FINAL EXAMINATION VERSION A

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
a.   using math to make decisions.
b.   making sacrifices today for a better future.
c.   maximizing one's income.
d.   ignoring "soft" concerns like friendships and charity.
e.   doing the best one can with what one has.

(2) Aaron buys a ticket to a football game for $50. When he arrives at the stadium, he discovers that scalpers are willing to pay $150 for his ticket. His *opportunity cost* of attending the game is
a. $0.
b. $50.
c. $100.
d. $150.

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

(4) 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.
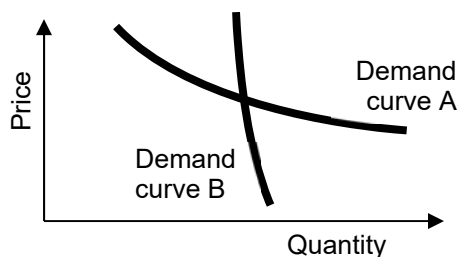
(5) Suppose the price of watermelons is $5 in Kansas City and the cost of shipping a watermelon between Des Moines and Kansas City is $2. Markets are *out of equilibrium* if the price of melons in Des Moines is
a. $1.
b. $4.
c. $5.
d. $6.

(6) The number of pedometers actually sold would increase if the government enacted a
a.   a tax on pedometers.
b.   a quota on sellers of pedometers.
c.   a subsidy for pedometers.
d.   a price floor (or legal minimum price) for pedometers.
e.   all of the above.
f.   none of the above.

(7) Production of electric cars is increasing. An increase in the number of electric cars produced by each company is called a change at the
a.   extensive margin.
b.   intensive margin.
c.   marginal product.
d.   marginal revenue.

(8) The increase in a firm's total revenue from producing and selling one more unit of output by definition equals the firm's
a.   total revenue.
b.   average revenue.
c.   marginal revenue.
d.   total cost.
e.   average cost.
f.   marginal cost.

(9) The increase in a firm's total cost from producing and selling one more unit of output by definition equals the firm's
a. average cost.
b. marginal cost.
c. total cost.
d. average revenue.
e. marginal revenue.
f. total revenue.

(10) 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
a. 1/5 of a teeshirt.
b. 1/6 of a teeshirt.
c. 1 teeshirt.
d. 5 teeshirts.
e. 6 teeshirts.

(11) A "natural monopoly" is a firm that enjoys
a. exclusive ownership of a natural resource essential for producing the product.
b. a downward-sloping average cost curve.
c. patent protection.
d. an exclusive government franchise allowing it alone to sell the product.

(12) At its current level of output, Acme Manufacturing's marginal revenue is $5 and its marginal cost is $2. 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) Water aquifers (underground water sources) in the western United States are rapidly being depleted. No one can be prevented from taking water from a well on their own property—yet the more water is taken, the less is left for other people. Water aquifers in the western United States are therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(14) Satellite radio broadcasts (like Sirius XM) can be enjoyed by many people without interfering with each other. But unlike over-the-air broadcasters, the satellite broadcaster encrypts the signal, so no one can listen without paying. Satellite radio broadcasts are therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(15) If you gaze at the moon, other people can do so at the same time, and no one can make you pay for it. A view of the moon is therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(16) Electric power plants that burn coal can put sulphur dioxide in the atmosphere. This chemical returns to earth as "acid rain," killing fish and ruining the fishing downwind of the plants. Burning coal therefore creates
a. an external benefit.
b. an external cost.
c. a budget constraint.
d. an inferior good.

(17) Economists believe that environmental problems are caused, for the most part, by
a. lack of awareness.
b. moral failing.
c. misaligned incentives.
d. market power.

