ECON 002 - Principles of Microeconomics
Drake University, Fall 2025
William M. Boal

Signature: _____

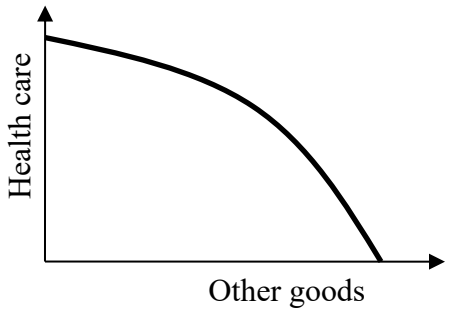
Printed name: _____

FINAL EXAMINATION VERSION B
December 8, 2025

INSTRUCTIONS: This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators, calculators with alphabetical keyboards, cell phones, and wireless devices are NOT permitted. Numerical answers, if rounded, must be correct to at least 3 significant digits. Point values for each question are noted in brackets. Maximum total points are 200.

I. Multiple choice: Please circle the one best answer to each question. [1 pt each, 25 pts total]

(1) Suppose a country's production possibility curve is as shown below. By definition, what is held constant along the curve?
a. The country's total inputs.
b. The prices of health care and other goods.
c. Output of health care.
d. Output of other goods.
e. None of the above.

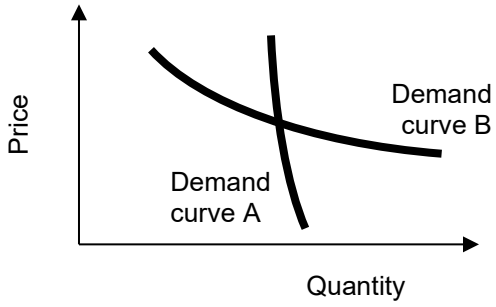


(2) The Law of One Price means
a. a good cannot be resold.
b. all sellers are required by law to quote the same price.
c. the buyer and the seller in each transaction must agree on a price.
d. efficient markets eliminate price dispersion.
e. the total quantity buyers want to buy is negatively related to the price.

(3) A fall in the in the price of chips will shift the demand for salsa to the right, assuming chips and salsa are
a. complementary goods.
b. substitute goods.
c. normal goods.
d. inferior goods.

(4) Data show that the price of electricity is rising and the quantity of electricity produced is also rising. This could be caused by a
a. rightward shift in the demand for electricity.
b. rightward shift in the supply of electricity.
c. leftward shift in the demand for electricity.
d. leftward shift in the supply of electricity.

(5) Which demand curve below is *less* elastic?
a. Demand curve A.
b. Demand curve B.
c. Both have the same elasticity because they pass through the same point.
d. Cannot be determined from information given.



The next three questions refer to the following demand and supply schedules for corn in two countries.

	Country X		Country Y	
Price	Q_D	Q_S	Q_D	Q_S
\$1	110	10	50	30
\$2	100	20	45	35
\$3	90	30	40	40
\$4	80	40	35	45
\$5	70	50	30	50
\$6	60	60	25	55
\$7	50	70	20	60

(6) In the absence of international trade, Country X's equilibrium price of corn would be
a. \$2.
b. \$3.
c. \$4.
d. \$5.
e. \$6.

(7) With international trade, the equilibrium price of corn in both countries would be
a. \$2.
b. \$3.
c. \$4.
d. \$5.
e. \$6.

(8) Who in Country X benefits from international trade in corn?
a. Buyers in Country X.
b. Sellers in Country X.
c. Both buyers and sellers in Country X.
d. Neither buyers nor sellers in Country X.

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(9) A change in the amount of cigarettes each person buys is called a change at the
a. extensive margin.
b. intensive margin.
c. marginal product.
d. marginal revenue.

(10) The increase in a firm's total revenue from producing and selling one more unit of output by definition equals the firm's
a. total revenue.
b. average revenue.
c. marginal revenue.
d. total cost.
e. average cost.
f. marginal cost.

(11) The slope of the firm's total cost curve by definition equals the firm's
a. total revenue.
b. average revenue.
c. marginal revenue.
d. total cost.
e. average cost.
f. marginal cost.

(12) In the *short run*, a firm should shut down if its revenue is insufficient to pay even its
a. accounting cost.
b. fixed cost.
c. variable cost.
d. total cost.

(13) A perfectly competitive firm expects that if it increases its output, the price will
a. increase.
b. decrease.
c. stay the same.
d. cannot be determined from information given.

(14) A monopolist always sets price
a. above marginal cost.
b. equal to marginal cost.
c. below marginal cost.
d. cannot be determined from the information given.

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

(16) Entry into the ethnic restaurant business is practically free, but each restaurant's cuisine is somewhat different from others'. Therefore, a sensible economic model for ethnic restaurants is
a. monopoly.
b. monopolistic competition.
c. perfect competition.
d. joint-profit-maximizing cartel.

(17) 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.

(18) If one person downloads a particular musical recording, the same recording can be downloaded by other people. However, everyone who downloads the recording is forced to pay for it. This recording is therefore
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(19) The American bison ("buffalo") was nearly wiped out in the nineteenth century. No one could be prevented from killing a buffalo, but when someone did, there were fewer buffalo for others. Buffalo were
a. a nonrival good.
b. a nonexcludable good.
c. both of the above.
d. none of the above.

