

FINAL EXAMINATION VERSION A

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, 28 pts total]

(1) Rational choice implies pursuing an activity until the marginal benefit of the last unit

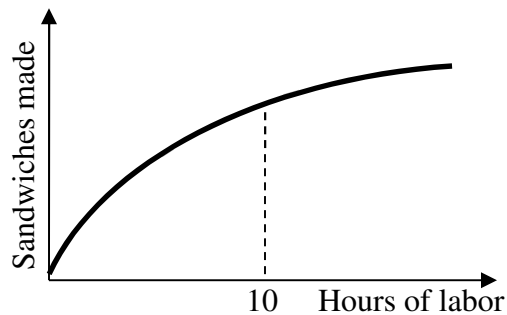
- a. begins to exceed its marginal cost.
- b. is much greater than its marginal cost.
- c. begins to fall below its marginal cost.
- d. is much less than its marginal cost.

(2) "Congress should avoid abrupt changes in spending" is an example of

- a. a positive statement.
- b. a normative statement.
- c. both of the above.
- d. none of the above.

(3) Is the production function below characterized by diminishing returns to labor input?

- a. Yes, for all levels of labor input.
- b. No, not for any levels of labor input.
- c. Yes, but only after 10 hours of labor input.
- d. Yes, but only before 10 hours of labor input.



(4) Farm A can produce 200 units of corn per acre or 100 units of soybeans per acre. Farm B can produce 50 units of corn per acre or 50 units of soybeans per acre. Which farm has a comparative advantage in soybeans?

- a. Farm A.
- b. Farm B.
- c. Both farms.
- d. Neither farm.

(5) The *Law of One Price* means

- a. the total quantity buyers want to buy is negatively related to the price.
- b. a good cannot be resold.
- c. all sellers are required by law to quote the same price.
- d. the buyer and the seller in each transaction must agree on a price.
- e. efficient markets eliminate price dispersion.

(6) Most pizza is made with mozzarella cheese, so if the price of mozzarella cheese falls, then the

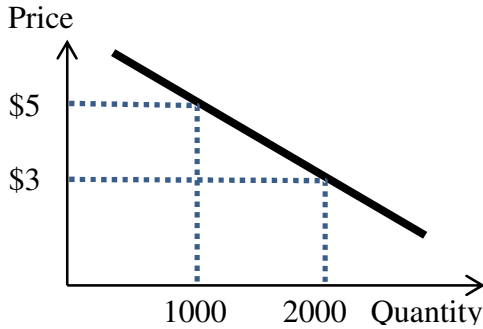
- a. demand for pizza will shift left.
- b. demand for pizza will shift right.
- c. supply of pizza will shift left.
- d. supply of pizza will shift right.

(7) In autumn, the price of watermelon rises and the quantity sold decreases. This could be caused by

- a. a rightward shift in the demand.
- b. a rightward shift in the supply.
- c. a leftward shift in the demand.
- d. a leftward shift in the supply.

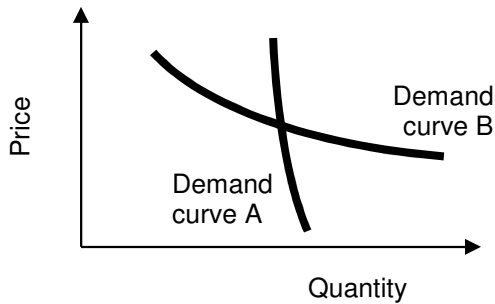
(8) The graph below shows the demand for sandwiches. If the market price of sandwiches rises from \$3 to \$5, then total consumer surplus

- decreases by \$2000.
- decreases by \$3000.
- decreases by \$4000.
- increases by \$2000.
- increases by \$3000.



(9) Which demand curve below is *less* elastic?

- Demand curve A.
- Demand curve B.
- Both have the same elasticity because they pass through the same point.
- Cannot be determined from information given.



(10) Assuming that hybrid-engine cars and gasoline are substitutes, then the cross-price elasticity of demand for hybrid cars with respect to the price of gasoline must be

- positive
- negative.
- zero.
- cannot be determined from information given.

(11) A quota on *buying* rosewood would cause the price of rosewood to

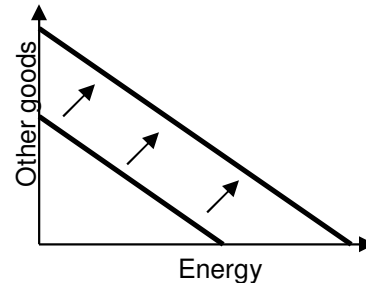
- rise.
- fall.
- rise or fall, depending on the shapes of the demand and supply curves.
- remain constant.

(12) Suppose the price elasticity of demand for hotel rooms in a small city is -5.0 and the price elasticity of supply is 1.5. If hotel rooms are taxed,

- Sellers (hotel operators) will pay most of the tax.
- Buyers (guests) 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.

