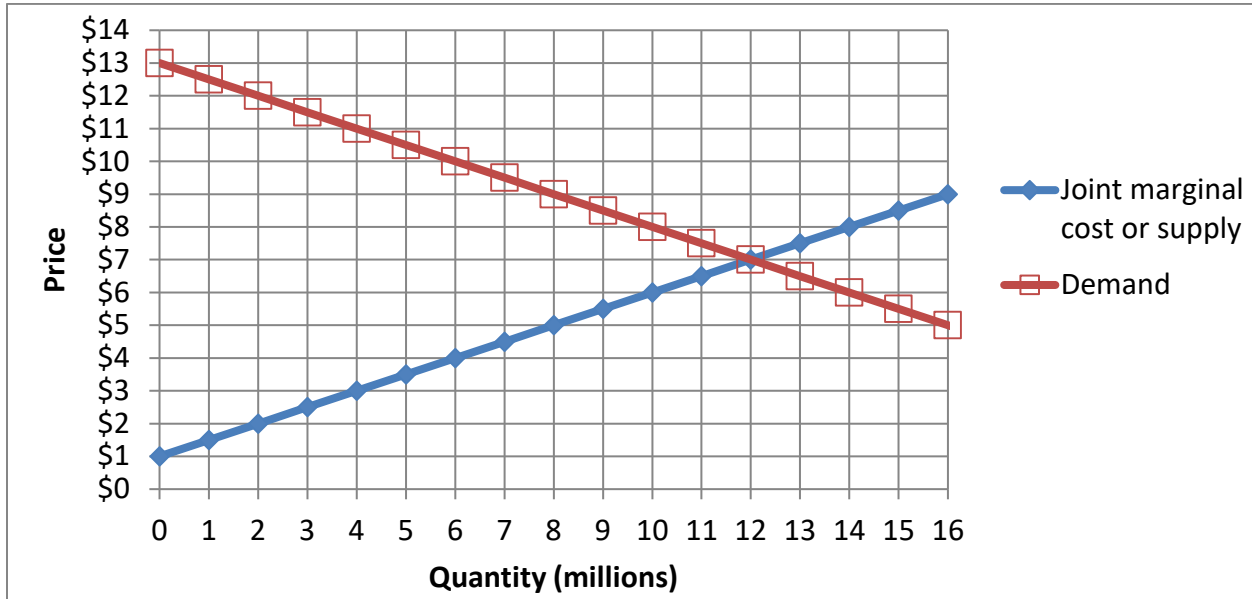
units of clothing
units of food

(10) [Monopoly price discrimination: 4 pts] Suppose the only movie theatre in town sells tickets to both children and adults. The theatre believes the elasticity of demand by children is -5 , and the elasticity of demand by adults is -3 . Assume the theatre's marginal cost of a ticket is \$8.

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

	\$
	\$

(11) [Competition versus collusion: 16 pts] Suppose a small group of firms produce a certain vitamin. The graph below shows the demand curve for the vitamin, 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?
- 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?

