

FINAL EXAMINATION VERSION A

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, 36 pts total]

- (1) In economics, *rational behavior* means
- using math to make decisions.
 - ignoring "soft" concerns like friendships and charity.
 - doing the best one can with what one has.
 - making sacrifices today for a better future.
 - maximizing one's income.

- (2) Brian buys a ticket to a concert for \$60. When he arrives at the concert hall, he discovers that scalpers are willing to pay \$100 for his ticket. His *opportunity cost* of attending the concert is now
- \$40.
 - \$60.
 - \$100.
 - \$160.

- (3) A breakfast café charges \$3.00 for one pancake, \$4.00 for two pancakes, and \$4.50 for three pancakes. What is the marginal cost of the *second* pancake?
- \$0.50.
 - \$1.00.
 - \$2.00.
 - \$4.00.

The next three questions refer to the following information. Farm X can produce 10 units of tomatoes or 20 units of peppers per acre. Farm Y can produce 30 units of tomatoes or 30 units of peppers per acre.

- (4) What is Farm X's opportunity cost of a unit of peppers?
- 0.5 units of tomatoes.
 - 2 units of tomatoes.
 - 10 units of tomatoes.
 - 2 units of peppers.

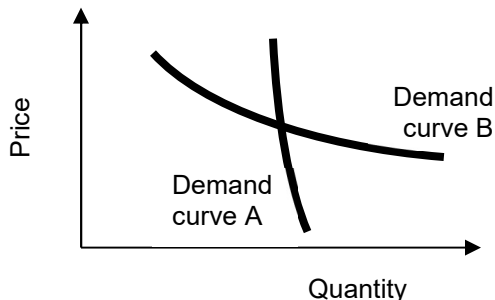
- (5) What is Farm Y's opportunity cost of a unit of peppers?
- 1 unit of tomatoes.
 - 2 units of tomatoes.
 - 10 units of tomatoes.
 - 30 units of peppers.

- (6) Which farm has a comparative advantage in peppers?
- Farm X.
 - Farm Y.
 - Both farms.
 - Neither farm.

- (7) As the price of gasoline rises, consumers are buying fewer large sport-utility vehicles, because gasoline and SUVs are
- substitute goods.
 - complementary goods.
 - inferior goods.
 - normal goods.

- (8) A rise in people's incomes will shift the demand for Ramen noodles to the left, if Ramen noodles are
- a complementary good.
 - a substitute good.
 - a normal good.
 - an inferior good.

- (9) 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.



- (10) Assuming that opera tickets are a *superior* or *luxury good*, the income elasticity of demand for opera tickets must be
 a. negative.
 b. exactly zero.
 c. between zero and one.
 d. exactly one.
 e. greater than one.

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

Price	Country X		Country Y	
	Q _D	Q _S	Q _D	Q _S
\$1	65	15	50	10
\$2	60	20	40	20
\$3	55	25	30	30
\$4	50	30	20	40
\$5	45	35	10	50
\$6	40	40	0	60
\$7	35	45	0	70

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

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

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

- (14) Who in Country X benefits from international trade in wheat?
 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.

- (15) Suppose the price of watermelons is \$5 in Kansas City and the cost of shipping a watermelon between Des Moines and Kansas City is \$2. Markets are *out of equilibrium* if the price of melons in Des Moines is
 a. \$1.
 b. \$4.
 c. \$5.
 d. \$6.

- (16) A quota (or legal maximum quantity) on *selling* ivory would cause its price to
 a. rise.
 b. fall.
 c. rise or fall, depending on the shapes of the demand and supply curves.
 d. remain constant.

- (17) Suppose the price elasticity of demand for baby food is -0.2 and the price elasticity of supply is 5.0. If a subsidy is given for baby food,
 a. producers will enjoy most of the subsidy.
 b. consumers will enjoy most of the subsidy.
 c. producers and consumers will each enjoy half of the subsidy.
 d. Answer depends on which side receives the check from the government.

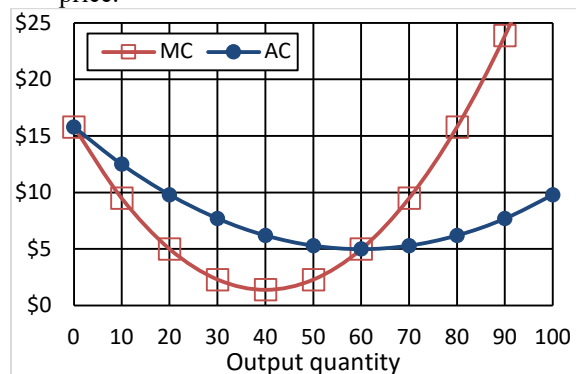
- (18) A change in the amount of pomegranate juice each person buys is called a change at the
- extensive margin.
 - intensive margin.
 - marginal product.
 - marginal revenue.
- (19) Price times a firm's quantity of output equals the firm's
- total cost.
 - average cost.
 - marginal cost.
 - total revenue.
 - average revenue.
 - marginal revenue.

- (20) All money paid by a firm for inputs equals by definition the firm's
- total cost.
 - average cost.
 - marginal cost.
 - total revenue.
 - average revenue.
 - marginal revenue.

- (21) The change in a firm's total revenue divided by the change in its output by definition equals the firm's
- total cost.
 - average cost.
 - marginal cost.
 - total revenue.
 - average revenue.
 - marginal revenue.