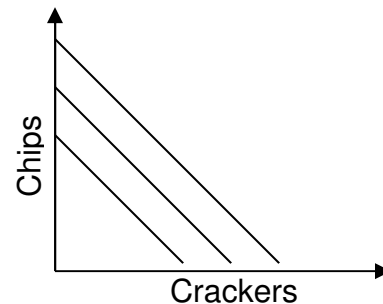
(13) In the graph below, the shift in the budget line could be caused by

- an increase in income.
- a decrease in income.
- an increase in the price of energy.
- a decrease in the price of energy.
- an increase in the price of other goods.
- a decrease in the price of other goods.



(14) The indifference-curve graph below shows Beth's preferences. It reveals that, for Beth, chips and crackers are

- perfect squares.
- perfect substitutes.
- perfect complements.
- perfectly elastic.



(15) Suppose a study shows that the marginal benefit of keeping open the Ellwood City Recreation Center is \$20 per hour, and the marginal cost is \$25. If these numbers are accurate, then Ellwood City would be better off

- a. keeping the Recreation Center open more hours.
- b. keeping the Recreation Center open fewer hours.
- c. making no change in the Recreation Center hours.
- d. Cannot be determined from information given.

(16) Which of the following is an economic cost but not an accounting cost?

- a. The opportunity cost of the business owner's time spent running the business.
- b. Wages paid to workers.
- c. Money paid for electricity, raw materials, and supplies.
- d. Lease payments.
- e. All of the above.

(17) If at a certain level of output, marginal cost is greater than average cost, then average cost must be

- a. increasing with output.
- b. decreasing with output.
- c. at its minimum point.
- d. Cannot be determined from information given.

(18) In the *short run*, a firm should continue operating if its revenue is sufficient to pay at least its

- a. fixed cost.
- b. variable cost.
- c. total cost.
- d. accounting cost.

(19) *Price equals average cost* in a competitive industry in long-run equilibrium because

- a. positive profits encourage entry of new firms while negative profits encourage existing firms to leave the industry.
- b. the threat of government regulation causes firms to hold prices down.
- c. business owners have a sense of fairness.
- d. individual firms adjust their output levels using the rule "price equals average cost" to maximize profit.
- e. consumers refuse to pay more than what is reasonable.

(20) A perfectly competitive firm expects that if it increases its output, this will cause the price to

- a. stay the same.
- b. increase.
- c. decrease.
- d. cannot be determined from information given.

(21) To pass the compensation test of Kaldor and Hicks, a change in the economy must result in

- a. winners but no losers.
- b. gains to winners that exceed any losses to losers.
- c. at least some winners.
- d. cost savings for the government.
- e. a rise in wages, salaries, and other compensation.

(22) Suppose that for some reason, at current levels of output, Firm A's marginal cost is \$10 and Firm B's marginal cost is \$4. If one unit of output is shifted from Firm A to Firm B, then total industry costs will

- a. increase by \$4.
- b. increase by \$6.
- c. remain unchanged.
- d. decrease by \$4.
- e. decrease by \$6.

(23) 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 \$2.95. The shop's marginal revenue of the 21st cup is therefore

- a. \$0.05 .
- b. \$1.95 .
- c. \$2.20 .
- d. \$2.95 .
- e. \$3.00 .
- f. \$20.00 .

(24) Products are said to be "differentiated" if

- a. one can buy them in fractional amounts.
- b. consumers do not view them as perfect substitutes.
- c. they are sold through different retail channels (stores, online, catalogs, etc.)
- d. different consumers buy different quantities of them.

(25) I enjoy viewing my neighbors' flowers, even though I do not pay for them. My neighbor's flowers therefore create

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

(26) If a market creates an external benefit then the resulting market failure can in theory be corrected

- a. with a tax.
- b. with a subsidy.
- c. by completely banning the product.
- d. any of the above.

(27) Since many people can enjoy a radio broadcast simultaneously, without detracting from each other's experience, radio broadcasts are an example of a

