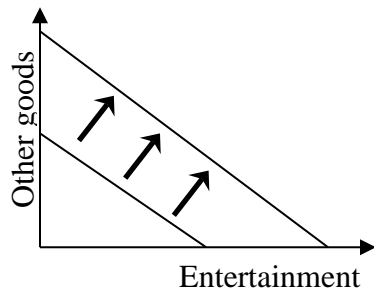


FINAL EXAMINATION VERSION B

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, 40 pts total].

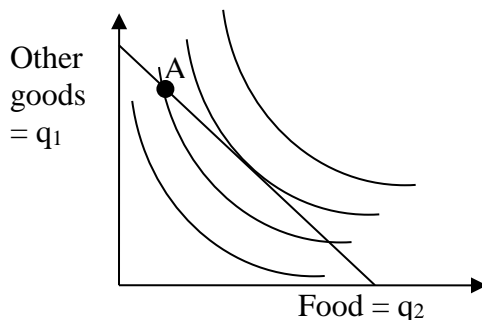
- (1) In the graph below, the shift in the budget line could be caused by
- an increase in income.
 - a decrease in income.
 - an increase in the price of entertainment.
 - a decrease in the price of entertainment.
 - an increase in the price of other goods.
 - a decrease in the price of other goods.



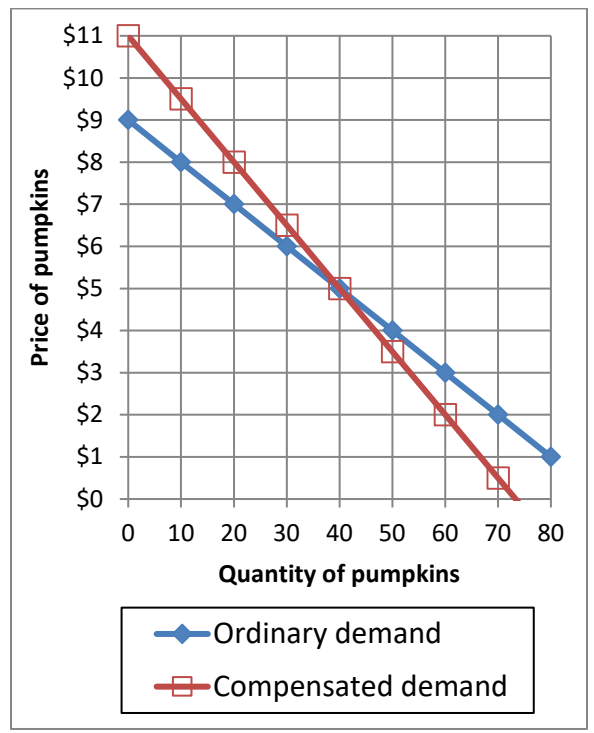
- (2) This consumer could enjoy higher utility, without increasing total spending, by
- purchasing less food and more other goods.
 - purchasing more food and fewer other goods.
 - purchasing less food and fewer other goods.
 - any of the above.
 - none of the above.

- (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 in the graph above,
- $MU_2 = MU_1$ and $p_2 = p_1$.
 - $MU_2/MU_1 = p_2/p_1$.
 - $MU_2/MU_1 < p_2/p_1$.
 - $MU_2/MU_1 > p_2/p_1$.
 - cannot be determined from information given.

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.



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



- (4) The increase in income that would exactly compensate consumers for a rise in price from \$5 to \$8, leaving consumers just as well off as before the price change, would be
- \$3.
 - \$75.
 - \$90.
 - \$120.
 - none of the above.

- (5) If the price rises from \$5 to \$8, then consumer surplus decreases by
- \$3.
 - \$75.
 - \$90.
 - \$120.
 - none of the above.

- (6) Suppose a production function is given by $q = 20 x_1^{1/4} x_2^{3/4}$. The number $(1/4)$ equals the
- marginal product of input #1.
 - marginal rate of substitution in production.
 - returns to scale.
 - elasticity of output with respect to input #1.

