ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2025
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Signature: _____

Printed name: _____

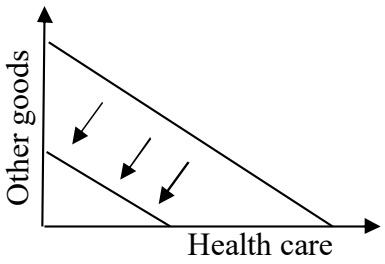
FINAL EXAMINATION VERSION A

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 = 200.

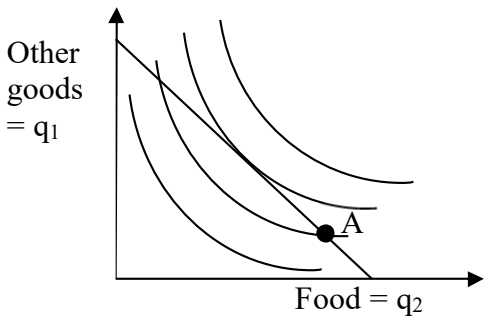
I. MULTIPLE CHOICE: Circle the one best answer to each question. Feel free to use margins for scratch work [2 pts each—42 pts total].

(1) The assumption of monotonicity 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 health care.
d. a decrease in the price of health care.
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 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.

(4) 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.

(5) What is wrong with this demand function?

$$q_1^* = 3\, I^{1.2}\, p_1^{-0.5}\, p_2^{0.1}$$

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.

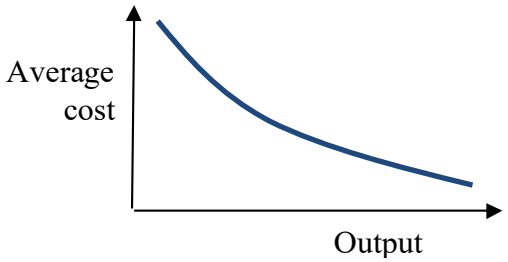
(6) Which price index tends to overestimate the rate of inflation, due to substitution bias?
a. Laspeyres price index.
b. Paasche price index.
c. Fisher price index.
d. All of the above.
e. None of the above.

(7) The *marginal product of capital* is the increase in output from a one-unit increase in capital input while holding constant
a. prices of all inputs.
b. the firm's profit.
c. the output price.
d. the quantity of other inputs.

(8) The *marginal rate of substitution* of labor for capital is the additional amount of capital required when labor input is reduced by one unit, while holding constant
a. the output price.
b. the quantity of output.
c. prices of all inputs.
d. the firm's profit.

(9) By definition, total output is constant all along
a. an isoquant.
b. an expansion path.
c. a supply curve.
d. an isocost line.
e. a total cost curve.

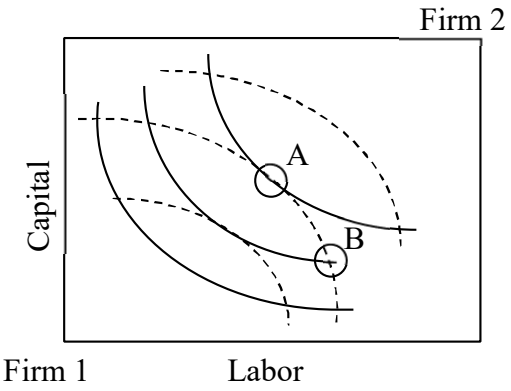
(10) The average cost curve below depicts
a. economies of scale.
b. diseconomies of scale.
c. economies of scale at low levels of output and diseconomies of scale at high levels of output.
d. neither economies of scale nor diseconomies of scale.



(11) 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.

(12) A quota on *sellers* of baseball bats would have basically the same effect on the market for baseball bats as
a. a price ceiling on baseball bats.
b. a price floor on baseball bats.
c. a tax on baseball bats.
d. a subsidy for baseball bats.
e. a free market for baseball bats.

