

## FINAL EXAMINATION VERSION A

**INSTRUCTIONS:** This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators, calculators with alphabetical keyboards, cell phones, and wireless devices 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, 12 pts total]

(1) The term “equilibrium” in economics describes a situation where

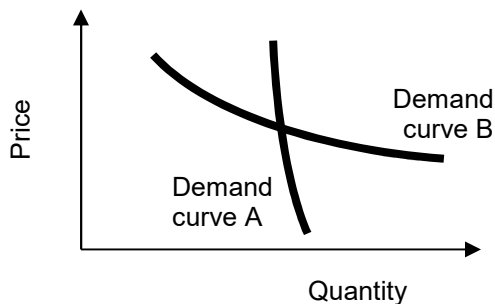
- a. all companies are the same size.
- b. all prices are equal.
- c. no one wants to change their choices.
- d. total costs exactly equal total benefits.

(2) As the price of smart phones falls, consumers are buying more apps to run on their smart phones, because smart phones and apps are

- a. substitute goods.
- b. complementary goods.
- c. inferior goods.
- d. normal goods.

(3) Which demand curve below is *more* 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.

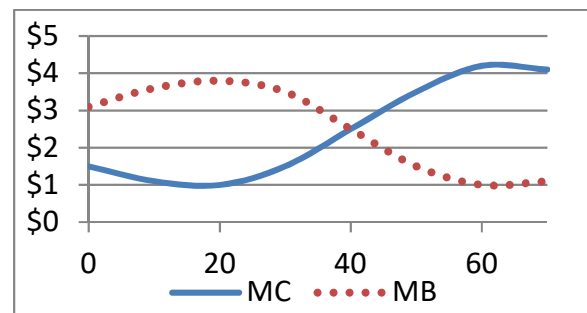


(4) Suppose the price of apples in Des Moines is \$0.80 per pound and the cost of shipping apples between Des Moines and Omaha is \$0.50 per pound. Markets are *out of equilibrium* if the price of apples in Omaha is

- a. \$0.20 per pound.
- b. \$0.70 per pound.
- c. \$1.00 per pound.
- d. \$1.20 per pound.

(5) The graph below shows Gotham City’s marginal cost (MC) and marginal benefit (MB) of fire stations, in millions of dollars. Gotham City should have

- a. zero fire stations.
- b. 20 fire stations.
- c. 40 fire stations.
- d. 60 fire stations.



(6) At its current level of output, ABC Company’s marginal cost is \$10, its average 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.

- (7) 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.

- (8) Suppose a flower vendor now sells 10 bouquets per hour at the price of \$15. If the vendor drops the price to \$14, the vendor can sell 11 bouquets per hour. The marginal revenue of the 11<sup>th</sup> bouquet is therefore
- a. \$1 .
  - b. \$4 .
  - c. \$10.
  - d. \$14 .
  - e. \$15 .

- (9) Certain flowers attract butterflies. If my neighbor buys and plants these flowers, I will enjoy butterflies in my yard, too. By planting these flowers, my neighbor is creating
- a. an external benefit.
  - b. an external cost.
  - c. a complement.
  - d. a superior good.

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

- (11) 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.

- (12) Unlike other taxes, a pollution tax
- a. causes deadweight loss.
  - b. increases economic efficiency.
  - c. generates no revenue for the government.
  - d. affects only producers.

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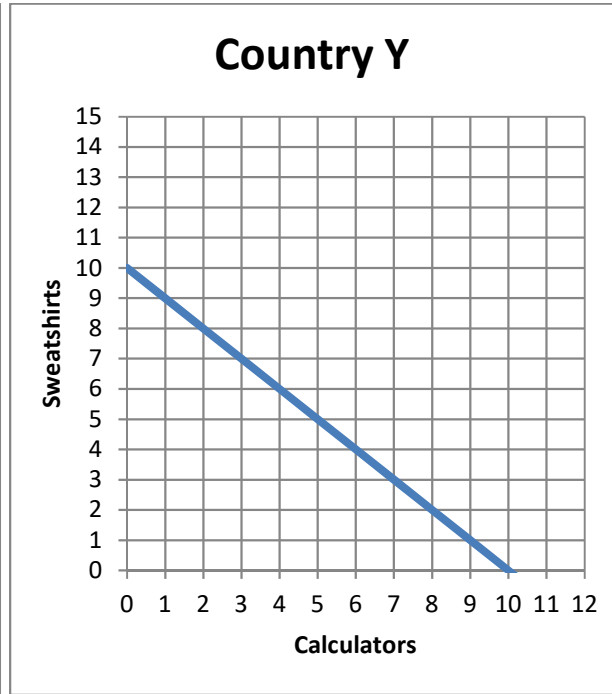
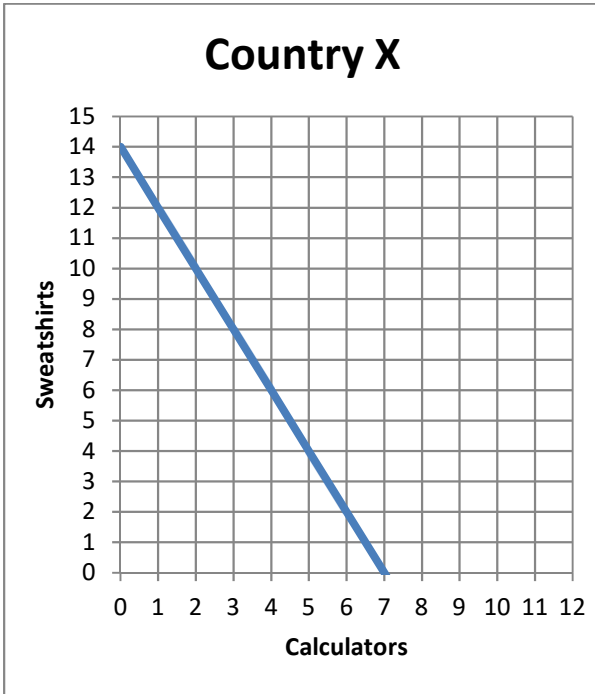
**II. Problems:** Insert your answer to each question in the box provided. Use margins and graphs for scratch work. Only the answers in the boxes will be graded. Work carefully—partial credit is not normally given for questions in this section.