(20) 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.

(21) When manure is spread on farm fields while the ground is still frozen, it runs off quickly into rivers and streams, forcing downstream water treatment plants to spend more money on purification. Thus, spreading manure on frozen fields creates
a. an external benefit.
b. an external cost.
c. an elasticity.
d. an inferior good.

(22) After my neighbor bought and installed outdoor lights, crime decreased at all properties in my neighborhood. My neighbor's outdoor lights created
a. an external benefit.
b. an external cost.
c. a common property resource.
d. an inferior good.

(23) If a good creates an external cost then the resulting market failure can in theory be corrected
a. with a tax.
b. with a subsidy.
c. by completely banning the product.
d. any of the above.

(24) Economists believe that environmental problems are caused, for the most part, by
a. lack of awareness.
b. moral failing.
c. misaligned incentives.
d. market power.

(25) Unlike other taxes, a pollution tax
a. causes deadweight loss.
b. increases economic efficiency.
c. generates no revenue for the government.
d. affects only producers.

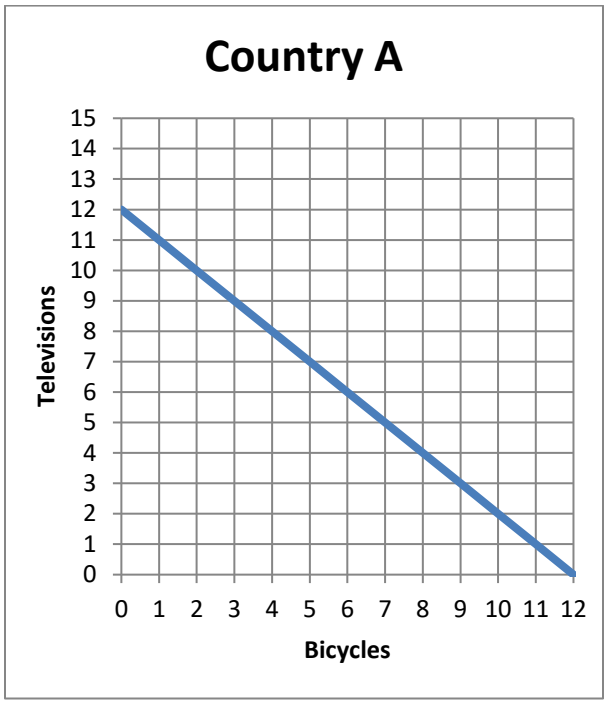
II. Problems: Insert your answer to each question in the box provided. Use margins and graphs for scratch work. Only the answers in the boxes will be graded. Work carefully—partial credit is not normally given for questions in this section.

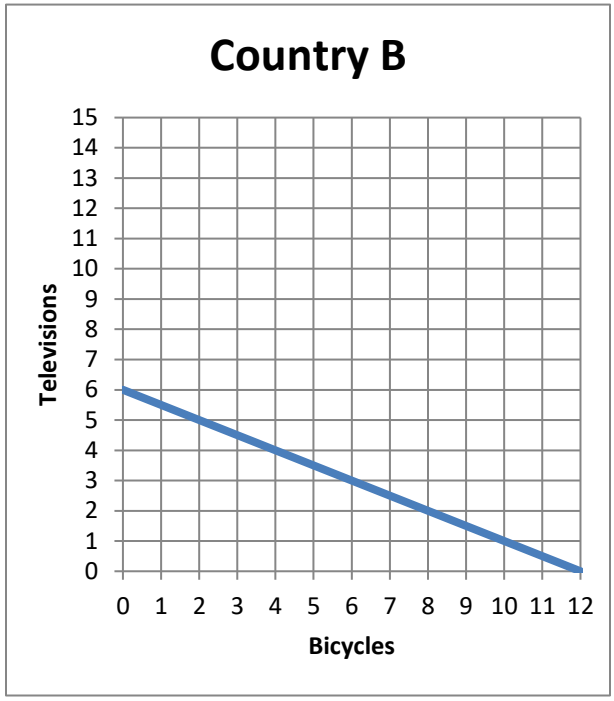
(1) [Production functions: 7 pts] A work crew reroofs houses. Complete the table by computing the work crew's average product and marginal product and placing your answers in the unshaded cells of the third and fourth columns below. Then answer the question below.

Number of workers	*Houses reroofed per month*	*Average Product*	*Marginal Product*
0 workers	0 houses		
			houses per worker
3 workers	18 houses	houses per worker	
			houses per worker
6 workers	24 houses	houses per worker	
			houses per worker
9 workers	27 houses	houses per worker	

Is the work crew's production function characterized by *diminishing returns* to their labor input? Answer YES or NO.

(2) [Comparative advantage, gains from trade: 17 pts] Country A and Country B can each produce televisions and bicycles. They each face a tradeoff between these two products because of limited workforces. Their production possibility curves are shown below.





a. What is Country A's opportunity cost of producing a television? bicycles

b. What is Country B's opportunity cost of producing a television? bicycles

c. What is Country A's opportunity cost of producing a bicycle? televisions

d. What is Country B's opportunity cost of producing a bicycle? televisions

e. Which country has a comparative advantage in producing televisions?

f. Which country has a comparative advantage in producing bicycles?