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.
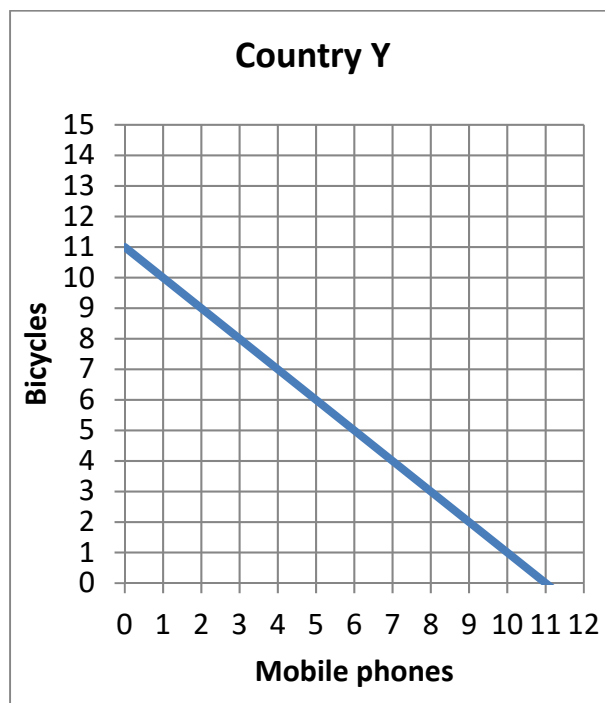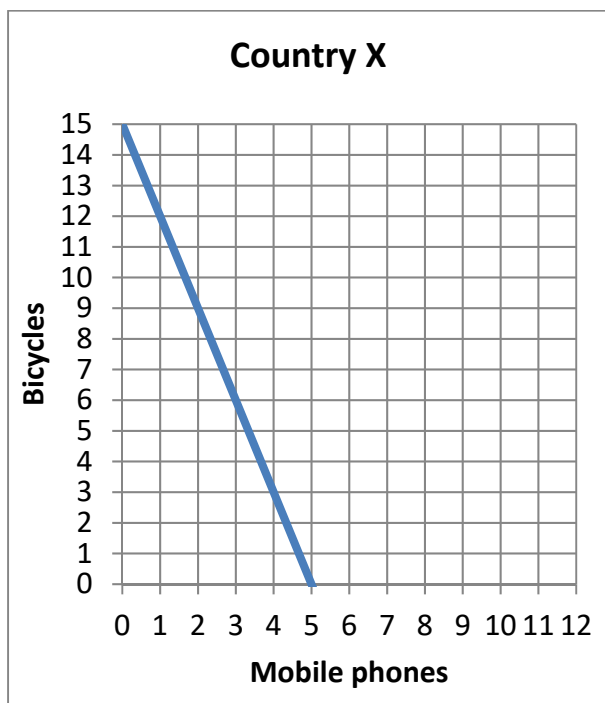
a. What is Country X's opportunity cost of producing a phone?

b. What is Country Y's opportunity cost of producing a phone?

c. What is Country X's opportunity cost of producing a bicycle?

d. What is Country Y's opportunity cost of producing a bicycle?

e. Which country has a comparative advantage in producing phones?

f. 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 *three* 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 ***natural gas***. Suppose we have an unusually cold winter. (Most homes in the Midwest are heated with 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).
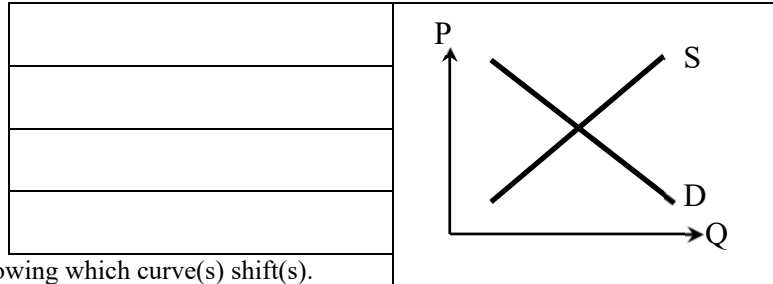
b. Consider the market for ***computers***: Suppose the price of computer components rises due to COVID-related disruptions.

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).
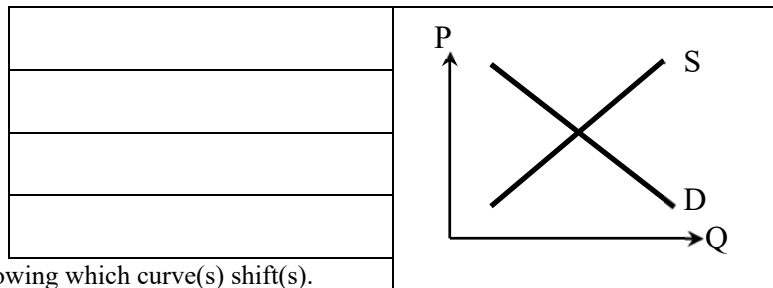
c. Consider the market for ***blueberries***: A new government study reports that eating blueberries helps fight cancer and heart disease. At the same time, new environmental regulations raise the cost of growing blueberries.

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).
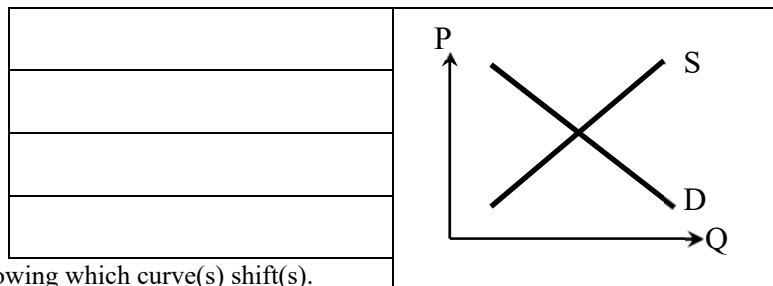
(3) [Calculating elasticities: 2 pts] Suppose that if the price of electricity is 10 cents per kilowatt-hour, the typical household uses 20 kilowatt-hours per day; but if the price is 20 cents per kilowatt-hour, the typical household uses 12 kilowatt-hours per day. Compute the price elasticity of demand for electricity using the "arc-elasticity" formula.