The next two questions refer to the following Edgeworth box diagram for production. The solid curves are Firm 1's isoquants. The dashed curves are Firm 2's isoquants.



(13) From allocation A, *both* firms can produce more output if
a. Firm 1 gives Firm 2 some capital, and Firm 2 gives Firm 1 some labor.
b. Firm 1 gives Firm 2 some labor, and Firm 2 gives Firm 1 some capital.
c. Firm 1 gives Firm 2 some capital and some labor.
d. Firm 2 gives Firm 1 some capital and some labor.
e. No trade will allow both firms to produce more output.

(14) From allocation B, *both* firms can produce more output if
a. Firm 1 gives Firm 2 some capital, and Firm 2 gives Firm 1 some labor.
b. Firm 1 gives Firm 2 some labor, and Firm 2 gives Firm 1 some capital.
c. Firm 1 gives Firm 2 some capital and some labor.
d. Firm 2 gives Firm 1 some capital and some labor.
e. No trade will allow both firms to produce more output.

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(15) Monopoly causes economic inefficiency because
a. monopolists are usually wealthier than their customers.
b. some consumers, willing to pay the marginal cost of the product, are not served.
c. monopolists enjoy profits, called monopoly rents, even in the long run.
d. monopoly prices are unfair.
e. it is unfair for one firm to control the market.

(16) Suppose all the firms in an industry reach an agreement to raise the product price above the competitive level and thereby maximize the sum of their profits. Then each firm has an incentive to cheat on the agreement by individually
a. decreasing its price.
b. producing less output than its quota as specified in the agreement.
c. increasing its price even further.
d. all of the above.

(17) 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.

(18) 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.

(19) Unlike other taxes, a pollution tax (also called a Pigou tax)
a. causes deadweight loss.
b. does not generate any revenue for the government.
c. affects only producers.
d. does not cause deadweight loss.

(20) In the western United States, water is scarce. Suppose no one can be prevented from taking water from a particular stream. Unfortunately, if any person takes water, there is less for others. Water from this stream is therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

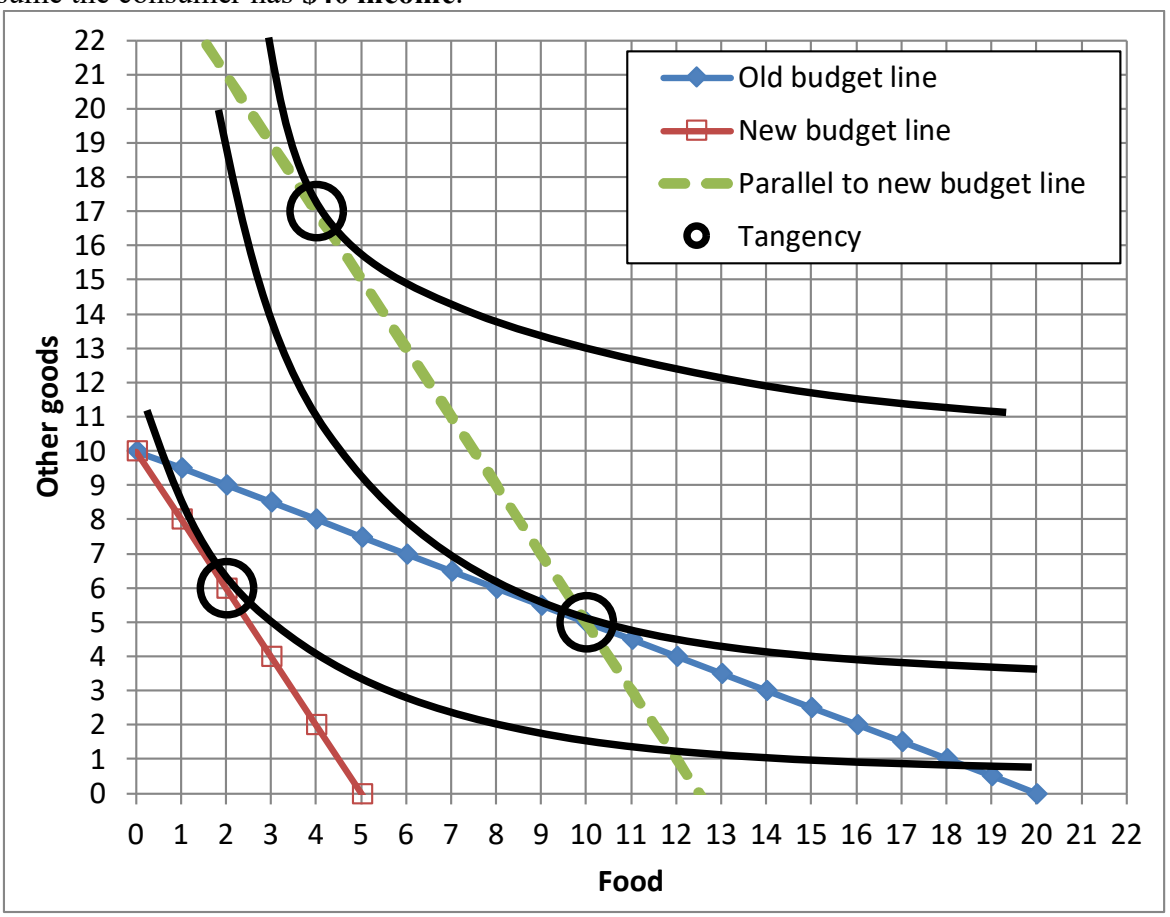
(21) The preservation of endangered species, such as the bald eagle, is a benefit we all can enjoy simultaneously, but no one can be forced to pay for enjoying it. Therefore species preservation is
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