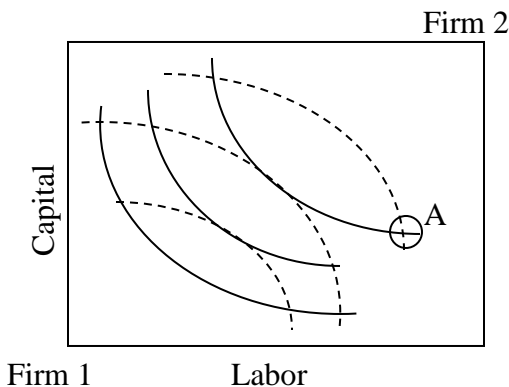
- (7) A certain kind of machine can produce 20 units of output per hour if it is operated by 4 workers. Fewer workers cannot operate the machine and extra workers contribute nothing. Let x_1 denote the number of machines in use of this type. Let x_2 denote the number of workers assigned to operate these machines. Let q denote output per hour. The formula for the firm's production function is
- $q = 20 x_1 x_2^4$.
 - $q = 20 x_1 x_2^{1/4}$.
 - $q = x_1 + 4x_2$.
 - $q = x_1 + (1/4) x_2$.
 - $q = 20 \min\{x_1, 4x_2\}$.
 - $q = 20 \min\{x_1, (x_2/4)\}$.

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

- (9) In the short run, a firm should continue to operate only if its revenue is greater than its
- fixed cost.
 - variable cost.
 - total cost.
 - producer surplus.

- (10) Suppose the price of corn rises. The increase in long-run producer surplus goes to farmers and
- all corn buyers.
 - farmland owners.
 - food processing companies that use corn to make other products.
 - ultimate consumers of corn-based products.

- (11) The graph below shows an Edgeworth box diagram for production. The solid curves are Firm 1's isoquants. The dashed curves are Firm 2's isoquants. From allocation A, *both* firms can produce more output if
- Firm 1 gives Firm 2 some capital, and Firm 2 gives Firm 1 some labor.
 - Firm 1 gives Firm 2 some labor, and Firm 2 gives Firm 1 some capital.
 - Firm 1 gives Firm 2 some capital and some labor.
 - Firm 2 gives Firm 1 some capital and some labor.
 - No trade will allow both firms to produce more output.



- (12) The so-called “First Welfare Theorem” of general equilibrium theory states that
- competitive forces push the economy toward the corners of the Edgeworth box.
 - any competitive equilibrium is on the contract curve.
 - deadweight loss is measured by the area of a triangle.
 - all is for the best in the best of all possible worlds.

- (13) Suppose a flower vendor with market power is now selling 10 bouquets per hour at a price of \$20. If she cuts the price to \$19, she can sell one more bouquet per hour (that is, a total of 11 bouquets per hour). The vendor's marginal revenue for the eleventh bouquet is therefore
- \$1 .
 - \$9 .
 - \$11
 - \$19 .
 - \$20 .

- (14) The Cournot model of oligopoly assumes that each firm maximizes its profit while taking its rivals'
- prices as given.
 - output quantities as given.
 - costs as given.
 - all of the above.

- (15) Which of the following characterizes a Nash equilibrium of a game?
- Neither player can be made better off without the other player being made worse off.
 - 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.

(16) If a good generates external benefits, and bargaining between affected parties is impractical, then an unregulated market will cause

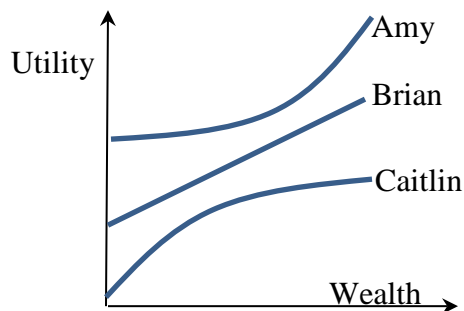
- a. the right amount of the good to be produced.
- b. too little of the good to be produced.
- c. too much of the good to be produced.
- d. cannot be determined from information given.

(17) Because no one could be stopped from killing bison in the nineteenth century, bison were

- a. a rival good.
- b. a nonrival good.
- c. an excludable good.
- d. a nonexcludable good.
- e. a normal good.
- f. an inferior good.

