

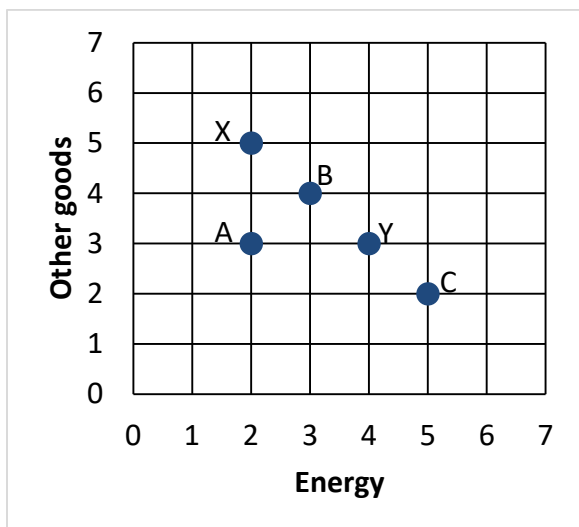
FINAL EXAMINATION VERSION A

INSTRUCTIONS: This exam is closed-book, closed-notes. Calculators, mobile phones, and wireless devices are NOT permitted. Point values for each question are noted in brackets. Maximum total points are 200.

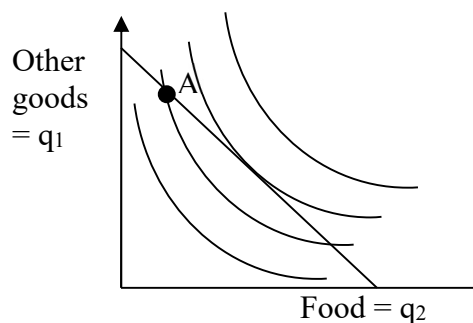
I. MULTIPLE CHOICE: Circle the one best answer to each question. Feel free to use margins for scratch work [2 pts each—42 pts total].

(1) Suppose in the graph below that the consumer is indifferent between bundles X and Y. (Assume as usual that the assumption of "monotonicity" or "more is better" applies.) According to the assumption of "diminishing marginal rate of substitution," which bundle below *must* be preferred to bundles X and Y?

- a. Bundle A only.
- b. Bundle B only.
- c. Bundle C only.
- d. All of the above.
- e. None of the above.



The next two questions refer to the following graph of a consumer's budget line and indifference curves. Suppose the consumer is currently at bundle A for some reason.



(2) This consumer could enjoy higher utility, without increasing total spending, by

- a. purchasing less food and more other goods.
- b. purchasing more food and fewer other goods.
- c. purchasing less food and fewer other goods.
- d. any of the above.
- e. none of the above.

(3) Let MU_1 denote the marginal utility of other goods and MU_2 the marginal utility of food for this consumer. Let p_1 denote the price of other goods and p_2 denote the price of food. At bundle A,

- a. $MU_2 = MU_1$ and $p_2 = p_1$.
- b. $MU_2/MU_1 = p_2/p_1$.
- c. $MU_2/MU_1 < p_2/p_1$.
- d. $MU_2/MU_1 > p_2/p_1$.
- e. cannot be determined from information given.

(4) Which price index tends to underestimate the rate of inflation?

- a. Laspeyres price index.
- b. Paasche price index.
- c. Fisher price index.
- d. All of the above.
- e. None of the above.

(5) Suppose a firm produces an output using capital and labor. The increase in output from a one-unit increase in labor input, while holding capital input constant, is called

- a. the average product of labor.
- b. the price of labor.
- c. the marginal product of labor.
- d. the marginal rate of substitution in production of labor for capital.

(6) Suppose a firm uses both labor and capital to produce some output. Along the firm's *isoquant*, what is held constant?

- a. the firm's marginal rate of substitution in production.
- b. the firm's level of output.
- c. the firm's level of labor input.
- d. the firm's level of capital input.

(7) Suppose a firm is now producing 500 units of output per day. Its marginal cost is \$5, its average cost is \$2, and it can sell its output at a price of \$8. If it increases its output to 501 units, its profit will

- a. increase by \$5.
- b. increase by \$3.
- c. increase by \$2.
- d. decrease by \$5.
- e. decrease by \$3.
- f. decrease by \$2.