- (1) [Price elasticity of demand: 10 pts] Suppose the price elasticity of demand for milk is  $-0.4$ , and the price of milk falls by 10 %.

- a. Is the demand for milk *elastic, inelastic, or unitary-elastic* ?
- b. Will the quantity demanded of milk *increase, decrease, or remain constant*?
- c. By about how much?
- d. Will consumers' total spending on milk *increase, decrease, or remain constant*?
- e. By about how much?

%
%

(2) [Comparative advantage, gains from trade: 17 pts] Country X and Country Y can each produce sweatshirts and calculators. 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 sweatshirt?
- What is Country Y's opportunity cost of producing a sweatshirt?
- What is Country X's opportunity cost of producing a calculator?
- What is Country Y's opportunity cost of producing a calculator?
- Which country has a comparative advantage in producing sweatshirts?
- Which country has a comparative advantage in producing calculators?

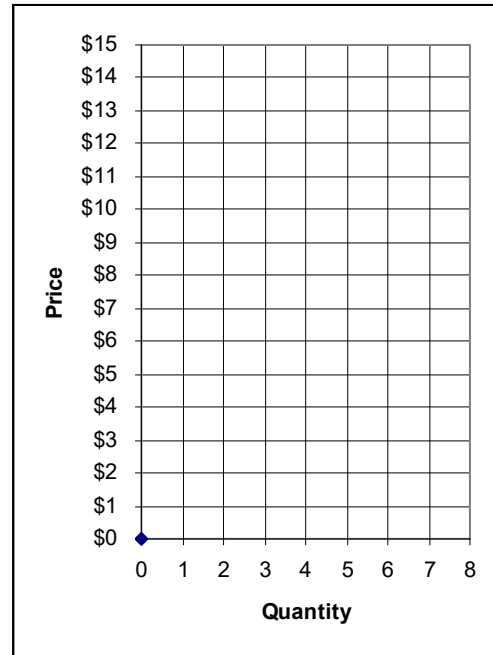
	calculators
	calculators
	sweatshirts
	sweatshirts

g. [3 pts] Fill in the blanks: *Both* countries can consume combinations of products *outside* their individual production possibility curves if \_\_\_\_\_ exports *two* calculators to \_\_\_\_\_, which exports \_\_\_\_\_ sweatshirts 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) [Market equilibrium: 12 pts] Suppose seven buyers and seven sellers engage in a market similar to the exercise we did in class. Each buyer may buy at most one unit and each seller may sell at most one unit, but no one is forced to trade. Assume that buyers and sellers are each trying to maximize their personal surplus (or “gains from trade”). Surplus for each buyer equals the buyer's value of the good minus the price paid. Surplus for each seller equals the price received minus the seller's cost of the good. Surplus of persons who do not trade are zero. Buyers’ values and sellers’ costs are given in the following table.

Buyer	Value	Seller	Cost
Bob	\$13	Sue	\$ 1
Barb	\$13	Steve	\$ 2
Ben	\$12	Sam	\$ 3
Bailey	\$12	Sven	\$ 4
Brian	\$11	Sarina	\$ 5
Brittany	\$11	Sam	\$ 6
Brandon	\$ 9	Sophia	\$14



Suppose with some experience, the market settles on a single price. All trades are made at that price. (You can use the graph at right for scratch work.)