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 blueberries is –1.5, and the price of blueberries rises by 4 %.

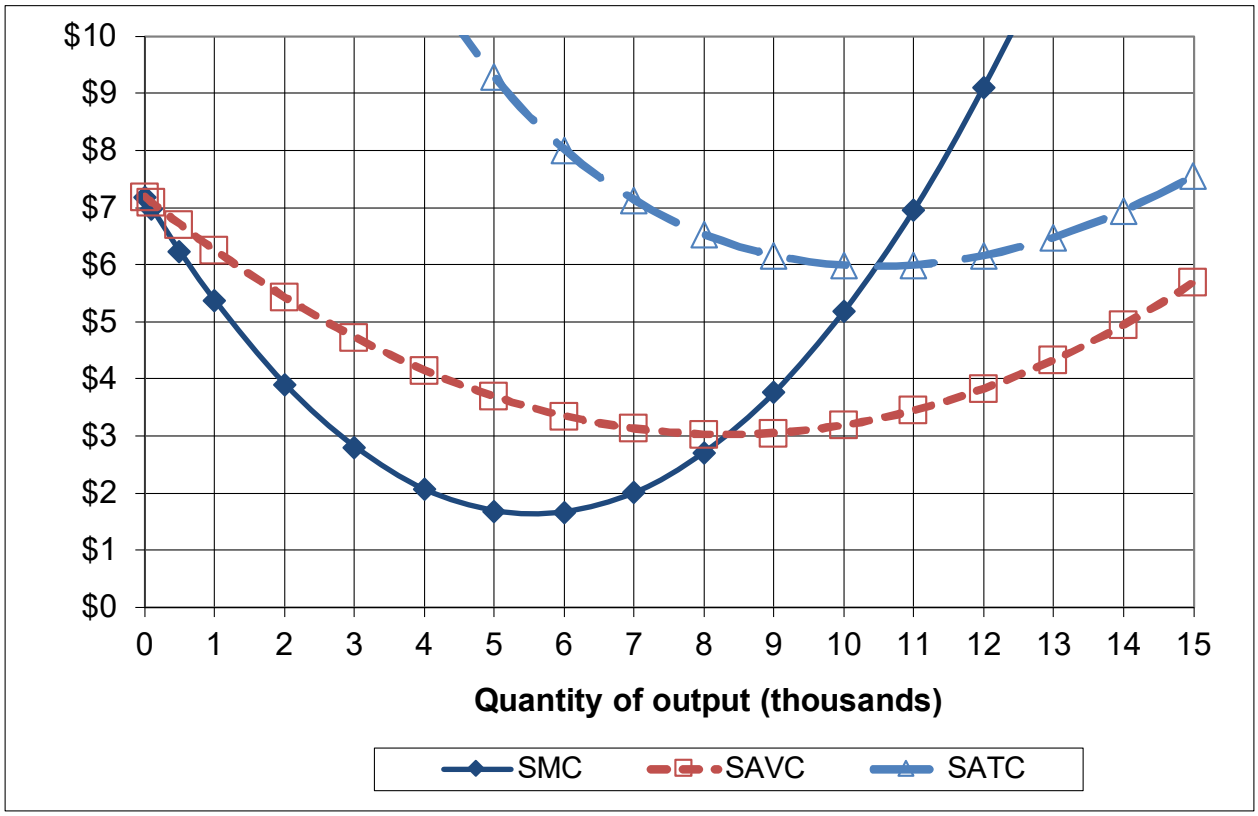
a. Is the demand for blueberries *elastic* or *inelastic* ?	
b. Will the quantity demanded of blueberries *increase* or *decrease*?	
c. By about how much?	%
d. Will consumers' total spending on blueberries *increase* or *decrease*?	
e. By about how much?	%

