

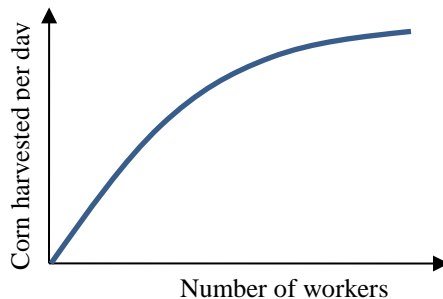
### FINAL EXAMINATION VERSION C

**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, 17 pts total]

- (1) When we assume that people do the best they can with what they have, we are assuming that people are
- “rational.”
  - “in equilibrium.”
  - “competitive.”
  - “positive.”

- (2) Consider the production function shown below. As more labor is used, the marginal product of labor
- decreases.
  - increases.
  - first increases, then decreases.
  - remains constant.



- (3) The *law of demand* means that
- demand curves are necessarily straight lines.
  - buyers will pay whatever price is necessary to purchase the good.
  - the number of buyers must equal the number of sellers.
  - the quantity that buyers want to buy is negatively related to the price.

- (4) Some estimates show that rich people spend a *greater fraction* of their income on new automobiles than poor people do. If this is true, then the income elasticity of demand for new automobiles must be
- negative.
  - exactly zero.
  - between zero and one.
  - exactly one.
  - greater than one.

- (5) 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.

- (6) 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,
- Sellers will pay most of the tax.
  - Buyers will pay most of the tax.
  - Sellers and buyers will each pay half of the tax.
  - Answer depends on which side is legally required to remit the tax to the government.

- (7) A change in the amount of fast food that each person buys is called a change at the
- marginal product.
  - marginal revenue.
  - extensive margin.
  - intensive margin.

(8) At its current level of output, ABC Company's marginal cost is \$10, its average cost is \$6, and its marginal revenue is \$8. If ABC produces and sells one more unit of output, its profit will

- a. increase by \$2.
- b. decrease by \$2.
- c. increase by \$8.
- d. decrease by \$4.
- e. remain constant.

(9) Suppose a competitive market is in long-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.

(10) A firm that takes price as given believes its marginal revenue from selling one more unit will be

- a. equal to zero.
- b. less than the price of that unit.
- c. greater than the price of that unit.
- d. equal to the price of that unit.

(11) An industry is a natural monopoly if

- a. the industry became a monopoly without government interference.
- b. the only seller in the market sells a natural or "green" product.
- c. one firm owns all the key natural resources required to produce the product.
- d. a firm's average cost is negatively related to its quantity.

(12) Suppose a coffee shop sells 20 cups of specialty coffee if the price is \$3, and sells 21 cups of the same coffee if the price is \$2.90. The shop's marginal revenue of the 21st cup is therefore

- a. negative \$2.25 .
- b. \$0.90 .
- c. \$1.95 .
- d. \$2.95 .
- e. \$3.00 .
- f. \$20.00 .

(13) Diesel trucks with poorly-tuned engines spew particulates (small particles) out their exhaust pipes, with adverse effects on the health of *other* people (not just the truck owners) who breathe the air.

These trucks therefore create

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

(14) After my neighbor bought and installed outdoor lights, crime decreased in my neighborhood. My neighbor's outdoor lights created

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

(15) If you rent a car, the car rental company makes sure you pay by insisting that you show them a credit card. However, they cannot rent the same car to several people at once. The rental car is therefore

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

(16) Massive open online courses ("MOOCs") can enroll huge numbers of students at essentially zero marginal cost and without detracting from the experience of other students who are already enrolled. Many MOOCs charge no fee, but they could easily do so. A MOOC is therefore

