

FINAL EXAMINATION VERSION B

INSTRUCTIONS: This exam is closed-book, closed-notes. 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, 40 pts total].

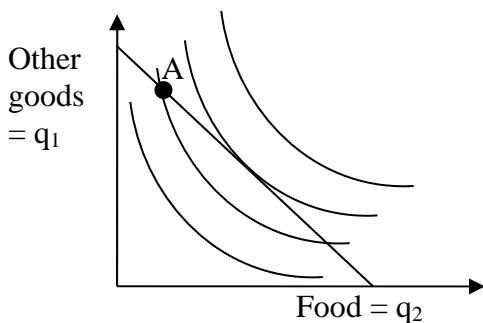
(1) Which utility function below violates the assumption of "monotonicity" or "more is better"?

- a. $U(q_1, q_2) = 5q_1^{1/2} + 4q_2^{1/2}$.
- b. $U(q_1, q_2) = (-5/q_1) + (-4/q_2)$.
- c. $U(q_1, q_2) = 3q_1q_2$.
- d. $U(q_1, q_2) = (5q_1)/(4q_2)$.
- e. $U(q_1, q_2) = -5q_1^{-1/2} - 4q_2^{-1/2}$.
- f. $U(q_1, q_2) = 3q_1^5q_2^4$.

(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.

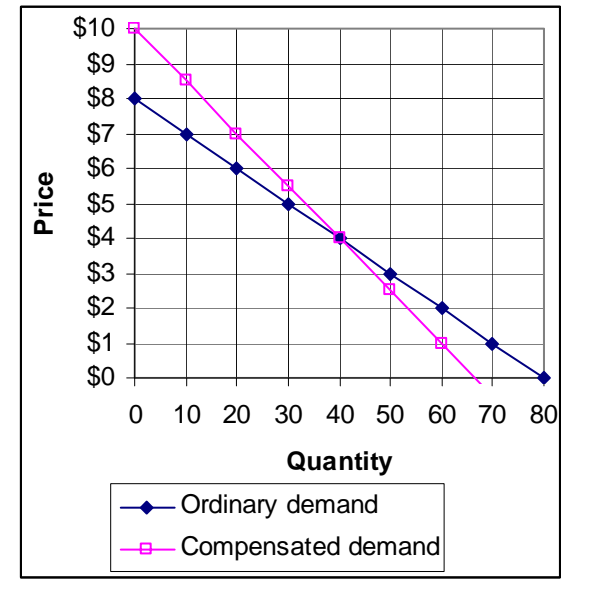
The next two questions refer to the following graph of a consumer's budget line and indifference curves. Suppose the consumer is currently at bundle A for some reason.



(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 in the graph above,

- 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.

The next two questions refer to the following graph of ordinary and compensated demand curves for some good.



- (4) If the price rises from \$4 to \$7, then consumer surplus decreases by
- \$3.
 - \$75.
 - \$90.
 - \$120.
 - none of the above.

- (5) The increase in income that would exactly compensate consumers for a rise in price from \$4 to \$7, leaving the consumer just as well off as before the price change, would be
- \$3.
 - \$75.
 - \$90.
 - \$120.
 - none of the above.

- (6) Suppose a production function is given by $q = 20 x_1^{1/4} x_2^{3/4}$. Then the marginal product of input #1 is given by
- $5 (x_2/x_1)^{3/4}$.
 - $20 (x_2/x_1)^{3/4}$.
 - $15 (x_1/x_2)^{1/4}$.
 - $20 (x_1/x_2)^{1/4}$.

- (7) "Economies of scale" mean that the firm's average cost curve
- slopes up.
 - slopes down.
 - is horizontal.
 - is vertical.

