ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2023
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Signature: _____

Printed name: _____

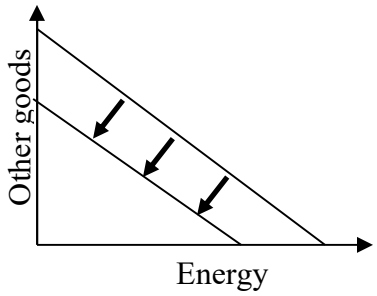
FINAL EXAMINATION VERSION A

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.

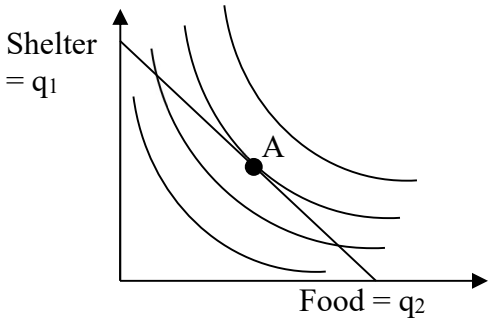
I. MULTIPLE CHOICE: Circle the one best answer to each question. Feel free to use margins for scratch work [2 pts each—42 pts total].

(1) The assumption of diminishing marginal rate of substitution implies that indifference curves
a. slope up.
b. slope down.
c. get flatter as they approach the horizontal axis.
d. get steeper as they approach the horizontal axis.
e. none of the above.

(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 energy.
d. a decrease in the price of energy.
e. an increase in the price of other goods.
f. a decrease in the price of other goods.



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) This consumer could enjoy higher utility, without increasing total spending, by
a. purchasing less food and more shelter.
b. purchasing more food and less shelter.
c. purchasing less food and less shelter.
d. any of the above.
e. none of the above.

(4) Let MU_1 denote the marginal utility of shelter and MU_2 denote the marginal utility of food for this consumer. Let p_1 denote the price of shelter 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.

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(5) What is wrong with this demand function?

$$q_1^* = 5\, I^{0.5}\, p_1^{0.2}\, p_2^{-0.7}$$

a. This demand function implies that the quantity demanded can be negative even if income and prices are positive.
b. This demand function implies that good 1 is a Giffen good.
c. This demand function is not homogeneous of degree zero.
d. This demand function implies that the price of another good influences the demand for good 1, which is impossible.

(6) A firm's *isoquants* are level curves of the firm's
a. average cost function.
b. profit function.
c. production function.
d. total cost function.

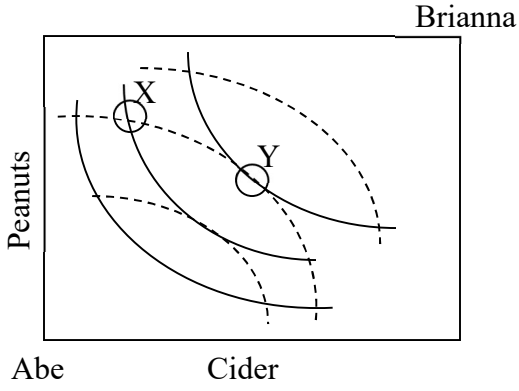
(7) Suppose that in a certain production process, doubling all inputs causes output to double. Then the production process is characterized by
a. constant returns to scale.
b. increasing returns to scale.
c. decreasing returns to scale.
d. homogeneity of degree zero.

(8) In the short run, a firm should shut down immediately if its
a. revenue is less than producer surplus.
b. revenue is less than variable cost.
c. revenue is less than fixed cost.
d. profit is negative.

(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) A *potential Pareto improvement* (also called an *economically efficient change*) 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 Abe's indifference curves. The dashed curves are Brianna's indifference curves.



(11) From allocation X, *both* consumers can enjoy greater utility if
a. Abe gives Brianna some peanuts, and Brianna gives Abe some cider.
b. Abe gives Brianna some cider, and Brianna gives Abe some peanuts.
c. Abe gives Brianna some peanuts and some cider.
d. Brianna gives Abe some peanuts and some cider.
e. No trade will allow both consumers to enjoy greater utility.