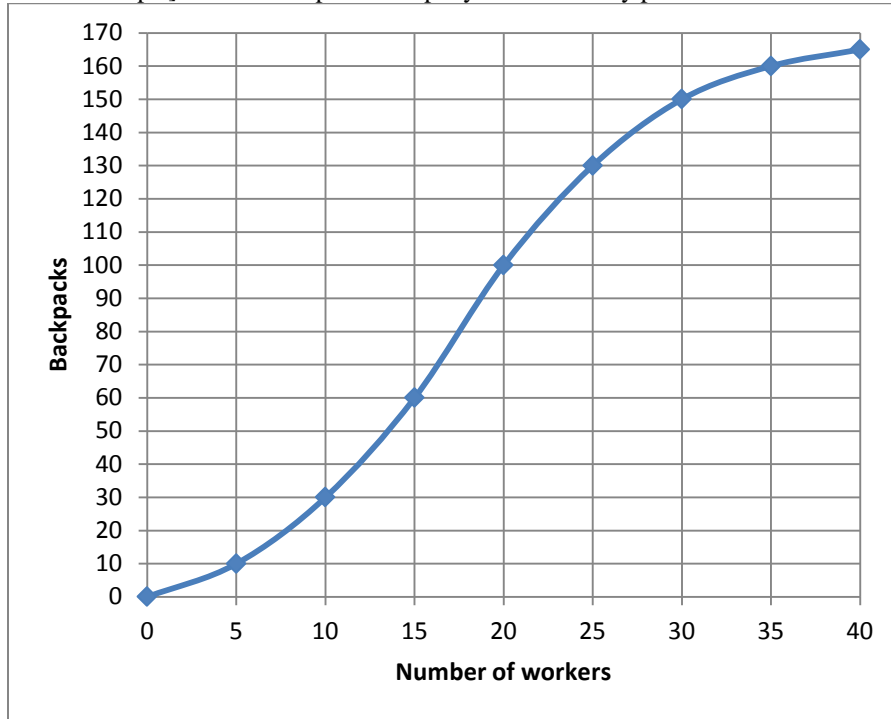
- a. a rival good.
- b. an excludable good.
- c. both of the above.
- d. none of the above.

(17) If a highway is not crowded and there are no toll gates, the highway is

- 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.

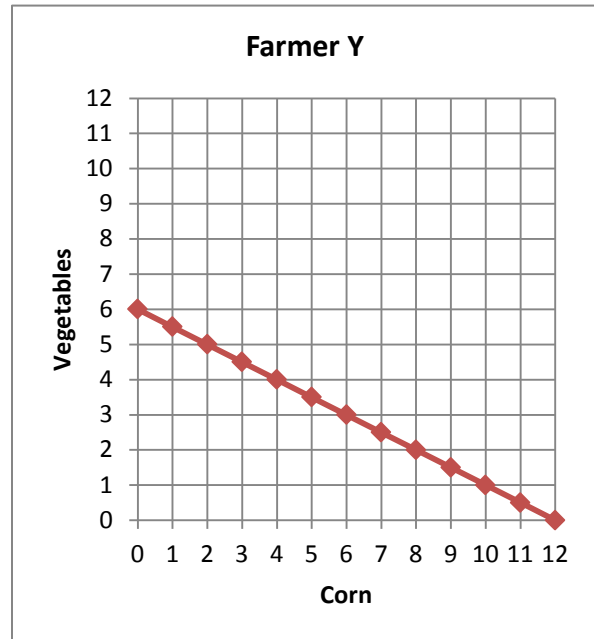
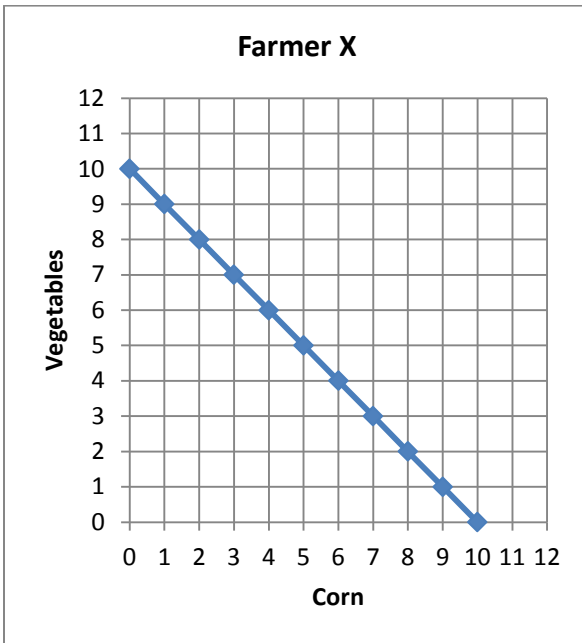
(1) [Production functions: 8 pts] Acme Backpack Company has the hourly production function shown below.