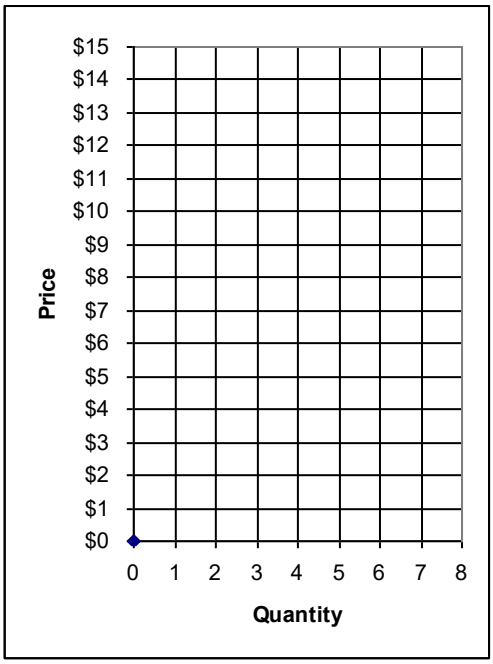
g. [3 pts] Fill in the blanks: *Both* countries can consume combinations of products *outside* their individual production possibility curves if _____ exports *three* bicycles to _____, which exports _____ televisions in return.

h. **Plot** the trade that you propose in part (g) on the graphs above. For each country, plot and label the starting point representing **production before trade**, and the ending point representing **consumption after trade**.

(3) [Market equilibrium: 12 pts] Suppose seven buyers and seven sellers engage in a market similar to the exercise we did in class. Each buyer may buy at most one unit and each seller may sell at most one unit, but no one is forced to trade. Assume that buyers and sellers are each trying to maximize their own surplus (or "gains from trade"). Surplus for each buyer equals the buyer's value of the good minus the price paid. Surplus for each seller equals the price received minus the seller's cost of the good. Surplus of persons who do not trade are zero. Buyers' values and sellers' costs are given in the following table.

Buyer	*Value*
Bob	\$15
Barb	\$13
Ben	\$11
Bailey	\$ 9
Brian	\$ 7
Betty	\$ 5
Bert	\$ 3

Seller	*Cost*
Sue	\$ 1
Steve	\$ 1
Sam	\$ 1
Sven	\$ 2
Sarina	\$ 2
Sean	\$ 3
Sally	\$ 5



Suppose with some experience, the market settles on a single price. All trades are made at that price. (Hint: use the graph at right for scratch work.)

a. If the price were **\$8**, would there by *excess demand, excess supply*, or *neither*?

Now consider the market equilibrium.

b. What is the equilibrium price? Give an answer to the nearest whole dollar. \$

c. How many units of the good will be sold in this market? units

d. Compute the total revenue received by sellers (which equals the total spending by buyers). \$

e. Compute the combined total surplus (or gains from trade) of all buyers and sellers. (Check your answer carefully! No partial credit for being "close"!) \$

f. Who enjoys higher surplus in this particular market, the *buyers* or the *sellers?* Or is buyers' total surplus *equal* to sellers' total surplus?