- (22) A small firm in a big market maximizes its profit by
- adjusting its price so that price equals marginal cost.
 - adjusting its output quantity so that price equals marginal cost.
 - shifting its marginal cost curve up or down so that price equals marginal cost at its desired output level.
 - all of the above.

- (23) ABC Company has very small market share and therefore takes the market price as given. Its marginal cost (MC) and average cost (AC) curves are shown below. To maximize profit, ABC Company should set its output at
- 20 units.
 - 40 units.
 - 60 units.
 - 80 units.
 - Cannot be determined without knowing market price.



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

- (25) The assumption that firms take the market price as given makes more sense if
- the owners of the firms are personal friends.
 - the necessary inputs to production are scarce.
 - there are a large number of firms in the market.
 - market demand is inelastic.

- (26) If consumers view the products of different firms as *perfect substitutes*, they will
- buy some of each.
 - choose whichever is cheaper.
 - stay with their current brand, even if it is a little more expensive.
 - flip a coin to decide which brand to buy.

(27) Suppose a flower vendor now sells 10 bouquets per hour at the price of \$15. If the vendor drops the price to \$14, the vendor can sell 11 bouquets per hour. The marginal revenue of the 11th bouquet is therefore

- a. \$1 .
- b. \$4 .
- c. \$10.
- d. \$14 .
- e. \$15 .

(28) A monopolist always sets price

- a. equal to marginal cost.
- b. above marginal cost.
- c. below marginal cost.
- d. cannot be determined from the information given.

(29) A monopoly causes social deadweight loss because

- a. it redistributes income from the poor to the rich.
- b. big corporations are bad for society.
- c. it creates a concentration of power.
- d. some buyers, willing to pay the marginal cost, do not get served.

(30) The Cournot model of oligopoly predicts that as the number of firms increases in an industry, the market price

- a. approaches zero.
- b. approaches marginal cost.
- c. approaches the monopoly price.
- d. remains constant.

(31) 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.

(32) 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 are therefore

- a. a nonrival good.
- b. a nonexcludable good.
- c. both of the above.
- d. none of the above.

(33) Suppose a large city park is spacious and never crowded, so one person using the park does not interfere with others using it. Moreover, the city has no way to charge admission to the park. Therefore the park is

- a. a nonrival good.
- b. a nonexcludable good.
- c. both of the above.
- d. none of the above.

(34) Diesel trucks with poorly-tuned engines spew particulates (small particles) out their exhaust pipes, with adverse effects on the health of *other* people (not just the truck owners) who breathe the air. These trucks therefore create

- a. an external benefit.
- b. an external cost.
- c. a common property resource.
- d. an inferior good.

(35) A large grocery store attracts many customers who also stop to shop at *other* nearby smaller stores. Those nearby stores become more profitable as a result. A large grocery store therefore creates

- a. an external benefit.
- b. an external cost.
- c. a differentiated product.
- d. a superior good.

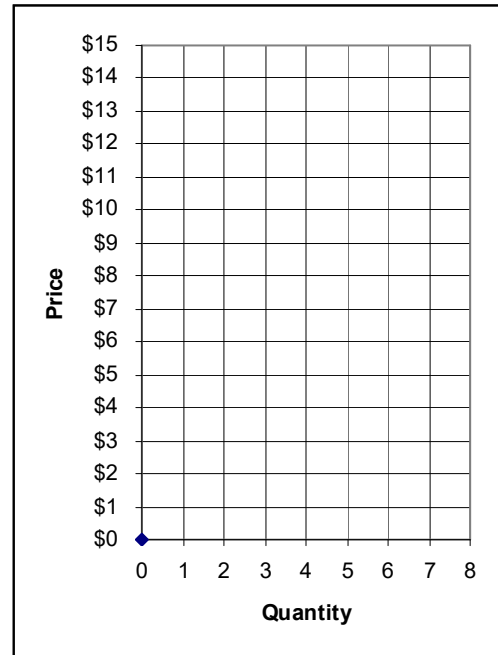
(36) Suppose 20 houses face a park with space for a playground. If each household is willing to pay \$100 for a shared playground, a nonrival good, then the social benefit of the playground would be

- a. \$5.
- b. \$20.
- c. \$100.
- d. \$2000.

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) [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 personal 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	Seller	Cost
Bob	\$14	Sue	\$ 1
Barb	\$13	Steve	\$ 2
Ben	\$12	Sam	\$ 3
Bailey	\$11	Sven	\$ 4
Brian	\$ 4	Sarina	\$ 6
Betty	\$ 3	Sean	\$14
Bert	\$ 1	Sally	\$15



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 \$12, would there be *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?
- 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?

\$	
	units
\$	
\$	

(2) [Shifts in demand and supply: 15 pts] Analyze each of the following markets according to the accompanying imaginary scenario.

a. Consider the market for **Brussels sprouts**. Suppose a new government study is published, showing that eating Brussels sprouts every day can prevent cancer.

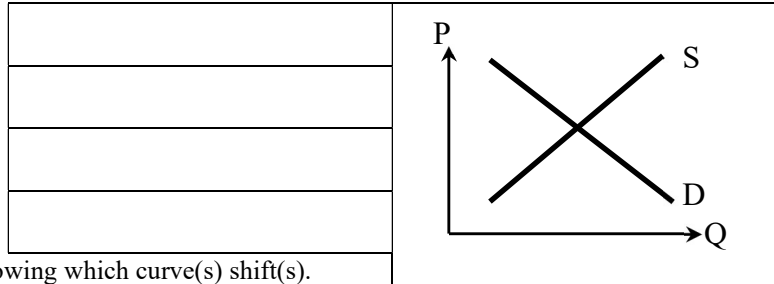
Does demand shift *left*, shift *right*, or remain *unchanged* ?