- a. If the company employs 5 workers, what is their *average product*?
- b. If the company employs 20 workers, what is their *average product*?
- c. What is the *marginal product* of workers, as the number of workers increases from 5 to 10?
- d. What is the *marginal product* of workers, as the number of workers increases from 20 to 25?

backpacks per worker
backpacks per worker
backpacks per worker
backpacks per worker

(2) [Comparative advantage, gains from trade: 17 pts] Farmer X and Farmer Y both can grow vegetables and corn. They each face a tradeoff between these two crops because their land is limited. Their production possibility curves are shown below.



- [2 pts] What is Farmer X's opportunity cost of a unit of vegetables?
- [2 pts] What is Farmer Y's opportunity cost of a unit of vegetables?
- [2 pts] What is Farmer X's opportunity cost of a unit of corn?
- [2 pts] What is Farmer Y's opportunity cost of a unit of corn?
- [2 pts] Which farmer has a comparative advantage in growing vegetables?
- [2 pts] Which farmer has a comparative advantage in growing corn?

	units of corn
	units of corn
	units of vegetables
	units of vegetables

- [3 pts] Fill in the blanks: *Both* farmers can consume combinations of vegetables and corn *outside* their individual production possibility curves if \_\_\_\_\_ gives **two** units of vegetables to \_\_\_\_\_, who gives \_\_\_\_\_ units of corn in return.
- [2 pts] **Plot** the trade that you propose in part (g) on the graph above. For each farmer, 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 **sodapop**: Consumers become more interested in avoiding junk food..

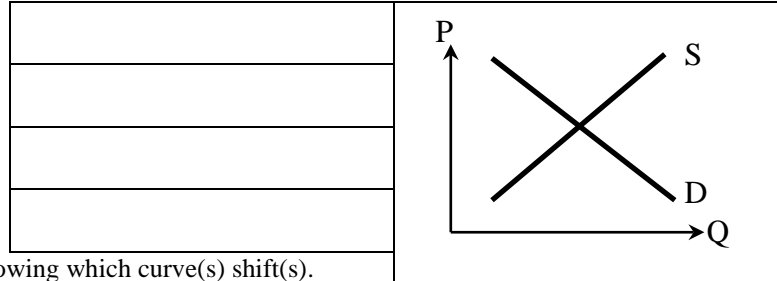
Does demand shift *left*, *shift right*, or remain *unchanged* ?

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 **pizza**: The price of mozzarella cheese (an important ingredient in pizza) rises.

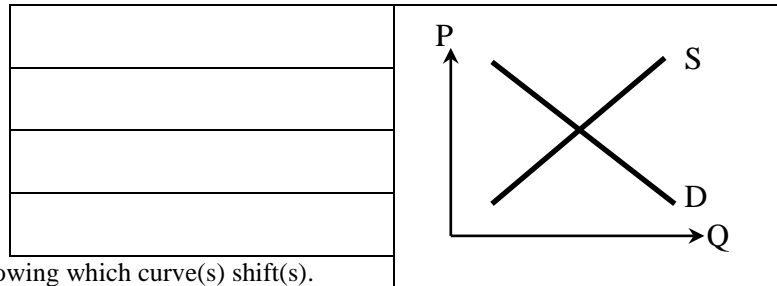
Does demand shift *left*, *shift right*, or remain *unchanged* ?

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).



c. Consider the market for **bottled water**: Drinking bottled water goes out of fashion. At the same time, the cost of plastic bottles rises.

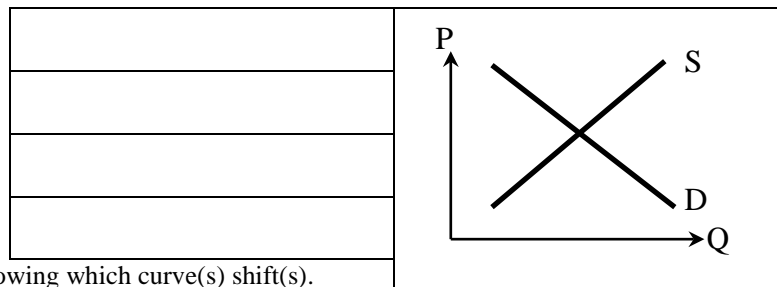
Does demand shift *left*, *shift right*, or remain *unchanged* ?