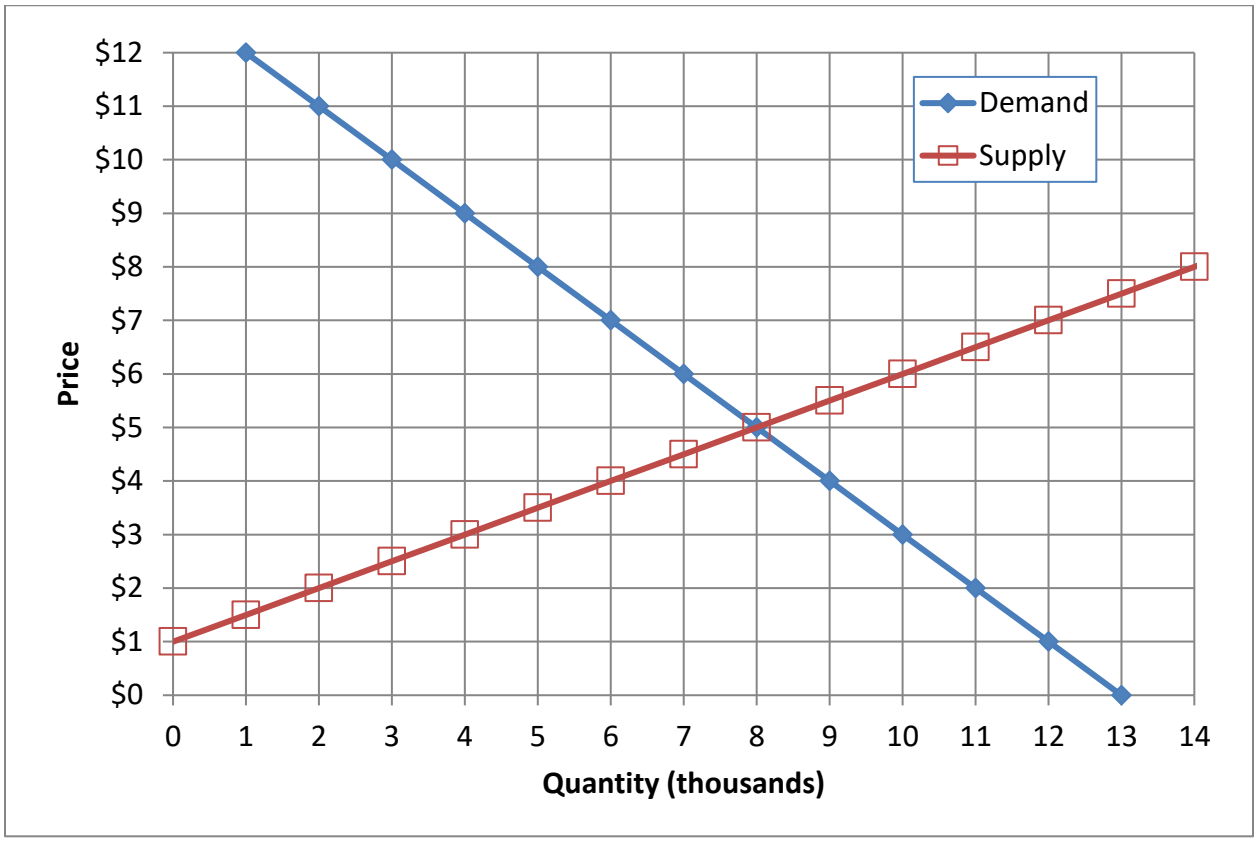
(4) [Income elasticity of demand. 8 pts] According to the 2022 Consumer Expenditure Survey, the following are budget shares for low-income and high-income households. For each good, indicate whether it is a necessary good or a luxury good (sometimes called a "superior good"). Also indicate whether the income elasticity of demand is greater or less than one.

Good	Budget share, low income	Budget share, high income	*Necessary good* or *luxury good?*	Income elasticity of demand *greater than one* or *less than one?*
a. Gasoline	5.0%	3.3%		
b. New cars	2.4%	4.1%		

(5) [Using price elasticity of demand: 10 pts] Suppose the amusement park *raises* the price of entrance tickets by **5%**. Suppose the price elasticity of demand for tickets is **-1.4**. Assume everything else affecting demand for entrance tickets remains constant.

a. According to the information above, is demand for entrance tickets *elastic, inelastic,* or *unitary-elastic*?	
b. As the price rises, will the quantity of entrance tickets demanded *increase*, *decrease*, or remain *constant*?	
c. ... by approximately how much?	%
d. Will the total revenue received by the amusement park *increase*, *decrease*, or remain *constant*?	
e. ... by approximately how much?	%

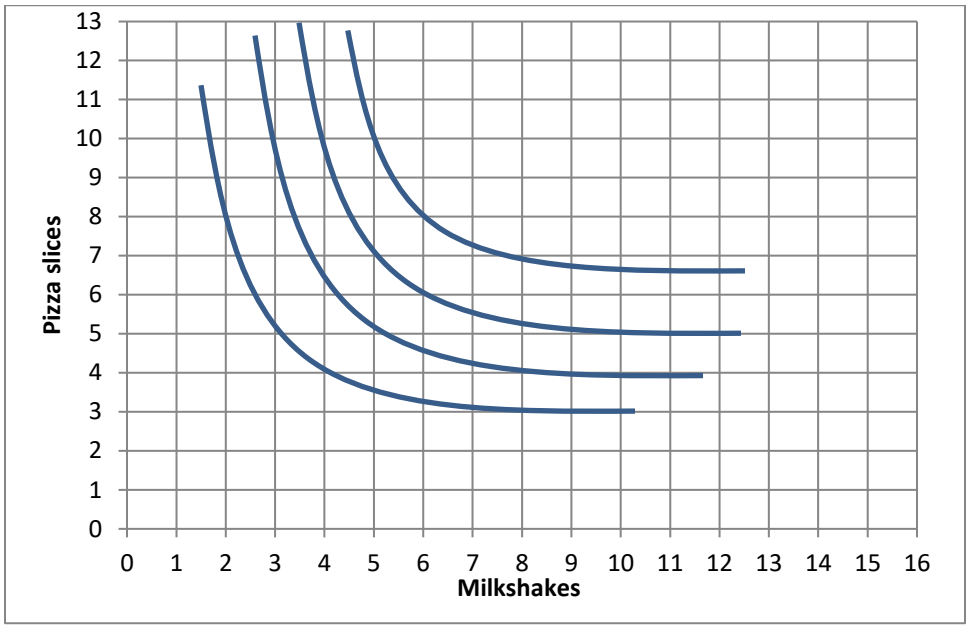
(6) [Welfare analysis of tax or subsidy: 18 pts] The graph below shows the market for pumpkins.



Suppose the government imposes an excise **tax of $ 3** per pumpkin.

