ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2022
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Signature: _____

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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.

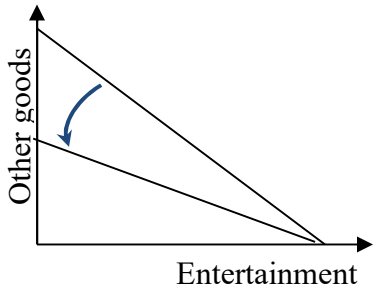
I. MULTIPLE CHOICE: Circle the one best answer to each question. Feel free to use margins for scratch work [2 pts each—46 pts total].

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

a. $U(q_1,q_2) = -q_1^{-1/2} - q_2^{-1/2}$.
b. $U(q_1,q_2) = 5\, q_1^2\, q_2^3$.
c. $U(q_1,q_2) = 5\, q_1\, q_2$.
d. $U(q_1,q_2) = (2q_1) / (3q_2)$.

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

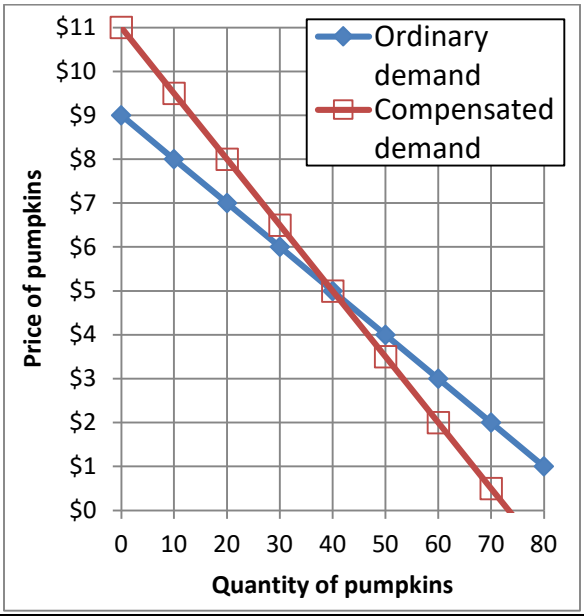
a. an increase in income.
b. a decrease in income.
c. an increase in the price of entertainment.
d. a decrease in the price of entertainment.
e. an increase in the price of other goods.
f. a decrease in the price of other goods.



(3) Which price index tends to *overestimate* 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.

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



(4) Suppose the price of pumpkins rose from \$5 to \$8. The compensating variation in income that would leave consumers just as well off as before the price change equals
a. \$3.
b. \$75.
c. \$90.
d. \$120.

(5) Again, suppose the price of pumpkins rose from \$5 to \$8. The decrease in consumer surplus equals
a. \$3.
b. \$75.
c. \$90.
d. \$120.

The next two questions refer to the following information. A certain kind of machine can produce 50 units of output per hour if it is operated by 3 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.

(6) The equation for the firm's expansion path is
a. $1 = 3$.
b. $x_1 = (1/3)\, x_2$.
c. $x_1 = 3\, x_2$.
d. $50 = x_1 + 3\, x_2$.
e. $50 = x_1\, x_2^3$.

(7) The formula for the firm's production function is
a. $q = x_1 + 3x_2$.
b. $q = x_1 + (1/3)\, x_2$.
c. $q = 50 \min\{x_1 , 3x_2\}$.
d. $q = 50 \min\{x_1, (x_2/3)\}$.
e. $q = 50\, x_1\, x_2^3$.
f. $q = 50\, x_1\, x_2^{1/3}$.

(8) If firms in an industry enjoy *economies of scale,* the industry will likely be eventually dominated by
a. small firms.
b. large firms.
c. a mix of small and large firms.
d. Cannot be determined.

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

(10) Suppose there is a change in government policy affecting the automobile industry. Which of the following outcomes would be a *Pareto improvement*?
a. Producers gain $5 billion while consumers are unaffected.
b. Producers gain $5 billion while consumers lose $10 billion.
c. Producers gain $10 billion while consumers lose $5 billion.
d. Both (a) and (c).
e. All of the above.

(11) The so-called "First Welfare Theorem" of general equilibrium theory states that
a. if all markets are competitive, then everyone enjoys the same income.
b. all is for the best in the best of all possible worlds.
c. competitive forces push the economy toward the corners of the Edgeworth box.
d. any competitive equilibrium is on the contract curve.

(12) If marginal cost is greater than marginal revenue at the current level of output, the firm can increase its profit by
a. increasing output.
b. decreasing output.
c. either increasing or decreasing output.
d. none of the above.
e. Cannot be determined from information given.

(13) 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.