Does supply shift *left*, shift *right*, or remain *unchanged* ?

Does the equilibrium price *increase*, *decrease*, or *cannot be determined* ?

Does the equilibrium quantity *increase*, *decrease*, or *cannot be determined* ?

Sketch a graph of this scenario at right, showing which curve(s) shift(s).



b. Consider the market for **ketchup**: Suppose the price of tomatoes rises. (Ketchup is made from tomatoes.)

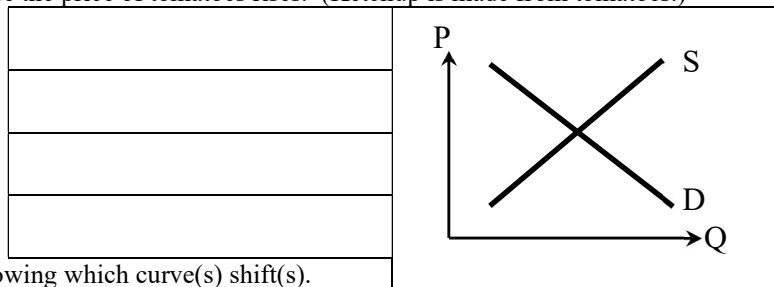
Does demand shift *left*, shift *right*, or remain *unchanged* ?

Does supply shift *left*, shift *right*, or remain *unchanged* ?

Does the equilibrium price *increase*, *decrease*, or *cannot be determined* ?

Does the equilibrium quantity *increase*, *decrease*, or *cannot be determined* ?

Sketch a graph of this scenario at right, showing which curve(s) shift(s).



c. Consider the market for **orange juice**: Suppose consumers begin shifting from fruit juices to water due to high sugar content in fruit juices. Simultaneously, a blight attacks orange trees.

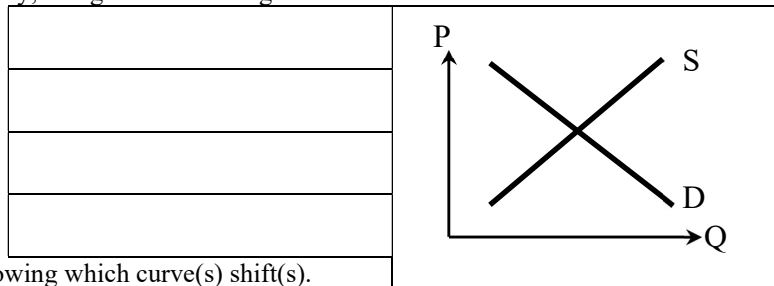
Does demand shift *left*, shift *right*, or remain *unchanged* ?

Does supply shift *left*, shift *right*, or remain *unchanged* ?

Does the equilibrium price *increase*, *decrease*, or *cannot be determined* ?

Does the equilibrium quantity *increase*, *decrease*, or *cannot be determined* ?

Sketch a graph of this scenario at right, showing which curve(s) shift(s).



(3) [Using price elasticity of demand: 10 pts] Suppose the cable TV company *raises* its price by 6%. Suppose the price elasticity of demand for cable TV service is -1.5. Assume everything else affecting demand for cable TV service remains constant.

a. According to the information above, is demand for cable TV service *elastic*, *inelastic*, or *unitary-elastic*?

b. As the price rises, will the number of cable TV customers *increase*, *decrease*, or remain *constant*?