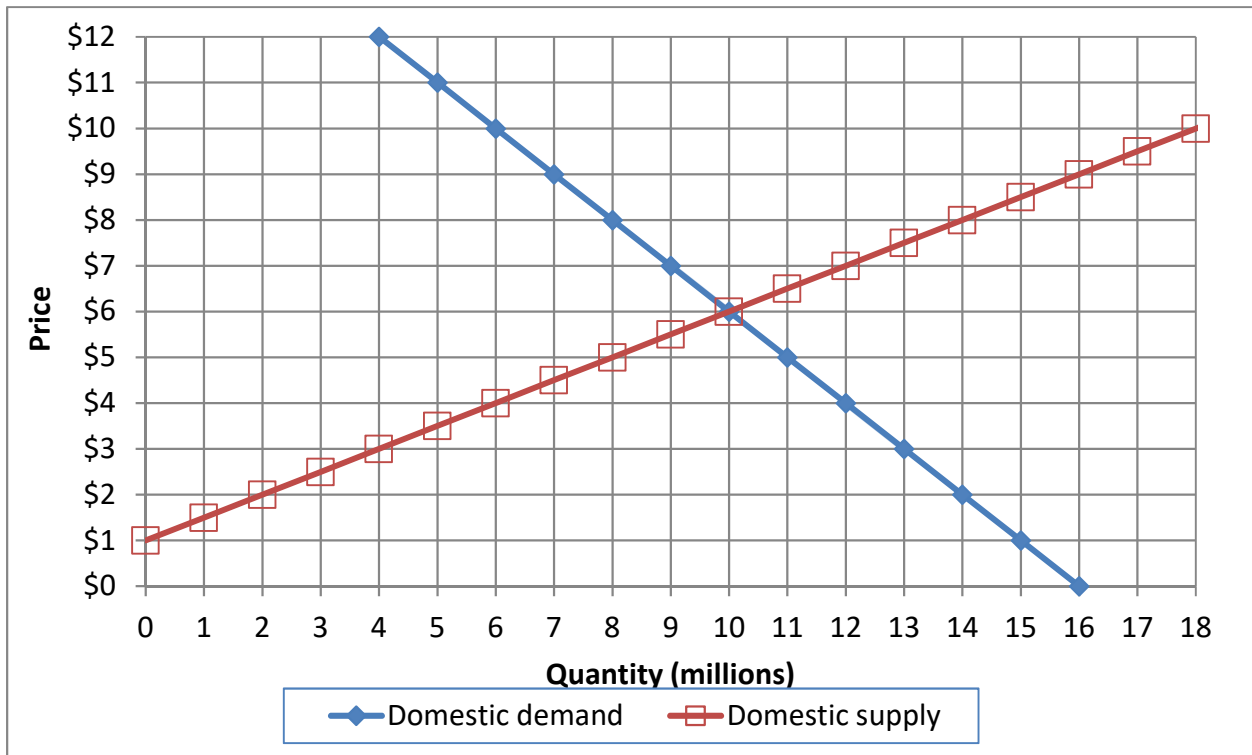
- a. If the price were \$3, would there be *excess demand*, *excess supply*, or *neither*?

Now consider the market equilibrium.

- b. What is the equilibrium price? Give an answer to the nearest whole dollar.
- c. How many units of the good will be sold in this market?
- d. Compute the total revenue received by sellers (which equals the total spending by buyers).
- e. Compute the combined total surplus (or gains from trade) of all buyers and sellers. (Check your answer carefully! No partial credit for being "close"!)
- f. Who enjoys higher surplus in this particular market, the *buyers* or the *sellers*? Or is buyers’ total surplus *equal* to sellers’ total surplus?

\$	
	units
\$	
\$	

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



a. At first, international trade in wristwatches 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 wristwatches turns out to be **\$ 8**.

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

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c. How many?

million
---------

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

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e. By how much?

\$	million
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f. Does producer surplus in this country *increase or decrease* from international trade in wristwatches?

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g. By how much?

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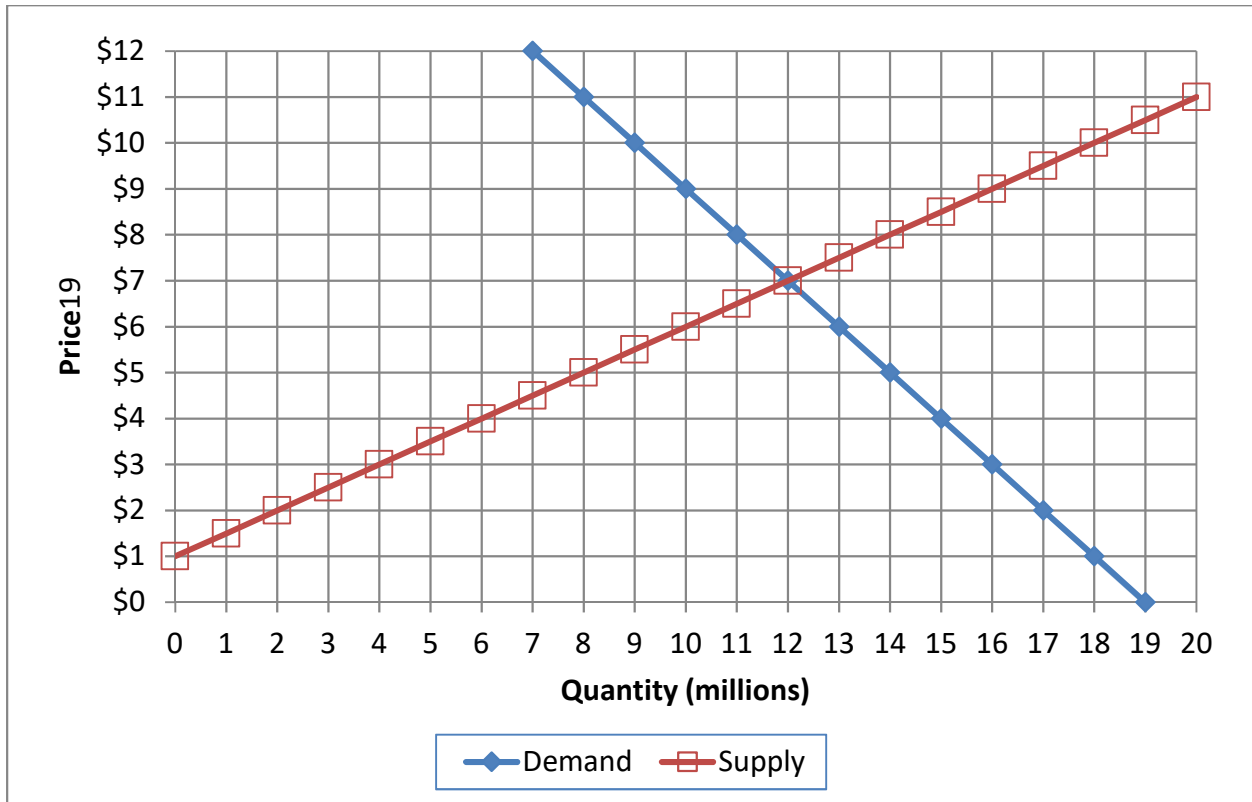
h. Does total social welfare in this country *increase or decrease* from international trade in wristwatches?