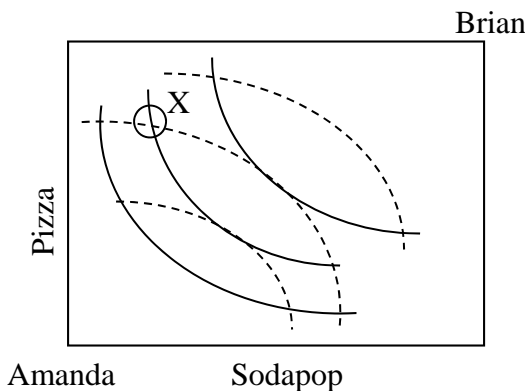
- (8) Price equals average cost in markets which are in
- short-run competitive equilibrium.
 - long-run competitive equilibrium.
 - either short-run or long-run competitive equilibrium.
 - none of the above.

- (9) A *potential Pareto improvement* (also called an *economically efficient change*) is defined as a change in the economy where
- everyone gains.
 - at least one person gains.
 - at least one person gains and no one loses.
 - the gains to the winners exceed the losses to the losers.

- (10) A quota on sellers of baseball bats would have basically the same effect on the market for baseball bats as
- a price ceiling on baseball bats.
 - a price floor on baseball bats.
 - a tax on baseball bats.
 - a subsidy for baseball bats.
 - a free market for baseball bats.

(11) Consider the Edgeworth box diagram below. From allocation X, *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) A "natural monopoly" is a firm that enjoys

- a downward-sloping average cost curve.
- patent protection.
- an exclusive government franchise allowing it alone to sell the product.
- exclusive ownership of a natural resource essential for producing the product.

(13) The Cournot model of oligopoly assumes that each firm maximizes its profit while taking its rivals'

- costs as given.
- prices as given.
- output quantities as given.
- all of the above.

(14) A certain industry is served by a symmetric Cournot oligopoly of 5 firms. If the elasticity of market demand is -2, the Lerner index (or "price-cost margin") in equilibrium equals

- 0.1 .
- 0.2 .
- 0.3 .
- 0.5 .

(15) Which of the following characterizes a Nash equilibrium of a game?

- Each player is receiving the highest possible payoff in the game.
- The sum of the payoffs for both players is maximized.
- Neither player wants to change strategies unilaterally.
- Neither player can be made better off without the other player being made worse off.

(16) Newspapers like the *Wall Street Journal* and the *New York Times* offer online versions. Many people can access the online versions without interfering with each other. However, the newspapers can require viewers to pay for access. An online newspaper is therefore

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

(17) Water aquifers (underground water sources) in the western United States are rapidly being depleted. No one can be prevented from taking water from a well on their own property—yet the more water is taken, the less is left for other people. Water aquifers in the western United States are therefore

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

(18) Which utility function shows risk aversion?

- a. $U(W) = 4 + 3W$.
- b. $U(W) = 4 + 3W^2$.
- c. $U(W) = 4 \ln(3W)$.
- d. $U(W) = 4 + 3^W$.

(19) Suppose people in dangerous occupations are more likely to apply for life insurance. This would be an example of

- a. market power.
- b. adverse selection.
- c. moral hazard.
- d. exchange efficiency.

(20) Suppose that after drivers buy towing insurance, they take less care of their cars. This would be an example of

- a. substitution effects.
- b. adverse selection.
- c. monotonicity.
- d. moral hazard.