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

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



a. If the market price is \$2, about how much output will Bulldog try to produce (to the nearest thousand)? _____ thousand

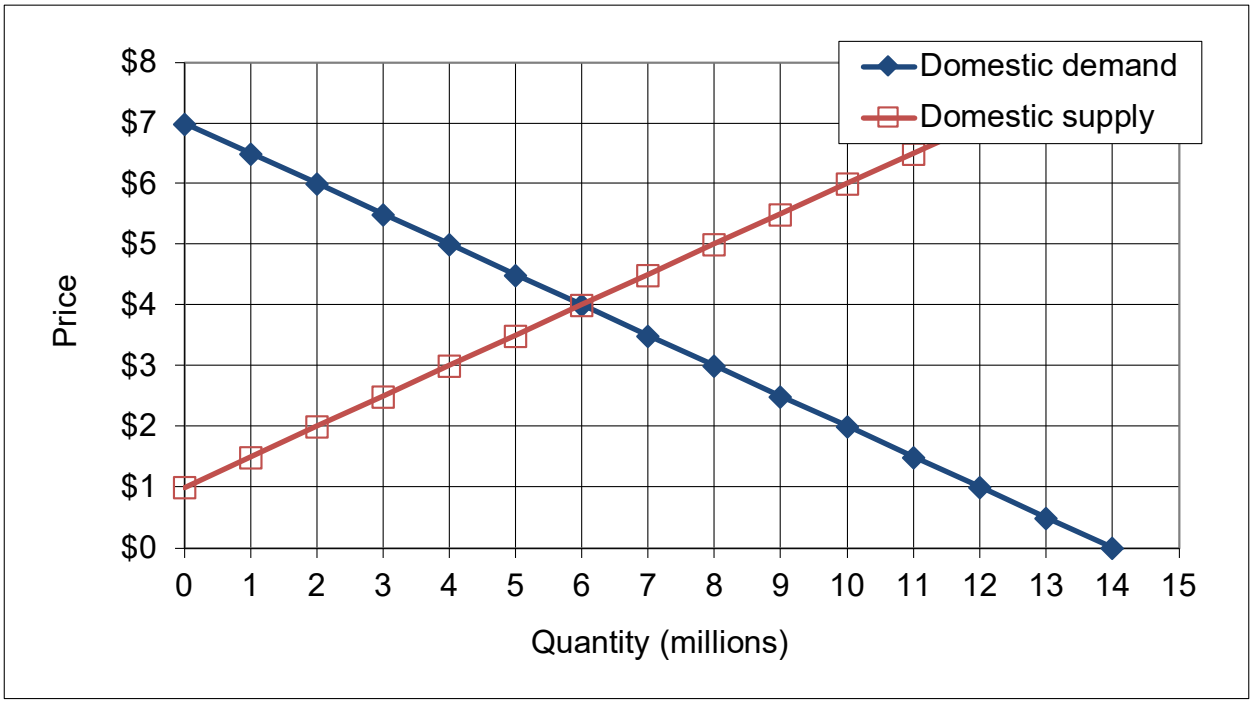
b. If the market price is \$5, about how much output will Bulldog try to produce (to the nearest thousand)? _____ thousand