(4) [Using price elasticity of demand: 10 pts] Suppose an internet entertainment service *raises* its price by 4%. Suppose the price elasticity of demand for this service is -2.5. Assume everything else affecting demand for the service remains constant.

   a. According to the information above, is demand for this service *elastic, inelastic,* or *unitary-elastic*?

   b. As the price rises, will the number of customers *increase*, *decrease*, or remain *constant*?

   c. ... by approximately how much?
   %

   d. Will the total revenue received by the service *increase*, *decrease*, or remain *constant*?

   e. ... by approximately how much?
   %

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

   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 –10, and the elasticity of demand by adults is –3. Assume the ballet's marginal cost of a ticket is $18.

   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.
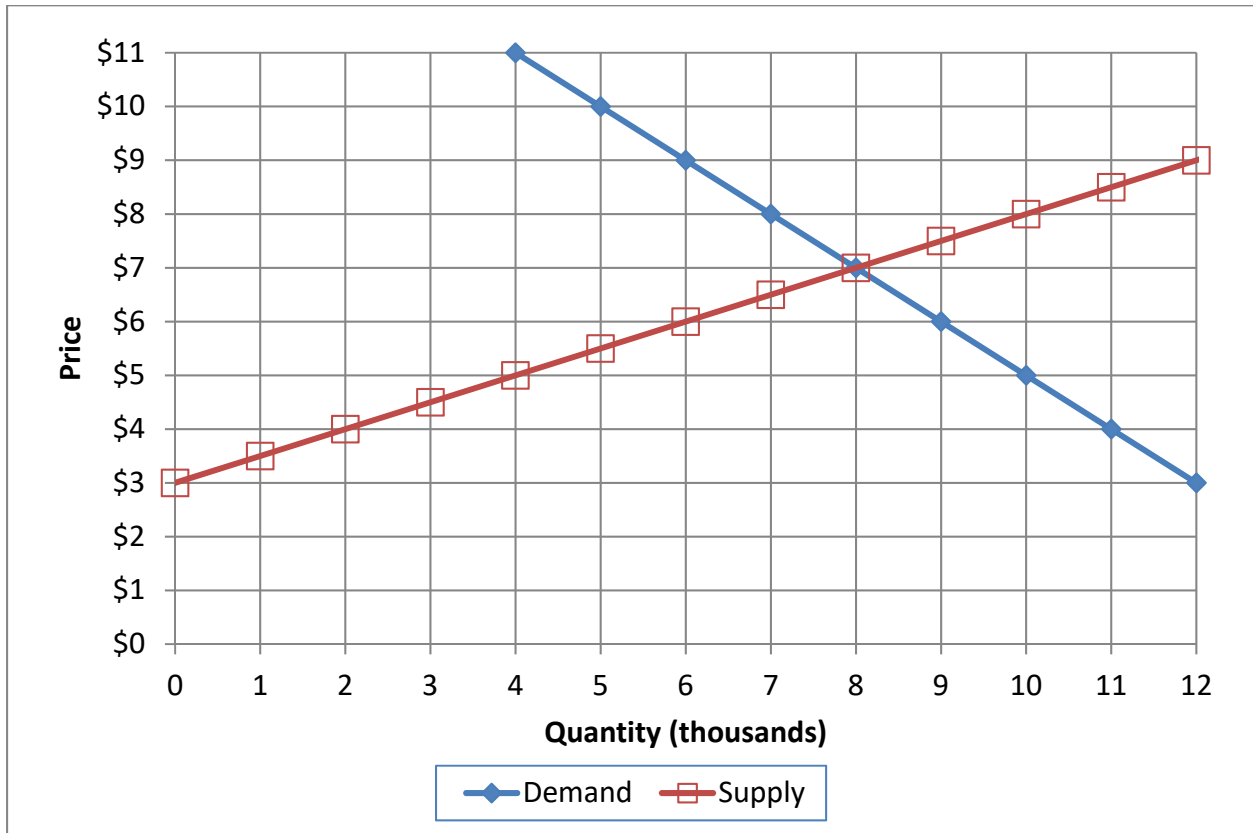
Suppose the government imposes an excise **tax of $3** per rake.