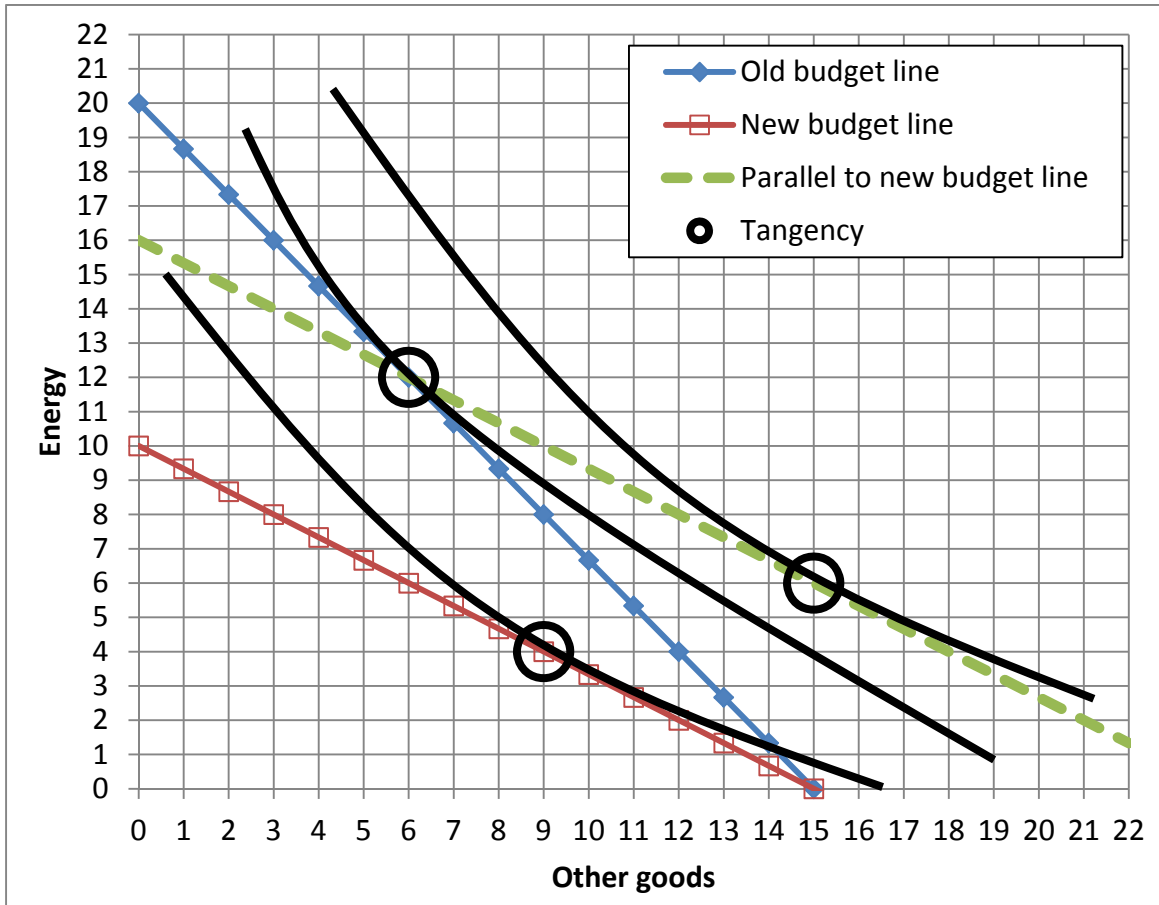
II. SHORT ANSWER: Please write your answers in the boxes on this question sheet. Use margins for scratch work.

(1) [Price elasticity of demand: 10 pts] Suppose the price elasticity of demand for electricity is -1.2 , and the electric utility company *lowers* the price of electricity by 5 %.

- a. Is the demand for electricity *elastic* or *inelastic* ?
- b. Will the quantity demanded of electricity *increase* or *decrease*?
- c. By about how much?
- d. Will the revenue received by the electric utility company *increase* or *decrease*?
- e. By about how much?