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

(15) Which market model predicts the highest equilibrium price?
a. Price competition.
b. Collusion to maximize joint profits.
c. Cournot oligopoly.
d. All models predict the same equilibrium price, if all use the same assumptions about market demand and marginal cost.

(16) According to the so-called "Coase theorem," external costs like pollution can be efficiently resolved if bargaining is efficient and
a. property rights are given to the polluter.
b. property rights are given to the victim of pollution.
c. either of the above.
d. none of the above.

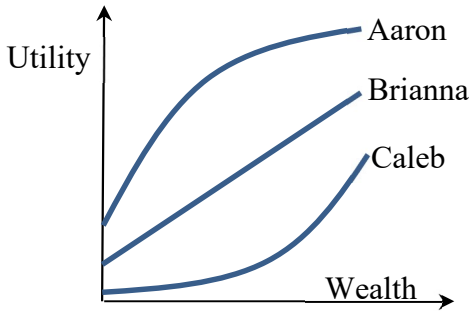
(17) If a good generates external benefits, and bargaining between affected parties is impractical, then an unregulated market will cause
a. the right amount of the good to be produced.
b. too little of the good to be produced.
c. too much of the good to be produced.
d. cannot be determined from information given.

(18) The grocery store requires you to pay for all oranges that you take. The same orange cannot be taken by more than one person. Oranges are therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(19) A certain downtown bridge is so crowded that traffic is very slow. Each car that uses the bridge prevents another car from using the bridge. However, the city has no way to force people to pay for using the bridge. Therefore the bridge is
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(20) 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
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(21) The graph below shows utility functions for three people. Who is risk-loving?
a. Aaron.
b. Brianna.
c. Caleb.
d. All of the above.
e. None of the above.



(22) Irving Berlin wrote a song called "Doin' What Comes Naturally" for the musical *Annie Get Your Gun* in 1946. One verse goes

Cousin Jack insured his shack,
And now he plays with matches.
He'll collect just wait and see,
Doin' what comes naturally.

Cousin Jack's behavior is an example of
a. market power.
b. moral hazard.
c. substitution effects.
d. adverse selection.

(23) Suppose people in dangerous occupations are more likely to apply for life insurance. This would be an example of
a. moral hazard.
b. exchange efficiency.
c. market power.
d. adverse selection.

II. MULTIPLE ANSWER: Circle **all** correct answers to the following question. [4 pts].

Which of the following types of market failure cause *too much* of the good or service to be produced?
a. Monopoly.
b. External cost.
c. External benefit.
d. Adverse selection.

III. 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 milk is –0.7, and the price of milk rises by 10 %.

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

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

$$\varepsilon = -S\,\eta + \varepsilon^{comp}$$

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 natural gas, $\varepsilon = -0.2$, $S = 0.04$, and $\eta = 0.5$.

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

Suppose the price of natural gas rises by 40%, but the consumer's income does *not* change.

b. Does the quantity demanded of natural gas *increase* or *decrease*?