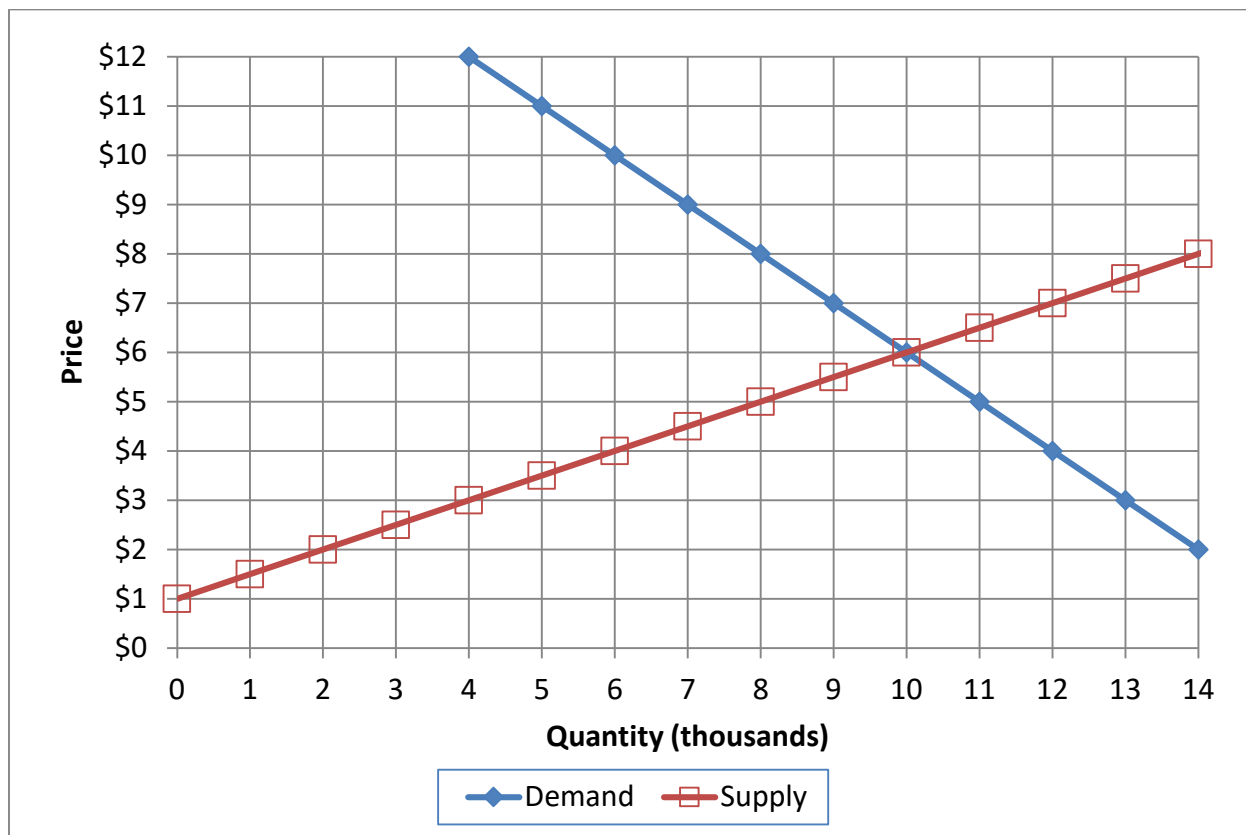
c. ... by approximately how much?

d. Will the total revenue received by the cable TV company *increase*, *decrease*, or remain *constant*?

e. ... by approximately how much?

%
%

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

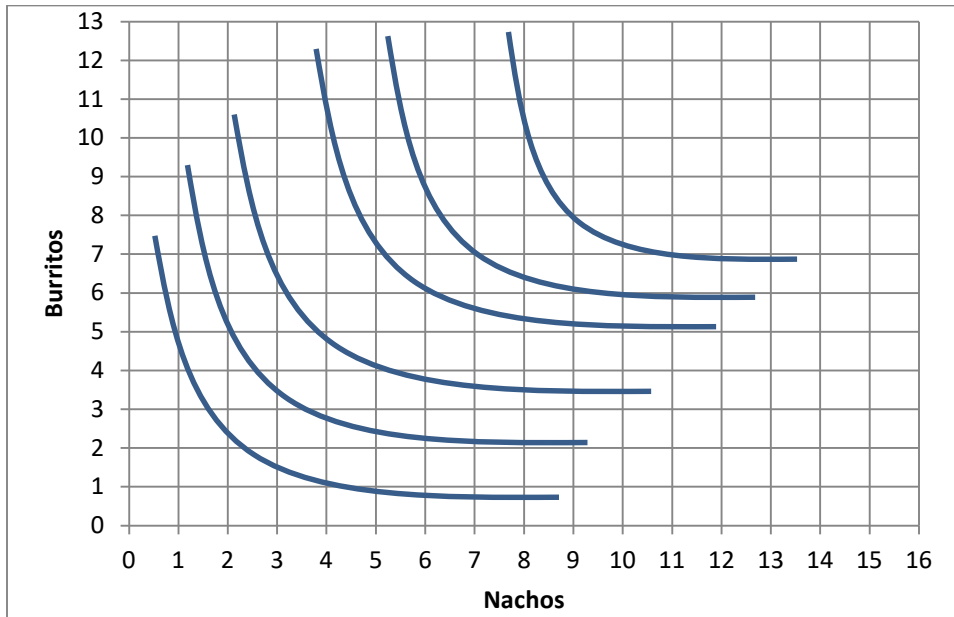


Suppose the government imposes an excise tax of \$3 per snow shovel.

- Compute the equilibrium quantity sold.
- Compute the equilibrium net price received by sellers (excluding the tax).
- Compute the equilibrium total price paid by buyers (including the tax).
- Does producer surplus *increase, decrease, or remain constant* because of the tax?
- By how much?
- Does consumer surplus *increase, decrease, or remain constant* because of the tax?
- By how much?
- Compute the total tax revenue collected by the government.
- Compute the deadweight social loss caused by the tax.

	thousand
\$	per snow shovel
\$	per snow shovel
\$	thousand
\$	thousand
\$	thousand
\$	thousand

(5) [Consumer choice and demand: 14 pts] The indifference curves in the graph below represent Beth's preferences for nachos and burritos.



- a. Would Beth rather have 2 burritos and 9 nachos, or 4 burritos and 5 nachos?
- b. Would Beth rather have 11 burritos and 4 nachos, or 7 burritos and 7 nachos?

	burritos and	nachos
	burritos and	nachos

Suppose Beth has a budget of \$60 to spend on burritos and nachos. The price of nachos is \$4.

c. **Using a straightedge**, carefully draw Beth's budget line when the price of burritos is \$6. Label this budget line "A".

d. How many burritos will Beth buy if the price of burritos is \$6?