	%
	%

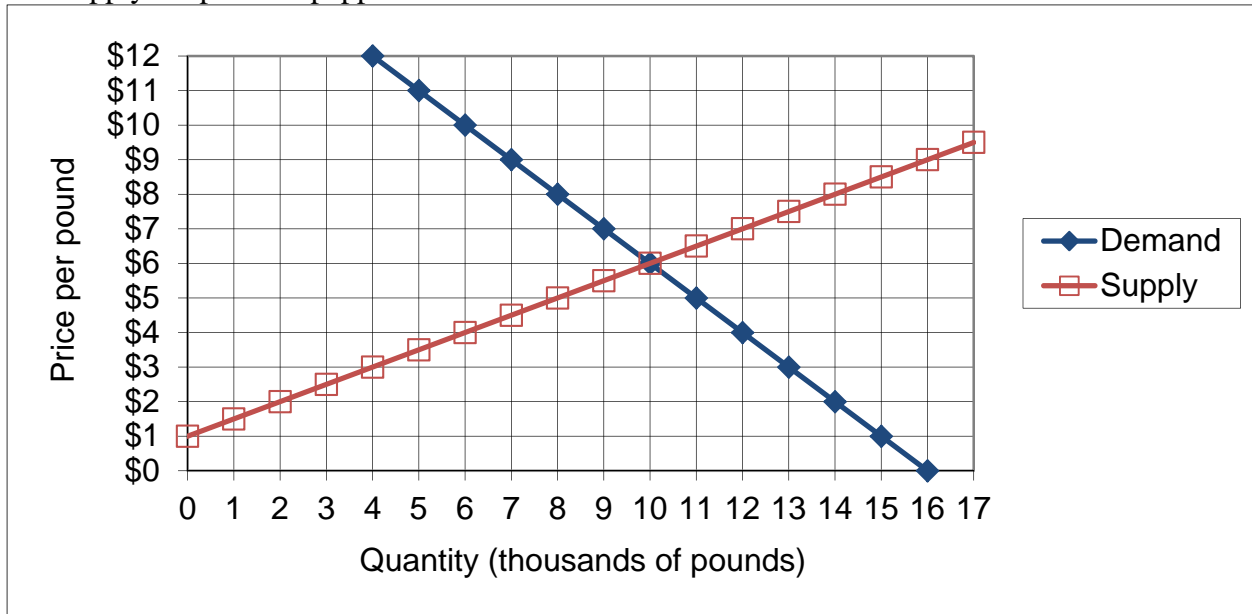
(2) [Substitution and income effects: 12 pts] Consider the indifference-curve diagram below. Assume the consumer has \$60 income.



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

\$	
	units
\$	
	units
	units
	units

(3) [Welfare effects of international trade: 16 pts] The following graph shows domestic demand and supply for poblano peppers.

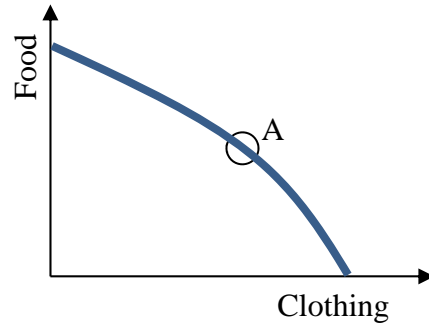


At first, international trade in poblano peppers is not permitted. Then this industry is opened to international trade and the international price of poblano peppers turns out to be \$ 8 per pound.

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

	thousand pounds
\$	thousand
\$	thousand
\$	thousand

(4) [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 clothing? In other words, how many units of food must be given up in order to produce one more unit of clothing?
- 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?
- Consider the typical consumer's budget line with food on the vertical axis and clothing 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 \$ 12, then what must be the price of a unit of food?

	units of food
	units of clothing
\$	

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

(1) [Properties of individual demand functions: 16 pts] Suppose an alleged demand function is $q_1^* = 47 I^{0.9} (p_1)^{-0.8} (p_2)^{-0.1}$, where I denotes the consumer's income, p_1 denotes the price of good #1, and p_2 denotes the price of good #2.

- a. Is this function homogeneous of degree zero in income and prices? Justify your answer.

- b. Is good #1 an ordinary good or a Giffen good? Justify your answer.

- c. Is good #1 an inferior good or a normal good? Justify your answer.

- d. Are goods #1 and #2 substitutes, complements, or unrelated in demand? Justify your answer.

(2) [Finding individual demand functions: 12 pts] A consumer has the following utility function: $U(q_1, q_2) = q_1^4 q_2^3$, where q_1 denotes the quantity of housing and q_2 denotes the quantity of other goods.

- a. Find a formula for the consumer's marginal rate of substitution in consumption of other goods for housing—that is, the |slope| of the consumer's indifference curve with housing 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.

Let p_1 denote the price of housing and let p_2 denote the price of other goods. Let I denote the consumer's income.