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

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

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

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



At first, international trade in screwdrivers is not permitted. Then this industry is opened to international trade and the international price of screwdrivers turns out to be **$ 3.**

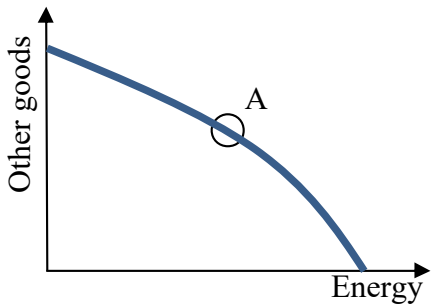
a. Will this country now *export* or *import* screwdrivers?	
b. How much?	million
c. Does consumer surplus in this country *increase* or *decrease* from international trade in screwdrivers?	
d. By how much?	$ million
e. Does producer surplus in this country *increase* or *decrease* from international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

(5) [Technical change: 4 pts] Suppose the elasticity of output with respect to labor input for the US economy as a whole is about 0.6, and the elasticity of output with respect to capital input is about 0.4. Further suppose labor input increases by 5% and capital input increases by 10%.

a. By how much would output increase, without any technical change? ____ %

b. Suppose output in fact increases by 8%. What is the increase in multifactor or total factor productivity (also called the Solow residual)? ____ %

(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 **–4**.



a. What is the opportunity cost of a unit of energy? In other words, how many units of other goods must be given up in order to produce one more unit of energy? ____ units of other goods

b. What is the opportunity cost of a unit of other goods? In other words, how many units of energy must be given up in order to produce one more unit of other goods? ____ units of energy

c. Consider the typical consumer's budget line with other goods on the vertical axis and energy 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 other goods is **$ 8**, then what must be the price of a unit of energy? $ ____