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

(7) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Zach's preferences for pizza and milkshakes.



a. Would Zach rather have 7 pizza slices and 5 milkshakes, or 4 pizza slices and 11 milkshakes?

b. Would Zach rather have 10 pizza slices and 3 milkshakes, or 6 pizza slices and 6 milkshakes?

	pizza slices and	milkshakes
	pizza slices and	milkshakes

Suppose Zach has a budget of $60 to spend on pizza and milkshakes. The price of pizza slices is $6.

c. **Using a straightedge**, carefully draw Zach's budget line when the price of milkshakes is $4. Label this budget line "A".

d. How many milkshakes will Zach buy if the price of milkshakes is $4?

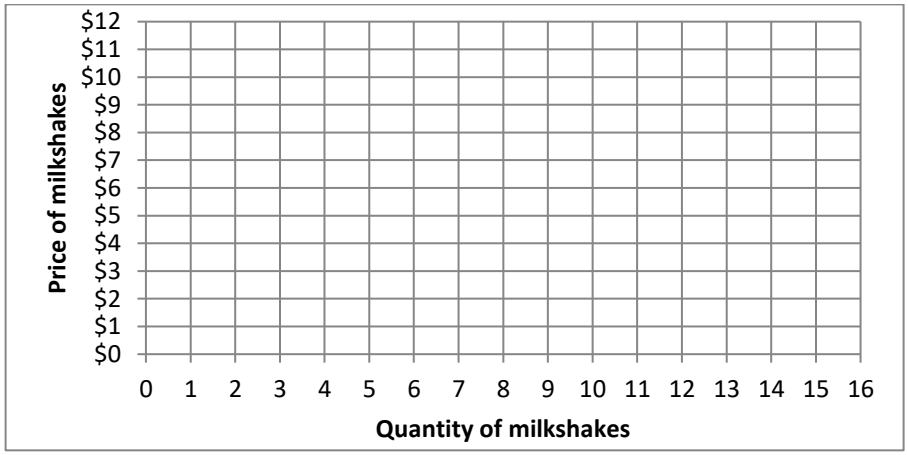
	milkshakes

e. **Using a straightedge**, carefully draw Zach's budget line when the price of milkshakes is $10. Label this budget line "B".

f. How many milkshakes will Zach buy if the price of milkshakes is $10?

	milkshakes

g. Plot two points on Zach's demand curve for milkshakes, and sketch Zach's demand curve at right.



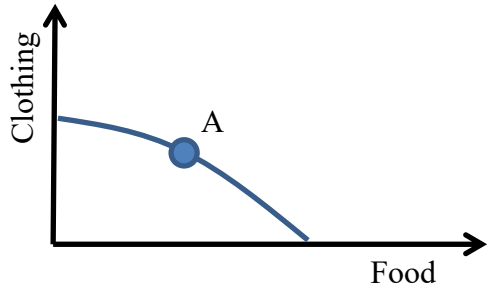
(8) [Rational choice: 10 pts] Ellwood City is installing traffic signals. The city manager has obtained cost estimates (there is some discount for volume purchases) and computed benefit estimates (where high priority locations would be served first). The following are total cost and total benefit estimates.

Traffic signals	Total cost	Total benefit	Marginal cost per signal	Marginal benefit per signal
0	$ 0	$0		
			$ thousand	$ thousand
5	$15 thousand	$20 thousand		
			$ thousand	$ thousand
10	$25 thousand	$35 thousand		
			$ thousand	$ thousand
15	$30 thousand	$38 thousand		
			$ thousand	$ thousand
20	$35 thousand	$40 thousand		

a. [4 pts] Compute the marginal cost schedule. Insert your answers above.
b. [4 pts] Compute the marginal benefit schedule. Insert your answers above.
c. [2 pts] How many traffic signals should Ellwood City install? (Answer must be 0, 5, 10, 15, or 20).

signals

(9) [Economy-wide efficiency: 16 pts] The graph below shows a country's production possibilities curve. The country is currently at point A, where the slope equals **-1/3**.



Production possibilities curve

a. What is this **country's** opportunity cost of a unit of food? units of clothing

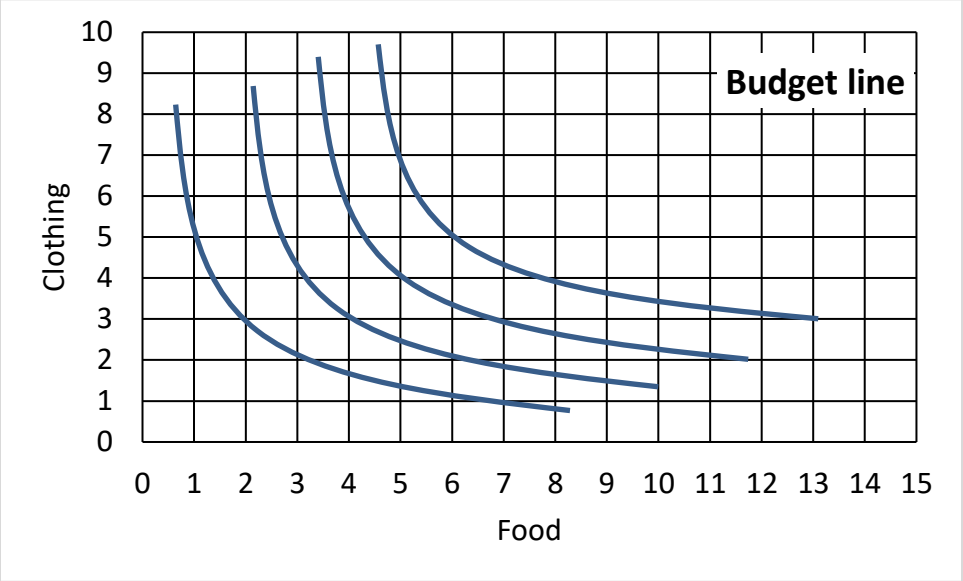
b. What is this **country's** opportunity cost of a unit of clothing? units of food