- b. Solve for the consumer's demand function for housing—that is, the formula showing q_1^* as a function of p_1 , p_2 , and I . Show your work and circle your final answer. [Hint: check that your answer is homogeneous of degree zero.]

- c. Solve for the consumer's demand function for other goods—that is, the formula showing q_2^* as a function of p_1 , p_2 , and I . Show your work and circle your final answer. [Hint: check that your answer is homogeneous of degree zero.]

(3) [Cost minimization: 10 pts] Suppose a firm wishes to produce 12 units of output per hour at minimum cost. Machines cost \$40 per hour to rent and workers must be paid \$10 per hour. The firm's hourly production function is given by $q = x_1^{0.5} x_2^{0.5}$, where x_1 denotes the number of machines and x_2 denotes the number of workers.

- a. [2 pts] Give an equation for the firm's target isoquant. The variables x_1 and x_2 should be the only unknowns.

- b. [2 pts] Find a formula for the firm's marginal rate of substitution in production of workers for machines—that is, the slope of the firm's isoquant with machines on the vertical axis and workers on the horizontal axis. The variables x_1 and x_2 should be the only unknowns. Circle your final answer.

- c. [4 pts] Solve for the number of machines (x_1^*) and workers (x_2^*) required to produce the firm's target output at minimum cost. Circle your final answers.

- d. [2pts] Compute the total cost to produce 12 units of output, $TC(12)$.

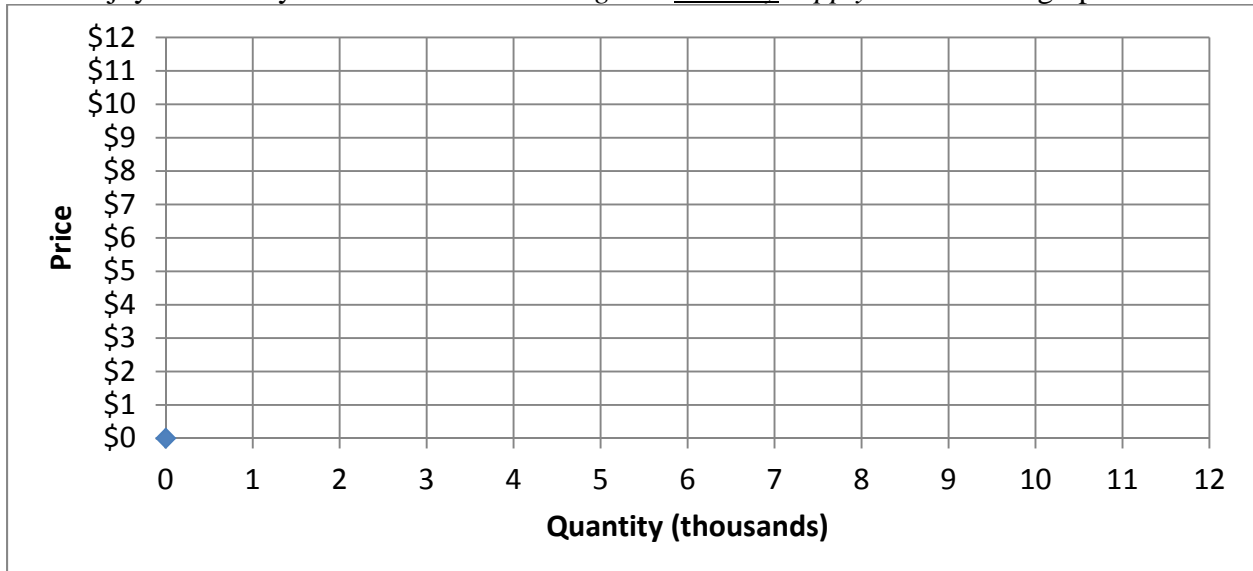
(4) [Long-run profit maximization and supply: 8 pts] Suppose a typical firm faces a (long-run) total cost function given by $TC(q) = 0.1q^3 - 2q^2 + 15q$.

a. Compute the typical firm's efficient scale q_{ES} . Show your work and circle your final answer.

b. Compute the firm's breakeven price—the minimum price at which it will avoid losses. Show your work and circle your final answer.

c. Find an equation for the *firm's supply curve*. Show your work and circle your final answer.

d. Suppose all firms in this industry have the same costs, and these costs are not affected by other firms in the same industry or by total industry output. Further assume the industry enjoys free entry and exit. Draw the *long-run industry supply curve* in the graph below.