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i. By how much?

\$	million
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(5) [Welfare analysis of tax or subsidy: 18 pts] The graph below shows the market for tee-shirts.

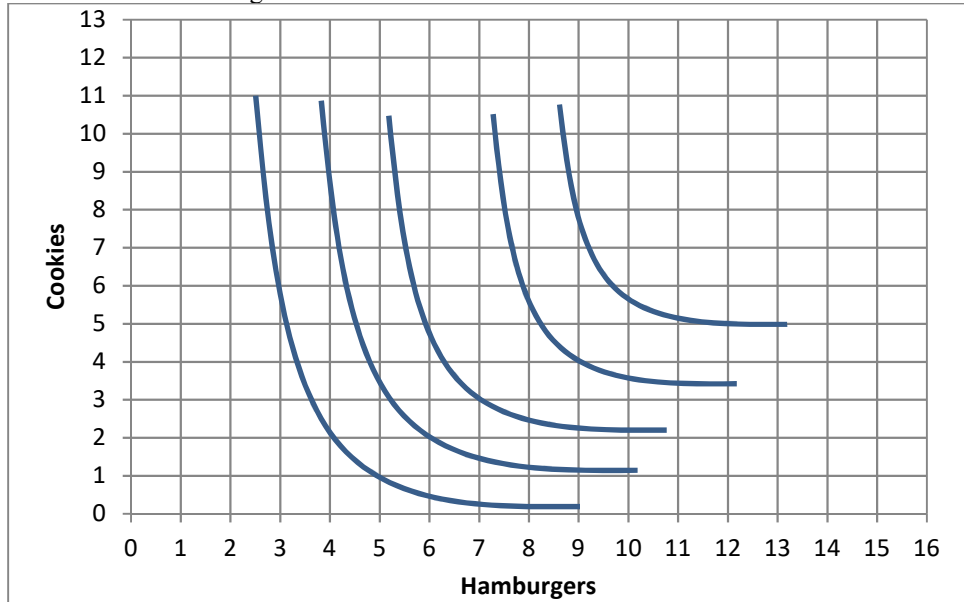


Suppose the government imposes an excise **tax of \$ 3** per tee-shirt.

- 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.

	million
\$	per tee-shirt
\$	per tee-shirt
\$	million
\$	million
\$	million
\$	million

(6) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Anna's preferences for cookies and hamburgers.



- a. Would Anna rather have 4 hamburgers and 9 cookies, or 6 hamburgers and 5 cookies?
- b. Would Anna rather have 7 hamburgers and 3 cookies, or 10 hamburgers and 1 cookie?

hamburgers and	cookies
hamburgers and	cookies

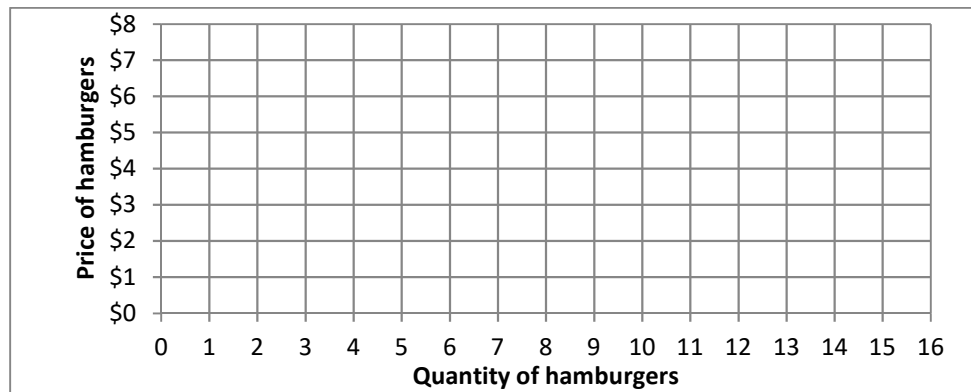
Suppose Anna has a lunch budget of \$30 to spend on hamburgers and cookies. The price of cookies is \$3.