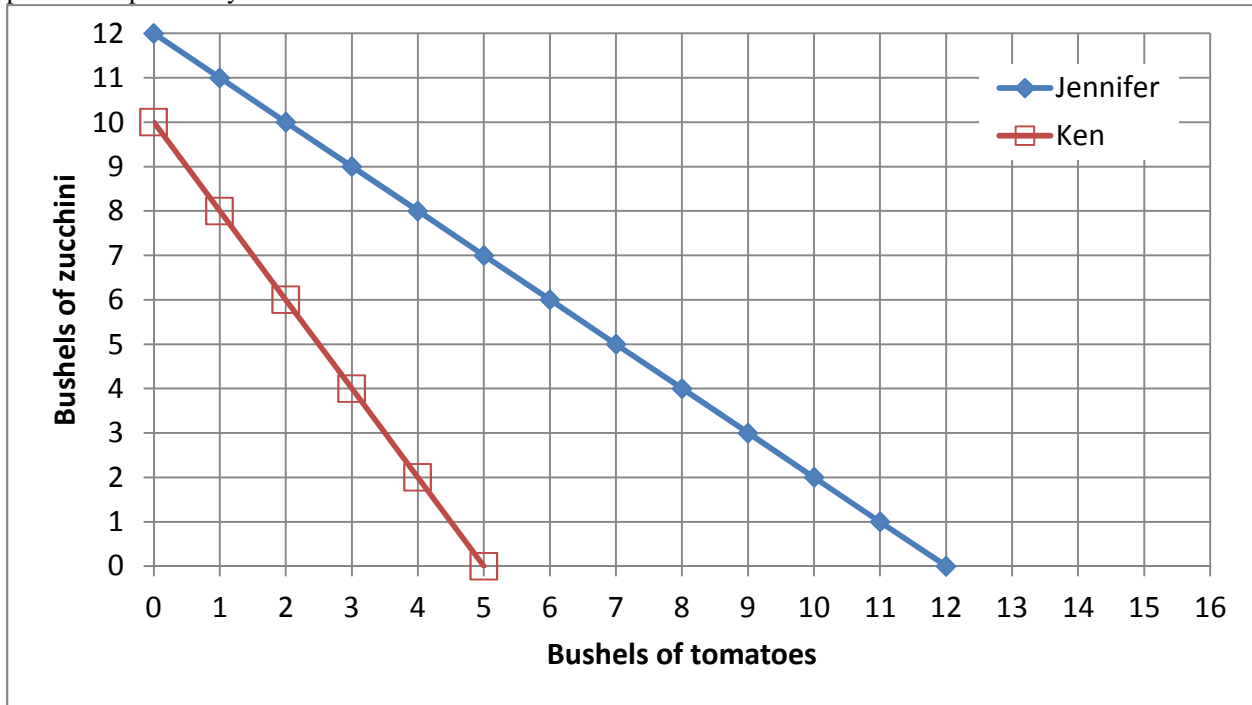
- a. private good.
- b. nonexcludable good.
- c. nonrival good.
- d. common-property resource.

(28) Taco Bell requires you to pay for a burrito before you eat it. Only one person can eat the burrito, of course. So a burrito from Taco Bell 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) [Comparative advantage, gains from trade: 17 pts] Jennifer and Ken each have gardens where they grow tomatoes and zucchini. They each face a tradeoff between these two crops because their space is limited. Their production possibility curves are shown below.



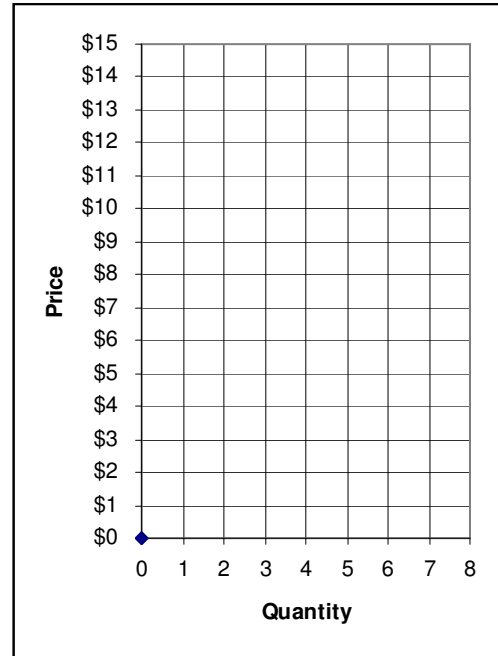
- [2 pts] What is Jennifer's opportunity cost of a bushel of zucchini?
- [2 pts] What is Ken's opportunity cost of a bushel of zucchini?
- [2 pts] What is Jennifer's opportunity cost of a bushel of tomatoes?
- [2 pts] What is Ken's opportunity cost of a bushel of tomatoes?
- [2 pts] Who has a comparative advantage in producing zucchini?
- [2 pts] Who has a comparative advantage in producing tomatoes?

	bushels of tomatoes
	bushels of tomatoes
	bushels of zucchini
	bushels of zucchini

- [3 pts] Fill in the blanks: *Both* people can consume combinations of zucchini and tomatoes *outside* their individual production possibility curves if _____ gives **three** bushels of zucchini to _____, who gives _____ bushels of tomatoes in return.
- [2 pts] **Plot** the trade that you propose in part (g) on the graph above. For each producer, plot and label the starting point representing **production before trade**, and the ending point representing **consumption after trade**.

(2) [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	\$12	Sue	\$ 1
Barb	\$10	Steve	\$ 2
Ben	\$ 8	Sam	\$ 3
Bailey	\$ 6	Sven	\$ 4
Brian	\$ 4	Sarina	\$ 6
Brittany	\$ 2	Sam	\$ 8
Brandon	\$ 1	Sophia	\$10



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.)