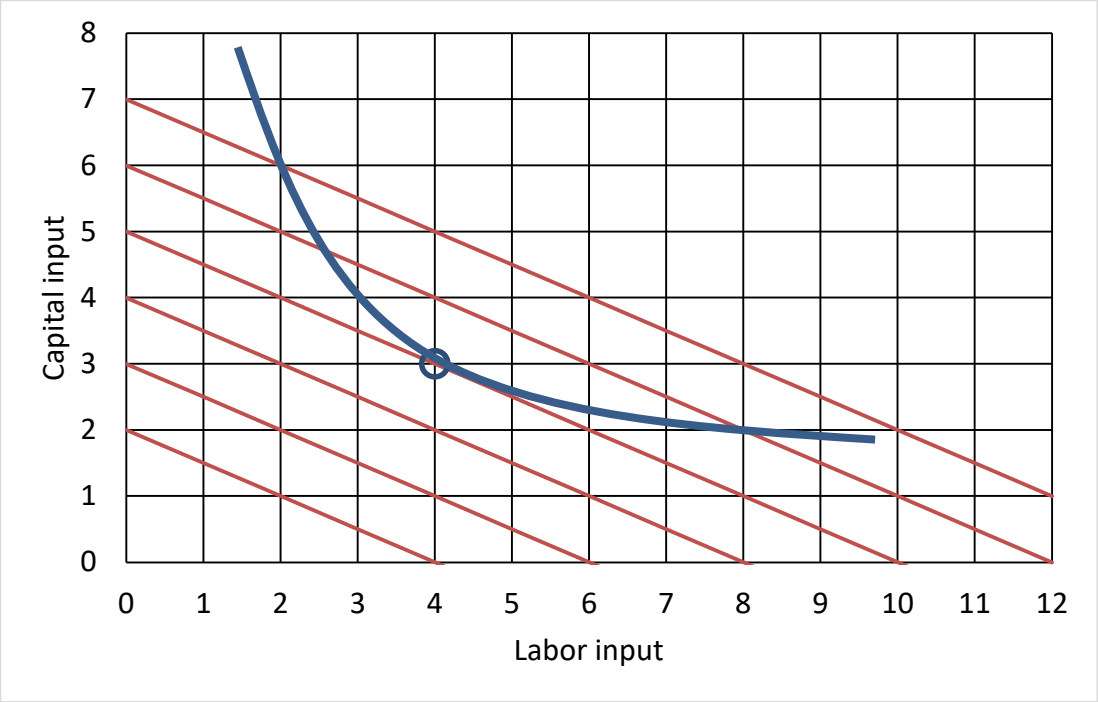
c. By about how much? %

Continue to assume that the price of natural gas rises by 40%, but now suppose the government helps the consumer by giving them a cash transfer equal to 40% of last year's spending on natural gas.

d. Does the quantity demanded of natural gas *increase* or *decrease*?

e. By about how much? %

(3) [Cost minimization; Cost in the short run: 10 pts] A firm wants to produce 50 units of output at lowest cost. This firm must pay \$10 per hour for labor and \$20 per hour for capital. The graph below shows the firm's isoquant for 50 units of output per hour and several isocost lines. The small circle marks a tangency.



First, suppose the firm can hire whatever amounts of labor and capital it wants.

a. How many units of capital will it hire? ____ units

b. How many units of labor will it hire? ____ units

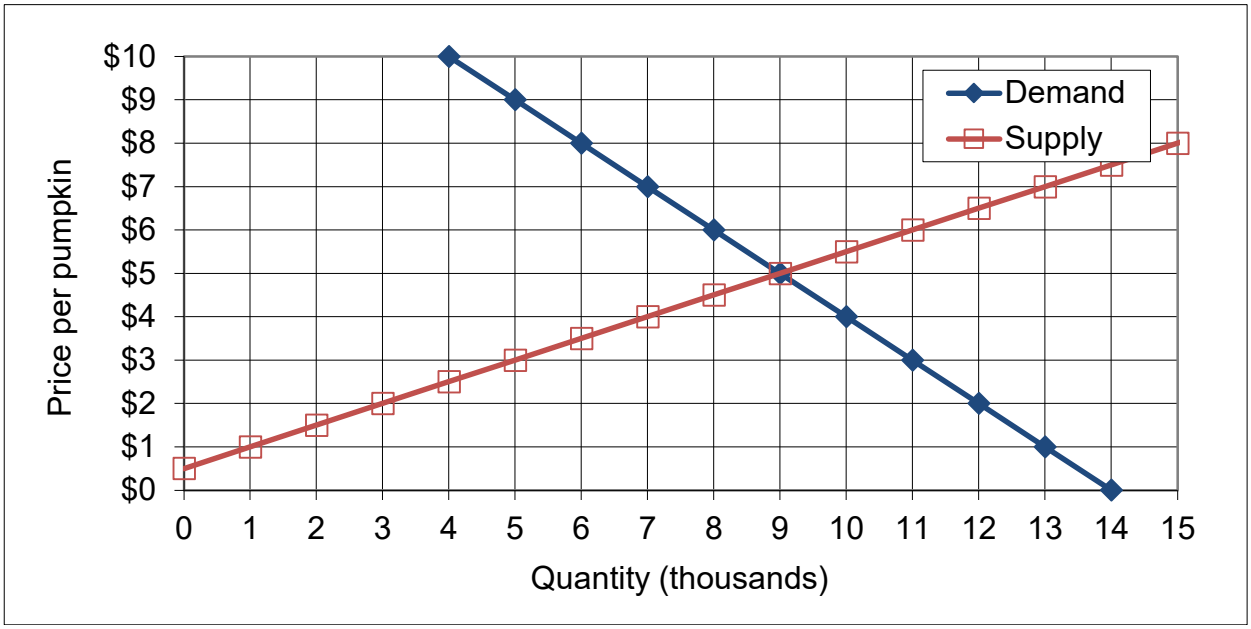
c. Compute the firm's total cost. \$ ____

Alternatively, suppose the firm's capital input is fixed in the short run at 2 units, but the firm's labor input is variable. The firm still wants to produce 50 units of output.

d. How many units of labor will it hire? ____ units

e. Compute the firm's total cost in the short run. \$ ____

(4) [Welfare analysis of taxes and subsidies: 20 pts] The following graph shows the market for watermelons.