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

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



(7) [Short-run cost: 26 pts] Acme Manufacturing Company operates a small plant whose daily cost is \$ 48 whether the plant is idle or running. In addition, the company has labor, energy, and materials costs that depend on the amount of output, as shown in the schedule below.

Units of output per day	Cost of labor, energy, and materials	SAVC	SAFC	SATC	SMC
0	\$ 0				
					\$
2	\$20	\$	\$	\$	
					\$
4	\$60	\$	\$	\$	
					\$
6	\$120	\$	\$	\$	
					\$
8	\$240	\$	\$	\$	

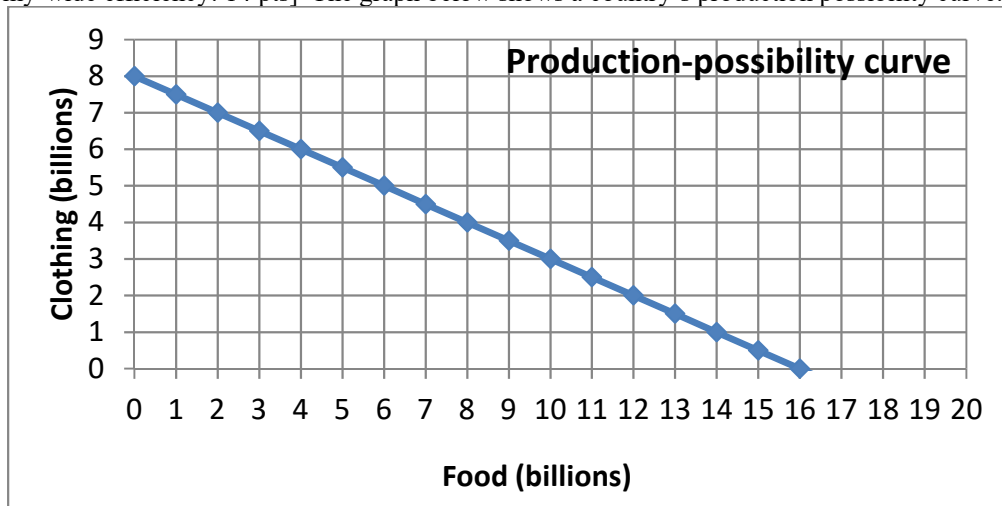
- a. [4 pts] Compute the company's short-run average variable cost schedule (SAVC). Insert your answers above.
- b. [4 pts] Compute the company's short-run average fixed cost schedule (SAFC). Insert your answers above.
- c. [4 pts] Compute the company's short-run average total cost schedule (SATC). Insert your answers above.
- d. [4 pts] Compute the company's short-run marginal cost schedule (SMC). Insert your answers above.
- e. [2 pts] What is Acme's shutdown price?

\$
\$
units
\$

- f. [2 pts] What is Acme's breakeven price?
- g. [2 pts] If the price of Acme's output is \$ 25, how many units of output should it produce to maximize profit in the short run: 0 units, 2 units, 4 units, 6 units, or 8 units?
- h. [2 pts] Will Acme enjoy a profit or a loss ?
- i. [2 pts] How much?



(8) [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?

units of clothing
units of food

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

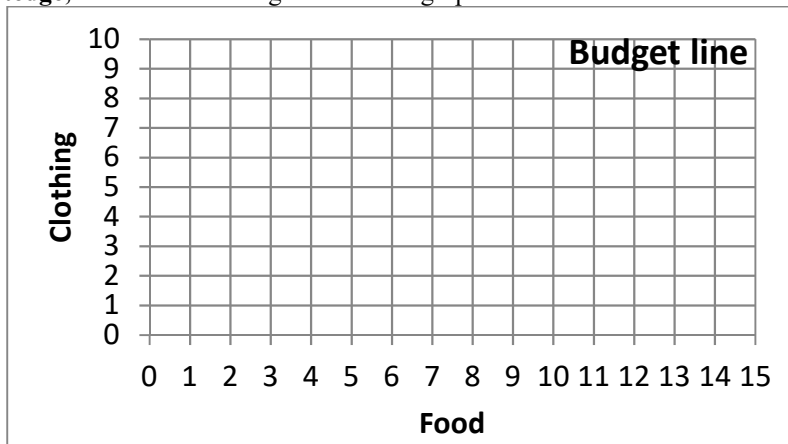
Assume this country's economy is in competitive equilibrium in all markets and the price of a unit of food is \$6.

c. What must be the price of a unit of clothing?

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

d. Using a straightedge, draw Adam's budget line in the graph below.



e. What is **Adam's** opportunity cost of a unit of food?