- If the price were \$7, would there be *excess demand*, *excess supply*, or *neither*?
- What is the equilibrium price? Give an answer to the nearest whole dollar.
- How many units of the good will be sold in this market?
- Compute the total revenue received by sellers (which equals the total spending by buyers).
- Compute the combined total surplus (or gains from trade) of all buyers and sellers. (Check your answer carefully! No partial credit for being "close"!)
- Who enjoys higher surplus in this particular market, the *buyers* or the *sellers*? Or is buyers' total surplus *equal* to sellers' total surplus?

\$
units
\$
\$

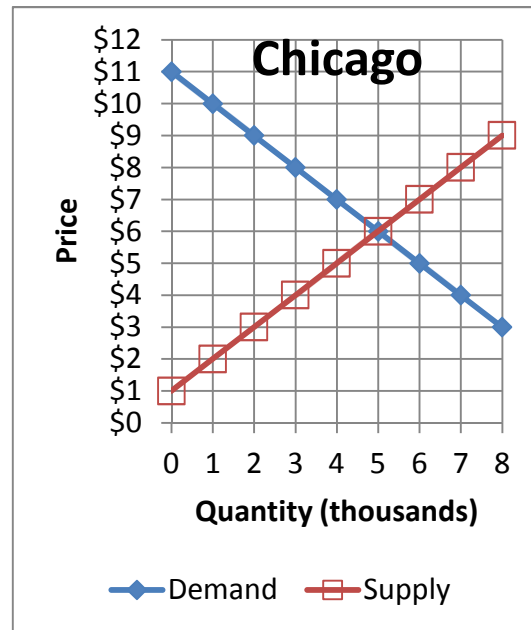
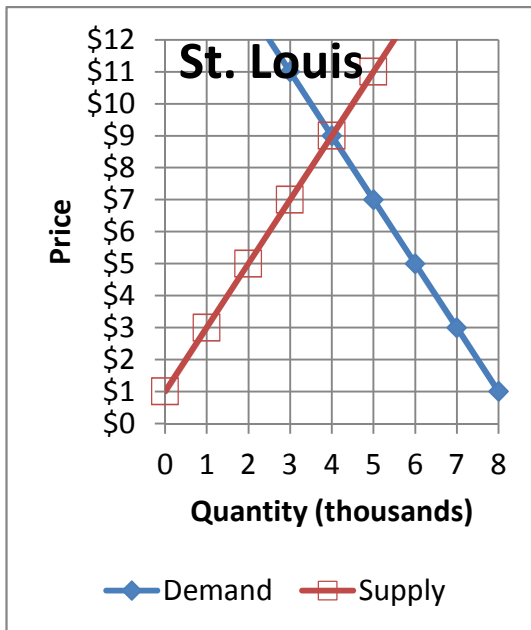
(3) [Calculating elasticities: 2 pts] Suppose that if the price of electricity is \$0.07 per kilowatt-hour, the average household uses 1800 kilowatt-hours per month. If the price is \$0.13 per kilowatt-hour, the average household uses 1200 kilowatt-hours per month. Compute the price elasticity of demand for electricity using the “arc-elasticity” formula.

(4) [Using price elasticity of demand: 10 pts] Suppose the government wants consumers to use 15% less water and it wants to use price as an incentive to conserve. Suppose the price elasticity of demand for water is -0.6.

- According to the information above, is demand for water *elastic*, *inelastic*, or *unitary-elastic*?
- To decrease water consumption by this much, must the price of water *increase*, *decrease*, or remain *constant*?
- ... by about how much?
- Will consumers' total spending on water *increase*, *decrease*, or remain *constant*?
- ... by about how much?

%
%

(5) [Arbitrage: 12 pts] The following graphs show markets for flashdrives in St. Louis and Chicago, in the absence of any arbitrage activity. Assume flashdrives are very easy to transport.