(5) [Welfare effects of tax or subsidy: 14 pts] Suppose demand and supply for a good are given by the following equations. (Use the graph at right for scratch work.)

Demand:

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

Supply:

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



First consider the market without government intervention.

- a. Compute the equilibrium price and quantity.

Now suppose the government offers a **subsidy of \$3** per unit.

- b. Compute the new equilibrium quantity.

c. Does consumer surplus *increase* or *decrease* as a result of the subsidy? By how much?

d. Does producer surplus *increase* or *decrease* as a result of the subsidy? By how much?

e. [2 pts] Does society as a whole *gain* or *lose* as a result of the subsidy? By how much?

(6) [Monopoly pricing, deadweight loss: 16 pts] A company is considering whether to develop and patent a new device. Annual demand for the device is predicted to be given by $P = 14 - (Q/100)$. Marginal cost of production is predicted to be constant and equal to \$2. There are also up-front costs (sometimes called “quasi-fixed costs”) of developing the device and acquiring a patent.

- a. If the company were to develop and patent the device, what quantity would it produce and what price would it set?

- b. What is the maximum amount of up-front costs the company would pay for developing and patenting the device? For simplicity, assume the patent would be valid for only one year.

- c. After the patent runs out, other companies could produce the device with same marginal cost, but without having to incur up-front costs. What quantity would then be produced and what price would prevail in the market, which is now competitive?

- d. Compute the predicted deadweight loss to society from monopoly pricing of this device. [Hint: First sketch the graph.]

(7) [External cost and Pigou tax: 10 pts] Suppose supply and demand for a particular chemical are given by the following equations. Use the space at the bottom of this page for scratch work.

Demand: $P_D = 12 - (Q/100)$

Supply: $P_S = 2 + (Q/100)$.

- a. Compute the unregulated equilibrium price and quantity.

Unfortunately, the use of this chemical causes harm to ocean fisheries, creating an external cost. Marginal external cost per unit is estimated to be $MEC = 1 + (Q/100)$.

- b. Find a formula for the marginal social cost of the chemical.

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

- d. Compute the deadweight loss from unregulated competition.

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



(8) [Uncertainty, risk aversion, demand for insurance: 10 pts] Caleb has \$16 in income but faces a 50% chance of losing \$12 and thus being reduced to only \$4 in income. Caleb's utility function is given by $U(I) = I^{1/2}$, where I denotes income.

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

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

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

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

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

(9) [Hidden characteristics and adverse selection: 10 pts] Suppose the market for auto insurance consists of 400 people. Order these people from high-risk to low-risk, and index them by $Q = 0$ to 400. The expected loss of the Q th person is given by $EL = 250 - 0.4Q$. (Thus the last person's expected loss is about \$90.) 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?