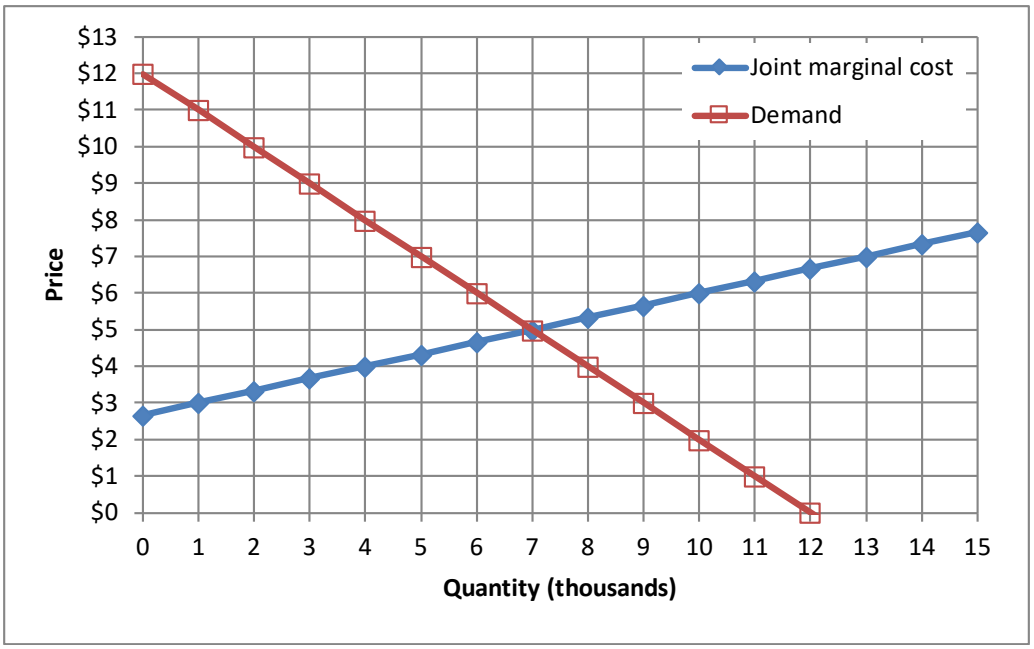
(7) [Nonrival goods: 6 pts] Ten houses surround a city park, the perfect place for a shared playground. But how big should the playground be? Suppose each household's marginal benefit from a playground is given by MB = 120 – 10 Q, where Q is the number of units of playground equipment. The marginal cost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

a. If an individual household must buy its own playground equipment, how many units will it buy? ____ units

b. Give an expression for marginal social benefit of shared playground equipment for the 10 households. MSB = ____

c. What is the socially optimal number of units of shared playground equipment? ____ units

(8) [Collusion/joint profit maximization: 16 pts] Three firms produce laundry soap. 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.

c. Compute the amount of deadweight loss.

$	
	thousand
$	thousand

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.

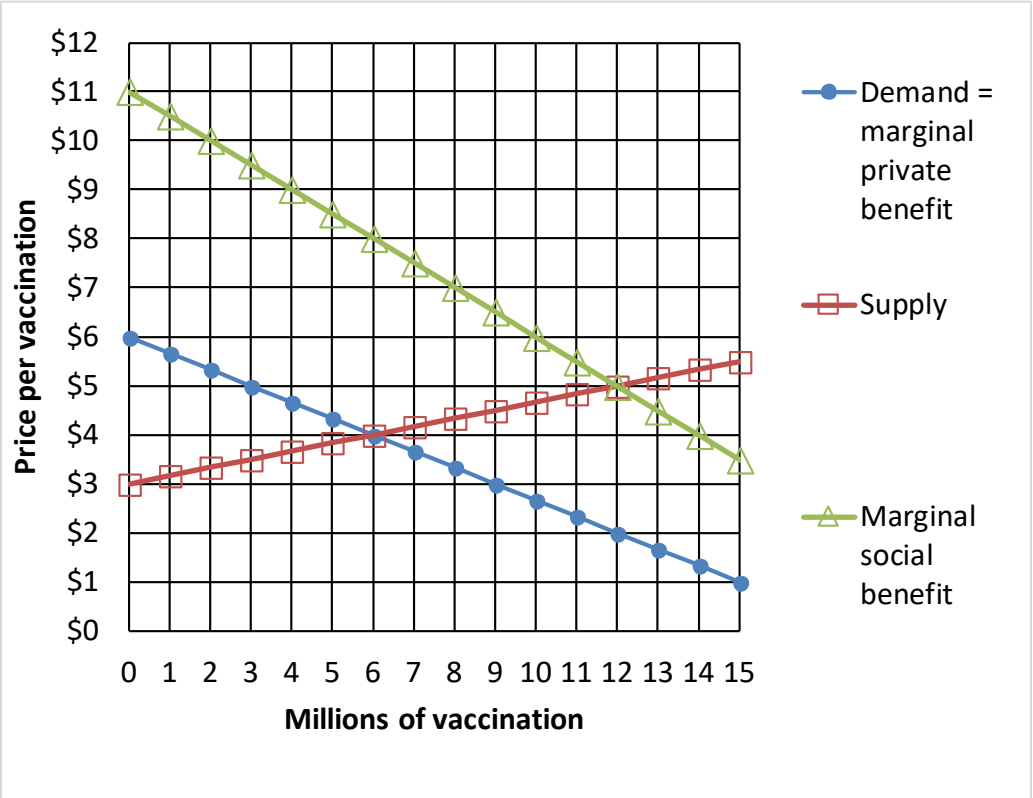
f. What price will the firms jointly set?