a. Compute the equilibrium quantity sold.	6 thousand
b. Compute the equilibrium net price received by sellers (excluding the tax).	$ 6 per rake
c. Compute the equilibrium total price paid by buyers (including the tax).	$ 9 per rake
d. Does producer surplus *increase, decrease,* or *remain constant* because of the tax?	decrease
e. By how much?	$ 7 thousand
f. Does consumer surplus *increase, decrease,* or *remain constant* because of the tax?	decrease
g. By how much?	$ 14 thousand
h. Compute the total tax revenue collected by the government.	$ 18 thousand
i. Compute the deadweight social loss caused by the tax.	$ 3 thousand

(8) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Barbara's
preferences for sundaes and sliders.
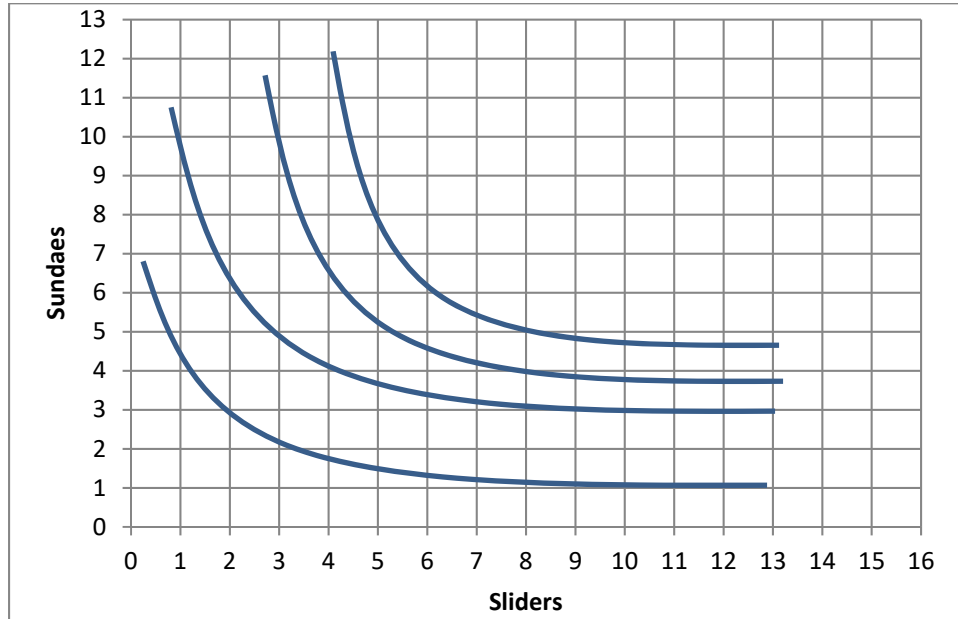
a. Would Barbara rather have 3 sundaes and 12 sliders,
   or 4 sundaes and 8 sliders?

b. Would Barbara rather have 10 sundaes and 3 sliders,
   or 5 sundaes and 8 sliders?

| sundaes and	sliders
sundaes and	sliders

Suppose Barbara has a budget of $36 to spend on sundaes and sliders. The price of sliders is $3.

c. **Using a straightedge**, carefully draw Barbara's budget line when the price of
   sundaes is $3. Label this budget line "A".

d. How many sundaes will Barbara buy if the price of sundaes is $3?

sundaes

e. **Using a straightedge**, carefully draw Barbara's budget line when the price of
   sundaes is $6. Label this budget line "B".

f. How many sundaes will Barbara buy if the price of sundaes is $6?