(12) From allocation Y, *both* consumers can enjoy greater utility if
a. Abe gives Brianna some peanuts, and Brianna gives Abe some cider.
b. Abe gives Brianna some cider, and Brianna gives Abe some peanuts.
c. Abe gives Brianna some peanuts and some cider.
d. Brianna gives Abe some peanuts and some cider.
e. No trade will allow both consumers to enjoy greater utility.

(13) An industry is a natural monopoly if
a. one firm owns all the key natural resources required to produce the product.
b. a firm's average cost is negatively related to its quantity.
c. the industry became a monopoly without government interference.
d. the only seller in the market sells a natural or "green" product.

(14) One implication of the Cournot model of oligopoly is that the equilibrium price is lower,
a. the more firms are in the industry.
b. the more elastic is market demand.
c. both of the above.
d. none of the above.

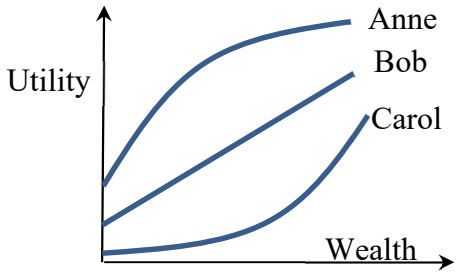
(15) The term "differentiated products" means, in economics,
a. the derivative of a firm's output.
b. the derivative of a firm's revenue with respect to its output.
c. products that a firm sells to different customers at different prices.
d. products for which different consumers have different elasticities of demand.
e. products that are not perfect substitutes.

(16) 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.

(17) Satellite television broadcasts (like Dish or DirectTV) 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 watch without paying. Satellite television broadcasts are therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(18) Suppose a factory creates a loud, unpleasant noise from its production activities that can be heard by neighbors up to a half-mile away. The factory's noise thus creates
a. an external benefit.
b. an external cost.
c. a common property resource.
d. an inferior good.

(19) The graph below shows utility functions for three people. Who is risk-averse?
a. Anne.
b. Bob.
c. Carol.
d. All of the above.
e. None of the above.



(20) Healthy individuals are less likely to apply for health insurance. This is an example of
a. adverse selection.
b. moral hazard.
c. exchange efficiency.
d. market power.
e. risk aversion.

(21) When a person is covered by auto insurance, often they drive less carefully. This is an example of
a. adverse selection.
b. moral hazard.
c. exchange efficiency.
d. market power.
e. risk aversion.