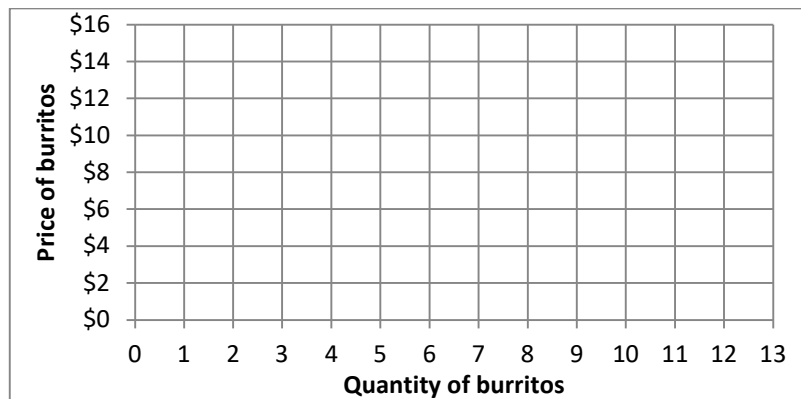
	burritos
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e. **Using a straightedge**, carefully draw Beth's budget line when the price of burritos is \$10. Label this budget line "B".

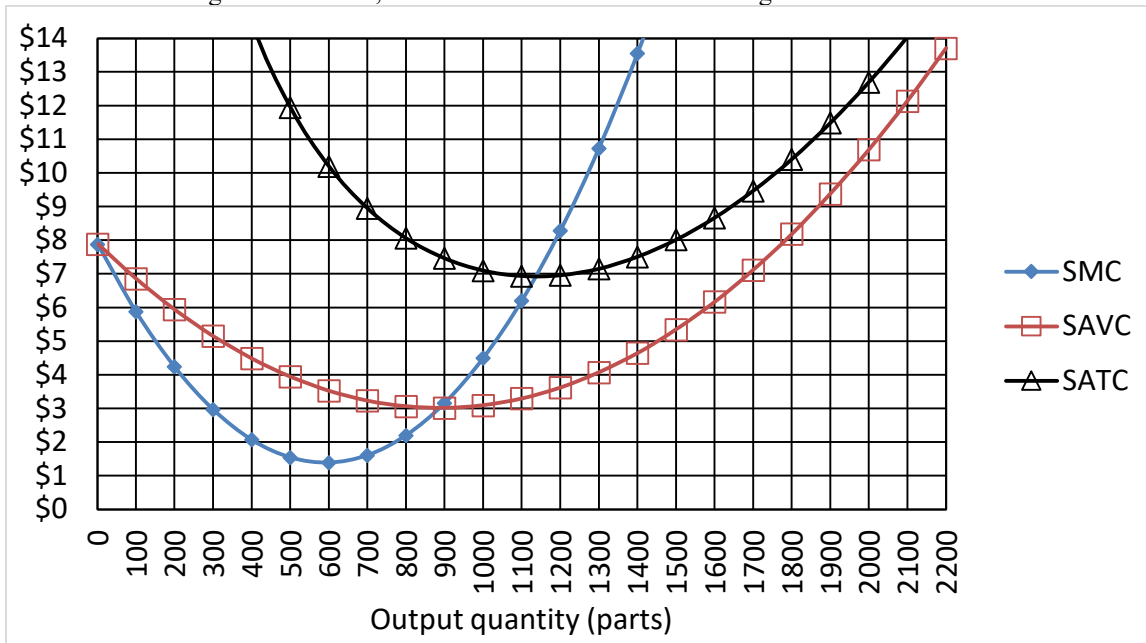
f. How many burritos will Beth buy if the price of burritos is \$10?

	burritos
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g. Plot two points on Beth's demand curve for burritos, and sketch her demand curve at right.



(6) [Short-run cost curves and supply: 20 pts] XYZ Manufacturing Company makes a small part used in trucks. XYZ is a small company in a big market, and therefore takes its output price as given. In the short run, the company faces daily cost curves as shown in the following diagram. Here, SMC denotes short-run marginal cost, SAVC denotes short-run average variable cost, and SATC denotes short-run average total cost.



Suppose the company were currently producing 500 parts for some unknown reason.

a. Compute the company's short-run total cost, to the nearest thousand dollars.

\$	thousand
\$	thousand
\$	thousand

b. Compute the company's short-run variable cost, to the nearest thousand dollars.

c. Compute the company's short-run fixed cost, to the nearest thousand dollars.

d. Suppose the company were currently producing 300 parts for some unknown reason. If the company produced one more part, by how much would its total cost increase? That is, what would be the *change in total cost* as the company increased output from 300 to 301 parts? (Give an answer to the nearest dollar.)

\$

e. What is the company's break-even price—that is, the lowest price at which the company can avoid losses? (Give an answer to the nearest dollar.)

f. What is the company's shut-down price—that is, the lowest price at which it will remain in operation in the short run? (Give an answer to the nearest dollar.)

g. Suppose the price of parts is \$2. How many parts should the company produce? (Give an answer to the nearest hundred.)

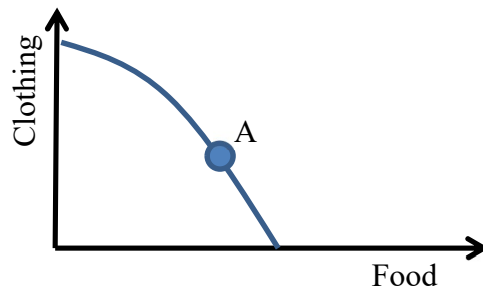
h. Will the company make a *profit* or a *loss* at a price of \$2?

i. Suppose the price of parts is \$6. How many parts should the company produce? (Give an answer to the nearest hundred.)

j. Will the company make a *profit* or a *loss* at a price of \$6?