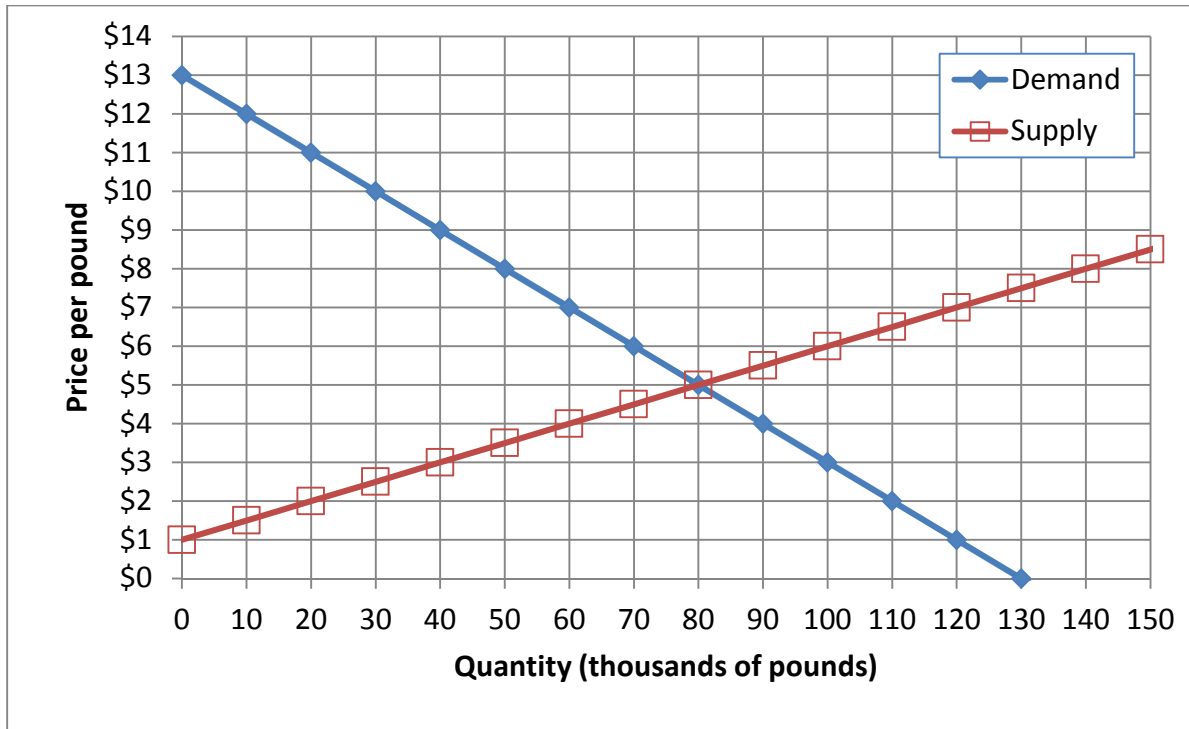
- Will arbitrage shift the demand curve in St. Louis *left*, or *right*, or leave it *unchanged*?
- Will arbitrage shift the demand curve in Chicago *left*, or *right*, or leave it *unchanged*?
- Will arbitrage shift the supply curve in St. Louis *left*, or *right*, or leave it *unchanged*?
- Will arbitrage shift the supply curve in Chicago *left*, or *right*, or leave it *unchanged*?

Suppose there are no costs of arbitrage. That is, the cost of shipping flashdrives between St. Louis and Chicago (in either direction) is *zero*.

- What will be the final price of the item in St. Louis, in equilibrium?
- What will be the final price of the item in Chicago, in equilibrium?

\$
\$

(6) [Welfare analysis of price controls or quotas: 18 pts] The following graph shows the market for artichokes.



a. Find the equilibrium price without government intervention.

\$

Suppose the government imposes a **quota on sellers of 40 thousand pounds**. Sellers are not permitted to sell more than this amount.

b. What will be the new equilibrium price with the quota?

\$

c. Does producer surplus *increase, decrease, or remain constant* because of the quota, as compared to the market without government intervention? (Assume optimistically that quota permits are given to those producers with the lowest cost of production.)

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d. By how much?

\$	thousand
----	----------

e. Does consumer surplus *increase, decrease, or remain constant* because of the quota, as compared to the market without government intervention?

\$	thousand
----	----------

f. By how much?

\$	thousand
----	----------

g. Compute the deadweight social loss caused by the quota.

\$	thousand
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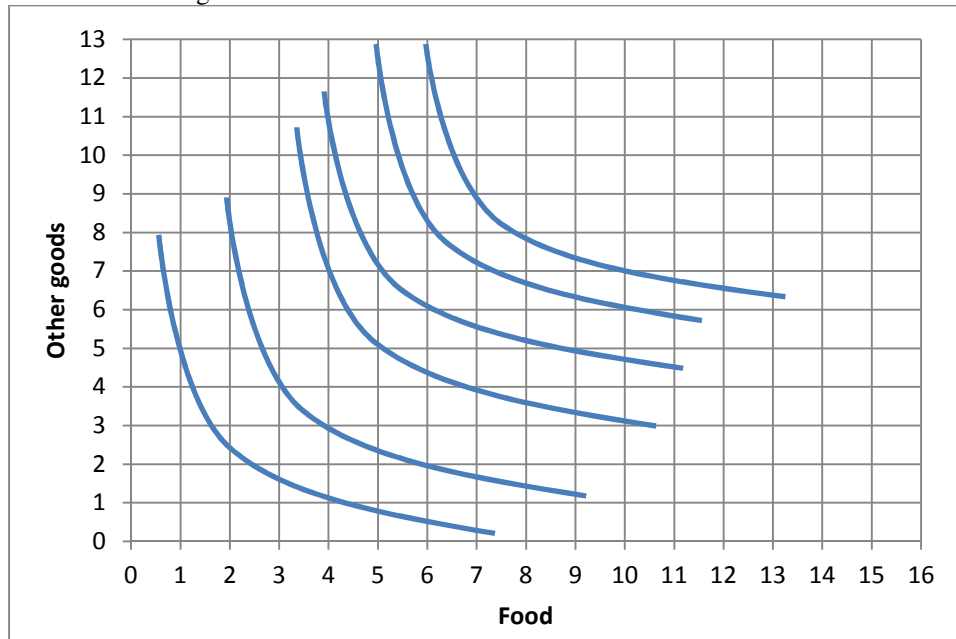
h. Suppose the government sells the quota permits at auction to producers. What will be the equilibrium price of a **quota permit** to sell one pound?