sundaes

g. Plot two points on Barbara's
   demand curve for sundaes, and
   sketch Barbara's demand curve at
   right.
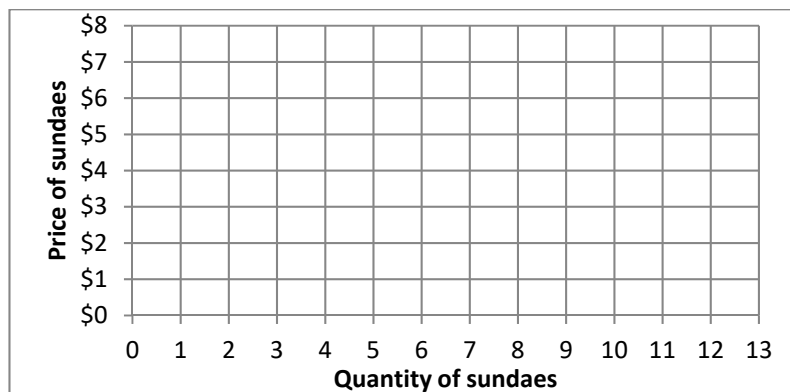
(9) [Short-run cost curves and supply: 20 pts] ABC Manufacturing Company makes a small part used in automobiles. ABC is a small company in a big market, and therefore takes its output price as given. In the short run, the company faces daily cost curves as shown in the following diagram. Here, SMC denotes short-run marginal cost, SAVC denotes short-run average variable cost, and SATC denotes short-run average total cost.
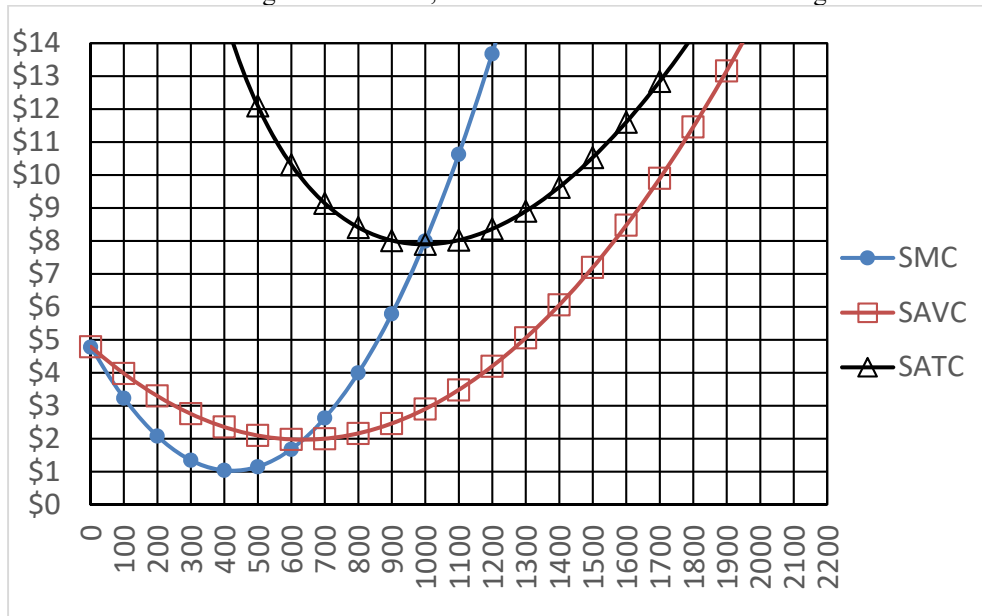
Suppose the company were currently producing 1000 parts for some unknown reason.

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

$ _____ thousand

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

$ _____ thousand

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

$ _____ thousand

d. Suppose the company were currently producing 200 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 200 to 201 parts? (Give an answer to the nearest dollar.)

$ _____

e. 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.)

$ _____

f. 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.)

$ _____

g. Suppose the price of parts is $4. How many parts should the company produce? (Give an answer to the nearest hundred.)

_____ parts

h. Will the company make a *profit* or a *loss* at a price of $4?

i. Suppose the price of parts is $14. How many parts should the company produce? (Give an answer to the nearest hundred.)

_____ parts

j. Will the company make a *profit* or a *loss* at a price of $14?

(10) [Efficiency of competition: 16 pts] The following graph shows the market for can openers.
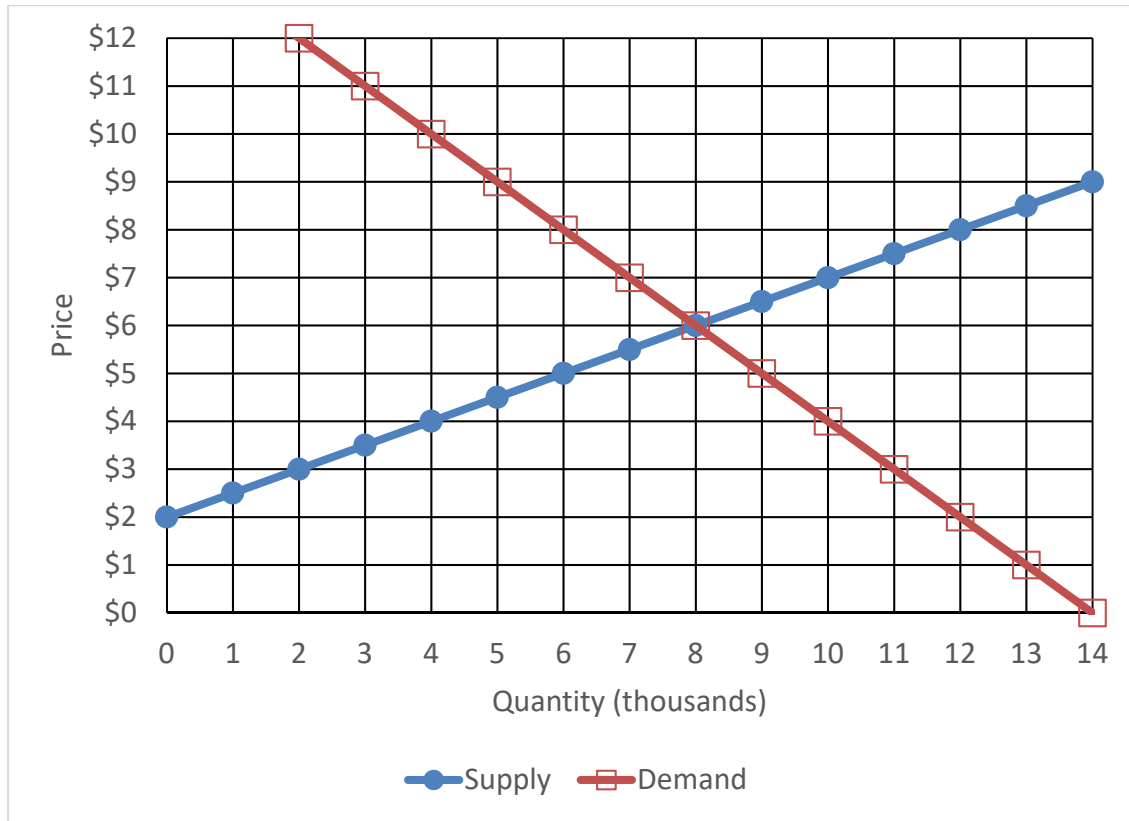
Suppose only 6,000 can openers were produced for some unknown reason.