Assume this country's economy is in competitive equilibrium in all markets and the price of a unit of food is **$3**

c. What must be the price of a unit of clothing? $

Adam is a consumer in this economy. He has an income of **$ 36**.

d. **Using a straightedge,** draw Adam's budget line in the indifference-curve graph below.



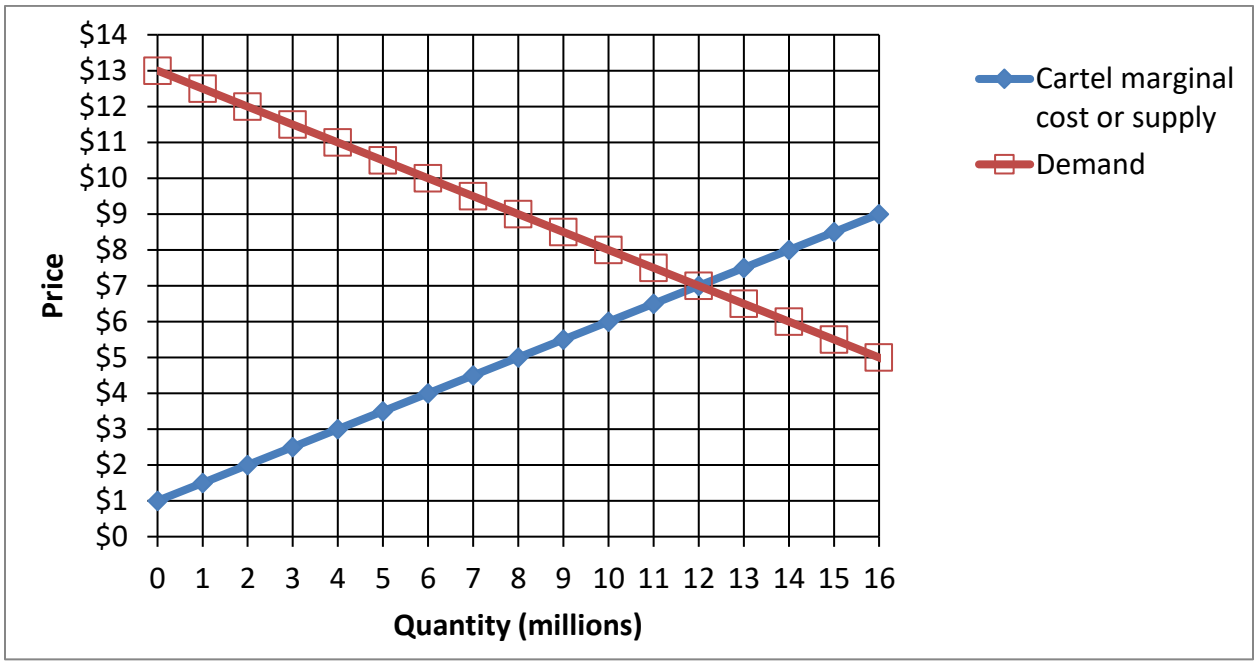
e. What is **Adam's** opportunity cost of a unit of food? units of clothing

f. What is **Adam's** opportunity cost of a unit of clothing? units of food

g. How many units of clothing will Adam choose to purchase? units of clothing

h. At **Adam's** chosen bundle, what is his marginal rate of substitution, that is, the |slope| of his indifference curve at his chosen bundle? (Give a number.)

(10) [Competition versus collusion: 16 pts] Suppose a small group of firms produce vitamins. The graph below shows the demand curve and the joint marginal cost or supply curve of the group of firms.



First, assume the firms *compete* with each other, each maximizing its own profit while taking the market price as given.

a. What will be the equilibrium market quantity?	million
b. If output increased by one more unit at any firm, total costs would increase by how much?	$
c. What will be the equilibrium market price?	$

Second, alternatively assume the firms *collude* with each other, setting price jointly as a cartel to maximize the sum of their profits.

d. *Using a straightedge*, draw and label the colluding firms' marginal revenue curve.