(18) The graph below shows utility functions for three people. Who is risk-averse?

- a. Amy.
- b. Brian.
- c. Caitlin.
- d. All of the above.
- e. None of the above.



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

- a. exchange efficiency.
- b. moral hazard.
- c. income effects.
- d. adverse selection.

(20) Clumsy smart phone users are more likely to apply for extended warranties. This is an example of

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

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

(1) [Income elasticity of demand: 10 pts] Suppose that a consumer's income rises by 5%, and the income elasticity of demand for entertainment is 1.4 .

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

	%
	%

(2) [Slutsky equation: 10 pts] The Slutsky equation in elasticity form is given by the following equation.

$$\epsilon = -S \eta + \epsilon^{\text{comp}}$$

where, as usual, ϵ denotes the own-price elasticity of demand, S denotes the share of total consumer spending devoted to the good (a fraction), η denotes the income elasticity of demand, and ϵ^{comp} denotes the compensated demand elasticity. Suppose that for travel, $\epsilon = -1.4$, $S = 0.05$, and $\eta = 2.0$.

- a. Compute the compensated demand elasticity (ϵ^{comp}).

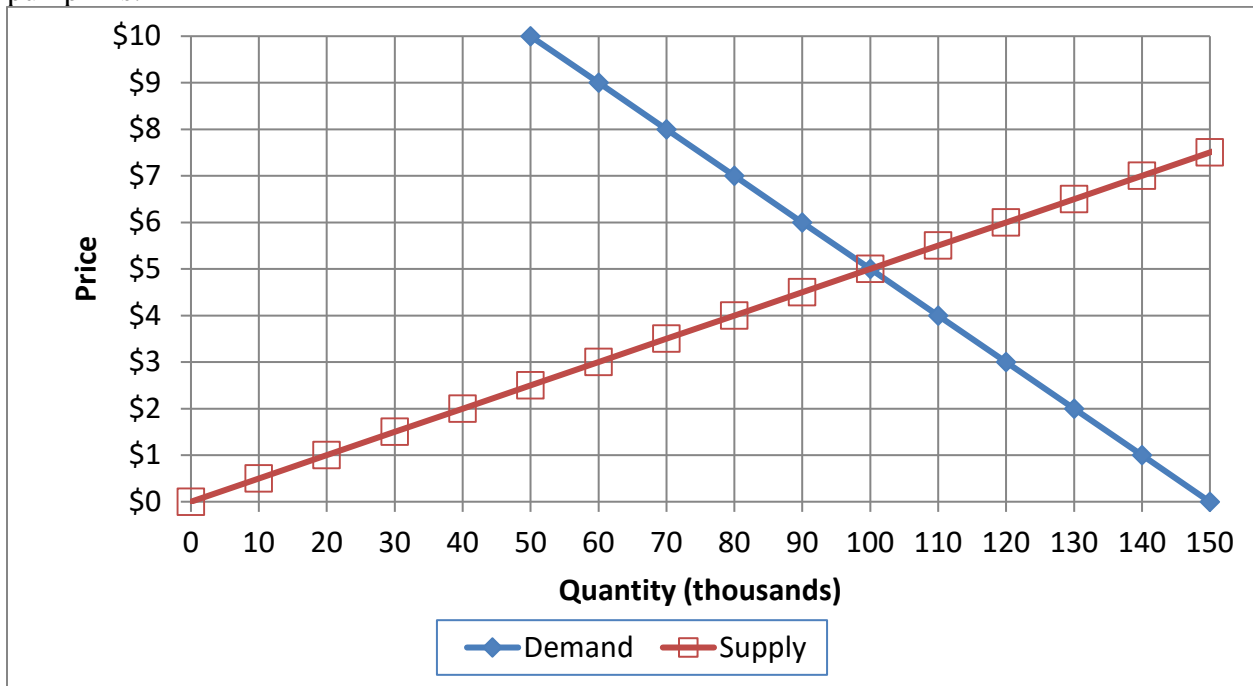
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Suppose the price of travel falls by 10%, but the consumer's income does *not* change.