|	
a. How much would consumers be willing to pay for a 6001st can opener?	$
b. By how much would the can opener industry's total costs increase from producing a 6001st can opener?	$
c. If the 6001st can opener were produced, would total surplus *increase*, *decrease*, or *remain constant*?	
c. By how much?	$

Alternatively, suppose 12,000 can openers were produced for some unknown reason.

d. How much were consumers willing to pay for the 12,000th can opener?	$
e. How much would the can opener industry's total cost decrease from NOT producing the 12,000th can opener?	$
f. If the 12,000th 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.
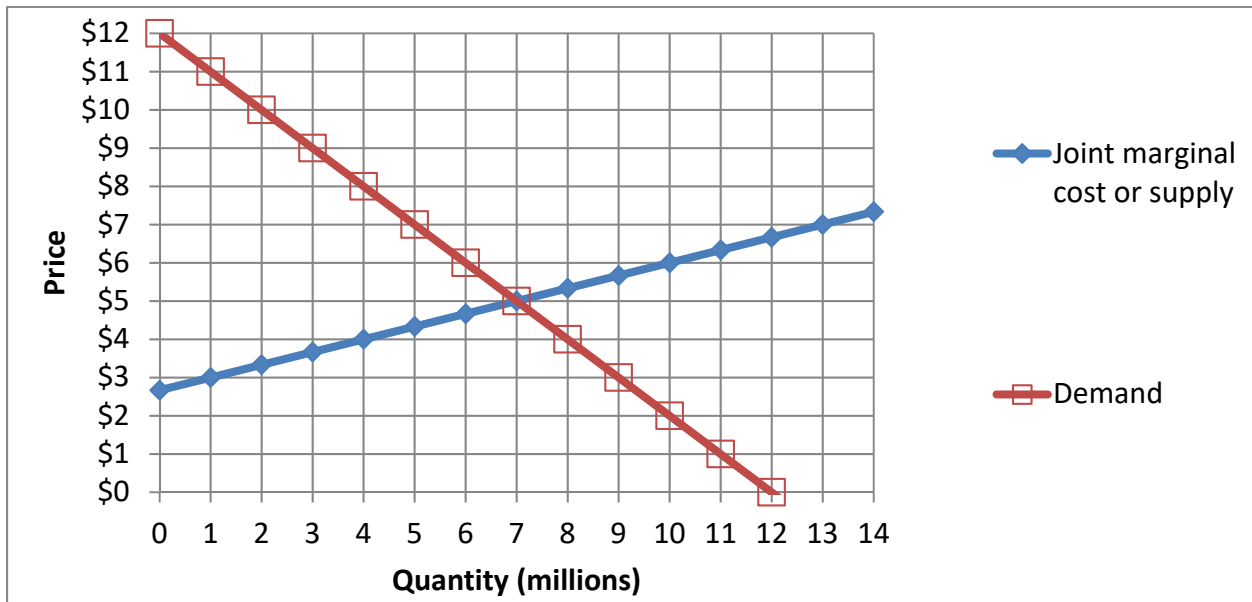
First, assume the firms *compete* with each other, each maximizing its own profit while taking the market price as given.