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

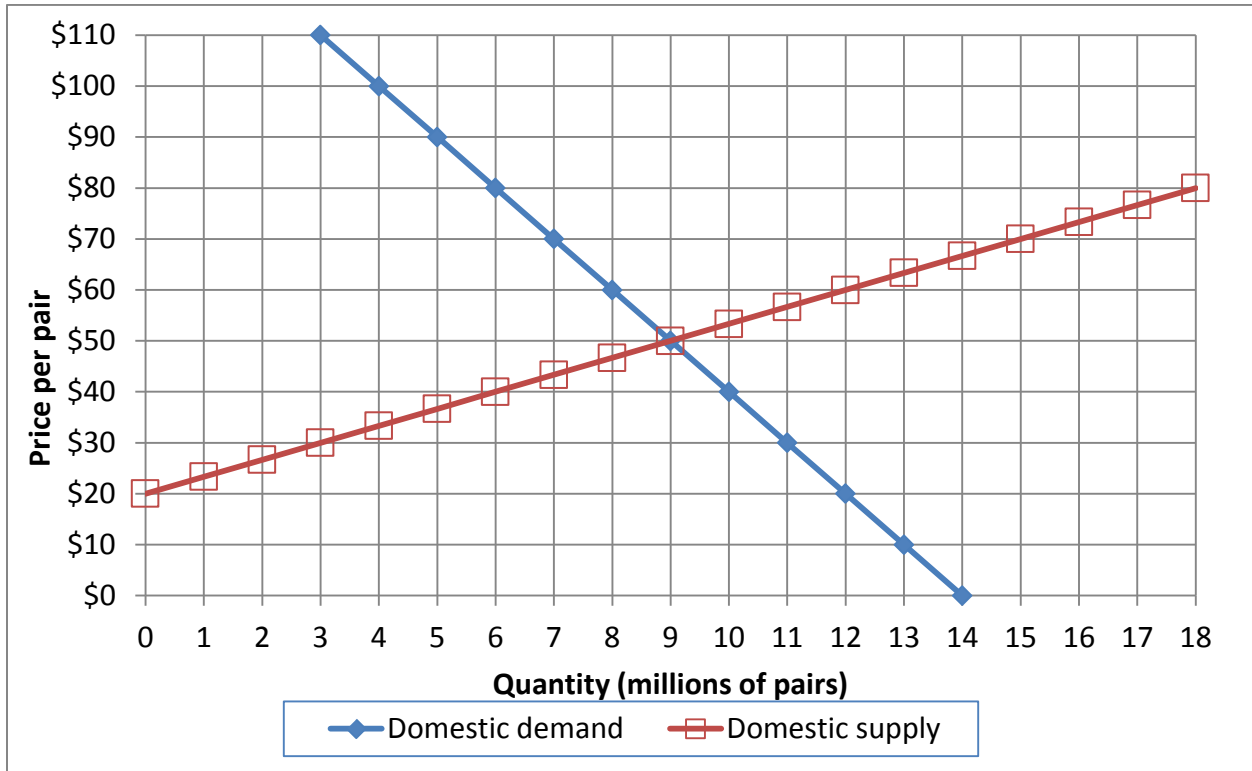
Does the equilibrium price *increase*, *decrease*, or *cannot be determined* ?

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

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



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



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

\$	
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Then this industry is opened to international trade and the international price of shoes turns out to be **\$ 60**.

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

--

c. How many pairs?

million
---------

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

--

e. By how much?

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

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

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g. By how much?