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

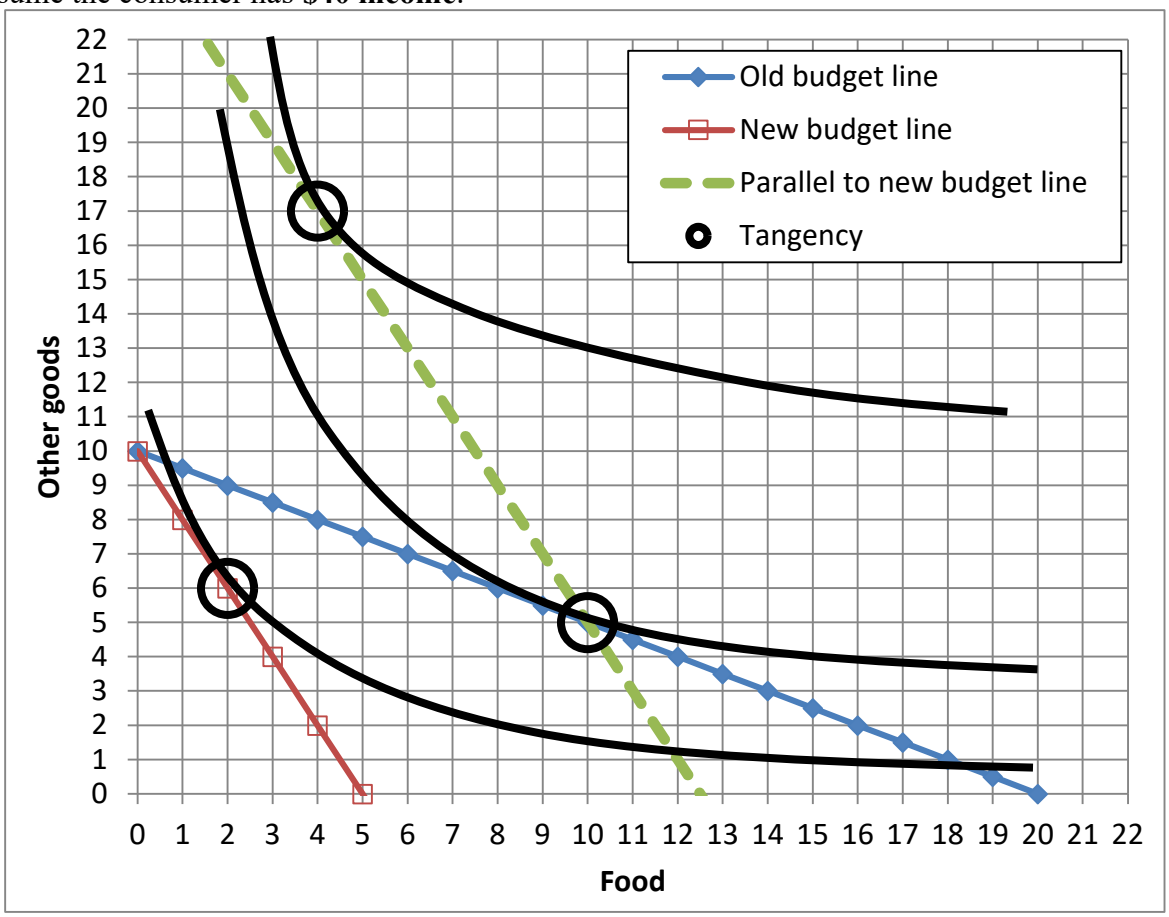
(1) [Price elasticity of demand: 10 pts] Suppose the price elasticity of demand for hummus is **–1.5,** and the price of hummus **rises by 4 %.**

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

(2) [Nonrival goods: 6 pts] Suppose a section of a river will be redeveloped for whitewater kayaking (by removing dams, placing rocks, etc.). It is estimated that **1000** people are likely to use the river, which will cost about **$60,000** per kilometer to redevelop. A typical user's marginal benefit is given by **MB = 100 - 10 Q,** where Q is the length of the redeveloped section in kilometers.