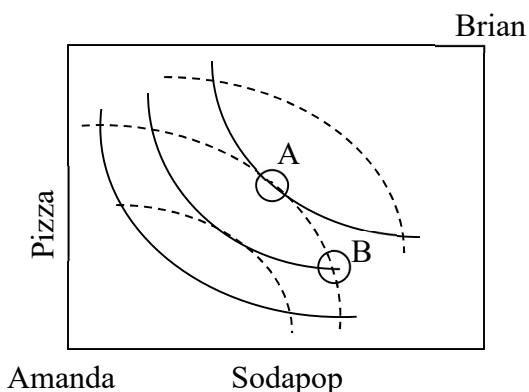
(8) In the short run, a firm should shut down if its revenue falls below its

- a. total cost.
- b. producer surplus.
- c. fixed cost.
- d. variable cost.

(9) A *Pareto improvement* is defined as a change in the economy where

- a. everyone gains.
- b. at least one person gains.
- c. at least one person gains and no one loses.
- d. the gains to the winners exceed the losses to the losers.

The next two questions refer to the following Edgeworth box diagram for consumption. The solid curves are Amanda's indifference curves. The dashed curves are Brian's indifference curves.



(10) From allocation A, *both* consumers can enjoy greater utility if

- Amanda gives Brian some pizza, and Brian gives Amanda some sodapop.
- Amanda gives Brian some sodapop, and Brian gives Amanda some pizza.
- Amanda gives Brian some pizza and some sodapop.
- Brian gives Amanda some pizza and some sodapop.
- No trade will allow both consumers to enjoy greater utility.

(11) From allocation B, *both* consumers can enjoy greater utility if

- Amanda gives Brian some pizza, and Brian gives Amanda some sodapop.
- Amanda gives Brian some sodapop, and Brian gives Amanda some pizza.
- Amanda gives Brian some pizza and some sodapop.
- Brian gives Amanda some pizza and some sodapop.
- No trade will allow both consumers to enjoy greater utility.

(12) Suppose a flower vendor with market power is now selling 7 bouquets per hour at a price of \$10. If he cuts the price to \$9, he can sell one more bouquet per hour (that is, a total of 8 bouquets per hour). The vendor's marginal revenue for the eighth bouquet is therefore

- \$2.
- \$6.
- \$7.
- \$9.
- \$10.

(13) Suppose the elasticity of demand for concert tickets is -6 for customer group A, and -2 for customer group B. If the box office can charge a different price to each group, which group should get the higher price, to maximize profit?

- Both groups should get the same price because the marginal cost is the same for each.
- Group A should get the higher price.
- Group B should get the higher price.
- Cannot be determined from information given.

(14) The term "differentiated products" means, in economics,

- the derivative of a firm's output.
- the derivative of a firm's revenue with respect to its output.
- products that are not perfect substitutes.
- products that a firm sells to different customers at different prices.
- products for which different consumers have different elasticities of demand.

(15) According to the so-called “Coase theorem,” external costs like pollution can be efficiently resolved if bargaining is efficient and

- property rights are given to the polluter.
- property rights are given to the victim of pollution.
- either of the above.
- none of the above.

(16) Unlike other taxes, a pollution tax (also called a Pigou tax)

- causes deadweight loss.
- does not generate any revenue for the government.
- affects only producers.
- reduces deadweight loss.

(17) 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 nonrival good.
- a nonexcludable good.
- both of the above.
- none of the above.

(18) In some parts of the world, open areas for grazing animals (like sheep or goats) are freely available to anyone. However, these areas are so heavily used that each animal reduces the forage available to other animals. An open grazing area is therefore

- a nonrival good.
- a nonexcludable good.
- both of the above.
- none of the above.

(19) Suppose Adam has utility function $U(I)$, where I denotes income, and Adam is risk-averse. Which is *greater* for Adam?

- $U(200)$.
- $0.5 U(100) + 0.5 U(300)$.
- Answers (a) and (b) are equal if Adam is risk-averse.
- Cannot be determined from information given.