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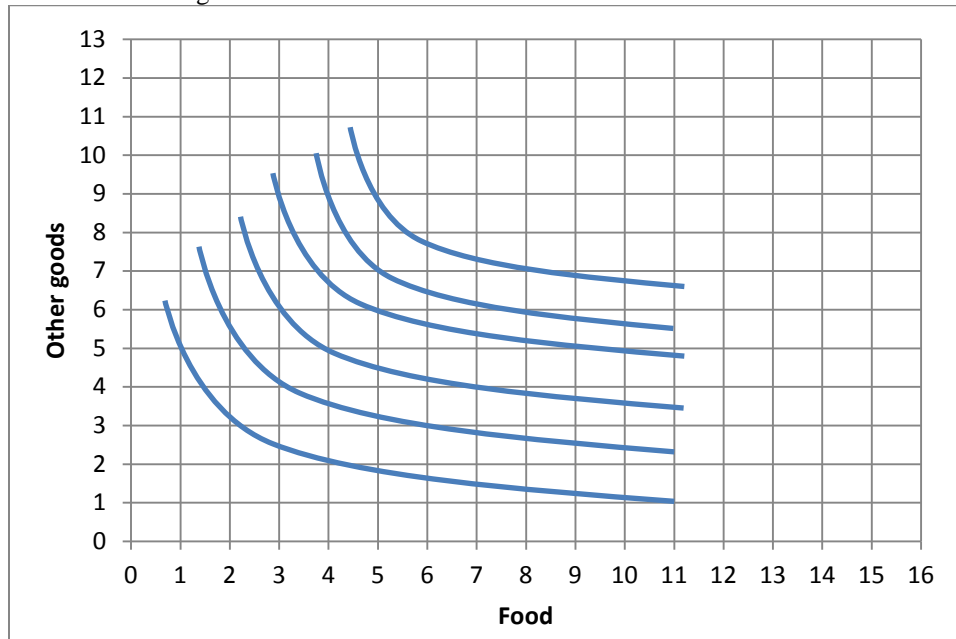
h. Does total social welfare in this country *increase* or *decrease* from international trade in shoes?

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i. By how much?

\$	million
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(5) [Consumer choice and demand: 16 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 5 units of other goods, or 8 units of food and 6 units of other goods?
- b. Would Brittany rather have 6 units of food and 3 units of other goods, or 4 units of food and 5 units of other goods?

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

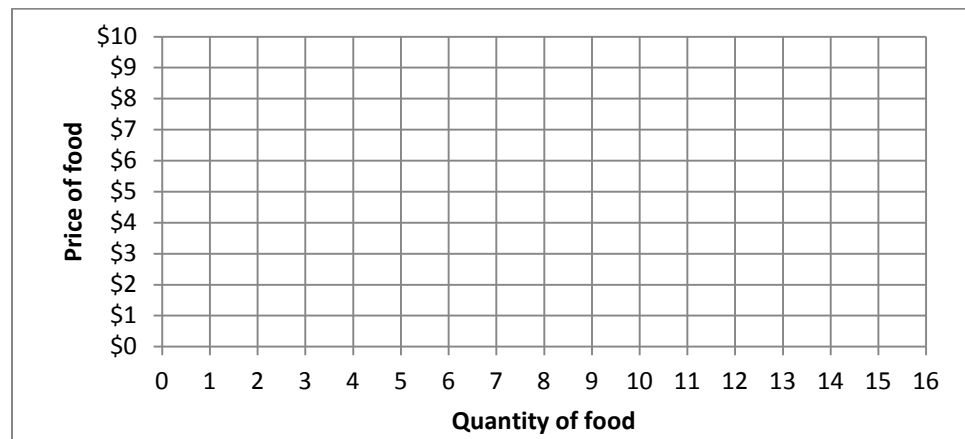
Suppose Brittany has a budget of \$60 to spend on food and other goods. The price of other goods is \$5.

- c. **Using a straightedge**, carefully draw Brittany's budget line when the price of food is \$10. Label this budget line "A".
- d. How much food will Brittany buy if the price of food is \$10?
- e. **Using a straightedge**, carefully draw Brittany's budget line when the price of food is \$5. Label this budget line "B".
- f. How much food will Brittany buy if the price of food is \$5?

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

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

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



(6) [Using price elasticity of demand: 10 pts] Suppose the water utility *raises* its price by 5%. Suppose the price elasticity of demand for water is -1.4. Assume everything else affecting demand for water remains constant.