- b. Does the quantity demanded of travel *increase* or *decrease*?
- c. By about how much?
- d. How much of this change is due to the income effect alone?
- e. How much of this change is due to the substitution effect alone?

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(3) [Welfare analysis of market controls: 16 pts] The following graph shows the market for pumpkins.



Suppose the government imposes a **price ceiling (or legal maximum price) of \$ 4** . No pumpkins may be sold for a price more than the price ceiling.

- How many pumpkins will actually be sold?
- Will there be *excess demand*, *excess supply*, or *neither*?
- How much?
- Does producer surplus *increase*, *decrease*, or *remain constant* because of the price ceiling, as compared to the market without government intervention?
- By how much?
- Does consumer surplus *increase*, *decrease*, or *remain constant* because of the price ceiling, as compared to the market without government intervention? (Assume optimistically that pumpkins are purchased by those consumers who value pumpkins the most.)
- By how much?
- Compute the deadweight social loss caused by the price ceiling.

	thousand
	thousand
\$	thousand
\$	thousand
\$	thousand

(4) [Monopoly price discrimination: 4 pts] Suppose a movie theatre believes that the elasticity of demand for admission by adults is -2 , and the elasticity of demand by children is -6 . Assume the theatre's marginal cost is \$5 per admission.

a. Compute the profit-maximizing admission price for adults.

\$

b. Compute the profit-maximizing admission price for children.

\$

(5) [Lerner index of market power: 3 pts] The Lerner index of market power is defined as the fraction of price that represents a markup over marginal cost: $L = (P-MC)/P$. Suppose the market for mobile phone service has a price elasticity of demand of -4 .

a. Compute the Lerner index if this market is a monopoly.

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b. Compute the Lerner index if this market is a symmetric Cournot oligopoly of five firms.

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c. Compute the Lerner index if this market is a symmetric Cournot oligopoly with a very large number of firms (approaching infinity).

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(6) [Game theory: 12 pts] Old Firm has been the only firm in a certain market so it can set the market price. New Firm is deciding whether to enter this market. The following table describes their interaction as a game in normal form.

		Old Firm	
		Low price	High price
New Firm	Stay out of market	New gets \$0 million. Old gets \$-2 million.	New gets \$0 million. Old gets \$10 million.
	Enter market	New gets \$-1 million. Old gets \$-3 million.	New gets \$5 million. Old gets \$5 million.

a. Which outcomes of this game (if any) are Pareto-optimal¹? Answer “YES” or “NO.”

New Firm plays “Stay out” and Old Firm plays “Low price”	
New Firm plays “Stay out” and Old Firm plays “High price”	
New Firm plays “Enter market” and Old Firm plays “Low price”	
New Firm plays “Enter market” and Old Firm plays “High price”	

b. Which outcomes of this game (if any) are dominant-strategy equilibria²? Answer “YES” or “NO.”

New Firm plays “Stay out” and Old Firm plays “Low price”	
New Firm plays “Stay out” and Old Firm plays “High price”	
New Firm plays “Enter market” and Old Firm plays “Low price”	
New Firm plays “Enter market” and Old Firm plays “High price”	

c. Which outcomes of this game (if any) are Nash equilibria in pure strategies? Answer “YES” or “NO.”

New Firm plays “Stay out” and Old Firm plays “Low price”	
New Firm plays “Stay out” and Old Firm plays “High price”	
New Firm plays “Enter market” and Old Firm plays “Low price”	
New Firm plays “Enter market” and Old Firm plays “High price”	

¹ Ignore the welfare of consumers.

² "Equilibria" is the plural form of "equilibrium."

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

(1) [Finding individual demand functions: 12 pts] A consumer has the following utility function: $U(q_1, q_2) = q_1 q_2^3$, where q_1 denotes the quantity of gasoline 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 gasoline—that is, the |slope| of the consumer's indifference curve with gasoline 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 gasoline 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 gasoline—that is, the formula showing q_1^* as a function of p_1 , p_2 , and I (but not q_2). 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 (but not q_1). Show your work and circle your final answer. [Hint: check that your answer is homogeneous of degree zero.]