(20) Healthy individuals are less likely to apply for health insurance. This is an example of

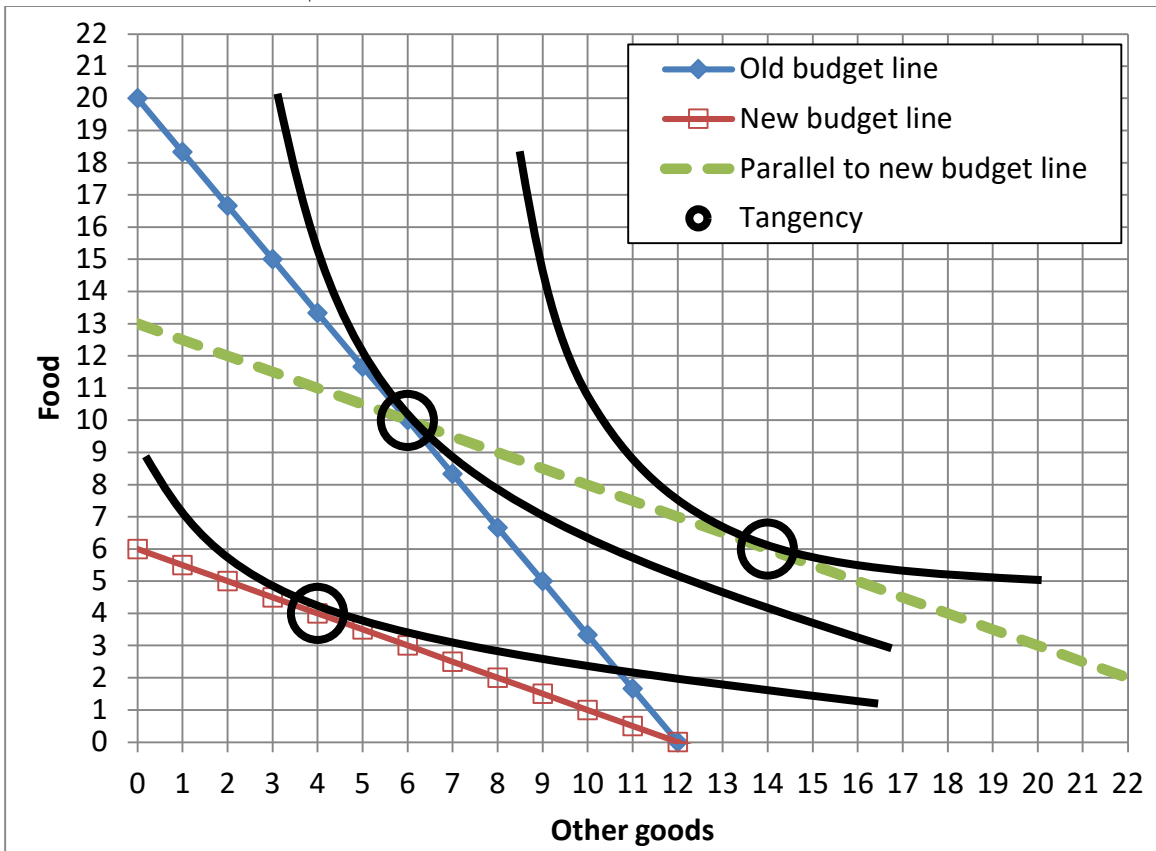
- adverse selection.
- moral hazard.
- exchange efficiency.
- market power.
- risk aversion.

(21) Sometimes people who lose their auto insurance drive more carefully. This is an example of

- exchange efficiency.
- moral hazard.
- income effects.
- adverse selection.

II. SHORT ANSWER: Please write your answers in the boxes on this question sheet. Use margins for scratch work.

(1) [Substitution and income effects: 12 pts] Consider the indifference-curve diagram below. Assume the consumer has \$60 income.



- What was the price of a unit of food on the old budget line?
- Given the old budget line, how many units of food does the consumer demand?
- What is the price of a unit of food on the new budget line?
- Given the new budget line, how many units of food does the consumer demand?
- Compute the *change* in quantity of food demanded due to the substitution effect: Δq^{sub} .
- Compute the *change* in quantity of food demanded due to the income effect: Δq^{inc} .