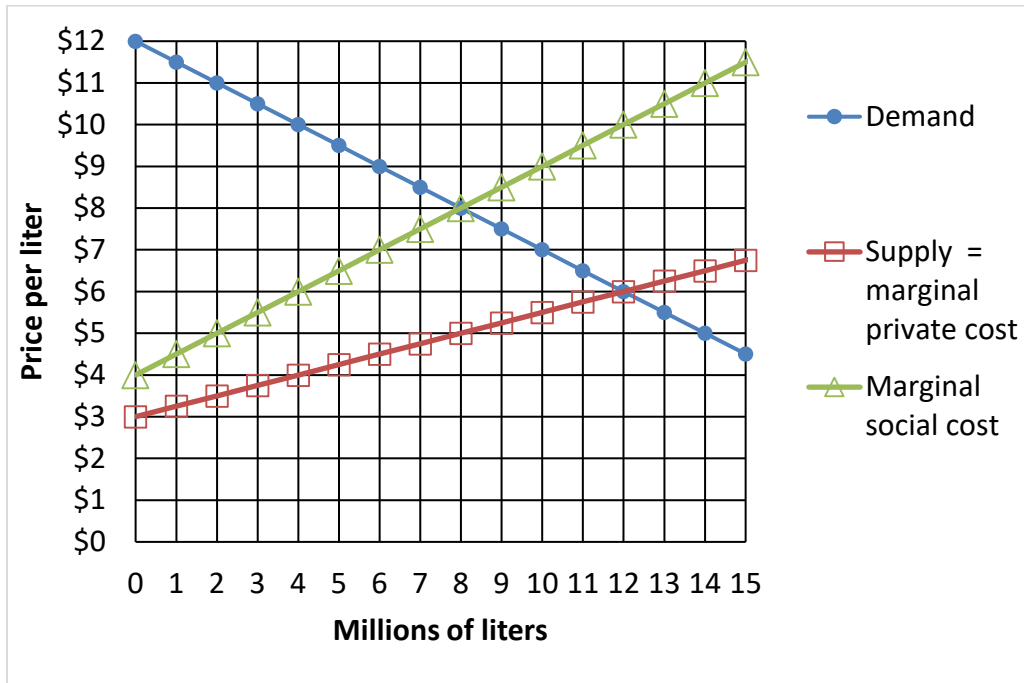
	million
	\$
	\$

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 deadweight loss from collusion.

	million
	\$
	\$
	\$ million

(12) [Externalities: 12 pts] The graph below shows the market for a particular chemical that generates water pollution, an external cost born by other people. Therefore, in addition to demand and supply curves, a curve representing marginal social cost 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?

\$	per liter
	million liters
	million liters
\$	million
\$	per liter

(13) [Regulating pollution: 20 pts] Six 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 2 units). The cost of cleaning up pollution at each factory is given below.

Factory	A	B	C	D	E	F
Annual cost of cleaning up pollution	\$10	\$25	\$45	\$35	\$15	\$55

Command-and-control:

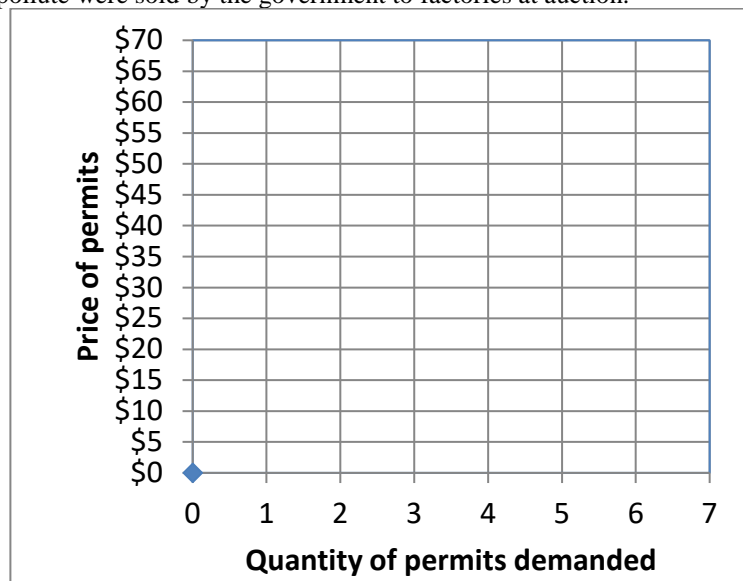
- a. To minimize the total cost of cleaning up, which 2 factories should be commanded to clean up? Give their letters.
- b. What would be the total cost of cleaning up for these 2 factories together?

\$

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. [6 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 4 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 2 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 4 units: \$0, \$10, \$20, \$30, \$40, or \$50 ?
- h. What would be the total cost of cleaning up for those 2 factories that chose not to pay the fee?