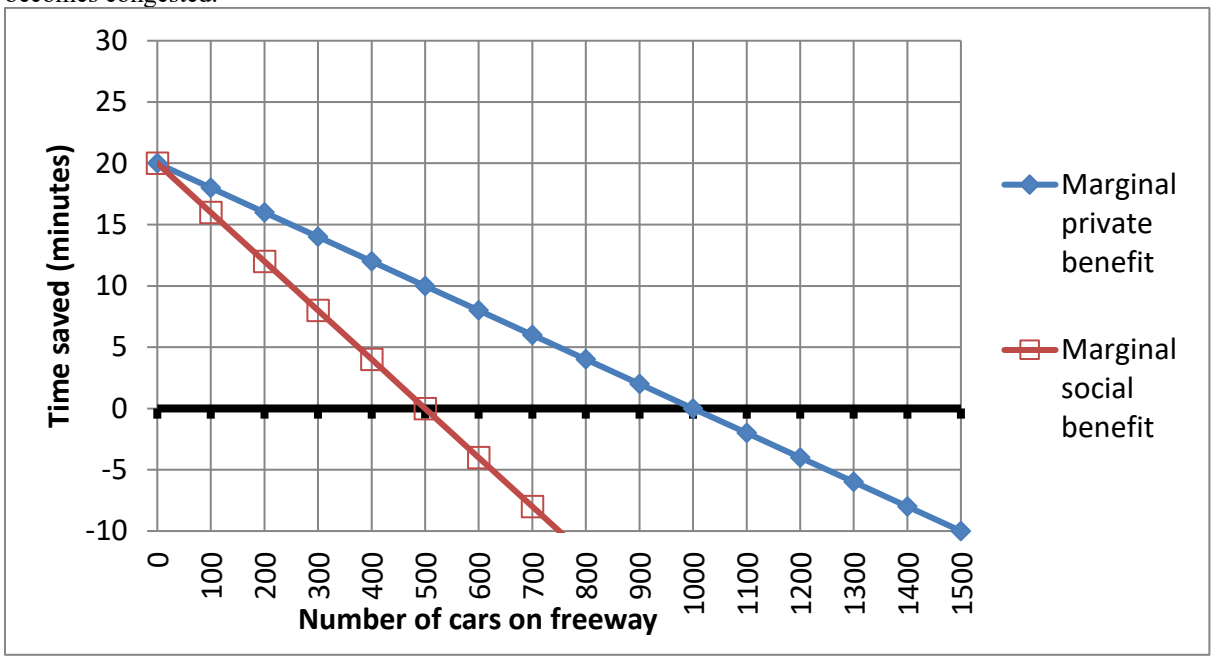
e. What total quantity will the firms produce?	million
f. If output increased by one more unit at any firm, total costs would increase by how much?	$
g. What price will the firms jointly set?	$
h. Compute the social deadweight loss from collusion.	$ million

(11) [Nonrival goods: 6 pts] Suppose 1000 people live near a proposed bike trail. The trail will cost $10,000 per mile to build. Let Q denote the length of the bike trail in miles. A typical individual person's marginal benefit from this bike trail is given by the following expression (or formula): **MB = 50 – 4 Q** .

a. How many miles of bike trail would a typical *individual* pay to build for their own use?
b. Give an expression (or formula) for the marginal social benefit from the bike trail. [Hint: This must be a formula containing one variable: Q.]
c. Compute Q*, the socially-optimal length of the bike trail.

miles
MSB =
miles

(12) [Common property resources: 6 pts] A certain freeway can easily become congested. It is normally the quickest route to downtown, but during rush hour, when one car enters the freeway, all the cars already on the freeway slow down a bit. The graph below shows the average time saved by each car when it enters the freeway ("marginal private benefit"), and the change in total time saved by all cars when another car enters the freeway ("marginal social benefit"). Note that the change in total time saved by all cars turns negative as the freeway becomes congested.

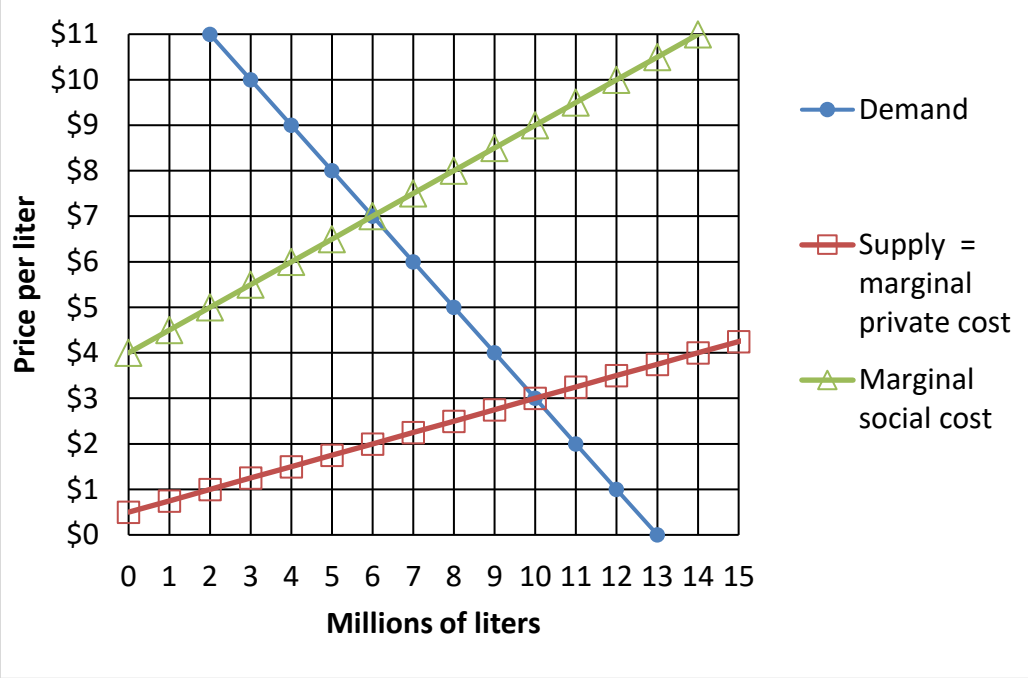


a. How many cars will enter the freeway if entry onto the freeway is unregulated?