(2) [Production functions: 12 pts] Suppose a production function is given by $q = 5x_1 + 10x_2$.

- 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) [Short-run profit maximization and supply: 12 pts] Suppose a firm faces short-run fixed cost of \$8 and short-run variable cost given by $SVC(q) = 0.5q^2 + q$, where q denotes the number of units of output. Suppose the market price is \$11.

- a. How much output q will the firm produce in order to maximize profit? Show your work and circle your final answer.

- b. Compute the firm's profit at this price.

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

(4) [Welfare effects of international trade: 15 pts] Suppose domestic demand and supply for a good are given by the following equations. Answer the questions below. Show your work and circle your final answers. (Use the graph at right for scratch work.)

Domestic demand:

$$Q_D = 2000 - 100 P$$

Domestic supply:

$$Q_S = 200 P - 100$$



First consider the market without international trade.

a. Compute the equilibrium price and quantity.

Now suppose the market is opened to international trade, and the world price of the good turns out to be **\$9**.

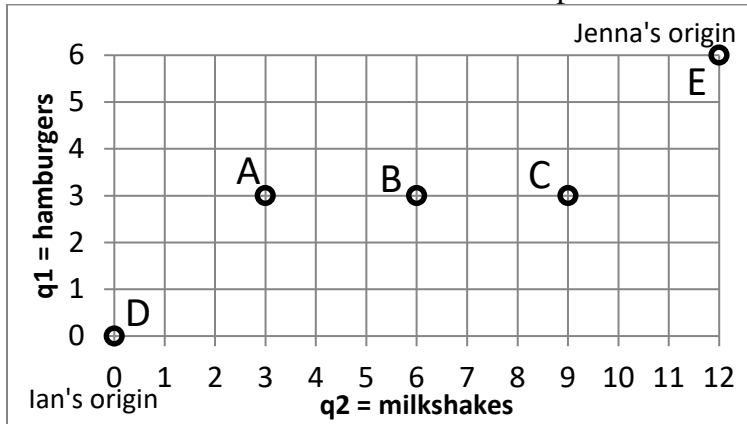
b. Will the country now *import* or *export* the good? How much?

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

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

e. Does the country as a whole *gain* or *lose* as a result of international trade? By how much?

(5) [Exchange efficiency: 12 pts] Ian and Jenna both like hamburgers and milkshakes. Let q_1 denote hamburgers and q_2 denote milkshakes. Ian's utility function is $U_I = q_1^3 q_2$. Jenna's utility function is $U_J = q_1 q_2$. A total of 6 hamburgers and 12 milkshakes must be divided between them. Consider the allocations depicted in the Edgeworth box below.



a. Is allocation A Pareto-efficient? Why or why not?

b. Is allocation B Pareto-efficient? Why or why not?

c. Is allocation C Pareto-efficient? Why or why not?

d. Is allocation D Pareto-efficient? Why or why not?

e. Is allocation E Pareto-efficient? Why or why not?

f. Sketch and label the contract curve in the Edgeworth box above.

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

Demand: $P_D = 14 - (Q/100)$

Supply: $P_S = 2 + (Q/200)$.

- 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 $MEB = 8 - (Q/200)$.

- 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.



(7) [Uncertainty, risk aversion, demand for insurance: 10 pts] Anna has \$200 in income but faces a 50% chance of losing \$150 and thus being reduced to only \$50 in income. Anna's utility function is given by $U(I) = 15 - (400/I)$, where I denotes income.

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

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

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

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

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

(8) [Hidden characteristics and adverse selection: 10 pts] Suppose the market for homeowners 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 $EL = 500 - 0.2 Q$. (Thus the last person's expected loss is about \$300.) Everyone is risk-averse, and willing to pay \$60 more than their expected loss (EL) for insurance.

- a. Give an equation for the demand for insurance, with P (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.)