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

h. Compute the amount of deadweight loss.

$	
	thousand
$	thousand

(9) [Externalities: 12 pts] The graph below shows the market for a particular vaccine. A vaccination protects the purchaser of the vaccine, but also reduces the chances of other people catching the illness. Therefore, in addition to demand and supply curves, a curve representing marginal social benefit is shown.



a. Compute the (unregulated) competitive equilibrium price.	$
b. Compute the (unregulated) competitive equilibrium quantity.	million
c. Compute the economically efficient (or socially optimal) quantity.	million
d. Compute the deadweight loss from unregulated competition.	$ million
e. To eliminate this deadweight loss, should the government enact a *tax* or a *subsidy*?	
f. What should be the tax rate or subsidy rate?	$ per vaccination

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: $U(q_1,q_2) = q_1 (q_2 - 5)$, 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 \$6. The consumer has \$150 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.

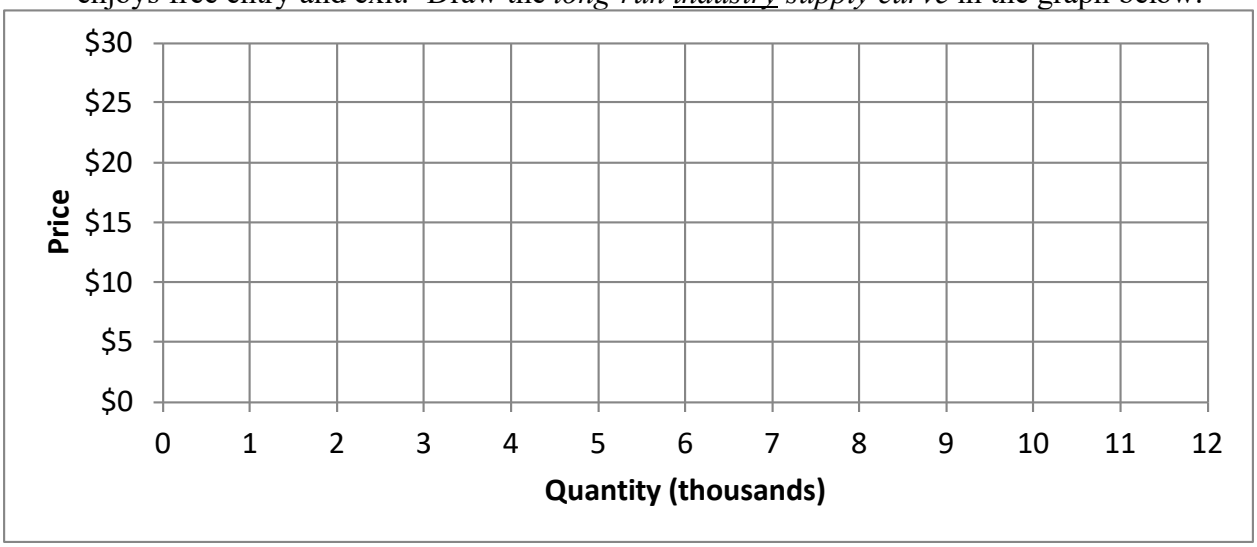
(2) [Cost curves; Long-run market equilibrium: 8 pts] Suppose a typical firm faces a (long-run) total cost function given by $TC(q) = 0.01\,q^3 - 0.8\,q^2 + 26\,q$.