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

	%
	%

(7) [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*

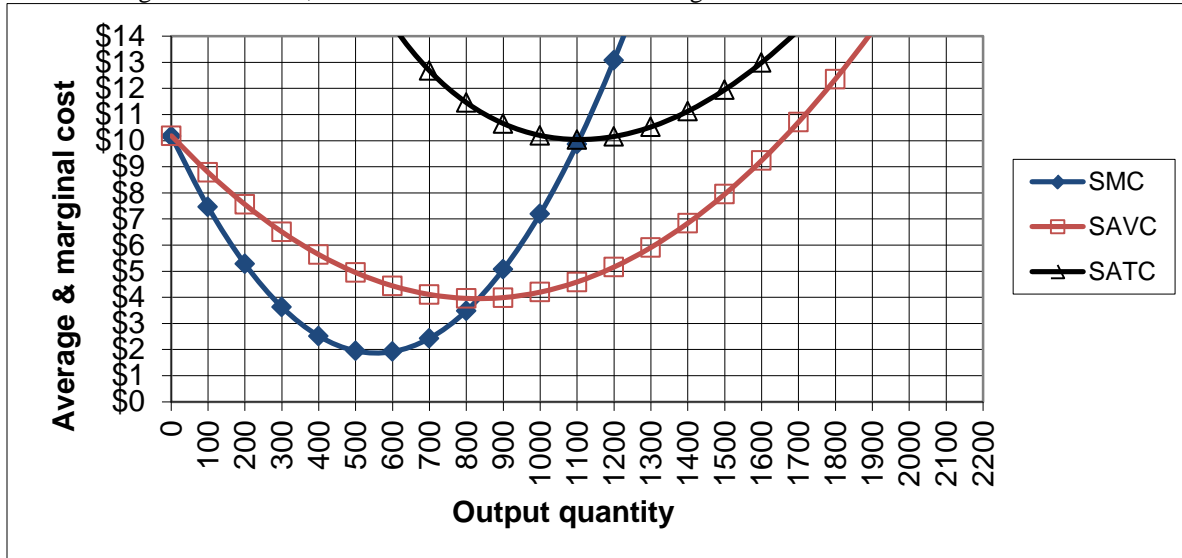
*Average revenue*  
*Average cost*

*Marginal revenue*  
*Marginal cost*

- a. Change in cost divided by change in output.
- b. Money paid for all inputs purchased or hired.
- c. Change in revenue divided by change in output.




(8) [Short-run cost curves and supply: 20 pts] Zoom Incorporated makes an automotive part for sports cars. It 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 1500 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 900 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 900 to 901 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 \$7. 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 \$7?
- Suppose the price of parts is \$13. 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 \$13?

\$	
\$	
\$	
	parts
	parts

(9) [Economy-wide efficiency: 20 pts] The graph at right shows a country's production possibility curve.

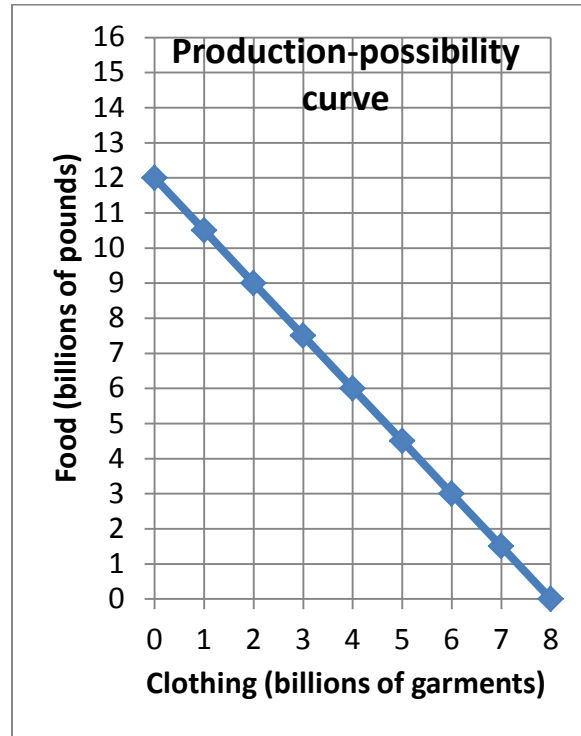
- a. What is this **country's** opportunity cost of a garment?
- b. What is this **country's** opportunity cost of a pound of food?

	pounds of food
	garments

Assume this country's economy is in competitive equilibrium in all markets and the price of a pound of food is \$4.

- c. What must be the marginal cost of food (per pound) for all firms producing food?
- d. What must be the price of a garment?
- e. What must be the marginal cost of clothing (per garment) for all firms producing garments?