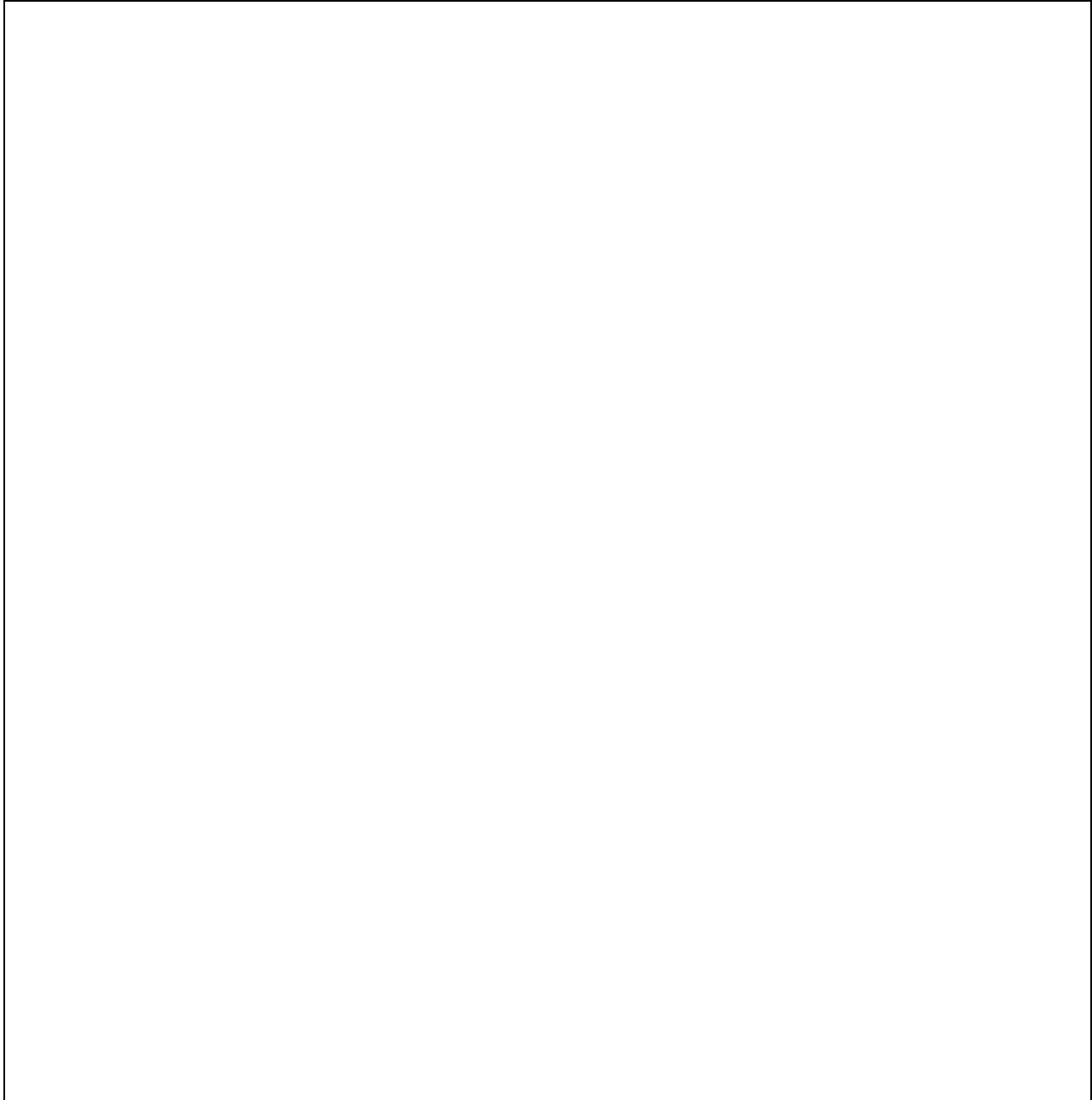
- c. If the market were efficient, how many people would get insurance?