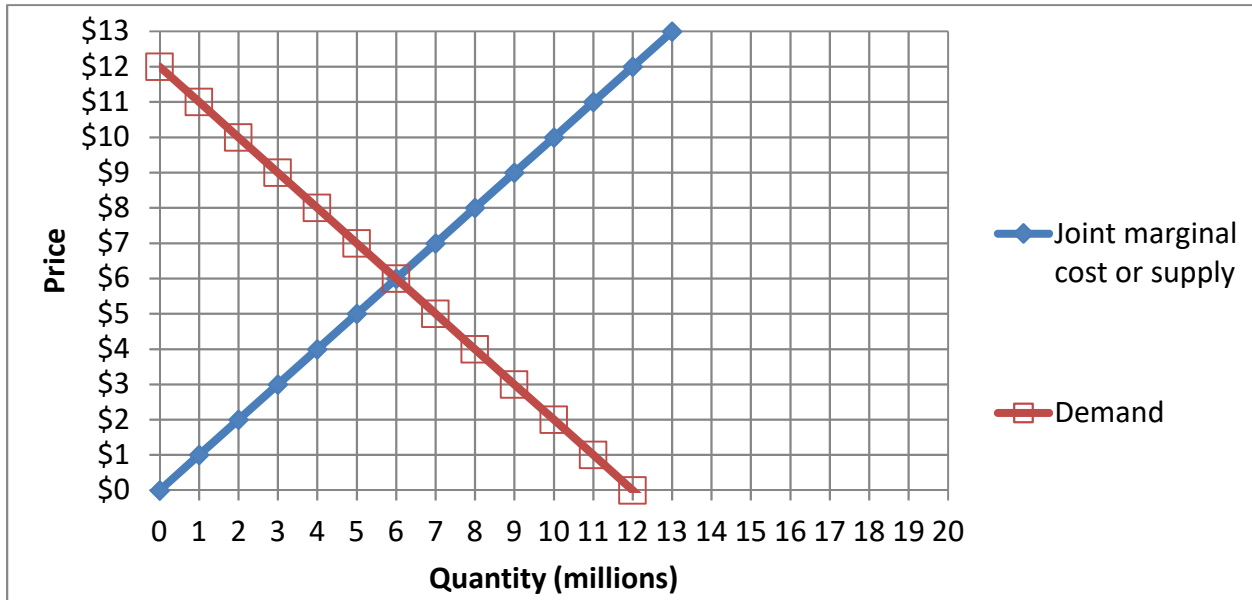
units of clothing
units of food

f. What is **Adam's** opportunity cost of a unit of clothing?

g. Sketch an indifference curve tangent to Adam's budget line. What is the slope of that indifference curve (that is, Adam's marginal rate of substitution) at the tangency point?

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(9) [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?

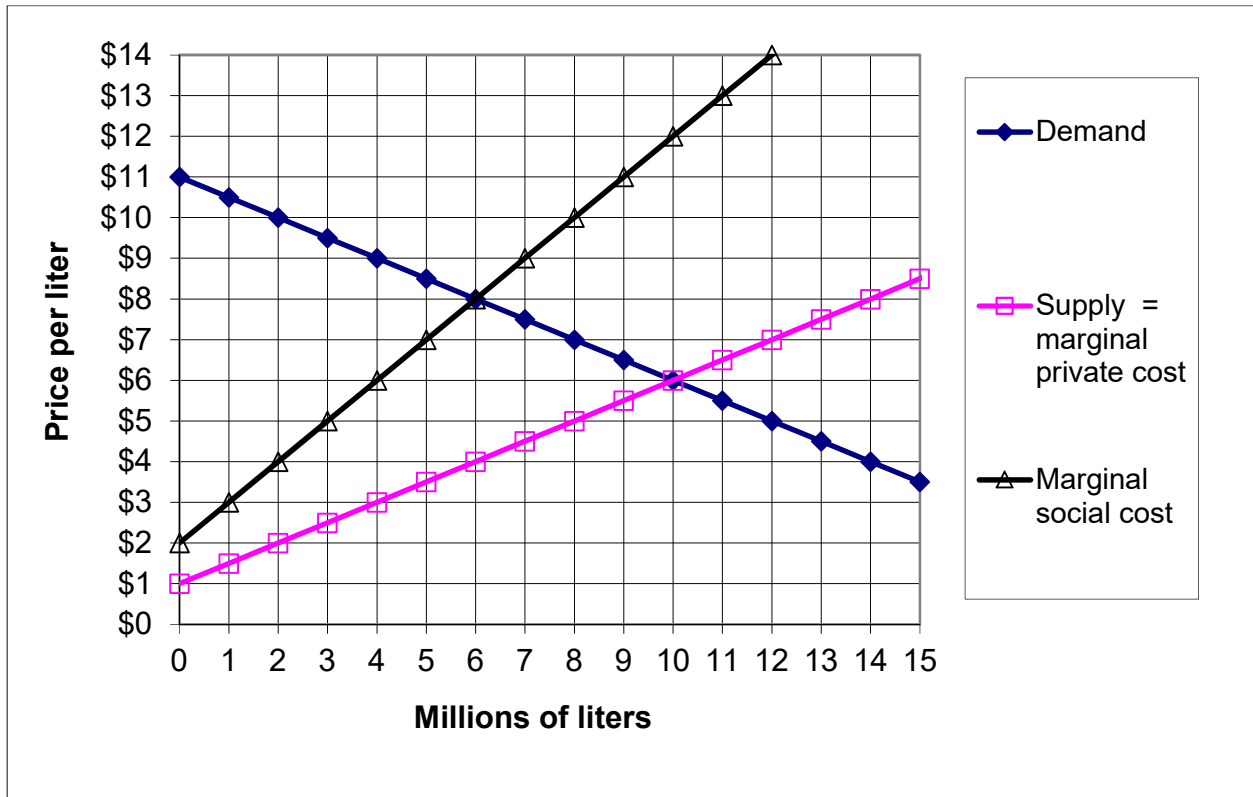
f. If output increased by one more unit at any firm, total costs would increase by how much?