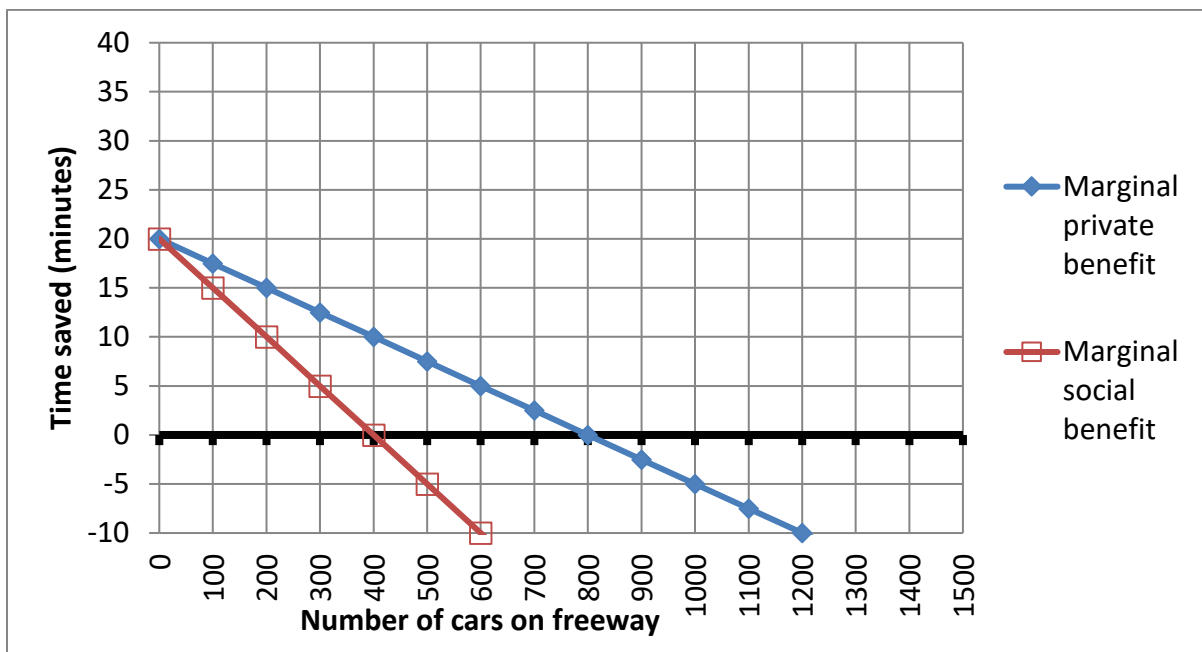
\$
\$

(14) [Public goods: 4 pts] A village government will offer a free outdoor movie series during the summer in a neighborhood park. About **500** people are likely to enjoy the movies. Each movie costs **\$500** to show. Let Q denote the number of movies. A typical individual person's marginal benefit from the movie series is given by the following expression (or formula): $MB = 10 - Q$.

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

$MSB =$
movies

(15) [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 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.