\$

i. How much revenue will the government receive from selling quota permits at auction?

\$	thousand
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(7) [Consumer choice and demand: 16 pts] The indifference curves in the graph below represent Brian's preferences for food and other goods.



- a. Would Brian rather have 10 units of food and 3 units of other goods, or 6 units of food and 6 units of other goods?
- b. Would Brian rather have 4 units of food and 11 units of other goods, or 7 units of food and 7 units of other goods?

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

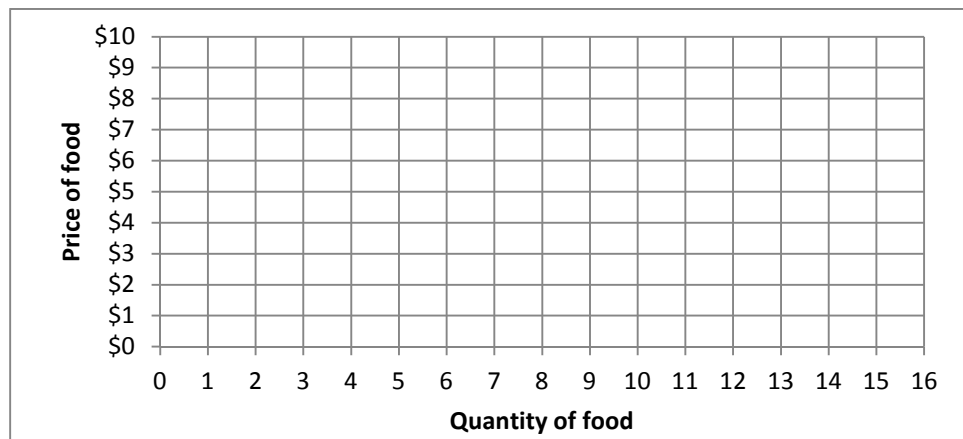
Suppose Brian has a budget of \$30 to spend on food and other goods. The price of other goods is \$3.

- c. **Using a straightedge**, carefully draw Brian's budget line when the price of food is \$2. Label this budget line "A".
- d. How much food will Brian buy if the price of food is \$2?
- e. **Using a straightedge**, carefully draw Brian's budget line when the price of food is \$6. Label this budget line "B".
- f. How much food will Brian buy if the price of food is \$6?

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

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



(8) [Basic definitions, cost and revenue: 6 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

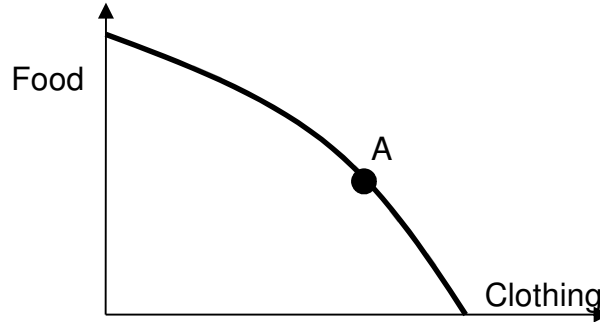
- a. Money paid for all inputs purchased or hired.
- b. Change in revenue divided by change in output.
- c. Increase in total revenue from producing and selling another unit of output.
- d. Total cost divided by the quantity of output.
- e. Increase in cost from producing another unit of output.
- f. Change in cost divided by change in output.

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

- a. Suppose a particular project will *cost* a firm \$2000 today, but will bring \$1500 in revenue a year from today, and \$1000 in revenue two years from today. Compute the *net present value* of this project, to the nearest whole dollar.
- b. Suppose a firm is expected to enjoy \$12 million in profit every year, perpetually, beginning a year from today. Compute the value of the firm.

\$	
\$	million

(10) [Economy-wide efficiency: 20 pts] The graph below shows a country's production possibility curve. Assume the country is at point A, where the slope of the production possibility curve equals -4 .



- 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

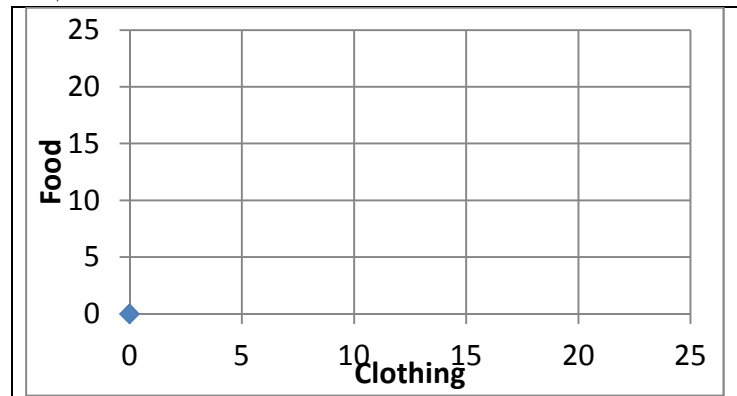
Assume this economy is in competitive equilibrium in all markets and the price of a unit of clothing is \$12.