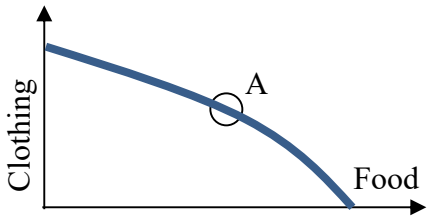


a. Find the equilibrium price without government intervention.	$

Suppose the government imposes a **tax of $ 6** per watermelon.

b. Compute the equilibrium quantity sold.	thousand
c. Compute the equilibrium total price paid by buyers (including the tax).	$ per watermelon
d. Compute the equilibrium net price received by sellers (excluding the tax).	$ per watermelon
e. Does producer surplus *increase, decrease,* or *remain constant* because of the tax?	
f. By how much?	$ thousand
g. Does consumer surplus *increase, decrease,* or *remain constant* because of the tax?	
h. By how much?	$ thousand
i. Compute the total tax revenue collected by the government.	$ thousand
j. Compute the deadweight social loss caused by the tax.	$ thousand

(5) [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 **–2**.



a. 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?

b. 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?

c. 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?

d. 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
$

(6) [Monopoly price discrimination: 4 pts] Suppose a skating rink believes that the elasticity of demand for admission by adults is -3, and the elasticity of demand by children is -4. Assume the rink has a marginal cost of $6 per ticket.

a. Compute the skating rink's profit-maximizing admission price for adults.

b. Compute the skating rink's profit-maximizing admission price for children.

$
$

(7) [Nonrival goods: 6 pts] A city government will offer a free outdoor concert series during the summer in a neighborhood park. About **1000** people are likely to enjoy the concerts. Each concert costs $**4000** 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: **MB = 10 – 2 Q** .

a. How many concerts would a typical *individual* pay for, for their private enjoyment?

b. Give an expression for the marginal social benefit from the concert series.

c. Compute Q* the socially-optimal number of concerts.

concerts
MSB =
concerts

(8) [Game theory: 12 pts] Grocery chains A and B are choosing locations for a new store. The downtown location is more profitable than the uptown location, but if the chains choose the same location, they split the business. Their situation is expressed by the following game in normal form.

		Chain B	
		Locate uptown	Locate downtown
Chain A	Locate uptown	A gets \$2 million. B gets \$2 million.	A gets \$4 million. B gets \$6 million.
	Locate downtown	A gets \$6 million. B gets \$4 million.	A gets \$3 million. B gets \$3 million.

a. Which outcomes of this game (if any) are Pareto-optimal[1]? Answer "YES" or "NO."

Chain A plays "Uptown" and Chain B plays "Uptown."	
Chain A plays "Downtown" and Chain B plays "Downtown."	
Chain A plays "Uptown" and Chain B plays "Downtown."	
Chain A plays "Downtown" and Chain B plays "Uptown."	

b. Which outcomes of this game (if any) are dominant-strategy equilibria[2]? Answer "YES" or "NO."

Chain A plays "Uptown" and Chain B plays "Uptown."	
Chain A plays "Downtown" and Chain B plays "Downtown."	
Chain A plays "Uptown" and Chain B plays "Downtown."	
Chain A plays "Downtown" and Chain B plays "Uptown."	

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

Chain A plays "Uptown" and Chain B plays "Uptown."	
Chain A plays "Downtown" and Chain B plays "Downtown."	
Chain A plays "Uptown" and Chain B plays "Downtown."	
Chain A plays "Downtown" and Chain B plays "Uptown."	

[1] Ignore the welfare of consumers.
[2] "Equilibria" is the plural form of "equilibrium."

IV. 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: $U(q_1,q_2) = (q_1 + 8)\, q_2$, where q_1 denotes quantity of food and q_2 denotes the quantity of other goods. The price of food is \$5 and the price of other goods is \$7. The consumer has \$100 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 food—that is, the |slope| of the consumer's indifference curve with food 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 quantities of food (q_1*) and other goods (q_2*) that this consumer will choose. Circle your final answers.