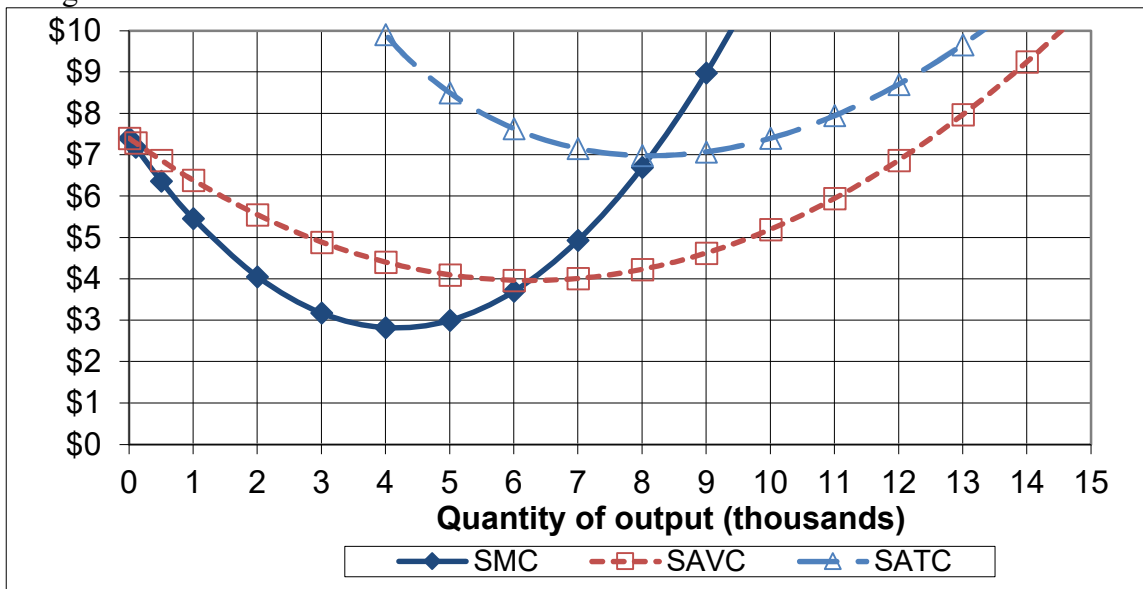
\$	
	units
\$	
	units
	units
	units

(2) [Income elasticity of demand: 10 pts] Suppose that a consumer's income rises by 8%, and the income elasticity of demand for gasoline is 0.25 .

- Does the income elasticity indicate that gasoline is an *inferior* good, a *necessary* good, or a *luxury or superior* good?
- Will the quantity demanded of gasoline *increase* or *decrease*?
- By about how much?
- Will the share of the consumer's budget devoted to gasoline *increase* or *decrease*?
- By about how much?

	%
	%

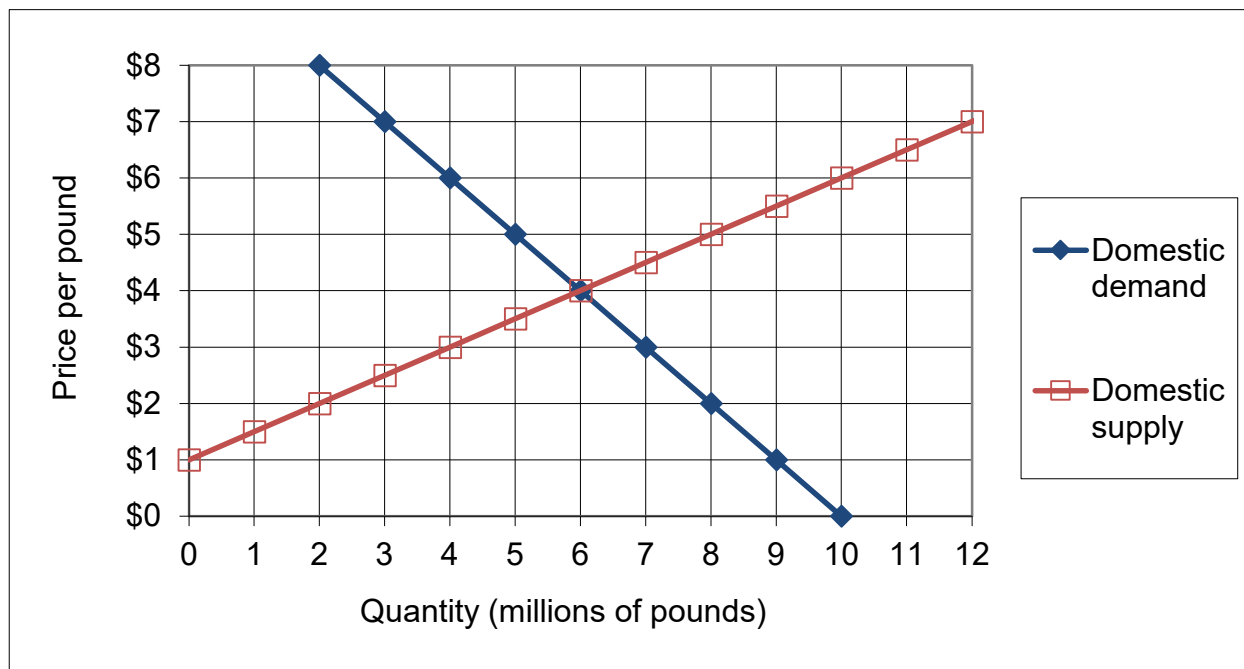
(3) [Short-run cost curves and supply: 10 pts] The following graph shows ACME Manufacturing Company's short-run average total cost (SATC), short-run average variable cost (SAVC), and short-run marginal cost (SMC). Assume ACME maximizes its profit while taking the market price as given.