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

(10) [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

(11) [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:**

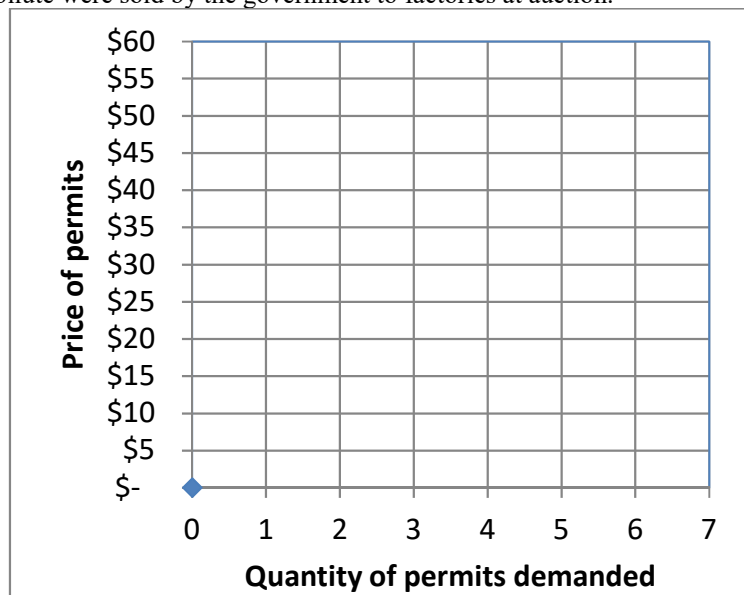
- To minimize the total cost of cleaning up, which 2 factories should be commanded to clean up? Give their letters.
- What would be the total cost of cleaning up for these 2 factories together?

\$

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.

- [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.

- Which 3 factories would win the permits? Give their letters.
- What would be the final auction price of a permit to pollute?
- 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.

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

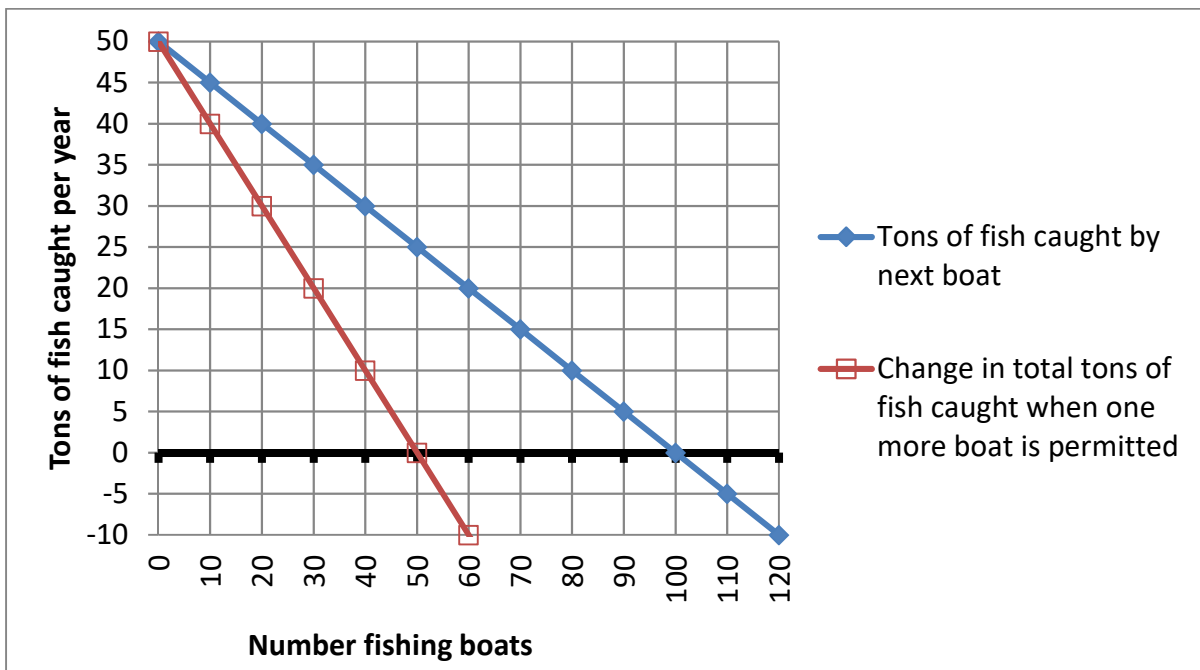
\$
\$

(12) [Public goods: 4 pts] A city government will offer a free outdoor concert series during the summer in a neighborhood park. About **500** people are likely to enjoy the concerts. Each concert costs **\$1000** 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):  $MB = 8 - Q$ .