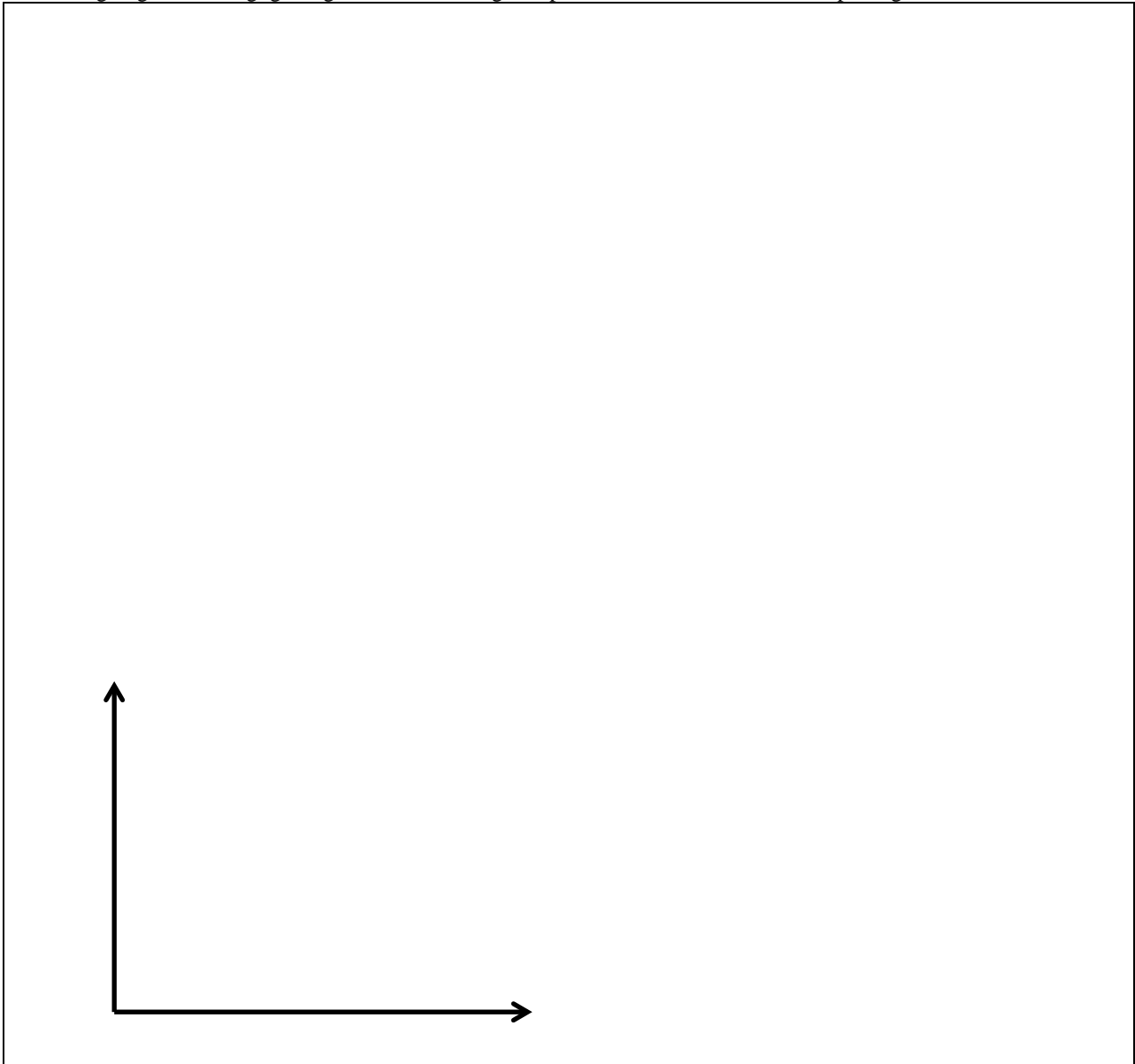
- a. How many cars will enter the freeway if entry onto the freeway is unregulated?
- b. What is the socially-optimal number of cars on the freeway—that is, the number of cars that maximizes total time saved by all cars on the freeway?
- c. Suppose a typical driver is willing to pay \$1 for each five 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 *one* question below (your choice). [4 pts]

- (1) Give an example of a government intervention that makes a market *less* efficient. Explain why the intervention decreases efficiency and illustrate your argument using a supply-and-demand graph. Label all curves and axes. Shade and label the triangle of deadweight loss caused by government intervention.
- (2) Give an example of a government intervention that makes a market *more* efficient. Explain why the intervention increases efficiency and illustrate your argument using a supply-and-demand graph. Label all curves and axes. Shade and label the triangle of deadweight loss eliminated by government intervention.

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]