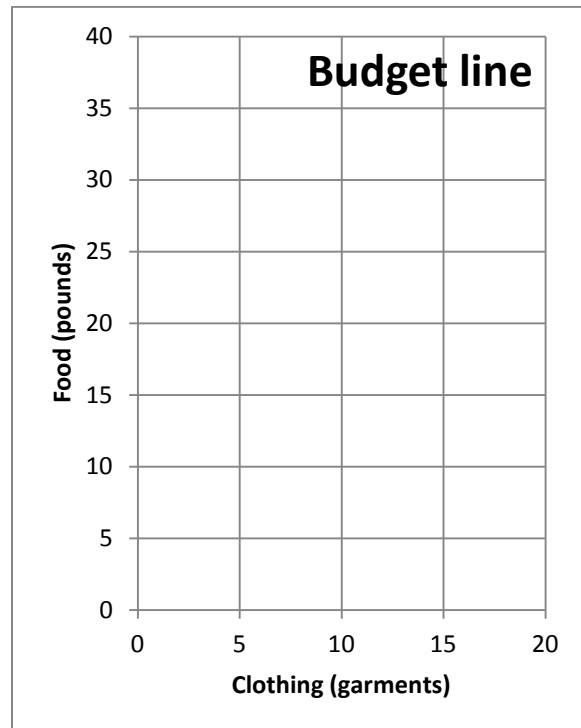
	\$
	\$
	\$



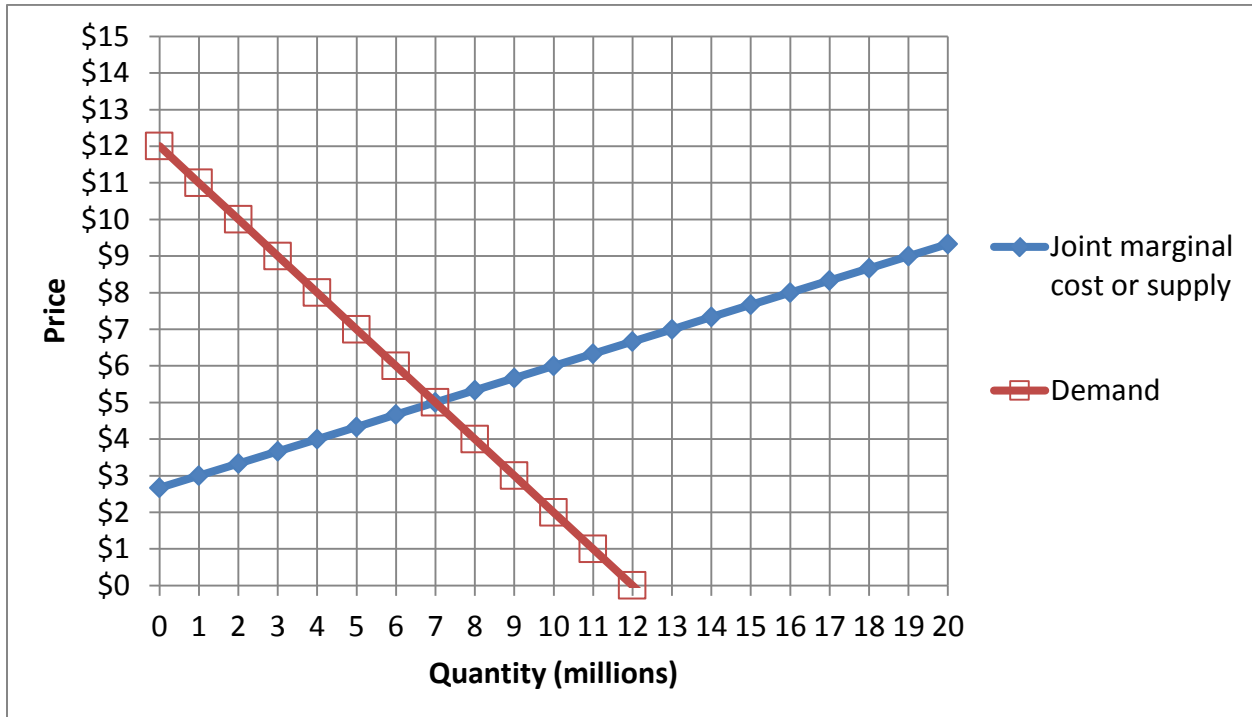
Adam is a consumer in this economy. He has an income of \$60.