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?	million
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

(12) [Nonrival goods: 6 pts] Suppose 1000 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 = 40 – 4 Q** .

a. How many miles of bike trail would a typical *individual* pay to build for their own use?

b. Give an expression (or formula) for the marginal social benefit from the bike trail. [Hint: This must be a formula containing one variable: Q.]

c. 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.
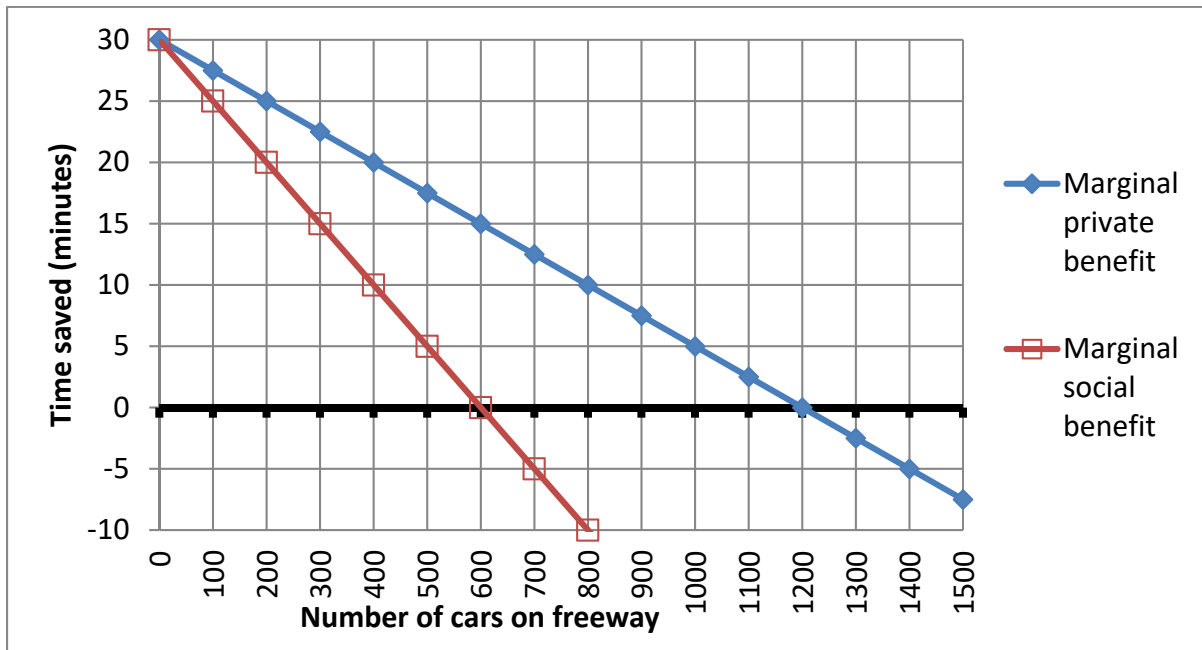
a. How many cars will enter the freeway if entry onto the freeway is unregulated?

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
$

(14) [Externalities: 12 pts] The graph below shows the market for a particular chemical that generates greenhouse gases, an external cost born by other people. Therefore, in addition to demand and supply curves, a curve representing marginal social cost is shown.
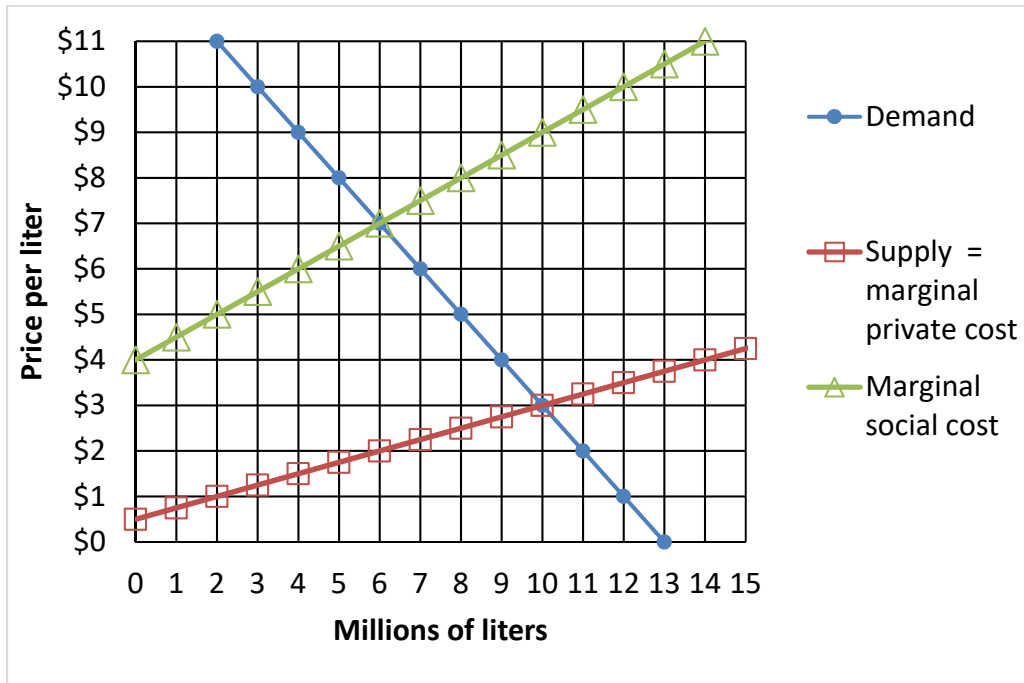
a. Compute the (unregulated) competitive equilibrium price.

b. Compute the (unregulated) competitive equilibrium quantity.

c. Compute the economically efficient (or socially optimal) quantity.

d. Compute the deadweight loss from unregulated competition.

e. To eliminate this deadweight loss, should the government enact a *tax* or a *subsidy*?

f. What should be the tax rate or subsidy rate?