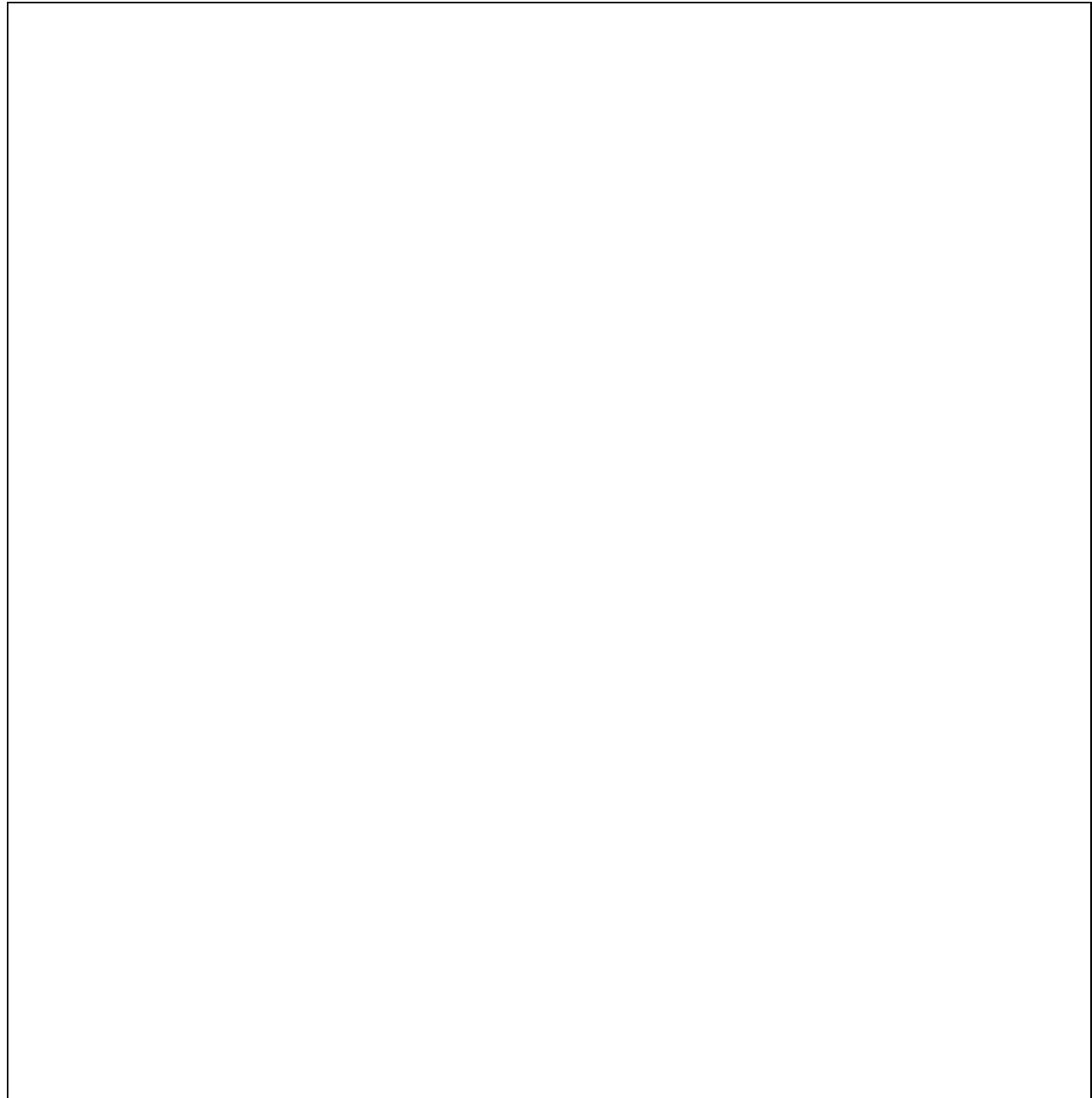
- d. Give an equation for the average cost of insurance AC as a function of Q .

- 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.

Economic efficiency can be hindered by market failure or government failure. Give an example of a market failure and explain how it decreases economic efficiency. Give an example of a government failure—that is, an ill-advised government intervention in a market—and explain how it decreases economic efficiency. Illustrate your explanations with graphs.





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]