\$
\$
parts
parts

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



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

units of clothing
units of food

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

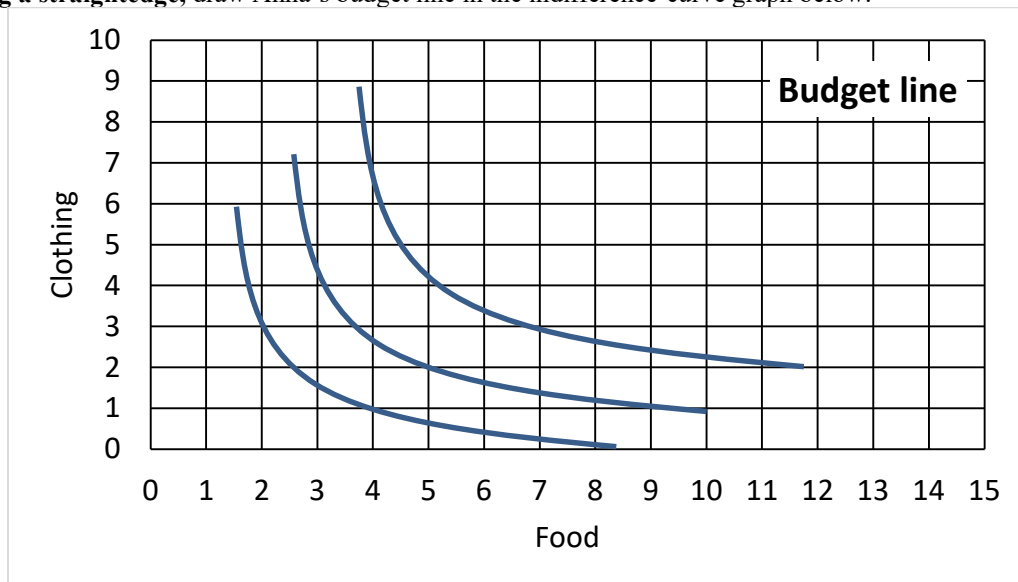
Assume this country's economy is in competitive equilibrium in all markets and the price of a unit of clothing is \$3.

c. What must be the price of a unit of food?

\$

Anna is a consumer in this economy. She has an income of \$27.

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



e. What is **Anna's** opportunity cost of a unit of food?

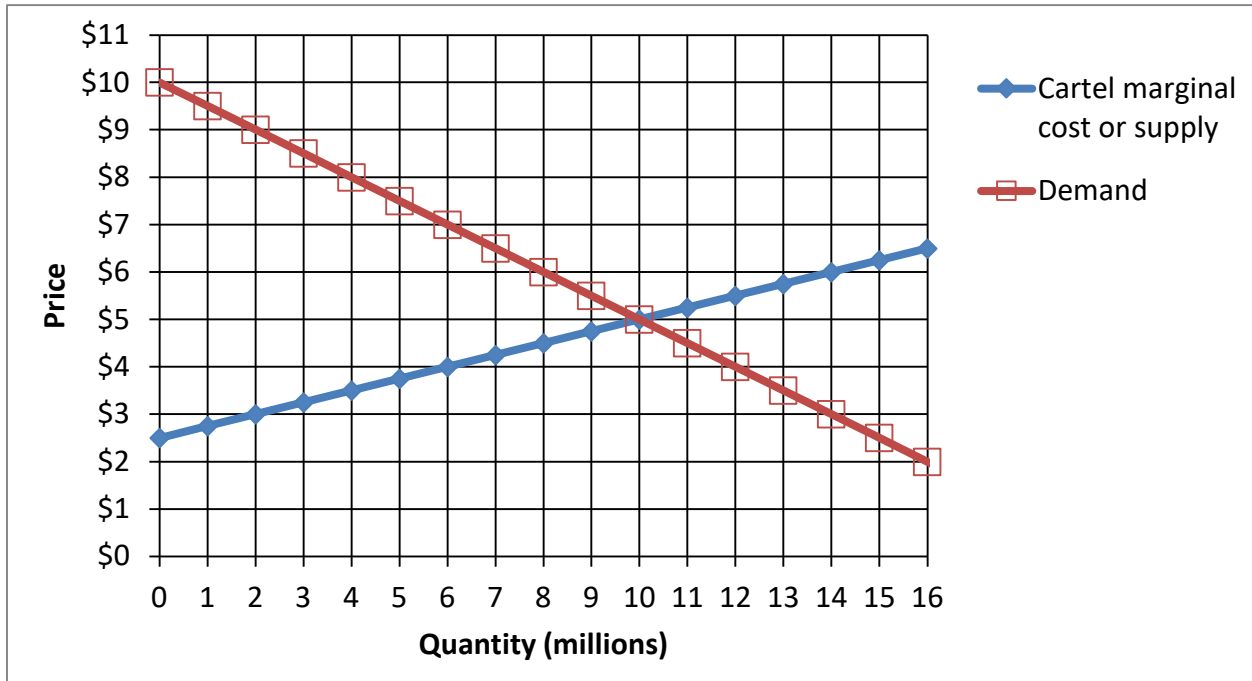
units of clothing
units of food
units of food

f. What is **Anna's** opportunity cost of a unit of clothing?

g. How many units of food will Anna choose to purchase?