b. What is the socially-optimal number of cars on the freeway—that is, the number of cars that maximizes total time saved by all cars on the freeway?
c. Suppose a typical driver is willing to pay $1 for each five minutes saved by entering the freeway. What toll (in dollars) would ensure that the optimal number of cars entered the freeway?

cars
cars
$

(13) [Externalities: 12 pts] The graph below shows the market for a particular chemical that, when used, creates air pollution, an external cost born by other people. Therefore, in addition to demand and supply curves, a curve representing marginal social cost is shown.



a. Compute the (unregulated) competitive equilibrium price.	$ per liter
b. Compute the (unregulated) competitive equilibrium quantity.	million liters
c. Compute the economically efficient (or socially optimal) quantity.	million liters
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 liter

(14) [Regulating pollution: 19 pts] Five factories are each producing one unit of pollution per year. The government has determined that total pollution must be reduced to **3** units per year (a reduction of **2** units). The cost of cleaning up pollution at each factory is given below.

Factory	A	B	C	D	E
Annual cost of cleaning up pollution	$15	$35	$25	$45	$5

Command-and-control:

a. To minimize the total cost of cleaning up, which **2** factories should be commanded to clean up? Give their letters.

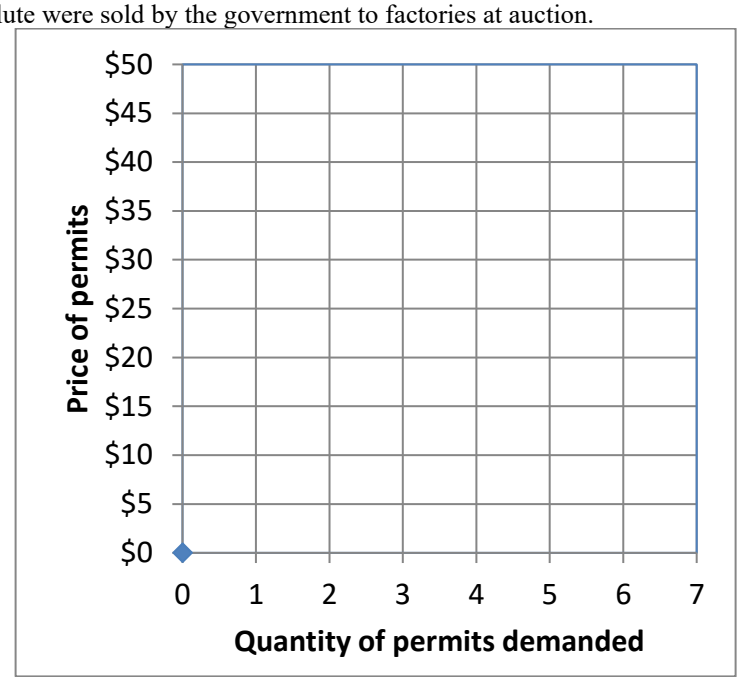
b. What would be the total cost of cleaning up for these **2** factories together?

$

Now suppose the government does not know each factory's cost of cleaning up, so the command-and-control approach is infeasible. Consider the following alternative approaches.

Auction: Suppose **3** permit (or waiver) to pollute were sold by the government to factories at auction.

c. [5 pts] Draw the factories' demand curve for permits in the graph at right. Be sure to draw correct "stairsteps."



In this auction, the price starts at $0 and rises in increments of $10.

d. Which factories would win the permit? Give their letters.

e. What would be the final auction price of a permit to pollute?

f. What would be the total cost of cleaning up for those **2** factories that did not win permits in the auction?

$
$

Pollution fee: Suppose the government imposed a fee for pollution. Factories could either pay the fee or pay the cost of cleaning up.

g. What fee would reduce the amount of pollution to **3** units: $0, $10, $20, $30, $40, $50, or $60?

h. What would be the total cost of cleaning up for those **2** factories that chose not to pay the fee?

$
$

III. Critical thinking: Write a one-paragraph essay answering ***one*** question below (your choice). [4 pts]

(1) Give an example of a government intervention that makes a market *less* efficient. Explain why the intervention decreases economic efficiency and illustrate your argument using a supply-and-demand graph. Label all curves and axes. Shade and label the triangle of deadweight loss *caused* by government intervention.

(2) Give an example of a government intervention that makes a market *more* efficient. Explain why the intervention increases economic efficiency and illustrate your argument using a supply-and-demand graph. Label all curves and axes. Shade and label the triangle of deadweight loss *eliminated* by government intervention.

Please circle the question you are answering. Write your answer below. Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling.

[end of exam]