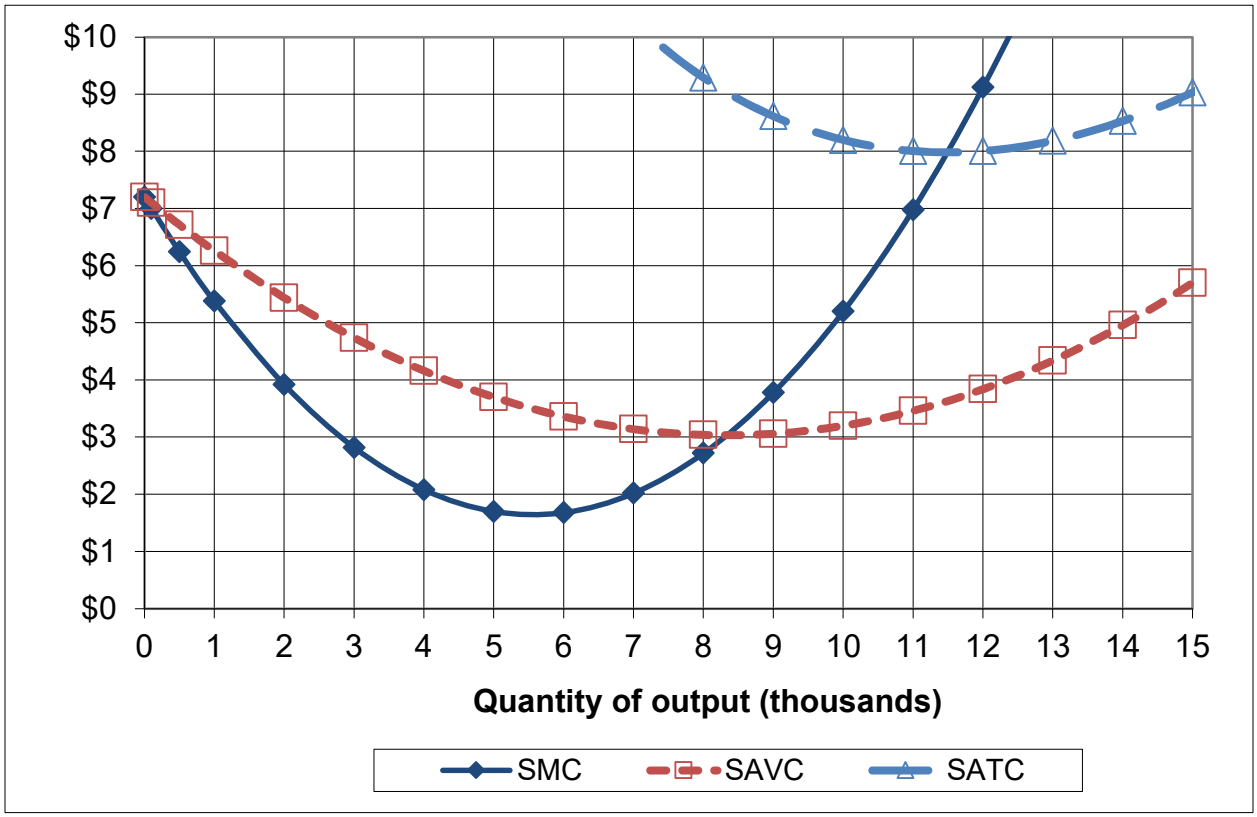
a. How many kilometers of the river would a typical *individual* pay to redevelop?	kilometers
b. Give an expression (or formula) for the marginal social benefit from river redevelopment. [Hint: This must be a formula containing one variable: Q.]	MSB =
c. Compute Q* the *socially optimal* length of the section to be redeveloped.	kilometers

(3) [Substitution and income effects: 12 pts] Consider the indifference-curve diagram below. Assume the consumer has **$40 income**.



a. What was the price of food on the old budget line?	$
b. Given the old budget line, how much food does the consumer demand?	units
c. What is the price of food on the new budget line?	$
d. Given the new budget line, how much food does the consumer demand?	units
e. Compute the change in quantity of food demanded due to the substitution effect: Δq^{sub} .	units
f. Compute the change in quantity of food demanded due to the income effect: Δq^{inc} .	units

(4) [Profit maximization in the short run: 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.



a. If the market price is \$9, about how much output will ACME try to produce (to the nearest thousand)? ____ thousand