- f. Using a straightedge, draw Adam's budget line in the graph at right.
- g. What is the slope of Adam's budget line?
- h. What is **Adam's** opportunity cost of a garment?
- i. What is **Adam's** opportunity cost of a pound of food?
- j. What is Adam's marginal rate of substitution of clothing for food—that is, the slope of his indifference curve—at his preferred bundle on this budget line?

	pounds of food
	garments
	garments
	garments



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

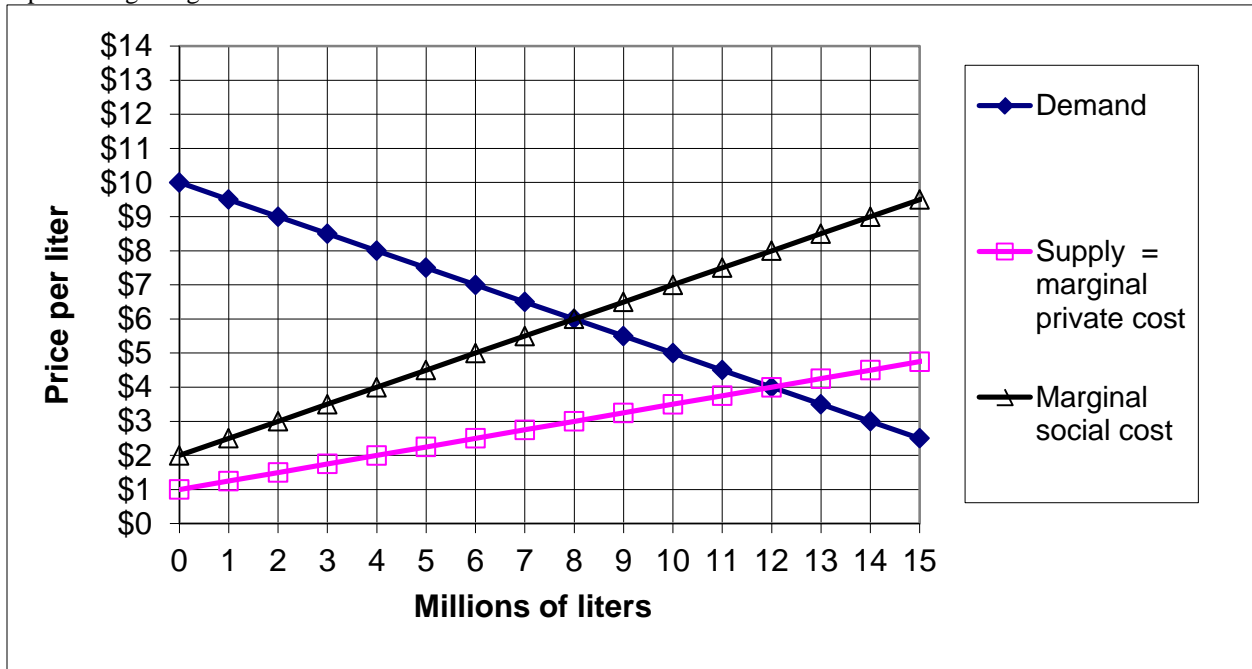
f. If output increased by one more unit at any firm, total costs would increase by how much?

g. What price will the firms jointly set?

h. Compute the deadweight loss from collusion.

	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 deadweight loss from collusion.	\$ million

(11) [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.



- 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

(12) [Nonrival goods: 4 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):  $MB = 40 - 4Q$ .

- 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.

MSB =
miles

(13) [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	\$2 thousand
Factory B	\$5 thousand
Factory C	\$7 thousand
Factory D	\$9 thousand
Factory E	\$11 thousand
Factory F	\$20 thousand
Factory G	\$25 thousand

**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

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 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

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

- (1) Consider the following statement. "They are building too many hotels in this city. All the hotels will be half full, so they will raise their prices just to stay profitable. In the end, the consumer will suffer from higher prices." Does this argument make sense? Why or why not? Justify your answer using a supply-and-demand graph.
- (2) Suppose the government imposed maximum prices on children's vitamins. Would this action tend to increase the number of children who take vitamins? Explain why or why not, using a supply-and-demand graph of the market for children's vitamins.

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



[end of exam]