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

(8) [Competition versus collusion: 16 pts] Suppose a small group of firms produce laundry soap. 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.

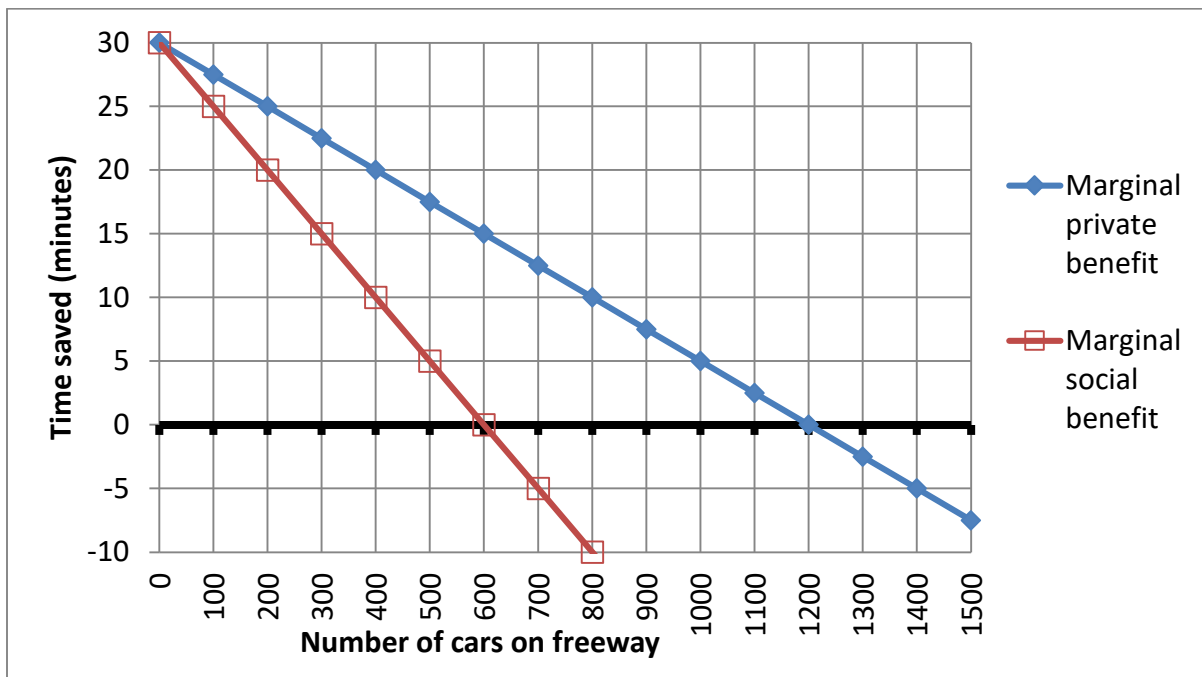
	\$ million
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(9) [Nonrival goods: 6 pts] Suppose **1000** people live near a proposed bike trail. The trail will cost **\$20,000** per mile to build. Let Q denote the length of the bike trail in miles. A typical individual person's marginal benefit from this bike trail is given by the following expression (or formula): $MB = 50 - 5Q$.

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

	miles
MSB =	
	miles

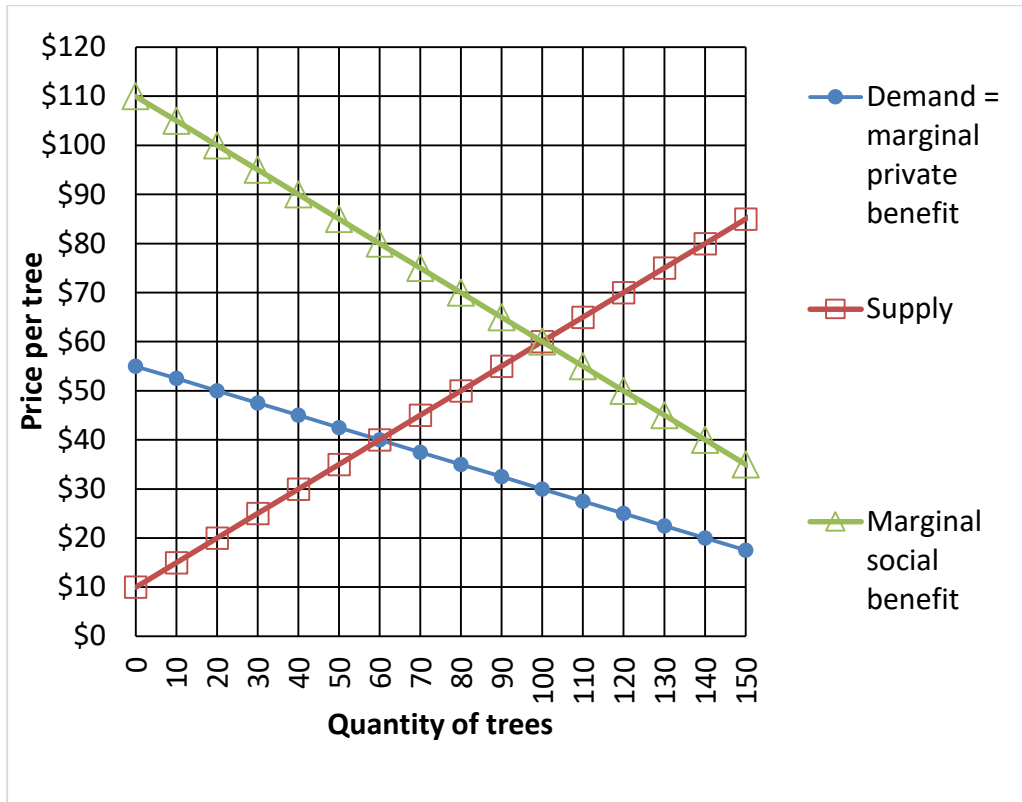
(10) [Common property resources: 6 pts] A certain freeway can easily become congested. It is the quickest route to downtown, but during rush hour, when one car enters the freeway, all the cars already on the freeway slow down a bit. The graph below shows the average time saved by each car when it enters 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.