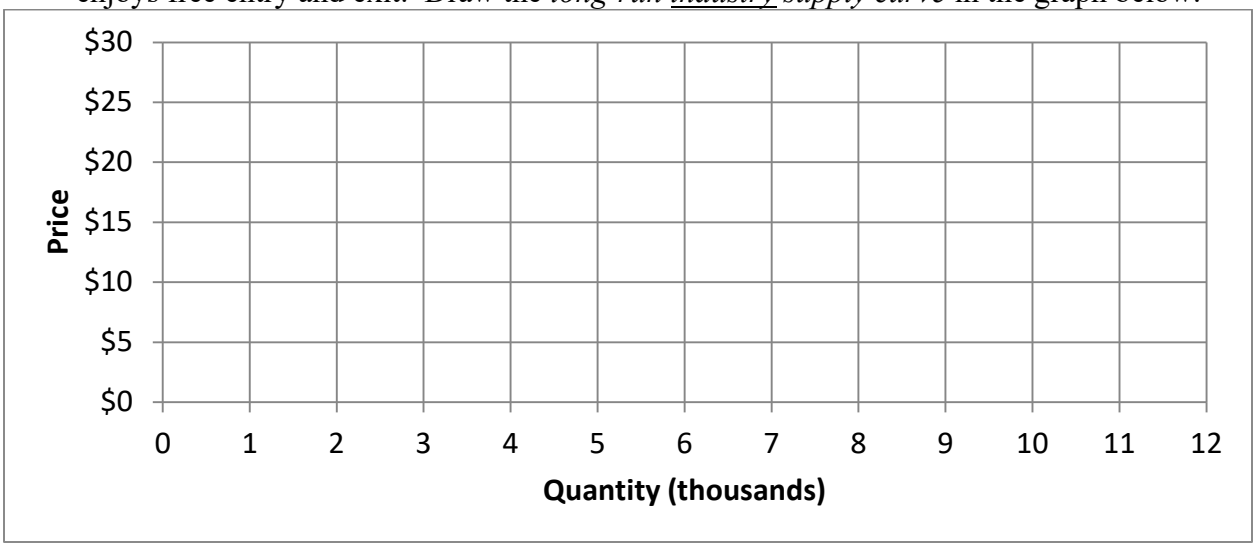
(2) [Cost curves; Long-run market equilibrium: 8 pts] Suppose a typical firm faces a (long-run) total cost function given by $TC(q) = 0.01\,q^3 - 0.8\,q^2 + 26\,q$.

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. Describe with equations the *firm's supply curve*. [Hint: What happens when the market price is above the breakeven price? When the market price is below the breakeven price?]

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.



(3) [Monopoly, profit maximization: 14 pts] Suppose a monopolist has total cost function given by **$TC(Q) = 4Q + (Q^2/20)$.** This monopolist faces a demand curve given by **$P = 10 - (Q/10)$.** Show your work and circle your final answers. Note: question continues on next page. Use graph at bottom of next page for scratch work.

a. Find the monopolist's marginal cost function.

b. Find the monopolist's average cost function.

c. Find the monopolist's marginal revenue function.

d. Compute the monopolist's profit-maximizing level of output Q_M.

e. Compute the monopolist's profit-maximizing price P_M.

f. Compute the monopolist's profit.

g. Compute the social deadweight loss caused by the monopolist. (You may use the graph for scratch work.)

(4) [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.

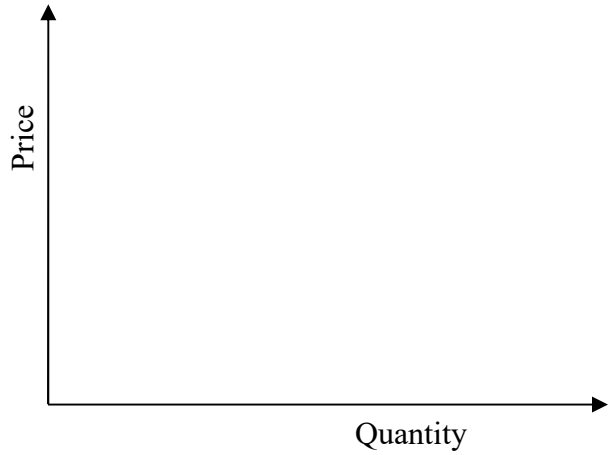
Persons who are vaccinated lower the risk of disease to everyone around them, creating an external benefit. Marginal external benefit per vaccine is estimated to be MEB = 8 – (Q/200).

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.



(5) [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.

(6) [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 Qth 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 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.

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

(1) Consider the following claim: "To gain the greatest advantage, a country should *permit* international trade in any good where its industry is competitive—that is, where the world price is *greater* than the domestic price. However, it should *prohibit* international trade in any good where its industry is not competitive—that is, where the world price is *less* than the domestic price." Do you agree or disagree? Justify your answer with supply-and-demand graphs.

(2) Give an example of a production function with two inputs, x_1 and x_2, that has diminishing returns to each input separately, but increasing returns to *scale*. Prove that it has these properties. (Ignore the graph.)

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]