- If the market price is \$5, about how much output will ACME try to produce (to the nearest thousand)?
- If the market price is \$9, about how much output will ACME try to produce (to the nearest thousand)?
- If the market price is \$3, about how much output will ACME try to produce (to the nearest thousand)?
- What is ACME's *breakeven price*—that is, the lowest price at which ACME can produce output without making losses in the short run?
- What is ACME's *shutdown price*—that is, the lowest price at which ACME will continue to operate in the short run?

	thousand
	thousand
	thousand
\$	
\$	

(4) [Welfare effects of international trade: 16 pts] The following graph shows domestic demand and supply for cheese in some country.

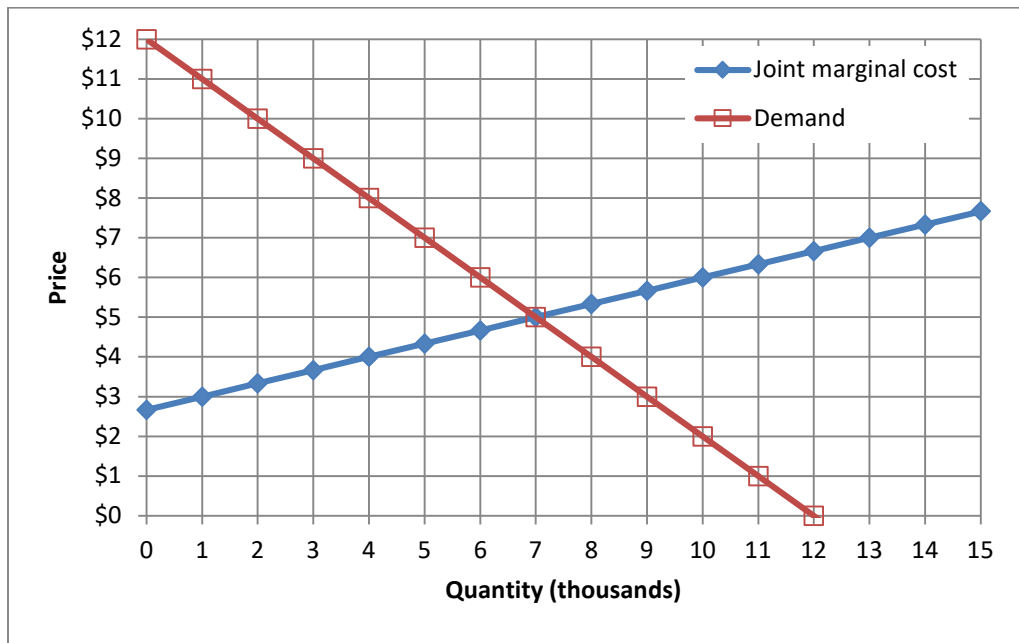


At first, international trade in cheese is not permitted. Then this industry is opened to international trade and the international price of cheese turns out to be \$ 2.

- Will this country now *export* or *import* cheese?
- How much?
- Does consumer surplus in this country *increase* or *decrease* from international trade in cheese?
- By how much?
- Does producer surplus in this country *increase* or *decrease* from international trade in cheese?
- By how much?
- Does total social welfare in this country *increase* or *decrease* from international trade in cheese?
- By how much?

	million pounds
\$	million
\$	million
\$	million

(5) [Collusion/joint profit maximization: 16 pts] Three firms produce vitamins. Market demand and the three firms' joint marginal cost are shown in the graph below.



First, suppose these firms engage in price competition.

a. Compute competitive equilibrium market price.