- 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

(13) [Common property resources: 6 pts] A certain fishing area can get over-exploited. When one more fishing boat is permitted, all the other fishing boats catch fewer fish. The graph below shows the tons of fish caught by the next boat, and the change in the total tons as one more boat is permitted. Note that the change in total tons eventually becomes negative as more boats are permitted—at that point the annual total catch begins *falling* as more boats are permitted.



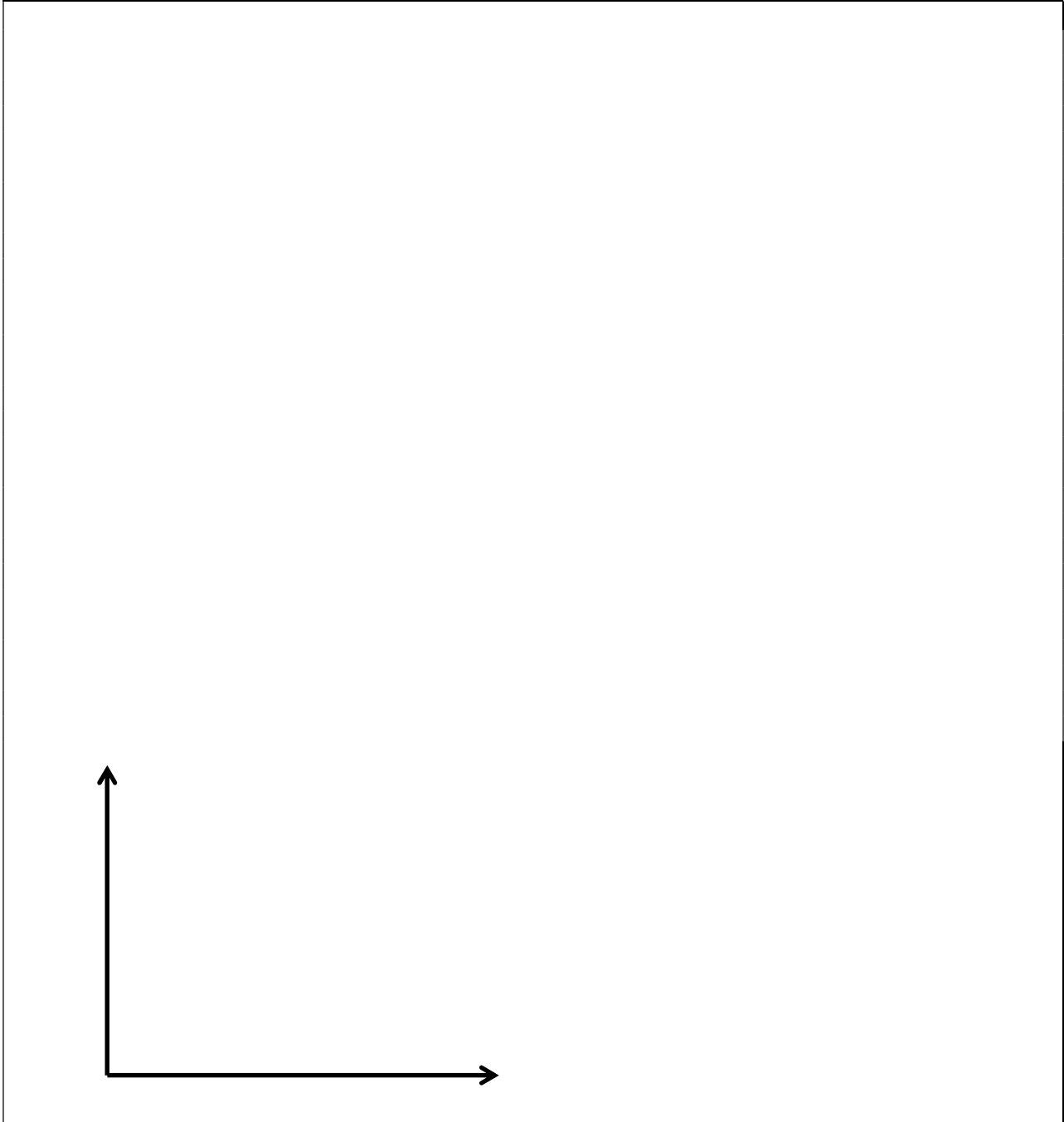
- How many boats will try to fish if access to the fishing area is unregulated? (Ignore any costs of operating a fishing boat.)
- What is the socially-optimal number of boats—that is, the number of boats that maximizes total catch?
- Suppose a fishing-boat operator is willing to pay \$20 per ton for fishing. What license fee for admission to the fishing area (in dollars per boat) would ensure that the optimal number of boats entered the fishing area?

	boats
	boats
	\$

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

- (1) Give an example of a good or service that you consume that is *nonrival*. Explain why this good is a *nonrival* good. (Ignore the graph.)
- (2) Economists continually recommend marginal-cost pricing. Why does marginal-cost pricing lead to economic efficiency? Support your answer with a graph.

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]