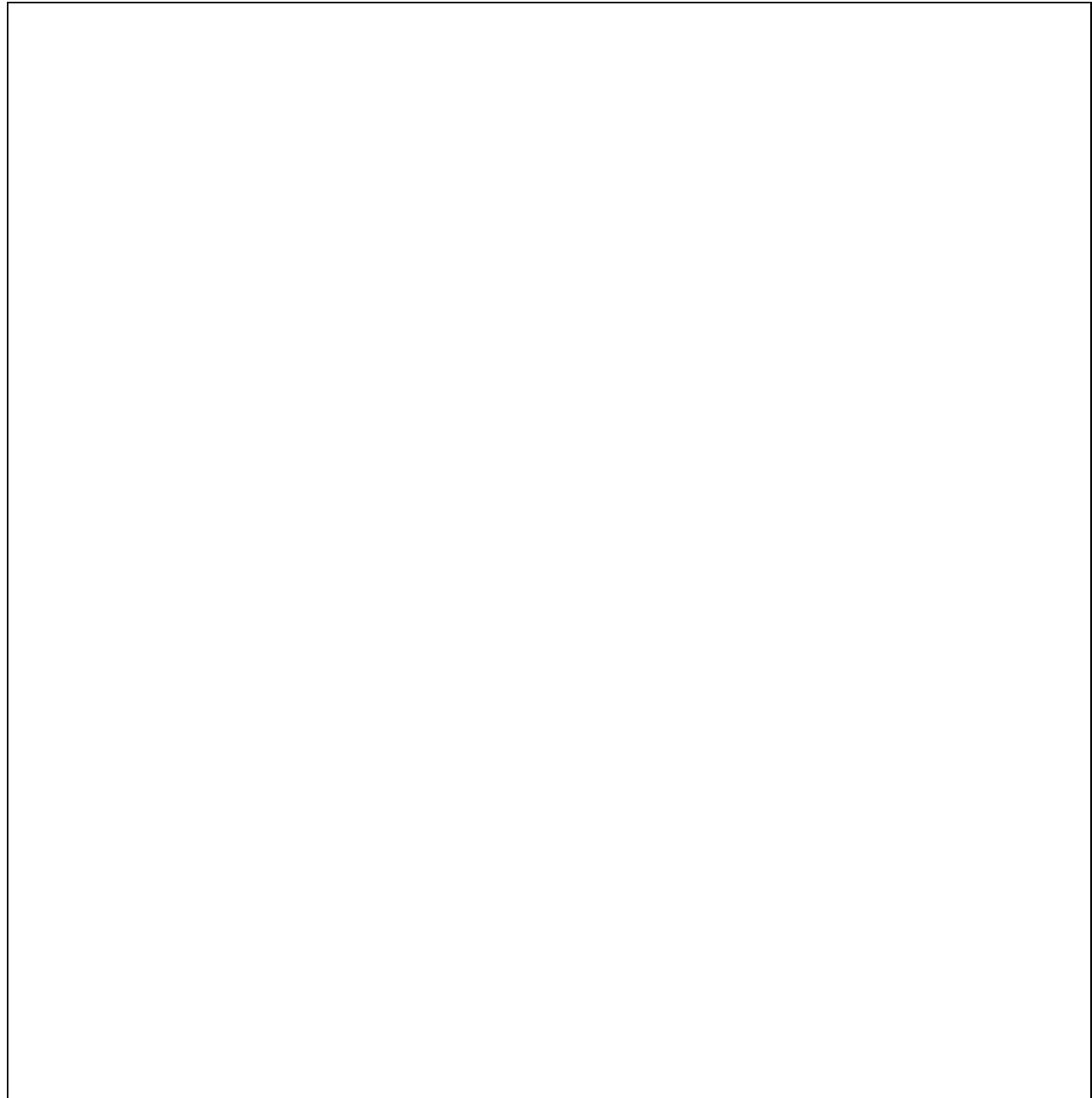
- d. Give an equation for the average cost of insurance AC as a function of Q . [Hint: AC has the same intercept but half the slope of MC .]

- 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. ESSAY: Write an essay of at least 100 words answering the following question. [8 pts]
Continue on the next page if necessary. Full credit requires good grammar, accurate spelling,
and correct reasoning. Support your answer with graph(s) as needed.

Often people are heard extolling the virtues of so-called “free markets.” Are “free markets” efficient markets?

[Hint: Begin by defining what you think people mean by “free markets.”]



SCORING RUBRIC

- 2 pts Explanation shows very limited understanding of the underlying concepts needed to analyze the information. Explanation is difficult to understand and is missing several components.
- 4 pts Explanation shows some understanding of the economic concepts and models needed to analyze the information. Explanation is a little difficult to understand but includes critical components.
- 6 pts Explanation shows substantial understanding of the economic concepts and models used to analyze the information. Explanation is clear.
- 8 pts Explanation shows complete understanding of the economic concepts and models used to analyze the information. Explanation is detailed and clear.

[end of exam]