\$	
	thousand
\$	thousand

b. Compute competitive equilibrium market quantity.

c. Compute the amount of deadweight loss.

Now suppose these firms form a cartel to maximize jointly the sum of their profits. The equation for demand is $P = 12 - Q$, where $Q =$ quantity in thousands.

d. Find the equation for the cartel's marginal revenue.

MR =

e. Carefully plot and label the cartel's marginal revenue curve in the graph above.

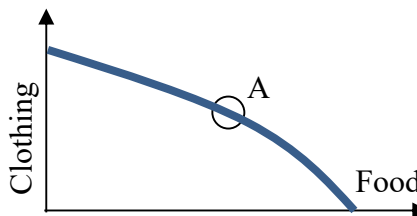
f. What price will the firms jointly set?

\$	
	thousand
\$	thousand

g. How much output will the firms produce, in total?

h. Compute the amount of deadweight loss.

(6) [General equilibrium: 8 pts] Consider the graph at right of an economy's production-possibility curve. Assume this economy is in general competitive equilibrium at point A, where the slope of the production-possibility curve is -3 .



- What is the opportunity cost of a unit of food? In other words, how many units of clothing must be given up in order to produce one more unit of food?
- What is the opportunity cost of a unit of clothing? In other words, how many units of food must be given up in order to produce one more unit of clothing?
- Consider the typical consumer's budget line with clothing on the vertical axis and food on the horizontal axis. What must be the slope of every consumer's budget line in this economy?
- If the price of a unit of clothing is \$ 6, then what must be the price of a unit of food?

	units of clothing
	units of food
\$	

(7) [Comparison of models: 6 pts] In long-run equilibrium, which models predict that price equals each firm's marginal cost, and which models predict that price equals each firm's average cost? Write YES or NO in each box.

- Perfect competition.
- Monopoly.
- Monopolistic competition.

	$P = MC$	$P = AC$

(8) [Nonrival goods: 6 pts] Ten houses surround a city park, the perfect place for a shared playground. But how big should the playground be? Suppose each household's marginal benefit from a playground is given by $MB = 120 - 10Q$, where Q is the number of units of playground equipment. The marginal cost of playground equipment \$100 per unit.

- If an individual household must buy its own playground equipment, how many units will it buy?
- Give an expression for marginal *social* benefit of shared playground equipment for the 10 households.
- What is the socially optimal number of units of shared playground equipment?

	units
MSB =	
	units

III. PROBLEMS: Please write your answers in the boxes on this question sheet. Show your work and circle your final answers.

(1) [Budgets and choice: 14 pts] A consumer has the following utility function:

$U(q_1, q_2) = -q_1^{-1} - q_2^{-1}$, where q_1 denotes the slices of pizza and q_2 denotes the quantity of other goods. The price of slices of pizza is \$4 and the price of other goods is \$9. The consumer has \$60 in income to spend on these items.

- a. [4 pts] Give an equation for the consumer's budget line. The variables q_1 and q_2 should be the only unknowns.

- b. [4 pts] Find a formula for the consumer's marginal rate of substitution in consumption of other goods for pizza—that is, the |slope| of the consumer's indifference curve with slices of pizza on the vertical axis and other goods on the horizontal axis. The variables q_1 and q_2 should be the only unknowns. Circle your final answer.

- c. [6 pts] Solve for the slices of pizza (q_1^*) and other goods (q_2^*) that this consumer will choose. Circle your final answers.

(2) [Production functions: 12 pts] Suppose a production function is given by

$$q = 8x_1^{3/4} + x_2^{3/4}.$$

- a. Find an expression for the marginal product of input 1. Are there diminishing returns to input 1? Justify your answer.

- b. Find an expression in terms of x_1 and x_2 for the marginal rate of substitution in production of input 2 for input 1—that is, the absolute value of the slope of an isoquant, with x_1 on the vertical axis and x_2 on the horizontal axis. Does production show a diminishing marginal rate of substitution? Justify your answer.

- c. Does this production function have *constant* returns to scale, *increasing* returns to scale, or *decreasing* returns to scale? Justify your answer.

(3) [Cournot duopoly: 14 pts] Suppose two makers of a consumer good form a symmetric Cournot duopoly, each firm setting its own quantity while taking the other firm's quantity as given. Let q_1 = firm #1's quantity and q_2 = firm #2's quantity, so that total market quantity $Q = q_1 + q_2$. The market demand curve is $P = 10 - (Q/10)$. Each firm has constant marginal and average cost equal to \$4. Note: question continues on next page. Use graph at bottom of next page for scratch work.