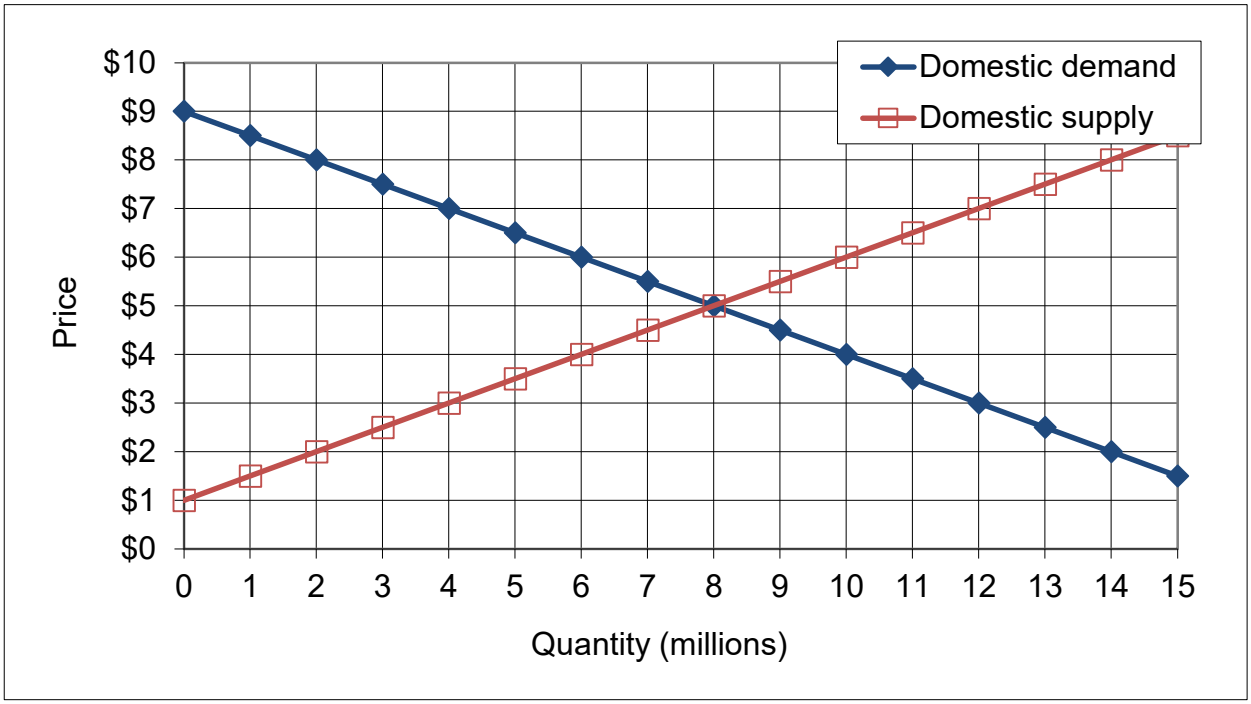
b. If the market price is \$2, about how much output will ACME try to produce (to the nearest thousand)? ____ thousand

c. If the market price is \$7, about how much output will ACME try to produce (to the nearest thousand)? ____ thousand

d. What is ACME's *breakeven price*—that is, the lowest price at which ACME can produce output without making losses in the short run? \$ ____

e. What is ACME's *shutdown price*—that is, the lowest price at which ACME will continue to operate in the short run? \$ ____

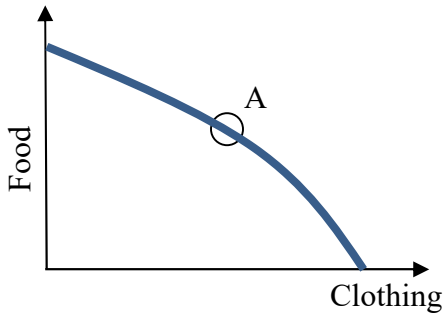
(5) [Welfare effects of international trade: 16 pts] The following graph shows domestic demand and supply for stocking caps in some country.



At first, international trade in stocking caps is not permitted. Then this industry is opened to international trade and the international price of stocking caps turns out to be **$ 7.**

a. Will this country now *export* or *import* stocking caps?	
b. How much?	million
c. Does consumer surplus in this country *increase* or *decrease* from international trade in stocking caps?	
d. By how much?	$ million
e. Does producer surplus in this country *increase* or *decrease* from international trade in stocking caps?	
f. By how much?	$ million
g. Does total social welfare in this country *increase* or *decrease* from international trade in stocking caps?	
h. By how much?	$ million

(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**.



a. 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?

b. 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?

c. 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?