- c. What must be the marginal cost of clothing, for all firms producing clothing in this economy?
- d. What must be the price of a unit of food?
- e. What must be the marginal cost of food, for all firms producing food in this economy?

\$
\$
\$

Brian, a consumer in this economy, has an income of \$60.

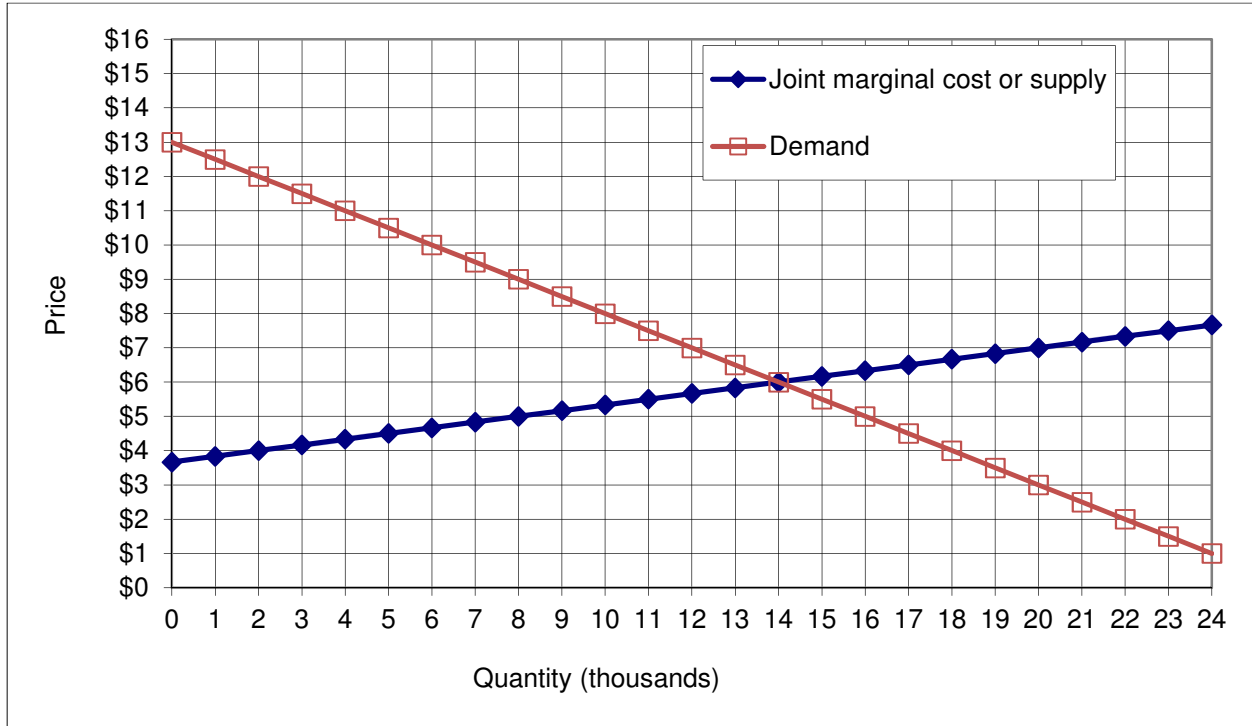
f. [4 pts] *Using a straightedge*, draw Brian's budget line in the graph at right.



- g. What is the slope of Brian's budget line?
- h. What is Brian's opportunity cost of a unit of clothing? That is, if he is spending all his income, but then decides to buy another unit of clothing, how many units of food must he give up?
- i. What is Brian's opportunity cost of a unit of food? That is, if he is spending all his income, but then decides to buy another unit of food, how many units of clothing must he give up?
- j. What is Brian'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?

units of food
units of clothing

(11) [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?

	thousand
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?	\$

Now, 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?