- a. Find an expression for firm #1's revenue, as a function of its own quantity and the quantity produced by the other firm: $TR_1(q_1, q_2)$.

- b. Find an expression for firm #1's marginal revenue, as a function of its own quantity and the quantity produced by the other firm: $MR_1(q_1, q_2)$.

- c. Find an expression for firm #1's reaction function, showing how much firm #1 will produce for any given quantity set by the other firm: $q_1^* = f(q_2)$.

- d. Assume the equilibrium is symmetric (that is, assume $q_1^* = q_2^*$) and compute firm #1's equilibrium quantity q_1^* .

e. Compute total market quantity Q^* and the equilibrium price P^* .

f. Compute the combined total profit of both firms.

g. Compute the social deadweight loss.



(4) [External benefit and Pigou subsidy: 10 pts] Suppose supply and demand for a particular vaccine are given by the following equations. (Use the graph at right for scratch work.)

Demand: $P_D = 14 - (Q/10)$

Supply: $P_S = 2 + (Q/20)$



- a. Compute the unregulated equilibrium price and quantity.

Persons who are vaccinated lower the risk of disease to everyone around them, creating an external benefit. Marginal external benefit per vaccine is estimated to be $MEB = 8 - (Q/20)$.

- b. Find a formula for the marginal social benefit of the vaccine.

- c. Compute the socially-optimal quantity of vaccinations.

- d. Compute the deadweight loss from unregulated competition.

- e. Compute the Pigou subsidy rate on this vaccine, in dollars per unit, that would result in the socially-optimal quantity of vaccinations.

(5) [Uncertainty, risk aversion, demand for insurance: 10 pts] Bret has \$40 in income but faces a 50% chance of losing \$30 and thus being reduced to only \$10 in income. Bret's utility function is given by $U(I) = 20 - (80/I)$, where I denotes income.

- a. Compute Bret's expected income (in dollars).

- b. Compute Bret's expected utility (in utils).

- c. Compute the level of risk-free income that would be just as desirable as Bret's current risky situation (in dollars).

- d. Compute the maximum insurance premium Bret would be willing to pay for full insurance against potential loss.

- e. Compute the so-called "fair insurance" premium for full insurance against Bret's potential loss.

(6) [Hidden characteristics and adverse selection: 10 pts] Suppose the market for accident insurance consists of 1000 people. Order these people from high-risk to low-risk, and index them by $Q = 0$ to 1000. The expected loss of the Q th person is given by $EL = 300 - 0.2 Q$. (Thus the last person's expected loss is about \$100.) Everyone is risk-averse, and willing to pay \$50 more than their expected loss (EL) for insurance.

- a. Give an equation for the demand for insurance P_D or willingness-to-pay, as a function of Q .

- b. Give an equation for the marginal cost of insurance MC , as a function of Q . (Assume there are no administrative costs.)

- c. If the market were efficient, how many people would get insurance? Why?

- d. Give an equation for the average cost of insurance AC as a function of Q . [Hint: AC has the same intercept but half the slope of MC .]

- e. Assume the market is competitive, but that insurance companies cannot observe individual persons' expected loss. Find the equilibrium price P and quantity Q of insurance.

IV. CRITICAL THINKING: Answer just *one* of the questions below (your choice). [4 pts]

(1) Two factories emit pollution. Pollution benefits the factories by saving them the cost of clean-up, but the pollution is causing health problems, so the government wants to limit total pollution to 12 units. The marginal benefit of pollution for Factory A is $MB_A = 10 - (q_A/2)$, and the marginal benefit of pollution for Factory B is $MB_B = 6 - (q_B/2)$, where q_A and q_B are the amounts of pollution emitted by the two factories. What pollution limits q_A and q_B should the government impose so as to meet the target $12 = q_A + q_B$ at least cost? Show your work and circle your final answers.

(2) Suppose the government offers to buy any house at 90 percent of the price that the owner originally paid for it. Will the government likely make a *profit* or a *loss*? Justify your answer using appropriate economic concepts of imperfect information.

Circle the question you are answering and write your answer below. Full credit requires good grammar, legible writing, accurate spelling, and correct reasoning.

[end of exam]