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

(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 **3** 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
Annual cost of cleaning up pollution	$15	$35	$25	$45	$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 **3** 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.")
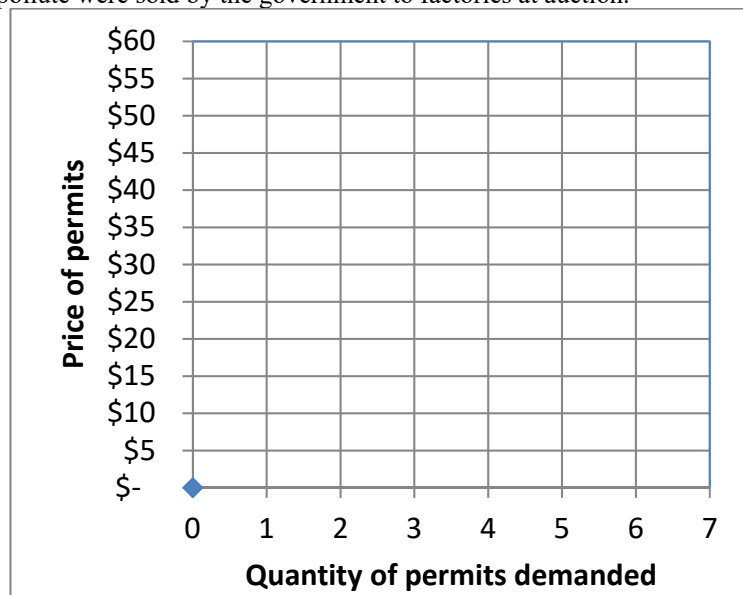
In this auction, the price starts at $0 and rises in increments of $10.

d. Which **3** 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.
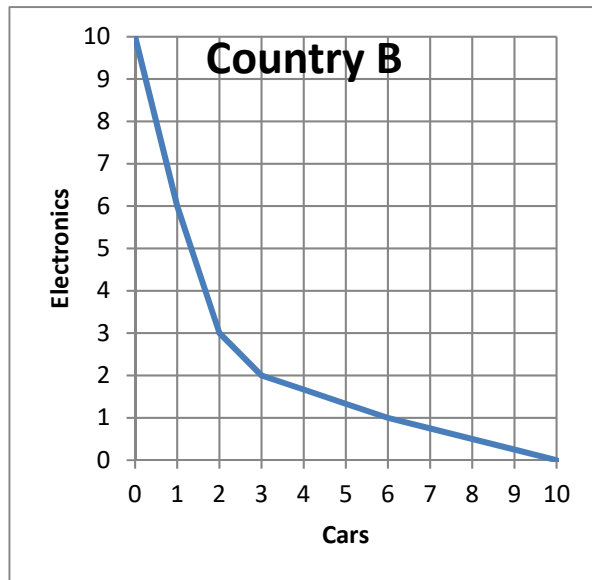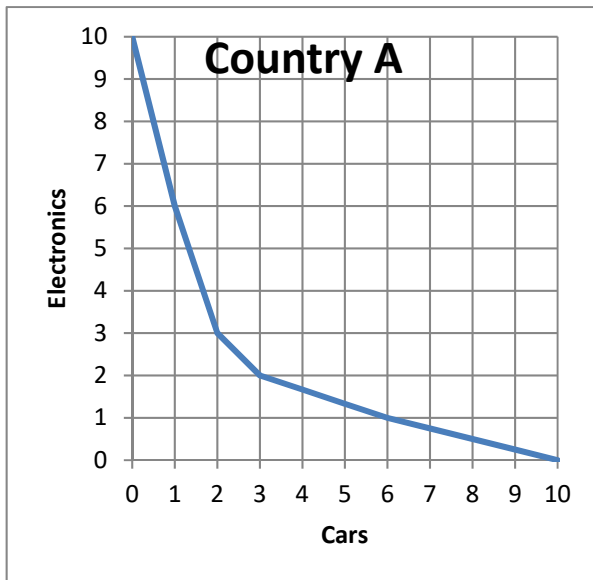
g. What fee would reduce the amount of pollution to **3** units: $0, $10, $20, $30, $40, $50, or $60? $

h. What would be the total cost of cleaning up for those **2** 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]