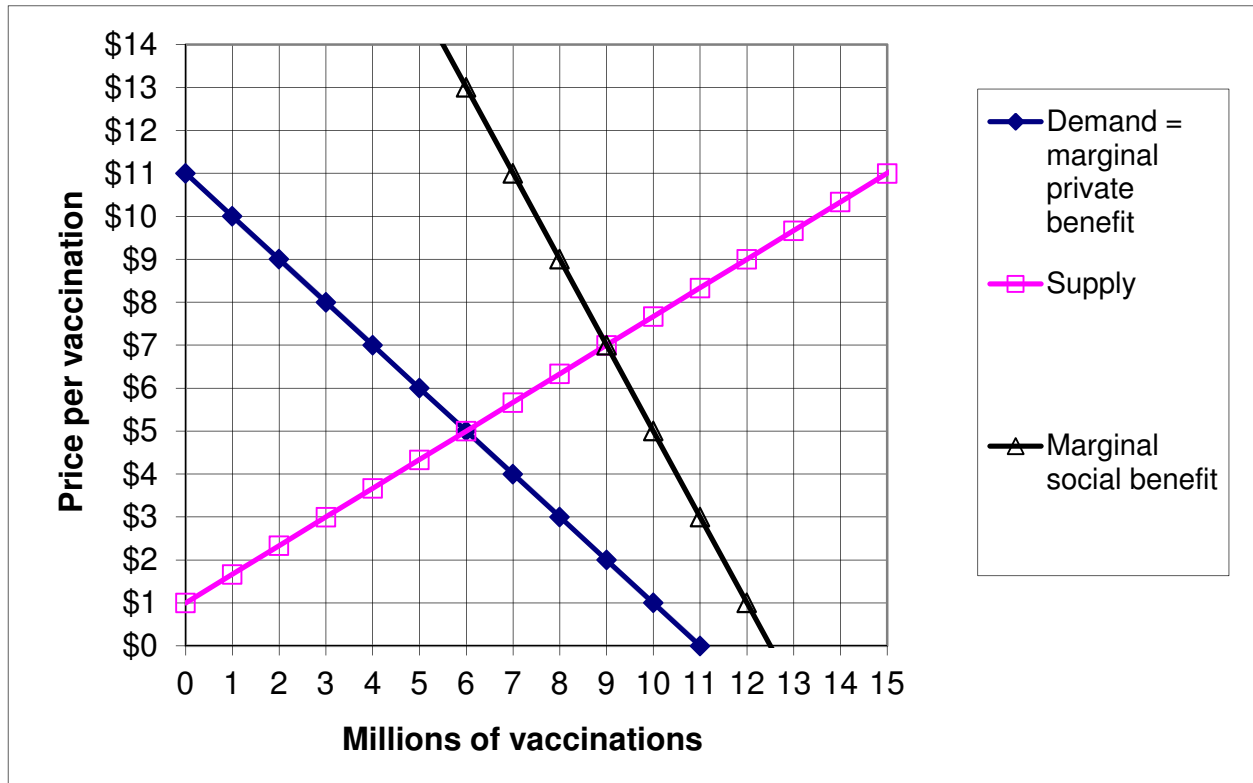
f. If output increased by one more unit at any firm, total costs would increase by how much?

g. What price will the firms jointly set?

h. Compute the deadweight loss from collusion.

	thousand
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.	\$ thousand

(12) [Externalities: 12 pts] The graph below shows the market for a particular vaccine. A vaccination protects the purchaser of the vaccine, but also reduces the chances of other people catching the illness. Therefore, in addition to demand and supply curves, a curve representing marginal social benefit is shown.



- Compute the (unregulated) competitive equilibrium price.
- Compute the (unregulated) competitive equilibrium quantity.
- Compute the economically efficient (or socially optimal) quantity.
- Compute the deadweight loss from unregulated competition.
- To eliminate this deadweight loss, should the government impose a *tax* or a *subsidy*?
- What should be the tax rate or subsidy rate?

\$	
	million
	million
\$	million
\$	per vaccination

(13) [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

(14) [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 5 units per year (a reduction of 2 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

Consider alternative approaches to regulating pollution.

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?

\$ thousand

Auction: Suppose 5 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 5 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 2 factories that did not win permits in the auction?

\$ thousand
\$ thousand

Cap and trade: Suppose 5 permits to pollute were distributed to factories at random. Then the factories were permitted to trade permits in a market among themselves.

- f. Which 5 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 2 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 5 units? Give an answer to the nearest thousand dollars.
- j. What would be the total cost of cleaning up for those 2 factories that chose not to pay the fee?

\$ thousand
\$ thousand

III. Critical thinking: Write a one-paragraph essay answering *one* question below (your choice). [3 pts]

- (1) Consider the following statement. "Perfect competition is only the 'law of the jungle.' Unregulated competition drives profit to zero in a race to the bottom. If the government would allow firms to set prices cooperatively, everyone would benefit and society would be better off."
- Do you agree or disagree? Why?
 - Illustrate your answer with a supply-and-demand graph, using the concepts of consumer surplus, producer surplus, and deadweight loss.
- (2) Your company needs a new computer system. You have just paid \$100,000 to have a new system installed by Vendor A, and this money cannot be recovered. However, you will still need to spend \$50,000 on training so that your people learn to use the new system. Suddenly, Vendor B offers to sell you an alternative computer system. Vendor B's system will cost only \$50,000 to install, and only \$25,000 for training. Should you switch to Vendor B's system? Justify your answer, identifying any sunk costs. (Do not draw 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]