- How many cars will enter the freeway if entry onto the freeway is unregulated?
- 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?
- 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
\$	

(11) [Externalities: 12 pts] The graph below shows the market for trees in a particular city. A tree provides shade for the homeowner who buys and plants one on their property, but also helps reduce summer temperatures in the whole neighborhood and makes the neighborhood more attractive. Therefore, in addition to demand and supply curves, a curve representing marginal social benefit is shown.



- Compute the (unregulated) competitive equilibrium price.
- Compute the (unregulated) competitive equilibrium quantity.
- Compute the economically efficient (or socially optimal) quantity.
- Compute the deadweight loss from unregulated competition.
- To eliminate this deadweight loss, should the government enact a *tax* or a *subsidy* on trees?
- What should be the tax rate or subsidy rate?

\$	per tree
	trees
	trees
\$	
\$	per tree

(12) [Regulating pollution: 19 pts] Seven factories are each producing one unit of pollution per year. The government has determined that total pollution must be reduced to 5 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	F	G
Annual cost of cleaning up pollution	\$45	\$40	\$40	\$35	\$25	\$15	\$5

Command-and-control:

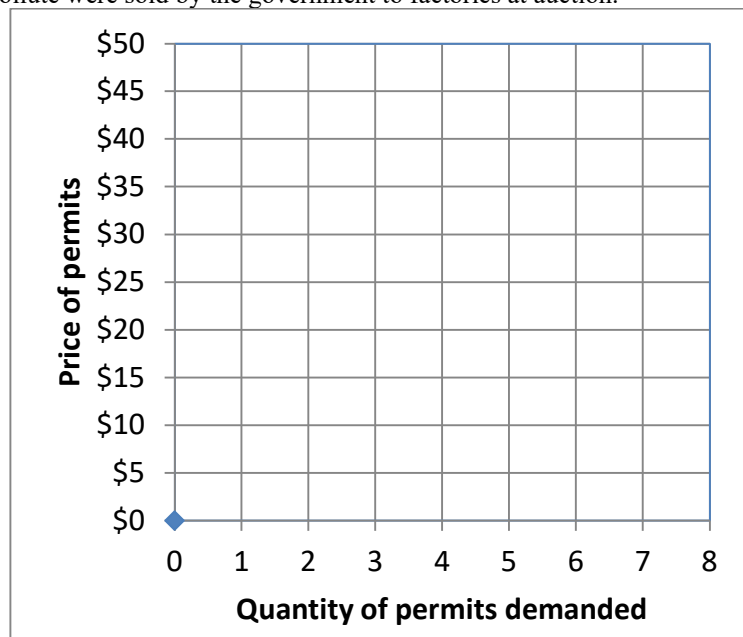
- a. To minimize the total cost of cleaning up, which 2 factories should be commanded to clean up? Give their letters.
- b. What would be the total cost of cleaning up for these 2 factories together?

	\$

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 5 permits (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.

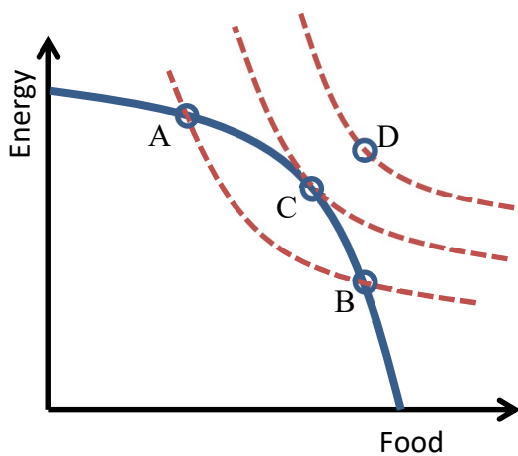
- g. What fee would reduce the amount of pollution to 5 units: \$0, \$10, \$20, \$30, \$40, \$50, or \$60?
- h. What would be the total cost of cleaning up for those 2 factories that chose not to pay the fee?

	\$
	\$

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

- (1) Give an example of a good or service that you consume that is *nonrival*. Explain why this good is a nonrival good. (Ignore the graph.)
- (2) The graph below describes the economy of Country X. The solid curve is Country X's production possibility curve and the dashed curves are indifference curves for a representative consumer. Both industries are competitive. The food industry causes no externalities but the energy industry causes substantial external costs, so that too much energy is produced compared to the efficient quantity. Where is Country X's economy—point A, B, C, or D? Why?

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]