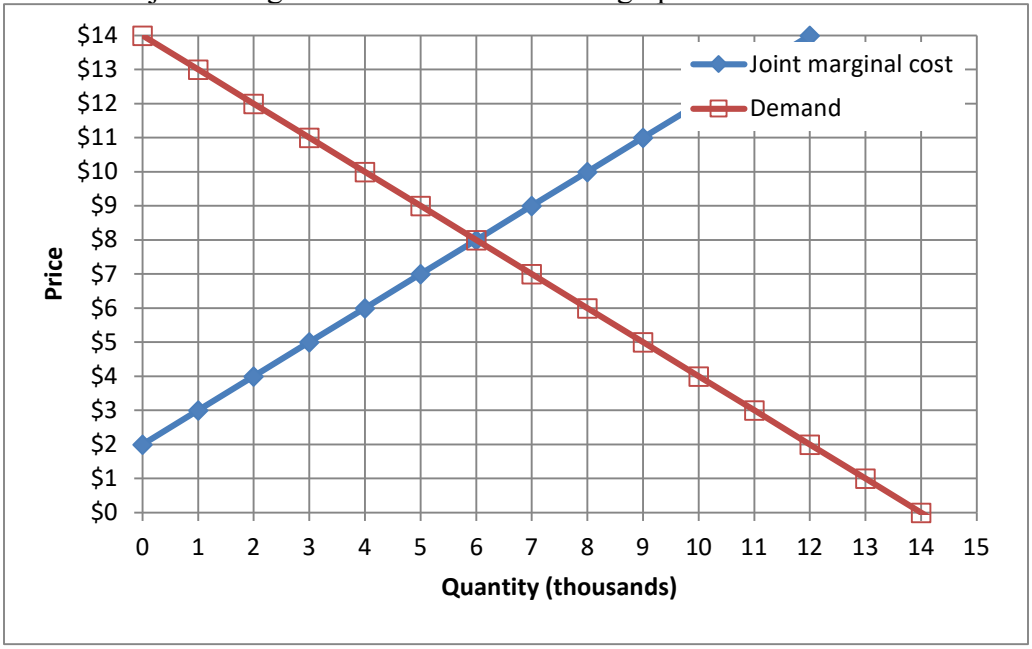
d. If the price of a unit of food is **$ 6**, then what must be the price of a unit of clothing?

units of food
units of clothing
$

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

	P = AC	P = MC
a. Monopoly.		
b. Perfect competition.		
c. Monopolistic competition.		

(8) [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. $_____

b. Compute competitive equilibrium market quantity. _____ thousand

c. Compute the amount of deadweight loss. $_____ thousand

Now suppose these firms form a cartel to maximize jointly the sum of their profits. The equation for demand is **P = 14 – 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? $_____

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

h. Compute the amount of deadweight loss. $_____ thousand

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: $U(q_1,q_2) = (q_1 + 4)\, q_2$, where q_1 denotes the 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 \$4. 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) [Input substitution; Returns to scale: 12 pts] Suppose a production function is given by

$$q = 2x_1 + 3x_2 + 4x_1^{1/2}x_2^{1/2}.$$

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) [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 **$P = 13 - (Q/20)$.** Each firm has constant marginal and average cost equal to **$1**. 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 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 cost and Pigou tax: 10 pts] Suppose supply and demand for a particular pesticide are given by the following equations. Use the graph at right for scratch work.

Demand: $P_D = 15 - (Q/10)$.

Supply: $P_S = 5 + (Q/10)$.

a. Compute the unregulated equilibrium price and quantity.

Unfortunately, the use of this pesticide pollutes sources of drinking water, creating an external cost. Marginal external cost per unit is estimated to be $MEC = 1 + (Q/10)$.

b. Find a formula for the marginal social cost of the pesticide.

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

d. Compute the deadweight loss from unregulated competition.

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

(5) [Uncertainty, risk aversion, demand for insurance: 10 pts] Anna has $100 in income but faces a 25% chance of losing $80 and thus being reduced to only $20 in income. Anna's utility function is given by $U(I) = 9 - (100/I)$, 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 = 300 – 0.1 Q. (Thus the last person's expected loss is about $200.) Everyone is risk-averse, and willing to pay $10 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) 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*? Why? Is this an example of adverse selection, moral hazard, or neither? Justify your answer.

(2) Suppose that five percent of students at Drake University typically fail a course. Then Drake University proposes to implement a program of "grade insurance": any student who fails a course receives $1000. To cover the costs of this program, the University will impose a required fee of $50 per student. Will the "grade insurance" program likely make a *profit* or a *loss* for Drake? Why? Is this an example of adverse selection, moral hazard, or neither? Justify your answer.

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]