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) [Welfare effects of tax or subsidy: 10 pts] Suppose demand and supply for a good are given by the following equations. (Use the graph at right for scratch work.)

Demand:

$P_D = 20 - (Q/10)$

Supply:

$P_S = 5 + (Q/20)$

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. Does society as a whole (including the government) *gain* or *lose* as a result of the subsidy? By how much?

(4) [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 **$P = 20 - (Q/10)$.** Each firm has constant marginal and average cost equal to **$2**. 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.

(5) [Game theory, nonexcludable goods: 12 pts] Two fishermen are each deciding how much to fish. Note that if they both fish a lot, the stock is depleted so the long-run catch is less.

		Fisherman B	
		Fish a little	Fish a lot
Fisherman A	Fish a little	A catches 40 fish. B catches 40 fish.	A catches 10 fish. B catches 50 fish.
	Fish a lot	A catches 50 fish. B catches 10 fish.	A catches 20 fish. B catches 20 fish.

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

Fisherman A plays "Fish a little" and Fisherman B plays "Fish a little."	
Fisherman A plays "Fish a little" and Fisherman B plays "Fish a lot."	
Fisherman A plays "Fish a lot" and Fisherman B plays "Fish a little"	
Fisherman A plays "Fish a lot" and Fisherman B plays "Fish a lot."	

b. Which outcomes of this game (if any) are dominant-strategy equilibria[1]? Answer "YES" or "NO."

Fisherman A plays "Fish a little" and Fisherman B plays "Fish a little."	
Fisherman A plays "Fish a little" and Fisherman B plays "Fish a lot."	
Fisherman A plays "Fish a lot" and Fisherman B plays "Fish a little"	
Fisherman A plays "Fish a lot" and Fisherman B plays "Fish a lot."	

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

Fisherman A plays "Fish a little" and Fisherman B plays "Fish a little."	
Fisherman A plays "Fish a little" and Fisherman B plays "Fish a lot."	
Fisherman A plays "Fish a lot" and Fisherman B plays "Fish a little"	
Fisherman A plays "Fish a lot" and Fisherman B plays "Fish a lot."	

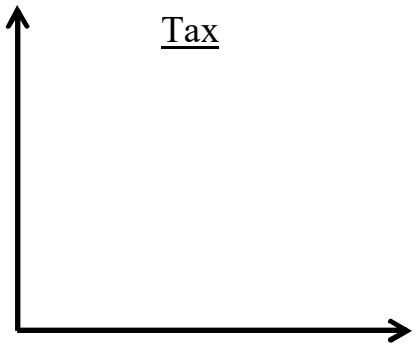
[1] "Equilibria" is the plural form of "equilibrium."

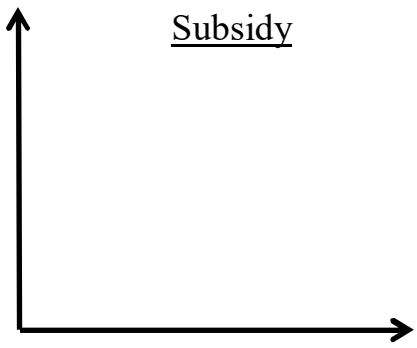
IV. CRITICAL THINKING: Answer just *one* question below (your choice). [5 pts]

(1) Consider the following claim: "Taxes reduce economic efficiency because they discourage production, but subsidies increase economic efficiency because they encourage production." Do you agree or disagree? Justify your answer with supply-and-demand graphs. Label all curves and axes.

(2) 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 $\mathbf{MB_A = 10 - (q_A/2),}$ and the marginal benefit of pollution for Factory B is $\mathbf{MB_B = 6 - (q_B/2),}$ 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 $\mathbf{12 = q_A + q_B}$ at least cost? Show your work and circle your final answers. (Ignore the graphs.)

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]